Tessera Solar
power from stirling energy systems

DOCKET
08-AFC-13
DATE SEP 13 2010
RECD. SEP 13 2010

September 13, 2010

Mr. Christopher Meyer
CEC Project Manager
Attn: Docket No. 08-AFC-13
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

RE: Calico Solar (formerly Solar One) Project (08-AFC-13)
Applicant's Submittal of Testimony with Applicant's Exhibits for Scenarios 5.5 and 6

Dear Mr. Meyer:

Tessera Solar hereby submits Testimony with Applicant's Exhibits related to two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010. I certify under penalty of perjury that the foregoing is true, correct, and complete to the best of my knowledge.

Sincerely,

Felicia L. Bellows
Vice President of Development

Tessera Solar | 4800 N. Scottsdale Road | Suite 5500 | Scottsdale, AZ 85251 | P +1 602 535 3576 | F +1 602 535 3617 | tesserasolar.com

This Page Intentionally Left Blank

EXHIBIT 114

Declaration of Felicia Bellows

This Page Intentionally Left Blank

Exhibit 114
TESTIMONY
OF
FELICIA BELLOWS
Project Overview

Q.1 Will you please state your name and occupation?

A.1 My name is Felicia Bellows and I am Vice President of Development for Tessera Solar.

Q.2 Are you the same Felicia Bellows that submitted opening and rebuttal testimony in this proceeding?

A.2 Yes.

Q.3 Are you sponsoring any additional exhibits?

A.3 Yes. Attached are a list of recently docketed items (Attachment A), fencing maps of the proposed scenarios (Attachment B), changes in conditions of certification (Attachments C, D and E) and declarations of the technical experts who evaluated the implications of the scenarios proposed (Exhibits 115-128).

Q.4 What is the purpose of your testimony?

A.4 The purpose of my testimony is to:

a) Describe the site development scenarios prepared by Tessera Solar in response to the Committee's September 3, 2010 Order.

b) Provide an overview of the implications and policy trade-offs associated with the Commission's consideration of these scenarios.

c) Discuss changes in the conditions of certification resulting from these scenarios.

Q.5 Did you direct the preparation of and have you reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010?

A.5 Yes, I have.

Q.6 Why are you proposing these additional project scenarios?

A.6 The Committee's September 3, 2010 order stated:

> "The Committee can not recommend approval of the Calico Solar Project as proposed by the Applicant due to the scope and scale of high quality habitat affecting desert tortoises and bighorn sheep that would be lost in order to construct and operate the project. That highest quality habitat exists in the portions of the proposed project site north of the Phase 1 boundary including the Phase 1 detention basins. The Committee is willing, if one or more parties are interested in pursuing the matter, to consider further evidence on project proposals with reduced footprints that exclude the highest quality tortoise habitat."

Based on this direction, we prepared six scenarios that progressively reduced the footprint of the project and the amount of higher quality desert tortoise habitat included within the

project's boundaries. These scenarios also progressively moved the project boundary farther away from the bighorn sheep habitat in the Cady Mountains.

During the workshop held on September 9, 2010, the Committee was clear that it is very concerned about the need to balance the need for renewable energy and its associated benefits with the environmental concerns associated with the siting of individual power plant proposals. In this case, a particular concern was expressed about potential impacts to desert tortoise. To make a decision in this case balancing these different considerations and the whole of the record, they expressed their desire to consider no more than two scenarios in subsequent hearings that would reduce biological impacts and produce renewable power. These included what we referred to as Scenario 6, designed to exclude all of the higher quality desert tortoise habitat and maximize the distance of the project from the toe of the Cady Mountains, and what we are now calling Scenario 5.5 which included a minimal amount of the higher quality desert tortoise habitat.

Q.7 Will you describe the scenarios you are proposing to the Committee?

A.7 As I said earlier, we initially proposed 6 scenarios that were docketed on September 8, 2010, and that were subsequently discussed with all of the parties at a workshop held on September 9, 2010. We are bringing forward one of those scenarios and a variant of another at this time for the Committee's consideration.

What we are calling Scenario 5.5 reduces the project footprint to 4,613 acres. I'd like to note that this is entirely a reduction in acres from the footprint the Commission has been evaluating. It does not include any lands located outside the previous project boundary. In terms of project phasing, Phase 1a would include 250 acres for the access road, main services complex, substation, and initial 60 SunCatchers as described before. Phase 1b would now be constructed on an additional 1,626 acres and Phase 2 on an additional 2,737 acres. Consistent with the concerns expressed by the Committee, the area previously occupied by the detention basins as well as the great majority of the higher quality desert tortoise habitat (the habitat proposed by the CDFG for mitigation at a 5:1 ratio) would be eliminated from the project site under scenario 5.5. Only 369 acres of 5:1 mitigation ratio land would remain within the project boundary. The total generating capacity of the project under this configuration will be 663.5 megawatts. This scenario is significantly less than the 850 MW identified in our power purchase agreement (PPA) but will allow delivery of first power in a manner consistent with the PPA, and can accommodate phasing to meet SCE's schedule for regional transmission upgrades. With the exception of removing the detention basins, this scenario will not require the relocation of other project components previously evaluated in this proceeding.

What we call Scenario 6 is similar to Scenario 5.5 but has a smaller footprint and avoids all of the higher quality desert tortoise habitat (the habitat proposed by the CDFG for mitigation at a 5:1 ratio). It occupies 4,244 acres. Phase 1a and 1b remain at 250 acres and 1,626 acres respectively. Phase 2 is reduced to 2,368 acres. The total generating capacity of this project is 603.9 MW. Again, this scenario only reduces the land area included within the project boundary. It does not result in development outside the boundary previously evaluated by the Commission in this proceeding and, except for removal of the detention basins, does not relocate any of the major project components.

Q.8 How do either of these scenarios affect the environmental implications of the project?

A.8 Both scenarios reduce the project footprint and also reduce the project's environmental consequences.

Scenario 5.5 excludes a majority of the higher quality desert tortoise habitat and Scenario 6 excludes all of this habitat, consistent with the Committee's order. In addition, compared to the 850 MW project, both scenarios would:

- Significantly reduce the number of desert tortoise needing to be moved or translocated and the number of desert tortoise affected by the project,
- Create a larger desert tortoise movement corridor between the project boundary and the toe of the Cady Mountains,
- Pull the project further away from the bighorn sheep habitat located in the Cady Mountains to the northeast of the 6,215 acre project layout,
- Reduce impacts to desert habitat,
- Reduce impacts to waters of the state (46% reduction in Scenario 5.5 and 55% reduction in Scenario 6),
- Reduce the amount of hydrogen used on the site,
- Reduce particulate matter generated by site disturbance activities during construction and by vehicular traffic during both construction and operation,
- Result in the installation of fewer transformers, fewer collector distribution feeders and other electrical components that would also reduce their associated environmental impacts, and
- Reduce the already minimal water use on site.

Details on how these scenarios affect specific environmental topics are discussed in the testimony and declarations submitted with my testimony.

Q.9 Will these scenarios necessitate modifications to the proposed conditions of certification?

A.9 The reduction in acreage for Scenarios 5.5 and 6 each result in reduced mitigation compensation for many of the biological resources as well as for fire protection where the compensation amount was calculated on a per acre basis. Specifically, the compensation included in Conditions of Certification BIO-17 (desert tortoise), BIO-18 (raven management), BIO-26 (waters of the state), WORKER SAFETY-7 and WORKER SAFETY-8 would all be reduced in proportion to the reduction in acreage. Additionally, the phased acreage amounts in BIO-13 (MFTL) would be reduced; however, the contemplated compensation would not change because the area of the Mojave fringe-toed lizard habitat is not changed by either Scenario. Revised versions of these conditions for Scenario 5.5 are included in Attachment C and revised versions of these conditions for Scenario 6 are included in Attachment D.

Q.10 How will these scenarios impact the drainage and sediment transfer on the site?

A.10 These scenarios eliminate the detention basins designed as part of the project to reduce on-site maintenance costs. The attached declarations by Dr. Chang, Mr. Moore, and Mr. Byall explain the implications of removing the basins.

The removal of the detention basins requires revision of Condition of Certification SOIL&WATER-8, the majority of which was concerned with the design of the detention basins, and ensuring that the detention basins did not deprive down-stream habitat of necessary sediment loads. Therefore, we propose revising SOIL&WATER-8 (a) to eliminate

references to the detention basins, (b) to include performance standards for drainage of the site to protect the washes, the BNSF railroad and the sediment transportation through the site, and (c) to require a hydrology report to demonstrate that these performance standards will be met. Additionally, due to the fact that the detention basins are being removed, Conditions of Certification GEO-2 and GEO-3, which dealt exclusively with detention basins and dams, should be deleted in their entirety. The proposed wording for revised SOIL&WATER-8 is included in Attachment E.

Q.11 Will these scenarios allow private property owners to have access to their property?

A.11 Yes. As always, we are committed to ensuring that private property owners have access. There will still be a perimeter road around the project site. Because the reduction in the project footprint will move the property boundary further south, the access road around the project site to private lands in Section 1 would be shorter than under the 6,215 acre project layout.

Q.12 Are there any adverse environmental implications of the Commission approving either of these scenarios?

A.12 The most significant tradeoff in approving one of these scenarios is the impact to achieving California's Renewable Portfolio Standard and greenhouse gas reduction goals. Both of these scenarios significantly reduce the generating capacity of this project (by 186.5 MW in Scenario 5.5 and 246.1 MW in Scenario 6) and the resultant system and climate change benefits. Since California is behind in meeting either of these mandates, another solar power plant or facility that provides similar benefits will need to be constructed somewhere. I can only assume that any new power generation facility will have some, although perhaps different, environmental consequences. I also expect that the time delay required to design, permit, and construct that facility will also have a climate change consequence. Those, however, are considerations this Commission is required to balance in its decision-making process.

Q.13 Does that complete your testimony?

A.13 Yes.

I swear under penalty of perjury that the above that this testimony is true and correct to the best of my knowledge.

9/13/10

Date

Felicia Bellows

A/73500402.2

ATTACHMENT A

This Page Intentionally Left Blank

ATTACHMENT A

1. Applicant's Submittal of Detention Basin Removal Analysis from Dr. Chang and Applicant's Proposed Revisions to Soil and Water 8 (docketed September 8, 2010)

2. Applicant's Submittal of Reduced Project Boundary Scenarios (docketed September 8, 2010)

3. Applicant's Submittal of Updated Reduced Project Boundary Scenarios 5.5 and 6 Information (docketed September 10, 2010)

4. Applicant's Submittal of Proof of Ownership for Well and Waterline Property and Title Insurance for Water Rights (docketed September 10, 2010)

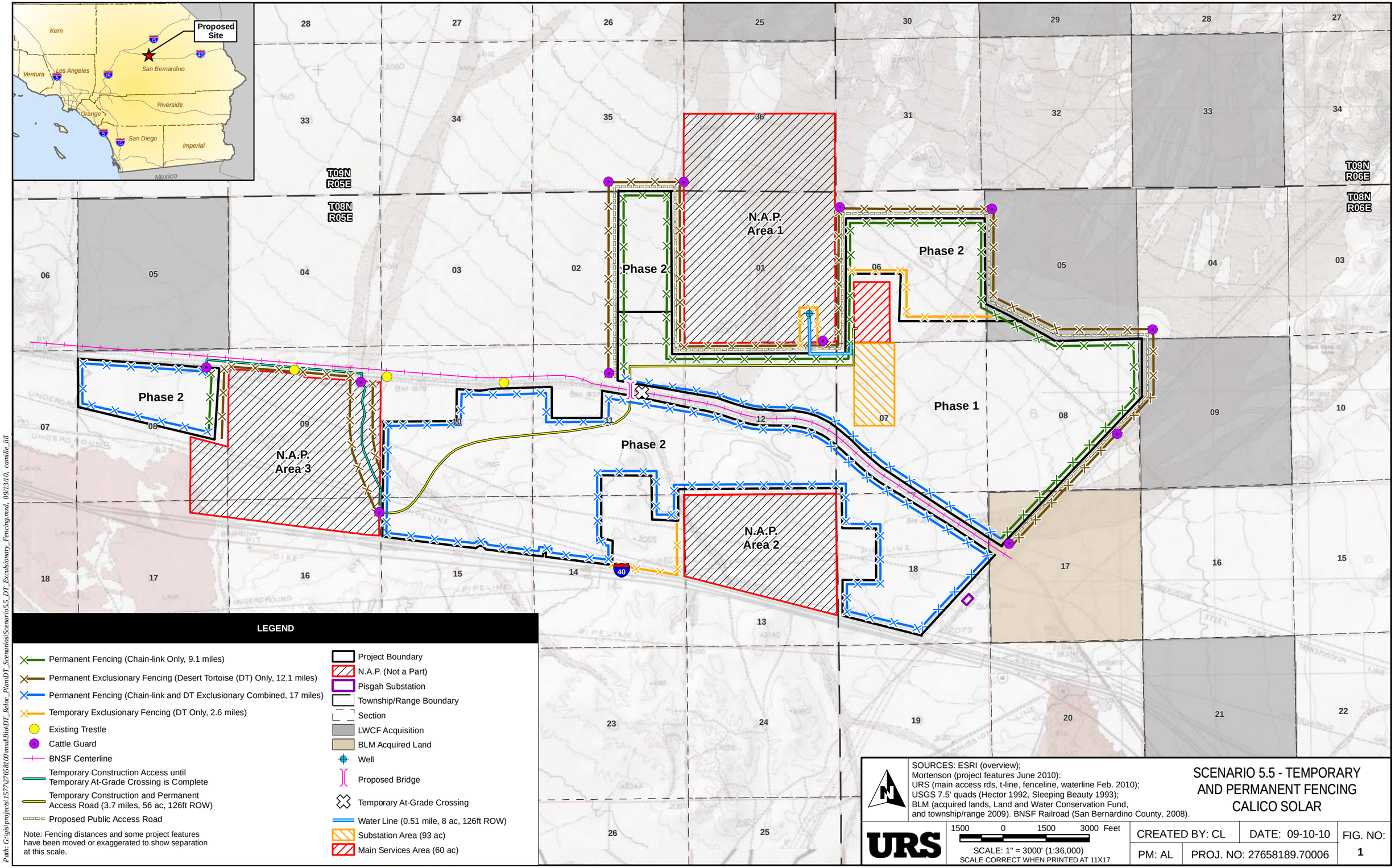
5. Applicant's Submittal of Information Requested by Chris Huntley at the Calico Workshop on September 9, 2010 (docketed September 10, 2010)

This Page Intentionally Left Blank

ATTACHMENT B

Scenario 5.5 and 6 Temporary and Permanent Fencing Figures

This Page Intentionally Left Blank



LEGEND

- Permanent Fencing (Chain-link Only, 9.1 miles)
- Permanent Exclusionary Fencing (Desert Tortoise (DT) Only, 12.1 miles)
- Permanent Fencing (Chain-link and DT Exclusionary Combined, 17 miles)
- Temporary Exclusionary Fencing (DT Only, 2.6 miles)
- Existing Trestle
- Cattle Guard
- BNSF Centerline
- Temporary Construction Access until Temporary At-Grade Crossing is Complete
- Temporary Construction and Permanent Access Road (3.7 miles, 56 ac, 126ft ROW)
- Proposed Public Access Road

Note: Fencing distances and some project features have been moved or exaggerated to show separation at this scale.

- Project Boundary
- N.A.P. (Not a Part)
- Pisgah Substation
- Township/Range Boundary
- Section
- LWCF Acquisition
- BLM Acquired Land
- Well
- Proposed Bridge
- Temporary At-Grade Crossing
- Water Line (0.51 mile, 8 ac, 126ft ROW)
- Substation Area (93 ac)
- Main Services Area (60 ac)

SOURCES: ESRI (overview);
Mortenson (project features June 2010):
URS (main access rds, t-line, fenceline, waterline Feb. 2010);
USGS 7.5' quads (Hector 1992, Sleeping Beauty 1993);
BLM (acquired lands, Land and Water Conservation Fund, and township/range 2009). BNSF Railroad (San Bernardino County, 2008).

SCENARIO 5.5 - TEMPORARY AND PERMANENT FENCING CALICO SOLAR

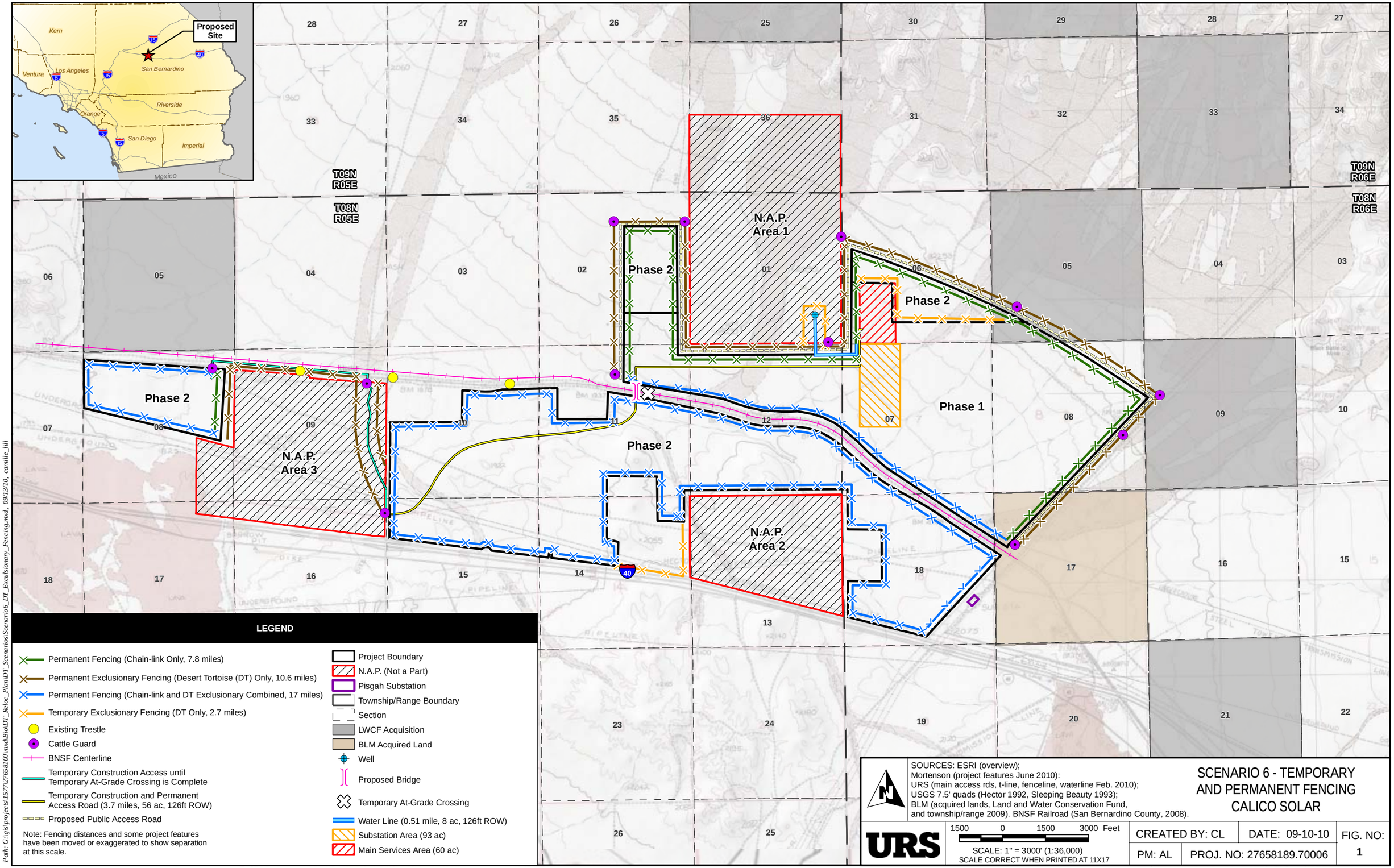
URS

1500 0 1500 3000 Feet

SCALE: 1" = 3000' (1:36,000)
SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: CL	DATE: 09-10-10	FIG. NO: 1
PM: AL	PROJ. NO: 27658189.70006	

Path: G:\gis\projects\15772\27658189.00\mxd\Bio\DT_Reloc_Plan\DT_Scenarios\Scenario5.5_DT_Exculsionary_Fencing.mxd, 09/13/10, camille_itl


Kern
Proposed Site
Ventura
Los Angeles
San Bernardino
Riverside
Orange
San Diego
Imperial
Mexico
T09N R05E
T08N R05E
T09N R06E
T08N R06E
N.A.P. Area 1
N.A.P. Area 2
N.A.P. Area 3
Phase 1
Phase 2
Phase 2
Phase 2
LEGEND
Permanent Fencing (Chain-link Only, 7.8 miles)
Permanent Exclusionary Fencing (Desert Tortoise (DT) Only, 10.6 miles)
Permanent Fencing (Chain-link and DT Exclusionary Combined, 17 miles)
Temporary Exclusionary Fencing (DT Only, 2.7 miles)
Existing Trestle
Cattle Guard
BNSF Centerline
Temporary Construction Access until Temporary At-Grade Crossing is Complete
Temporary Construction and Permanent Access Road (3.7 miles, 56 ac, 126ft ROW)
Proposed Public Access Road
Note: Fencing distances and some project features have been moved or exaggerated to show separation at this scale.
Project Boundary
N.A.P. (Not a Part)
Pisgah Substation
Township/Range Boundary
Section
LWCF Acquisition
BLM Acquired Land
Well
Proposed Bridge
Temporary At-Grade Crossing
Water Line (0.51 mile, 8 ac, 126ft ROW)
Substation Area (93 ac)
Main Services Area (60 ac)
SOURCES: ESRI (overview);
Mortenson (project features June 2010):
URS (main access rds, t-line, fenceline, waterline Feb. 2010);
USGS 7.5' quads (Hector 1992, Sleeping Beauty 1993);
BLM (acquired lands, Land and Water Conservation Fund, and township/range 2009). BNSF Railroad (San Bernardino County, 2008).
SCENARIO 6 - TEMPORARY AND PERMANENT FENCING CALICO SOLAR
URS
1500 0 1500 3000 Feet
SCALE: 1" = 3000' (1:36,000)
SCALE CORRECT WHEN PRINTED AT 11X17
CREATED BY: CL
DATE: 09-10-10
PM: AL
PROJ. NO: 27658189.70006
FIG. NO: 1
Path: G:\gis\projects\1577\27658189.70006\mxd\BioDT_Reloc_Plan\DT_Scenarios\Scenario6_DT_Exculsionary_Fencing.mxd, 09/13/10, camille_litl

ATTACHMENT C

CALICO SCENARIO 5.5

REVISED CONDITIONS AS REVISED BY APPLICANT

ATTACHMENT C

CALICO SCENARIO 5.5

REVISED CONDITIONS AS REVISED BY APPLICANT

MOJAVE FRINGE-TOED LIZARD MITIGATION

BIO-13 The project owner shall provide compensatory land to mitigate for habitat loss and direct impacts to Mojave fringe-toed lizards based on estimates of suitable Mojave fringe-toed lizard habitat on-site. The project owner shall provide compensatory mitigation at a 3:1 ratio for impacts to breeding habitat (i.e., dune, sand ramp, or fine-sandy wash habitat), and at a 1:1 ratio for impacts to adjacent suitable foraging and cover habitat, such as thin aeolian sand overlying bajada surfaces, or foraging habitat surrounding the breeding habitat. CEC staff estimated breeding habitat on site as 21.4 acres, and surrounding suitable foraging and cover habitat (i.e., 45 meter buffer) as 143.3 acres. Therefore, CEC staff anticipated this condition would require the acquisition and dedication in perpetuity of at 207.5 acres of habitat. The project owner shall provide funding for the acquisition, initial habitat improvements, and long-term management of the compensation lands, as described below.

Biological Resources Table 17
Mojave Fringe-toed Lizard Compensation Acreage Summary

Habitat Function	Project Impact Acreage	Mitigation Ratio	Compensation Acreage
Foraging and cover	143.3 acres	1:1	143.3 acres
Breeding	21.4 acres	3:1	64.2 acres
Total	164.7 acres		207.5 acres

This compensation acreage may be included ("nested") within the acreage acquired and managed as desert tortoise habitat compensation (Condition of Certification **BIO-17**) only if:

- Adequate acreage of qualifying desert tortoise compensation lands also meet the Selection Criteria (below) as habitat for Mojave fringe-toed lizard;
- The desert tortoise habitat compensation lands are acquired and dedicated as permanent conservation lands within 18 months of the start of project construction.

If these two criteria are not met, then the project owner shall provide the required number of acres of Mojave fringe-toed lizard habitat compensation

lands, adjusted to reflect the final project footprint and additional delineation of suitable habitat, independent of any compensation land required under other conditions of certification, and shall also provide funding for the initial improvement and long-term maintenance and management of the acquired lands, and shall comply with other related requirements of this condition.

Implementation and funding of this mitigation shall be phased to ensure that appropriate compensation lands and/or funding reflect the phasing of actual project impacts and will ensure that all impacts are fully compensated prior to occurring.

COMPENSATORY MITIGATION LAND ACQUISITION

1. **Method of Acquisition**. Compensation lands required to meet this condition shall be acquired in whole or in part either:

    a. By the project owner for donation, as approved by the CPM, to a state or federal land management agency or non-profit land management organization,

    b. By BLM with funds provided by the project owner,

    c. By a third party approved by the CPM to acquire or donate the lands with funds provided by the project owner, or

    d. By the National Fish and Wildlife Foundation (NFWF) with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account.

If the project owner chooses to delegate responsibility for acquisition of all or portions of compensation lands to a third party such as a nongovernmental organization supportive of desert habitat conservation, such delegation shall be subject to approval by the CPM, in consultation with the project owner and CDFG, BLM and USFWS, prior to land acquisition, enhancement or management activities. The CPM shall provide a written response and explanation to the project owner within 30 days of receiving the proposal. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be executed and implemented within 18 months of the Energy Commission's certification of the project or initiation of each phase of the project.

2. **Selection Criteria for Compensation Lands**. The compensation lands selected for acquisition to meet Energy Commission requirements shall:

    a. Be sand dune or partially stabilized sand dune habitat with potential to contribute to Mojave fringe-toed lizard habitat connectivity and build linkages between known populations of Mojave fringe-toed lizards and preserve lands with suitable habitat;

b. Be biologically contiguous to lands currently occupied by Mojave fringe-toed lizard;

c. Be near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long-term by a public resource agency or a non-governmental organization dedicated to habitat preservation;

d. Provide quality habitat for Mojave fringe-toed lizard, that has the capacity to regenerate naturally when disturbances are removed;

e. Not have a history of intensive recreational use or other disturbance that might make habitat recovery and restoration infeasible;

f. Not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration;

g. Not contain hazardous wastes;

h. Have water and mineral rights included as part of the acquisition, unless the CPM, in consultation with CDFG, BLM and USFWS, agrees in writing to the acceptability of land without these rights; and

i. Be on land for which long-term habitat management for Mojave fringe-toed lizard and other native biological resources is feasible.

These requirements may be adjusted upon mutual agreement with the resource agencies (CEC, CDFG, BLM, and USFWS) depending on the specific lands available and in consideration of larger fringe-toed lizard mitigation efforts.

3. **Review and Approval of Compensation Lands Prior to Acquisition**. If the project owner assumes responsibility for acquiring the compensation lands, the project owner shall submit a formal acquisition proposal to the CPM describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands for Mojave fringe-toed lizard in relation to the criteria listed above and must be approved by the CPM. The CPM will share the proposal with and consult with CDFG, BLM, and the USFWS before deciding whether to approve or disapprove the proposed acquisition. The CPM shall provide a written response and explanation to the project owner within 30 days of receiving the proposal.

4. **Compensation Lands Acquisition Conditions**: If the project owner assumes responsibility to acquire the compensation lands to meet Energy Commission and CESA requirements, the project owner shall comply with the following conditions relating to acquisition of the compensation lands

after the CPM, in consultation with CDFG, BLM and the USFWS, has approved the proposed compensation lands:

a. Preliminary Report: The Project owner, or approved third party, shall provide a recent preliminary title report, initial hazardous materials survey report, biological analysis, and other necessary documents for the proposed compensation land to the CPM. All documents conveying or conserving compensation lands and all conditions of title are subject to review and approval by the CPM, in consultation with CDFG, BLM and the USFWS. For conveyances to the State, approval may also be required from the California Department of General Services, the Fish and Game Commission and the Wildlife Conservation Board.

b. Title/Conveyance: The Project owner shall acquire and transfer fee title to the compensation lands, a conservation easement over the lands, or both fee title and conservation easement as required by the CPM in consultation with CDFG. Any transfer of a conservation easement or fee title must be to CDFG, a non-profit organization qualified to hold title to and manage compensation lands (pursuant to California Government Code section 65965), or to BLM or other public agency approved by the CPM in consultation with CDFG.

c. Property Analysis Record. Upon identification of the compensation lands, the Project owner shall conduct a Property Analysis Record (PAR) or PAR-like analysis to establish the appropriate amount of the long-term maintenance and management fund to pay the in-perpetuity management of the compensation lands. The PAR or PAR-like analysis must be approved by the CPM, in consultation with CDFG, before it can be used to establish funding levels or management activities for the compensation lands.

5. **Compensation Lands Acquisition Costs**: If the project owner assumes responsibility to acquire all or a part of the compensation lands to meet Energy Commission and CESA requirements, the project owner shall fund the following items in addition to actual land costs:

a. Level 1 Environmental Site Assessment,

b. Appraisal,

c. Closing and Escrow costs,

d. Biological survey for determining mitigation value of the land, and

e. Agency costs to accept the land.

If the project owner uses BLM to acquire all or a portion of the compensation lands, the project owner shall provide the BLM with funds for items a. to e. above as well as actual land costs.

If the project owner uses in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF) to acquire some or all of the compensation lands, the project owner shall provide funds for items a. to e. above as well as actual land costs and third party administrative costs. If the Project owner elects to use the REAT Account with NFWF, the Project owner will be responsible for providing sufficient funds to cover actual acquisition costs and fees

Estimated costs associated with acquisition of compensation lands are:

ESTIMATED LAND ACQUISITION COSTS PER ACRE OR PARCEL

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Land cost/acre	Covered by Owner	$500	$500
Level 1 Environmental Site Assessment / parcel	Covered by Owner	$3,000	$3,000
Appraisal/parcel	Covered by Owner	$5,000	$5,000
Closing and Escrow Costs/parcel	Covered by Owner	$5,000	$5,000
Biological Survey/parcel	Covered by Owner	$5,000	$5,000
3rd Party Admin. Costs/parcel	$0	$0	10% of land cost
Agency Cost to Accept	17.6% of land cost	17.6% of land cost	17.6% of land cost

These costs are current estimates and shall be modified based on actual costs or with the concurrence of the REAT agencies. The land cost per acre is based on actual acquisition costs by the BLM in San Bernardino County. The number of parcels is estimated based on 640 acres per parcel.

TOTAL ESTIMATED LAND ACQUISITION COSTS

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	207.5	207.5	207.5
Parcels Purchased	0.3	0.3	0.3
Land cost	$103,750	$103,750	$103,750
Level 1 Environmental Site Assessment	$324	$973	$973
Appraisal	$811	$1,621	$1,621
Closing and Escrow Costs	$811	$1,621	$1,621
Biological Survey	$811	$1,621	$1,621
3rd Party Admin. Costs	$0	$0	$5,188
Agency Cost to Accept	$18,208	$0	$18,208
TOTAL	$124,415	$127,846	$138,169

COMPENSATORY MITIGATION LAND IMPROVEMENT

1. **Land Improvement Requirements**: The Project owner shall fund activities that the CPM, in consultation with the CDFG, USFWS and BLM, requires for the initial protection and habitat improvement of the compensation lands. These activities will be implemented by the state or federal land management agency or non-profit organization holding the land or their representative. The specific activities will vary depending on the condition and location of the land acquired but may include:

    - Installation of signs,
    - Removal of trash,
    - Construction and repair of fences,
    - Surveys of boundaries and property lines,
    - Removal of invasive plants,
    - Removal of roads,
    - And similar measures to protect habitat and improve habitat quality.

    A non-profit organization, CDFG or another public agency may hold and expend the habitat improvement funds if it is qualified to manage the compensation lands (pursuant to California Government Code section 65965), if it meets the approval of the CPM in consultation with CDFG, and if it is authorized to participate in implementing the required activities on the compensation lands. If CDFG takes fee title to the compensation lands, the habitat improvement fund must be paid to CDFG or its designee.

2. **Compensation Lands Improvement Costs**: Land improvement costs will vary depending on the activities undertaken. The cost of those actions are estimated to be $250 per acre but will vary depending on the measures that are required for the compensation lands. Assuming all of the compensation is met with land acquisition, the total land improvement costs are estimated to cost $51,875.

COMPENSATORY MITIGATION LAND LONG-TERM MANAGEMENT

1. **Long-term Management Requirements**: Long-term management is required to ensure that the compensation lands are managed and maintained to protect desert tortoise. This may include maintenance of signs, fences, removal of invasive weeds, and elimination of unauthorized use.

2. **Long-term Management Plan:** The owner of or the entity responsible for management of the compensation lands shall prepare a Management Plan for the compensation lands. The Management Plan shall reflect site-specific enhancement measures on the acquired compensation lands. The plan shall be submitted for approval of the CPM, in consultation with CDFG, BLM and USFWS.

3. **Long-term Management Costs:** For those compensation lands that are donated to or owned by the BLM, the long-term management costs will be determined by BLM in consultation with the CDFG, CEC, and USFWS.

   For those compensation lands that are donated to or owned by a state land management agency or a non-profit organization, the Project owner shall provide money to establish an account with a non-wasting capital that will be used to fund the long-term maintenance and management of the compensation lands. The amount of money to be paid will be determined through an approved PAR or PAR-like analysis conducted for the compensation lands.

   The CPM will consult with the project owner and CDFG before deciding whether to approve an entity to hold the project's long-term maintenance and management funds on any lands. For any compensation lands that are not managed by a federal land management agency, the CPM, in consultation with the project owner and CDFG, will designate another state agency or non-profit organization to hold the long-term maintenance and management fee if the organization is qualified to manage the compensation lands in perpetuity.

   If CDFG takes fee title to the compensation lands, CDFG shall determine whether it will hold the long-term management fee in the special deposit fund, leave the money in the REAT Account, or designate another entity to manage the long-term maintenance and management fee for CDFG and with CDFG supervision.

   The long-term maintenance and management fee holder/manager shall be subject to the following conditions:

   I. Interest. Interest generated from the initial capital shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action approved by CDFG designed to protect or improve the habitat values of the compensation lands.

II. Withdrawal of Principal. The long-term maintenance and management fee principal shall not be drawn upon unless such withdrawal is deemed necessary by the CPM, in consultation with CDFG, or the approved third-party long-term maintenance and management fee manager to ensure the continued viability of the species on the compensation lands. If CDFG takes fee title to the compensation lands, monies received by CDFG pursuant to this provision shall be deposited in a special deposit fund established solely for the purpose to manage lands in perpetuity unless CDFG designates NFWF or another entity to manage the long-term maintenance and management fee for CDFG.

III. Pooling Funds. A CPM- approved non-profit organization qualified to hold long-term maintenance and management fees solely for the purpose to manage lands in perpetuity, may pool the fund with other funds for the operation, management, and protection of the compensation lands for local populations of desert tortoise. However, for reporting purposes, the long-term maintenance and management fee fund must be tracked and reported individually to the CDFG and CPM.

IV. Reimbursement Fund. The project owner shall provide reimbursement to CDFG or an approved third party for reasonable expenses incurred during title, easement, and documentation review

Long-term management on compensatory lands required for the Energy Commission and CESA is estimated to be $692 per acre based on comparable costs. If 207.5 acres are acquired and donated to a state land management agency or non-profit organization for long-term management, the total cost of this activity is estimated to be $51,875. This amount shall be adjusted based on final analysis and/or a PAR analysis.

If the compensation lands required for the Energy Commission and CESA are administered with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the project owner shall pay the following additional fees:

1. Project Specific Account Establishment - $12,000

2. Pre-proposal RFP or RFP procession - $30,000

3. Management fee for acquisition and enhancement – 3% of all acquisition and enhancement costs

4. Management fee for long-term management account – 1% of long-term management costs

COMPENSATORY MITIGATION LAND FUNDS

1. **Compensation Mitigation Fund**: The project owner shall provide funding for acquisition, improvement, and long-term management of desert tortoise compensation land. The current estimated funding shall be $ based on the costs itemized below and assuming all mitigation is provided by land acquisition and NFWF is responsible for long-term management. This amount shall be updated and verified prior to payment and shall be adjusted to reflect actual costs or more current estimates during phasing.

EXAMPLE of TOTAL COMPENSATION LAND COSTS

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	207.5	207.5	207.5
Parcels Purchased	0.3	0.3	0.3
Land Acquisition Cost	$124,278	$127,846	$138,169
Land Improvement Cost	$51,875	$51,875	$51,875
Long-term Management Cost	$143,590	$143,590	$143,590
NFWF Fees	$47,163	$0	$47,581
TOTAL	$366,855	$323,311	$381,215

2. **Fund Payment**: Because the project is phased, the mitigation funding will also be phased. The phasing of funding will ensure that the security is in place to ensure mitigation for any impact before it occurs. This will be accomplished by requiring funding for all the mitigation necessary to mitigate the impacts associated with a specific phase. Specific payments shall reflect the approach chosen by the project owner for land acquisition and shall include funds for land enhancement and long-term management consistent with the amount of land to be disturbed during each phase. The project owner shall make the following compensatory mitigation payments based on the following project phasing.

TIME	PROJECT ACTIVITY	MITIGATION PAYMENT
Phase 1a – October 2010	Start of construction, no more than 250 acres of site disturbance activities. (Note: No MFTL habitat will be impacted.)	$0
Phase 1b	Completion ~~on~~<of> Phase 1 construction (275 MW on ~~2,077~~<1,626> additional acres) (Note: No MFTL habitat will be impacted.)	$0
Phase 2	Initiation and completion of Phase 2 (~~575~~<the remaining> MW on ~~3,888~~<2,737> acres)	$381,215 less adjustments for land acquisition method, and land improvement costs

3. **REAT/NFWF Payment**: If the project owner elects to comply with the requirements in this condition for acquisition, initial improvement, long-term maintenance and management, or any combination of these three requirements by providing funds to implement those measures into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the Project owner shall make an initial deposit to the REAT Account in an amount equal to the estimated costs of administering these requirements.

   If the actual cost of the acquisition, initial protection and habitat improvements, or long-term funding is more than the estimated amount initially paid by the project owner, the project owner shall make an additional deposit into the REAT Account sufficient to cover the actual acquisition costs, the actual costs of initial protection and habitat improvement on the compensation lands, or the long-term funding requirements as established in an approved PAR or PAR-like analysis. If those actual costs or PAR projections are less than the amount initially transferred by the applicant, the remaining balance shall be returned to the project owner.

4. **Security**: The Project owner shall provide financial assurances to the CPM with copies of the document(s) to BLM, CDFG and the USFWS, to guarantee that an adequate level of funding is available to implement the mitigation required by this condition is available prior to the start of ground-disturbing activities for each phase of the project discussed in the described in section 2 immediately above.

   The CPM may use money from the Security solely for implementation of the requirements of this condition or if nesting of mitigation is obtained, to satisfy the conditions of BIO-12 and BIO-17. The CPM's use of the security to implement measures in this condition may not fully satisfy the Project owner's obligations under this condition. Any amount of the Security that is not used to carry out mitigation shall be returned to the Project owner upon successful completion of the associated requirements in this condition. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the Project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security.

   The amount of the Security shall correspond to the mitigation fund payments described in "fund payment" above.

5. **Audit**: The project owner may request the CPM to for an independent audit of the compensatory mitigation funds.

Verification: The project owner shall provide the CPM with written notice of intent to start ground disturbance at least 30 days prior to the start of ground-disturbing activities on the project site.

If the mitigation actions required under this condition are not completed prior to the start of ground-disturbing activities, the Project owner shall provide the CPM and CDFG with an approved Security in accordance with this condition of certification 30 days prior to beginning Project ground-disturbing activities. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security. The project owner, or an approved third party, shall complete and provide written verification to the CPM, CDFG, BLM and USFWS of the compensation lands acquisition and transfer within 18 months of the start of Project ground-disturbing activities.

No later than 12 months after the start of any phase of ground-disturbing project activities, the project owner shall submit a formal acquisition proposal to the CPM describing the parcels intended for purchase, and shall obtain approval from the CPM, in consultation with CDFG, BLM and USFWS, prior to the acquisition. If NFWF or another approved third party is handling the acquisition, the project owner shall fully cooperate with the third party to ensure the proposal is submitted within this time period. The project owner or an approved third party shall complete the acquisition and all required transfers of the compensation lands, and provide written verification to the CPM, CDFG, BLM and USFWS of such completion, no later than 18 months after the issuance of the Energy Commission Decision. If NFWF or another approved third party is being used for the acquisition, the project owner shall ensure that funds needed to accomplish the acquisition are transferred in timely manner to facilitate the planned acquisition and to ensure the land can be acquired and transferred prior to the 18-month deadline.

The project owner shall complete and submit to the CPM a PAR or PAR-like analysis no later than 60 days after the CPM approves compensation lands for acquisition associated with any phase of construction. The project owner shall fully fund the required amount for long-term maintenance and management of the compensation lands for that phase of construction no later than 30 days after the CPM approves a PAR or PAR-like analysis of the anticipated long-term maintenance and management costs of the compensation lands. Written verification shall be provided to the CPM and CDFG to confirm payment of the long-term maintenance and management funds.

No later than 60 days after the CPM determines what activities are required to provide for initial protection and habitat improvement on the compensation lands for any phase of construction, the project owner shall make funding available for those activities and provide written verification to the CPM of what funds are available and how costs will be paid. Initial protection and habitat improvement activities on the compensation lands for that phase of construction shall be completed, and written verification provided to the

CPM, no later than six months after the CPM's determination of what activities are required on the compensation lands.

If a third party is responsible for management of the compensation lands shall provide the CPM, they shall provide the CDFG, BLM and USFWS with a management plan for the compensation lands associated with any phase of construction within 180 days of the land or easement purchase, as determined by the date on the title. The CPM, in consultation with CDFG, BLM and the USFWS, shall approve the management plan after its content is acceptable to the CPM.

Within 90 days after completion of all project related ground disturbance, the project owner shall provide to the CPM, CDFG, BLM and USFWS an analysis, based on aerial photography, with the final accounting of the amount of habitat disturbed during Project construction. This shall be the basis for the final number of acres required to be acquired.

DESERT TORTOISE COMPENSATORY MITIGATION

BIO-17 To fully mitigate for habitat loss and potential take of desert tortoise, the project owner shall acquire, protect, and transfer no fewer than ~~14,365~~<10,295> acres of desert tortoise habitat lands, shall provide funding for the initial improvement and long-term maintenance and management of the acquired lands for protection of the desert tortoise, and comply with other related requirements of this condition. This acreage was calculated as follows: a ratio of 1:1 for the entire project area (~~6,215~~<4,613> acres)~~ and~~<,> an additional 2:1 ratio for ~~4,075~~<2,103> acres of the project area north of the BNSF railroad tracks <and an additional 4:1 ratio for 369 acres North of Phase 1 >(i.e., a total ratio of 1:1 on ~~2,140~~<2,141> acres~~ and~~<,> a total ratio of 3:1 on ~~4,075~~<2,103 acres and a total ratio of 5:1 on 369> acres).

Desert Tortoise Compensation Acreage Summary

Location	Project Impact Acreage	Mitigation Ratio	Compensation Acreage
South of BNSF RR	~~2,140~~<2,141> acres	1:1	~~2,140~~<2,141> acres
North of BNSF RR	~~4,075~~<2,103> acres	3:1	~~12,225~~<6,309> acres
<North of Phase 1>	<369 acres>	<5:1>	<1,845 acres>
Total	~~6,215~~<4,613> acres		~~14,365~~<10,295> acres

Of this compensatory mitigation, ~~6,215~~<4,613> acres meet requirements of BLM and ~~8,150~~<5,682> acres represent additional requirements of the State of California.

These impact acreages shall be adjusted to reflect the final project footprint. For purposes of this condition, the Project footprint means all lands disturbed in the construction and operation of the Calico Solar Project, including all linear project components, as well as undeveloped areas inside the Project's boundaries that will no longer provide viable long-term habitat for the desert tortoise.

These impact acreages may also be adjusted to reflect approval by BLM to meet their portion of the compensatory mitigation requirements, in whole or in part, through "habitat enhancement actions" rather than the purchase and donation of compensation lands.

Implementation and funding of this mitigation shall be phased to ensure that appropriate compensation lands and/or funding reflect the phasing of actual project impacts and will ensure that all impacts are fully compensated prior to occurring.

COMPENSATORY MITIGATION LAND ACQUISITION

1. **Method of Acquisition.** To the extent that these mitigation requirements are met through the purchase of compensation lands, these lands shall be acquired in whole or in part either by:

   a. The project owner for donation, as approved by the BLM for BLM required mitigation and the CPM for state required mitigation, to a state or federal land management agency or non-profit land management organization,

   b. The BLM with funds provided by the project owner,

   c. A third party approved by the BLM to acquire or donate the lands with funds provided by the project owner, or

   d. The National Fish and Wildlife Foundation (NFWF) with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account.

   If the project owner chooses to delegate responsibility for acquisition of all or portions of compensation lands to a third party such as a nongovernmental organization supportive of desert habitat conservation, such delegation shall be subject to approval by the CPM, in consultation with the project owner and CDFG, BLM and USFWS, prior to land acquisition, enhancement or management activities. The CPM shall indicate their approval or disapproval within 30 days of receipt of the project owner's delegation proposal. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be executed and implemented within 18 months of the Energy Commission's certification of the project or initiation of each phase of the project.

2. **Selection Criteria for Compensation Lands**. The compensation lands selected for acquisition to meet BLM requirements and to meet Energy Commission and CESA requirements shall be equal to or better than the quality and function of the desert tortoise habitat impacted and:

   a. Be within the Western Mojave Recovery Unit, with potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise designated critical habitat, known populations of desert tortoise, and/or other preserve lands;

   b. Provide habitat for desert tortoise with capacity to regenerate naturally when disturbances are removed;

   c. Be near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long-term by a public resource agency or a non-governmental organization dedicated to habitat preservation;

d. Be contiguous and biologically connected to lands currently occupied by desert tortoise, ideally with populations that are stable, recovering, or likely to recover;

e. Not have a history of intensive recreational use or other disturbance that might cause future erosion damage or other habitat damage, and make habitat recovery and restoration infeasible;

f. Not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration; and

g. Not contain hazardous wastes that cannot be removed to the extent that the site could not provide suitable habitat; and

h. Have water and mineral rights included as part of the acquisition, unless the CPM, in consultation with CDFG, BLM and USFWS, agrees in writing to the acceptability of land without these rights.

These requirements may be adjusted upon mutual agreement with the resource agencies (CEC, CDFG, BLM, and USFWS) depending on the specific lands available and in consideration of larger desert tortoise mitigation efforts.

3. **Review and Approval of Compensation Lands Prior to Acquisition**. If the project owner assumes responsibility for acquiring the compensation lands to meet Energy Commission and CESA requirements, the project owner shall submit a formal acquisition proposal to the CPM describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands for desert tortoise in relation to the criteria listed above and must be approved by the CPM. The CPM will share the proposal with and consult with CDFG, BLM and the USFWS before deciding whether to approve or disapprove the proposed acquisition. The CPM shall provide a written response and explanation to the project owner within 30 days of receiving the proposal.

4. **Compensation Lands Acquisition Conditions**: If the project owner assumes responsibility to acquire the compensation lands to meet Energy Commission and CESA requirements, the project owner shall comply with the following conditions relating to acquisition of the compensation lands after the CPM, in consultation with CDFG, BLM and the USFWS, has approved the proposed compensation lands:

a. Preliminary Report: The Project owner, or approved third party, shall provide a recent preliminary title report, initial hazardous materials survey report, biological analysis, and other necessary documents for the proposed compensation land to the CPM. All documents conveying

or conserving compensation lands and all conditions of title are subject to review and approval by the CPM, in consultation with CDFG, BLM and the USFWS. For conveyances to the State, approval may also be required from the California Department of General Services, the Fish and Game Commission and the Wildlife Conservation Board.

b. Title/Conveyance: The Project owner shall acquire and transfer fee title to the compensation lands, a conservation easement over the lands, or both fee title and conservation easement as required by the CPM in consultation with CDFG. Any transfer of a conservation easement or fee title must be to CDFG, a non-profit organization qualified to hold title to and manage compensation lands (pursuant to California Government Code section 65965), to the BLM, or other public agency approved by the CPM in consultation with CDFG. If an approved nonprofit organization holds fee title to the compensation lands, a conservation easement shall be recorded in favor of CDFG or another entity approved by the CPM.

c. Property Analysis Record. Upon identification of the compensation lands, the Project owner shall conduct a Property Analysis Record (PAR) or PAR-like analysis to establish the appropriate amount of the long-term maintenance and management fund to pay the in-perpetuity management of the compensation lands. The PAR or PAR-like analysis must be approved by the CPM, in consultation with CDFG, before it can be used to establish funding levels or management activities for the compensation lands.

5. **Compensation Lands Acquisition Costs**: If the project owner assumes responsibility to acquire all or a part of the compensation lands to meet Energy Commission and CESA requirements, the project owner shall fund the following items in addition to actual land costs:

   a. Level 1 Environmental Site Assessment,

   b. Appraisal,

   c. Closing and Escrow costs,

   d. Biological survey for determining mitigation value of the land, and

   e. Agency costs to accept the land.

   If the project owner uses BLM to acquire all or a portion of the compensation lands, the project owner shall provide the BLM with funds for items a. to e. above as well as actual land costs.

   If the project owner uses in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish

and Wildlife Foundation (NFWF) to acquire some or all of the compensation lands, the project owner shall provide funds for items a. to e. above as well as actual land costs and third party administrative costs. The project owner shall provide reimbursement to CDFG or an approved third party for reasonable expenses incurred during title, easement, and documentation review; expenses incurred by other State or State-approved outside consultants.

Estimated costs associated with acquisition of compensation lands are:

ESTIMATED LAND ACQUISITION COSTS PER ACRE OR PARCEL

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Land cost/acre	Covered by Owner	$500	$500
Level 1 Environmental Site Assessment / parcel	Covered by Owner	$3,000	$3,000
Appraisal/parcel	Covered by Owner	$5,000	$5,000
Closing and Escrow Costs/parcel	Covered by Owner	$5,000	$5,000
Biological Survey/parcel	Covered by Owner	$5,000	$5,000
3rd Party Admin. Costs/parcel	$0	$0	10% of land cost
Agency Cost to Accept	$17.6% of land cost	$17.6% of land cost	17.6% of land cost

These costs are current estimates and shall be modified based on actual costs or with the concurrence of the REAT agencies. The land cost per acre is based on actual acquisition costs by the BLM in San Bernardino County. The number of parcels are estimated based on 640 acres per parcel.

TOTAL ESTIMATED LAND ACQUISITION COSTS
(based on agency estimated costs)

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	~~14,365~~<10,295>	~~14,365~~<10,295>	~~14,365~~<10,295>
Parcels Purchased	~~22.4~~<16.1>	~~22.4~~<16.1>	~~22.4~~<16.1>
Land cost	Covered by Owner ($~~7,182,500~~<5,147,500>)	$~~7,182,500~~<5,147,500>	$~~7,182,500~~<5,147,500>
Level 1 Environmental Site Assessment	Covered by Owner ($~~22,445~~<48,258>)	$~~67,336~~<48,258>	$~~67,336~~<48,258>
Appraisal	Covered by Owner ($~~56,113~~<80,430>)	$~~112,227~~<80,430>	$~~112,227~~<80,430>
Closing and Escrow Costs	Covered by Owner ($~~56,113~~<80,430>)	$~~112,227~~<80,430>	$~~112,227~~<80,430>
Biological Survey	Covered by Owner ($~~56,113~~<80,430>)	$~~112,227~~<80,430>	$~~112,227~~<80,430>
3rd Party Admin. Costs	$0	$0	$~~718,250~~<514,750>
Agency Cost to Accept	$~~1,260,529~~<903,386>	$~~1,264,120~~<903,386>	$~~1,260,529~~<903,386>
TOTAL	$~~8,600,146~~<6,340,433>	$~~8,850,636~~<6,340,433>	$~~9,565,294~~<6,855,183>

COMPENSATORY MITIGATION LAND IMPROVEMENT

1. **Land Improvement Requirements**: The Project owner shall fund activities that the CPM, in consultation with the CDFG, USFWS and BLM, requires for the initial protection and habitat improvement of the compensation lands. These activities will be implemented by the state or federal land management agency or non-profit organization holding the land or their representative. The specific activities will vary depending on the condition and location of the land acquired but may include:

    - Installation of signs,
    - Removal of trash,
    - Construction and repair of fences,
    - Surveys of boundaries and property lines,
    - Removal of invasive plants,
    - Removal of roads,
    - And similar measures to protect habitat and improve habitat quality.

2. **Compensation Lands Improvement Costs**: Land improvement costs will vary depending on the activities undertaken. The cost of those actions may range between $25 per acre to $250 per acre and are estimated to be $250 per acre for this project.

    Assuming all of the compensation is met with land acquisition, the total land improvement costs are estimated to be $~~3,591,250.~~<2,573,750.> This amount will be reduced to the extent that direct habitat enhancements are used to satisfy some or all of the BLM's compensatory mitigation requirements.

COMPENSATORY MITIGATION LAND LONG-TERM MANAGEMENT

1. **Long-term Management Requirements**: Long-term management is required to ensure that the compensation lands are managed and maintained to protect desert tortoise. This may include maintenance of signs, fences, removal of invasive weeds, and elimination of unauthorized use.

2. **Long-term Management Plan:** The owner of or the entity responsible for the management of the compensation lands shall prepare a Management Plan for the compensation lands. The Management Plan shall reflect site-specific enhancement measures on the acquired compensation lands. The

plan shall be submitted for approval of the CPM, in consultation with CDFG, BLM and USFWS.

3. **Long-term Management Costs:** For those compensation lands that are donated to or owned by the BLM, the long-term management costs will be determined by BLM in consultation with the CDFG, CEC, and USFWS.

   For those compensation lands that are donated to or owned by a state land management agency or a non-profit organization, the Project owner shall provide money to establish an account with a non-wasting capital that will be used to fund the long-term maintenance and management of the compensation lands. The amount of money to be paid will be determined through an approved PAR or PAR-like analysis conducted for the compensation lands.

   The CPM will consult with the project owner and CDFG before deciding whether to approve an entity to hold the project's long-term maintenance and management funds on any lands. For any compensation lands that are not managed by a federal land management agency, the CPM, in consultation with the project owner and CDFG, will designate another state agency or non-profit organization to hold the long-term maintenance and management fee if the organization is qualified to manage the compensation lands in perpetuity.

   If CDFG takes fee title to the compensation lands, CDFG shall determine whether it will hold the long-term management fee in the special deposit fund, leave the money in the REAT Account, or designate another entity to manage the long-term maintenance and management fee for CDFG and with CDFG supervision.

   The following conditions shall apply to the long-term maintenance and management funds:

   I. Interest. Interest generated from the initial capital shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action approved by CDFG designed to protect or improve the habitat values of the compensation lands.

   II. Withdrawal of Principal. The long-term maintenance and management fee principal shall not be drawn upon unless such withdrawal is deemed necessary by the CPM, in consultation with CDFG, or the approved third-party long-term maintenance and management fee manager to ensure the continued viability of the species on the compensation lands. If CDFG takes fee title to the

compensation lands, monies received by CDFG pursuant to this provision shall be deposited in a special deposit fund established solely for the purpose to manage lands in perpetuity unless CDFG designates NFWF or another entity to manage the long-term maintenance and management fee for CDFG.

III. Pooling Funds. A CPM- approved non-profit organization qualified to hold long-term maintenance and management fees solely for the purpose to manage lands in perpetuity, may pool the fund with other funds for the operation, management, and protection of the compensation lands for local populations of desert tortoise. However, for reporting purposes, the long-term maintenance and management fee fund must be tracked and reported individually to the CDFG and CPM.

Long-term management on compensatory lands is estimated to be $692 per acre based on comparable cases. If ~~14,365~~<10,295> acres are acquired, the total cost of this activity is estimated to be $~~9,940,580.~~<7,124,140.> This amount shall be adjusted based on final analysis and/or a PAR analysis.

If the compensation lands required for the Energy Commission and CESA are administered with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the project owner shall pay the following additional fees:

1. Project Specific Account Establishment - $12,000

2. Pre-proposal RFP or RFP procession - $30,000

3. Management fee for acquisition and enhancement – 3% of all acquisition and enhancement costs

4. Management fee for long-term management account – 1% of long-term management costs

COMPENSATORY MITIGATION LAND FUNDS

1. **Compensation Mitigation Fund**: The project owner shall provide funding for acquisition, improvement, and long-term management of desert tortoise compensation land. The current estimated funding shall be $~~34,523,046~~<16,871,970> based on the costs itemized below and assuming all mitigation is provided by land acquisition and NFWF is responsible for long-term management. This amount shall be updated and verified prior to payment and shall be adjusted to reflect actual costs or more current estimates during phasing.

EXAMPLE of TOTAL COMPENSATION LAND COSTS

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	~~14,365~~<10,295>	~~6215~~<10,295>	~~8150~~<10,295>
Parcels Purchased	~~22.4~~<16.1>	~~22.4~~<16.1>	~~22.4~~<16.1>
Land Acquisition Cost	$~~8,600,146~~<6,340,433>	$~~8,850,636~~<6,340,433>	$~~9,565,294~~<6,855,183>
Land Improvement Cost	$~~3,591,250~~<2,573,750>	$~~3,591,250~~<2,573,750>	$~~3,591,250~~<2,573,750>
Long-term Management Cost	$~~9,940,580~~<7,124,140>	$~~9,940,580~~<7,124,140>	$~~9,940,580~~<7,124,140>
NFWF Fees	$~~399,410~~<303,454>	$0	$~~428,365~~<318,897>
TOTAL	$~~22,531,386~~<16,341,778>	$~~22,382,466~~<16,038,323>	$~~23,525,489~~<16,871,970>

2. **Fund Payment**: Because the project is phased, the mitigation funding will also be phased. The phasing of funding will ensure that the security is in place to ensure mitigation for any impact before it occurs. This will be accomplished by requiring funding for all the mitigation necessary to mitigate the impacts associated with a specific phase. Specific payments shall reflect the approach chosen by the project owner for land acquisition and shall include funds for land enhancement and long-term management consistent with the amount of land to be disturbed during each phase. The project owner shall make the following compensatory mitigation payments based on the following project phasing:

TIME	PROJECT ACTIVITY	MITIGATION PAYMENT
Phase 1a – October 2010	Start of desert tortoise translocation followed by no more than 250 acres of site disturbance activities<. 56 acres to be mitigated at a 1:1 ratio and 194 acres> to be mitigated at a 3:1 ratio for a total of ~~750~~<638> acres or ~~1.2~~<1.0> ~~parcels~~<parcel>	$~~1,268,078~~<1,084,984>
Phase 1b (Estimated to occur after the Close of Financing during the 1st quarter 2011)	Completion on Phase 1 construction of 275 MW on an ~~2,077~~<1,626> additional acres to be mitigated at a 3:1 ratio for a total of ~~6,231~~<4,878> additional acres or ~~9.7~~<7.6> parcels	$~~10,186,260~~<7,974,414> less adjustments from ~~phase~~<Phase> 1a and for ~~phase~~<Phase> 1 b for land acquisition method, and land improvement, long-term management costs, and habitat enhancement actions
Phase 2	Initiation and completion of Phase 2 (~~575~~<remaining> MW<)> on ~~3,888~~<2085> acres~~)~~< to be mitigated at a 1:1 ratio, 283 acres to be mitigated at a 3:1 ratio, and 369 acres to be mitigated at a 5;1 ratio for a total of 4,779 acres or 7.5 parcels>	$~~12,071,151~~<7,812,572> less adjustments from ~~phase~~<Phase> 1 b for habitat enhancement actions, land acquisition method, and land improvement costs

3. **REAT/NFWF Payment**: If the project owner elects to comply with the requirements in this condition for acquisition, initial improvement, long-term maintenance and management, or any combination of these three requirements by providing funds to implement those measures into the

Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the Project owner shall make an initial deposit to the REAT Account in an amount equal to the estimated costs of administering these requirements.

If the actual cost of the acquisition, initial protection and habitat improvements, or long-term funding is more than the estimated amount initially paid by the project owner, the project owner shall make an additional deposit into the REAT Account sufficient to cover the actual acquisition costs, the actual costs of initial protection and habitat improvement on the compensation lands, or the long-term funding requirements as established in an approved PAR or PAR-like analysis. If those actual costs or PAR projections are less than the amount initially transferred by the applicant, the remaining balance shall be returned to the project owner.

4. **Security**: The Project owner shall provide financial assurances to the CPM with copies of the document(s) to BLM, CDFG and the USFWS, to guarantee that an adequate level of funding is available to implement the mitigation required by this condition is available prior to the start of ground-disturbing activities for each phase of the project discussed in the described in section 2 immediately above.

   The CPM may use money from the Security solely for implementation of the requirements of this condition or if nesting of mitigation is obtained, to satisfy the conditions of BIO-12 and BIO-13. The CPM's use of the security to implement measures in this condition may not fully satisfy the Project owner's obligations under this condition. Any amount of the Security that is not used to carry out mitigation shall be returned to the Project owner upon successful completion of the associated requirements in this condition. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the Project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security.

   The amount of the Security shall correspond to the mitigation fund payments described in "fund payment" above.

5. **Audit**: The project owner may request the CPM to for an independent audit of the compensatory mitigation funds.

Verification: The project owner shall provide the CPM with a description of the phasing of the project's construction and ground disturbing activities at least 30 days prior to ground disturbing activities.

The project owner shall provide written notice of intent to start ground disturbance for any phase of project construction at least 30 days prior to the start of those activities on the project site.

If the mitigation actions required under this condition are not completed prior to the start of ground-disturbing activities, the Project owner shall provide the CPM and CDFG with an approved Security in accordance with this condition of certification prior to beginning Project ground-disturbing activities. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security. The project owner, or an approved third party, shall complete and provide written verification to the CPM, CDFG, BLM and USFWS of the compensation lands acquisition and transfer within 18 months of the start of Project ground-disturbing activities.

No later than 12 months after the start of any phase of ground-disturbing project activities, the project owner shall submit a formal acquisition proposal to the CPM describing the parcels intended for purchase, and shall obtain approval from the CPM, in consultation with CDFG, BLM and USFWS, prior to the acquisition. If NFWF or another approved third party is handling the acquisition, the project owner shall fully cooperate with the third party to ensure the proposal is submitted within this time period. The project owner or an approved third party shall complete the acquisition and all required transfers of the compensation lands, and provide written verification to the CPM, CDFG, BLM and USFWS of such completion, no later than 18 months after the issuance of the Energy Commission Decision. If NFWF or another approved third party is being used for the acquisition, the project owner shall ensure that funds needed to accomplish the acquisition are transferred in timely manner to facilitate the planned acquisition and to ensure the land can be acquired and transferred prior to the 18-month deadline.

The project owner shall complete and submit to the CPM a PAR or PAR-like analysis no later than 60 days after the CPM approves compensation lands for acquisition associated with any phase of construction. The project owner shall fully fund the required amount for long-term maintenance and management of the compensation lands for that phase of construction no later than 30 days after the CPM approves a PAR or PAR-like analysis of the anticipated long-term maintenance and management costs of the compensation lands. Written verification shall be provided to the CPM and CDFG to confirm payment of the long-term maintenance and management funds.

No later than 60 days after the CPM determines what activities are required to provide for initial protection and habitat improvement on the compensation lands for any phase of construction, the project owner shall make funding available for those activities and provide written verification to the CPM of what funds are available and how costs will be paid. Initial protection and habitat improvement activities on the compensation lands for that phase of construction shall be completed, and written verification provided to the

CPM, no later than six months after the CPM's determination of what activities are required on the compensation lands.

The land management entity, shall provide the CPM, CDFG, BLM and USFWS with a management plan for the compensation lands associated with any phase of construction within 180 days of the land or easement purchase, as determined by the date on the title. The CPM, in consultation with CDFG, BLM and the USFWS, shall approve the management plan after its content is acceptable to the CPM.

Within 90 days after completion of all project related ground disturbance, the project owner shall provide to the CPM, CDFG, BLM and USFWS an analysis, based on aerial photography, with the final accounting of the amount of habitat disturbed during Project construction. This shall be the basis for the final number of acres required to be acquired.

RAVEN MONITORING, MANAGEMENT, AND CONTROL PLAN

BIO-18 The project owner shall design and implement a Raven Monitoring, Management, and Control Plan (Raven Plan) that is consistent with the most current USFWS-approved raven management guidelines and that meets the approval of the USFWS, CDFG, and the CPM. Any subsequent modifications to the approved Raven Plan shall be made only with approval of the CPM in consultation with USFWS and CDFG. The Raven Plan shall include but not be limited to a program to monitor increased raven presence in the Project vicinity and to implement raven control measures as needed based on that monitoring. The purpose of the plan is to avoid any Project-related increases in raven numbers during construction, operation, and decommissioning. The threshold for implementation of raven control measures shall be any increases in raven numbers from baseline conditions, as detected by monitoring to be proposed in the Raven Plan. Regardless of raven monitoring results, the project owner shall be responsible for all other aspects of the Raven Plan, including avoidance and minimization of project-related trash, water sources, or perch/roost sites that could contribute to increased raven numbers. In addition, to offset the cumulative contributions of the Project to desert tortoise from increased raven numbers, the Project owner shall also contribute to the USFWS Regional Raven Management Program. The Project owner shall do all of the following:

1. Prepare and Implement a Raven Management Plan that includes the following:

    a. Identify conditions associated with the Project that might provide raven subsidies or attractants;

    b. Describe management practices to avoid or minimize conditions that might increase raven numbers and predatory activities;

    c. Describe control practices for ravens;

    d. Address monitoring and nest removal during construction and for the life of the Project, and;

    e. Discuss reporting requirements.

2. Contribute to the USFWS Regional Raven Management Program. The project owner shall submit a one-time or annual payments to the project sub-account of the REAT Account held by the National Fish and Wildlife Foundation (NFWF) to support the USFWS Regional Raven Management Program. For each phase, the amount of the one-time payment shall be $105 per acre of permanent disturbance ($~~652,175~~<26,250 for Phase 1a, $170,730 for Phase 1b, and $287,385 for Phase 2>). If project owner

chooses to make annual payments instead of the one-time payment, the annual payment per acre of permanent disturbance, for each phase, shall be calculated each year by USFWS and the initial annual payment is estimated to be $7.50 per acre of permanent disturbance.

Verification: No later than 30 days prior to the start of construction, the project owner shall provide written verification to the CPM that NFWF has received and accepted payment into the project's sub-account of the REAT Account to support the USFWS Regional Raven Management Program.

No later than 30 days prior to any construction-related ground disturbance activities, the Project owner shall provide the CPM, USFWS, and CDFG with the final version of a Raven Plan. All modifications to the approved Raven Plan shall be made only with approval of the CPM in consultation with USFWS and CDFG.

Within 30 days after completion of Project construction, the Project owner shall provide to the CPM for review and approval, a written report identifying which items of the Raven Plan have been completed, a summary of all modifications to mitigation measures made during the Project's construction phase, and which items are still outstanding.

On January 31st of each year following construction the Designated Biologist shall provide a report to the CPM that includes: a summary of the results of raven management and control activities for the year; a discussion of whether raven control and management goals for the year were met; and recommendations for raven management activities for the upcoming year.

BURROWING OWL IMPACT AVOIDANCE AND MINIMIZATION MEASURES

BIO-21 The Project owner shall implement the following measures to avoid, minimize and offset impacts to burrowing owls. Nothing in this condition requires the project owner to conduct burrowing owl surveys by entering private lands adjacent to the project site when the project owner has made reasonable attempts to obtain permission to enter the property for survey work but was unable to obtain such permission. In this situation only, the project owner may substitute binocular surveys for protocol field surveys.

1. Pre-Construction Surveys. The Designated Biologist or Biological Monitor shall conduct pre-construction surveys for burrowing owls no more than 30 days prior to initiation of construction activities. Surveys shall be focused exclusively on detecting burrowing owls, and shall be conducted from two hours before sunset to one hour after or from one hour before to two hours after sunrise. The survey area shall include the Project Disturbance Area and surrounding 500 foot survey buffer.

2. Implement Avoidance Measures. If an active burrowing owl burrow is detected within 500 feet from the Project Disturbance Area the following avoidance and minimization measures shall be implemented:

    a. Establish Non-Disturbance Buffer. Fencing shall be installed at a 250-foot radius from the occupied burrow to create a non-disturbance buffer around the burrow. The non-disturbance buffer and fence line may be reduced to 160 feet if all Project-related activities that might disturb burrowing owls would be conducted during the non-breeding season (September 1st through January 31st). Signs shall be posted in English and Spanish at the fence line indicating no entry or disturbance is permitted within the fenced buffer.

    b. Monitoring: If construction activities would occur within 500 feet of the occupied burrow during the nesting season (February 1 – August 31st) the Designated Biologist or Biological Monitor shall monitor to determine if these activities have potential to adversely affect nesting efforts, and shall implement measures to minimize or avoid such disturbance.

3. Passive Relocation of Burrowing Owls. If pre-construction surveys indicate the presence of burrowing owls within the Project Disturbance Area (the Project Disturbance Area means all lands disturbed in the construction and operation of the Genesis Project), the Project owner shall prepare and implement a Burrowing Owl Relocation and Mitigation Plan, in addition to the avoidance measures described above. The final Burrowing Owl Relocation and Mitigation Plan shall be approved by the CPM, in

consultation with USFWS, BLM and CDFG, and shall:

a. Identify and describe suitable relocation sites within 1 mile of the Project Disturbance Area, and describe measures to ensure that burrow installation or improvements would not affect sensitive species habitat or existing burrowing owl colonies in the relocation area;

b. Provide guidelines for creation or enhancement of at least two natural or artificial burrows per relocated owl, including a discussion of timing of burrow improvements, specific location of burrow installation, and burrow design. Design of the artificial burrows shall be consistent with CDFG guidelines (CDFG 1995) and shall be approved by the CPM in consultation with CDFG, BLM and USFWS;

c. Passive relocation sites shall be in areas of suitable habitat for burrowing owl nesting, and be characterized by minimal human disturbance and access. Relative cover of non-native plants within the proposed relocation sites shall not exceed the relative cover of non-native plants in the adjacent habitats;

d. Provide detailed methods and guidance for passive relocation of burrowing owls occurring within the Project Disturbance Area; and

4. Acquire Compensatory Mitigation Lands for Burrowing Owls. The following measures for compensatory mitigation shall apply only if burrowing owls that are detected within the Project Disturbance Area. The Project owner shall acquire, in fee or in easement, 19.5 acres of land for each burrowing owl that is displaced by construction of the Project. This compensation acreage of 19.5 acres per single bird or pair of nesting owls assumes that there is no evidence that the compensation lands are occupied by burrowing owls. If burrowing owls are observed to occupy the compensation lands, then only 9.75 acres per single bird or pair is required, per CDFG (1995) guidelines. If the compensation lands are contiguous to currently occupied habitat, then the replacement ratio will be 13.0 acres per pair or single bird. The Project owner shall provide funding for the enhancement and long-term management of these compensation lands. The acquisition and management of the compensation lands may be delegated by written agreement to CDFG or to a third party, such as a non-governmental organization dedicated to habitat conservation, subject to approval by the CPM, in consultation with CDFG and USFWS prior to land acquisition or management activities. Additional funds shall be based on the adjusted market value of compensation lands at the time of construction to acquire and manage habitat. In lieu of acquiring lands itself, the Project owner may satisfy the requirements of this condition by depositing funds into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), as described in Section 3.i. of Condition of Certification BIO-17.

a. Criteria for Burrowing Owl Mitigation Lands. The terms and conditions of this acquisition or easement shall be as described in Paragraph 1 of **BIO-17** [Desert Tortoise Compensatory Mitigation], with the additional criteria to include: 1) the mitigation land must provide suitable habitat for burrowing owls, and 2) the acquisition lands must either currently support burrowing owls or be within dispersal distance from an active burrowing owl nesting territory (generally approximately 5 miles). The burrowing owl mitigation lands may be included with the desert tortoise mitigation lands ONLY if these two burrowing owl criteria are met. If the burrowing owl mitigation land is separate from the acquisition required for desert tortoise compensation lands, the Project owner shall fulfill the requirements described below in this condition.

b. Security. If burrowing owl mitigation land is separate from the acreage required for desert tortoise compensation lands the Project owner or an approved third party shall complete acquisition of the proposed compensation lands prior to initiating ground-disturbing Project activities. Alternatively, financial assurance can be provided by the Project owner to the CPM with copies of the document(s) to CDFG, BLM and the USFWS, to guarantee that an adequate level of funding is available to implement the mitigation measure described in this condition. These funds shall be used solely for implementation of the measures associated with the Project. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security") prior to initiating ground-disturbing Project activities. Prior to submittal to the CPM, the Security shall be approved by the CPM, in consultation with CDFG, BLM and the USFWS to ensure funding. The estimated costs of enhancement and endowment are discussed in condition BIO-17. The final amount due will be determined by the PAR analysis conducted pursuant to **BIO-17.**

Verification: If pre-construction surveys detect burrowing owls within 500 feet of proposed construction activities, the Designated Biologist shall provide to the CPM, BLM, CDFG and USFWS documentation indicating that non-disturbance buffer fencing has been installed at least 10 days prior to the start of any construction-related ground disturbance activities. The Project owner shall report monthly to the CPM, CDFG, BLM and USFWS for the duration of construction on the implementation of burrowing owl avoidance and minimization measures. Within 30 days after completion of construction the Project owner shall provide to the CPM, BLM, CDFG and USFWS a written construction termination report identifying how mitigation measures described in the plan have been completed.

If pre-construction surveys detect burrowing owls within the Project Disturbance Area, the Project owner shall notify the CPM, BLM, CDFG and USFWS no less than 10 days of completing the surveys that a relocation of owls is necessary. The Project owner shall do all of the following if relocation of one or more burrowing owls is required:

a. Within 30 days of completion of the burrowing owl pre-construction surveys, submit to the CPM, CDFG and USFWS a Burrowing Owl Relocation and Mitigation Plan.

b. No less than 90 days prior to acquisition of the burrowing owl compensation lands, the Project owner, or an approved third party, shall submit a formal acquisition proposal to the CPM, CDFG, and USFWS describing the ~~39-acre~~ parcel intended for purchase. At the same time the Project owner shall submit a PAR or PAR-like analysis for the parcels for review and approval by the CPM, CDFG and USFWS.

c. Within 90 days of the land or easement purchase, as determined by the date on the title, the Project owner shall provide the CPM with a management plan for review and approval, in consultation with CDFG, BLM and USFWS, for the compensation lands and associated funds.

d. No later than 30 days prior to the start of construction-related ground disturbing activities, the Project owner shall provide written verification of Security in accordance with this condition of certification.

e. No later than 18 months after the start of construction-related ground disturbance activities, the Project owner shall provide written verification to the CPM, BLM, CDFG and USFWS that the compensation lands or conservation easements have been acquired and recorded in favor of the approved recipient.

f. On January 31st of each year following construction for a period of five years, the Designated Biologist shall provide a report to the CPM, USFWS, BLM and CDFG that describes the results of monitoring and management of the burrowing owl relocation area. The annual report shall provide an assessment of the status of the relocation area with respect to burrow function and weed infestation, and shall include recommendations for actions the following year for maintaining the burrows as functional burrowing owl nesting sites and minimizing the occurrence of weeds.

STREAMBED IMPACT MINIMIZATION AND COMPENSATION MEASURES

BIO-26 The project owner shall implement the following measures to avoid, minimize and mitigate for direct and indirect impacts to jurisdictional waters of the State and to satisfy requirements of California Fish and Game Code sections 1600 and 1607. Throughout this condition, "jurisdictional" refers to streambeds or acreages of streambed meeting CDFG criteria as waters of the State.

Section A: Acquire Off-Site State Waters:

The project owner shall acquire, in fee or in easement, a parcel or parcels of land that includes no fewer than ~~288.8~~<152.3> acres of State jurisdictional waters. ~~At least 9.9 acres must contain microphyll woodland.~~ Prior to construction the applicant shall map the vegetation with emphasis on desert wash, including mircrophyll woodland, communities within the drainages subject to project disturbance and provide a map to the CPM, CDFG and BLM. ~~Impacts to 3.3 acres of catclaw acacia or smoke tree habitat lost will be mitigated at a minimum 3:1 ratio.~~ The parcel or parcels comprising the ~~288.8~~<152.3> acres of ephemeral washes shall include the same types of vegetation as mapped in the project footprint.

This compensation acreage may be included ("nested") within the acreage acquired and managed as desert tortoise habitat compensation (Condition of Certification **BIO-17)** only if:

- Adequate acreage of qualifying state-jurisdictional streambed delineated within the desert tortoise compensation lands;
- The desert tortoise habitat compensation lands are acquired and dedicated as permanent conservation lands within 18 months of the start of project construction.

If these two criteria are not met, then the project owner shall provide no fewer than ~~288.8~~<152.3> acres of state-jurisdictional streambed compensation lands independent of any compensation land required under other conditions of certification (adjusted to reflect the final project footprint and expert's delineation of streambed on the compensation lands), and shall also provide funding for the initial improvement and long-term maintenance and management of the acquired lands, and to comply with other related requirements this condition. Costs of these requirements cannot be estimated in advance because jurisdictional streambed would make up only a small portion of any acquired parcel and might vary widely among available parcels. In general, however, the total costs are estimated to include per-acre cost of the land itself at approximately $500, pre-acquisition liability surveys, appraisal fees, and other transaction costs, appraisal fees at $3,000 per parcel, $250

per acre for initial habitat improvement, BLM internal costs for transfer of land, and $692 per acre for long-term management, and (if applicable) NFWF management fees. (For cost estimates, see BIO-17.) The terms and conditions of this acquisition or easement shall be as described in Condition of Certification **BIO-17.** Mitigation for impacts to State waters shall occur within the surrounding watersheds, as close to the project site as possible.

The project owner may elect to comply with the requirements in this condition for acquisition of compensation lands, initial protection and habitat improvement on the compensation lands, or long-term maintenance and management of the compensation lands by funding, or any combination of these three requirements, by providing funds to implement those measures into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF). To use this option, the Project owner must make an initial deposit to the REAT Account in an amount equal to the estimated costs of implementing the requirement. If the actual cost of the acquisition, initial protection and habitat improvements, or long-term funding is more than the estimated amount initially paid by the project owner, the project owner shall make an additional deposit into the REAT Account sufficient to cover the actual acquisition costs, the actual costs of initial protection and habitat improvement on the compensation lands, or the long-term funding requirements as established in an approved PAR or PAR-like analysis. If those actual costs or PAR projections are less than the amount initially transferred by the applicant, the remaining balance shall be returned to the project owner.

The responsibility for acquisition of compensation lands may be delegated to a third party other than NFWF, such as a non-governmental organization supportive of desert habitat conservation, by written agreement of the Energy Commission. Such delegation shall be subject to approval by the CPM, in consultation with CDFG, BLM and USFWS, prior to land acquisition, enhancement or management activities. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be executed and implemented within 18 months of the Energy Commission's certification of the project.

Management Plan for Acquired Lands: The project owner shall prepare and submit to Energy Commission CPM and CDFG a draft Management Plan that reflects site-specific enhancement measures for the drainages on the acquired compensation lands. The objective of the Management Plan shall be to enhance the wildlife value of the drainages, and may include enhancement actions such as weed control, fencing to exclude livestock, or erosion control. Where applicable, the management plan should be integrated with desert tortoise compensation land habitat management planning requirements as described in **BIO-17.**

Section B: On-site Measures:

1. Copies of Requirements, Stop Work Authority: The project owner shall provide a copy of the Streambed Impact Minimization and Compensation Measures to all contractors, subcontractors, and the applicant's project supervisors. Copies shall be readily available at work sites at all times during periods of active work and must be presented to any CDFG personnel or personnel from another agency upon demand. The CPM reserves the right to issue a stop work order after giving notice to the project owner, if the CPM, in consultation with CDFG, determines that the project owner is not in compliance with any of the requirements of this condition, including but not limited to the existence of any of the following:

    a. The information provided by the applicant regarding streambed alteration is incomplete or inaccurate;

    b. New information becomes available that was not known to the Energy Commission at the time of project certification; or

    c. The project or project activities as described in the Supplemental Staff Assessment/Final Environmental Impact Statement have changed.

2. Best Management Practices: The project owner shall comply with the following conditions to protect drainages near the Project Disturbance Area:

    a. The project owner shall not operate vehicles or equipment in ponded or flowing water except as described in this condition.

    b. With the exception of the retention basins and drainage control system installed for the project the installation of bridges, culverts, or other structures shall be such that water flow (velocity and low flow channel width) is not impaired. Bottoms of temporary culverts shall be placed at or below stream channel grade.

    c. When any activity requires moving of equipment across a flowing drainage, such operations shall be conducted without substantially increasing stream turbidity.

    d. Vehicles driven across ephemeral drainages when water is present shall be completely clean of petroleum residue and water levels shall be below the vehicles’ axels.

    e. The project owner shall minimize road building, construction activities and vegetation clearing within ephemeral drainages to the extent feasible.

f. The project owner shall not allow water containing mud, silt, or other pollutants from grading, aggregate washing, or other activities to enter ephemeral drainages or be placed in locations that may be subjected to high storm flows.

g. The project owner shall comply with all litter and pollution laws. All contractors, subcontractors, and employees shall also obey these laws, and it shall be the responsibility of the project owner to ensure compliance.

h. Spoil sites shall not be located at least 30 feet from the boundaries and drainages or in locations that may be subjected to high storm flows, where spoils might be washed back into drainages.

i. Raw cement/concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances that could be hazardous to vegetation or wildlife resources, resulting from project-related activities, shall be prevented from contaminating the soil and/or entering waters of the State. These materials, placed within or where they may enter a drainage by the project owner or any party working under contract or with the permission of the project owner, shall be removed immediately.

j. No broken concrete, debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or washings thereof, oil or petroleum products or other organic or earthen material from any construction or associated activity of whatever nature shall be allowed to enter into, or placed where it may be washed by rainfall or runoff into, waters of the State.

k. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high water mark of any drainage.

l. No equipment maintenance shall occur within 150 feet of any ephemeral drainage where petroleum products or other pollutants from the equipment may enter these areas under any flow.

m. Stationary equipment such as motors, pumps, generators, and welders, located within or adjacent to a drainage shall be positioned over drip pans. Stationary heavy equipment shall have suitable containment to handle a catastrophic spill/leak. Clean up equipment such as booms, absorbent pads, and skimmers, shall be on site prior to the start of construction.

n. The cleanup of all spills shall begin immediately. The CDFG, BLM Wildlife Biologist, and CPM shall be notified immediately by the project

owner of any spills and shall be consulted regarding clean-up procedures.

3. Non-Native Vegetation Removal. The owner shall remove any non-native vegetation (Consistent with the Weed Management Plan, see Condition of Certification **BIO-1 1)** from any on-site portion of any drainage that requires the placement of a bridge, culvert or other structure. Removal shall be done at least twice annually (Spring/Summer) throughout the life of the Project.

4. Reporting of Special-Status Species: If any special-status species are observed on or in proximity to the project site, or during project surveys, the project owner shall submit California Natural Diversity Data Base (CNDDB) forms and maps to the CNDDB within five working days of the sightings and provide the regional CDFG office with copies of the CNDDB forms and survey maps. The CNDDB form is available online at http://www. dfg.ca.gov/whdab/pdfs/natspec.pdf. This information shall be mailed within five days to: California Department of Fish and Game, Natural Diversity Data Base, 1807 13th Street, Suite 202, Sacramento, CA 95814, (916) 324-3812. A copy of this information shall also be mailed within five days to CDFG, BLM Wildlife Biologist, and the CPM.

5. Notification: Prior to any activities that cross or have the potential to impact any jurisdictional drainage, the project owner shall provide a detailed map to the CDFG, BLM Wildlife Biologist, and CPM in a GIS format that identifies all potential crossings of jurisdictional habitats including retention basins, detention basins, reconfigured channels and culverts. The maps shall identify the type of crossing proposed by the owner such as bridges, culverts, or other mechanism and the best management practices that would be employed. The project owner shall notify the CPM, BLM Wildlife Biologist, and CDFG, in writing, at least five days prior to initiation of project activities in jurisdictional areas and at least five days prior to completion of project activities in jurisdictional areas. The project owner shall notify the CPM, BLM Wildlife Biologist, and CDFG of any change of conditions to the project, the jurisdictional impacts, or the mitigation efforts, if the conditions at the site of the proposed project change in a manner which changes risk to biological resources that may be substantially adversely affected by the proposed project. The notifying report shall be provided to the CPM, BLM Wildlife Biologist, and CDFG no later than 7 days after the change of conditions is identified. As used here, change of condition refers to the process, procedures, and methods of operation of a project; the biological and physical characteristics of a project area; or the laws or regulations pertinent to the project, as described below. A copy of the notifying change of conditions report shall be included in the annual reports.

a. Biological Conditions: a change in biological conditions includes, but is not limited to, the following: 1) the presence of biological resources within or adjacent to the project area, whether native or non-native, not previously known to occur in the area; or 2) the presence of biological resources within or adjacent to the project area, whether native or non-native, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations.

b. Physical Conditions: a change in physical conditions includes, but is not limited to, the following: 1) a change in the morphology of a river, stream, or lake, such as the lowering of a bed or scouring of a bank, or changes in stream form and configuration caused by storm events; 2) the movement of a river or stream channel to a different location; 3) a reduction of or other change in vegetation on the bed, channel, or bank of a drainage, or 4) changes to the hydrologic regime such as fluctuations in the timing or volume of water flows in a river or stream.

c. Legal Conditions: a change in legal conditions includes, but is not limited to, a change in Regulations, Statutory Law, a Judicial or Court decision, or the listing of a species, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations.

Verification: No fewer than 30 days prior to the start of any site or related facilities mobilization activities, the project owner shall implement the mitigation measures described in this condition. No fewer than 30 days prior to the start of work potentially affecting waters of the State, the project owner shall provide written verification (i.e., through incorporation into the BRMIMP) to the CPM and BLM Wildlife Biologist that the above best management practices will be implemented and provide a discussion of work in waters of the State in Compliance Reports for the duration of the project.

Within 30 days after completion of the first year of project construction, the project owner shall provide to the CPM for review and approval a report identifying that appropriate mitigation lands have been obtained, verification of the acreage of state jurisdictional streambeds on the compensation lands (to be delineated using methodology identical to the delineation of on-site jurisdictional streambeds), a draft Management Plan for review and approval by the CPM and CDFG, and verification on ongoing enhancement techniques, and a summary of all modifications made to the existing channels on the project site.

GEO-2 Because of the embankments on the downhill side, the proposed storm water detention basins constitute detention dams, some of which may be large enough to be under the jurisdiction of the State of California, Department of Water Resources, Division of Safety of Dams. Each detention dam site shall be characterized in a geotechnical investigation to establish foundation conditions and assess geologic hazards that affect embankment design. Appropriate geotechnical recommendations shall be provided for use in design and construction of the embankments and the associated storage area. All dams must be designed by a California licensed geotechnical or civil engineer familiar with design of small dams.

Verification: At least 60 days prior to ground breaking for the detention basins, the project owner shall submit a geotechnical investigation report covering each proposed detention basin. Appropriate geotechnical recommendations and specifications shall be provided for use in design and construction of the embankments and the associated storage area. All detention facilities can be included in a single report or in the overall final project geotechnical report. One set of stamped design drawings, typical of the detention dams, must be submitted by the project owner, prior to starting detention dam construction.

GEOLOGY AND PALEONTOLOGICAL RESOURCES

GEO-3 The California Department of Water Resources, Division of Safety of Dams reviews plans for all dams that impound 50 acre-feet of water or more. Embankments 6 feet high or less are excluded, regardless of storage capacity and embankments impounding less than 15 acre-feet of water are excluded, regardless of height. Any detention basin meeting the Division of Safety of Dams jurisdictional criteria for a dam shall be approved by the CPM after review by the Division of Safety of Dams.

Verification: If final detention basin design results in no jurisdictional dams, the project owner shall submit a letter of verification from the design engineer. If one or more detention basins fall within the jurisdictional criteria of the Division of Safety of Dams, the project owner shall submit copies of the design plans to the Division of Dams Safety of Dams. Upon completion of construction of jurisdictional dams, the project owner shall submit copies of as-built drawings to the Division of Safety of Dams.

STORMWATER CONTROL/FLOOD PROTECTION DESIGN PLANS

SOIL&WATER-8: The project owner shall submit two (2) copies of the 30-percent, 60-percent and 90-percent design drawings for the grading and drainage facilities to the CPM for review and comment. The 30-percent, 60-percent and 90-percent design drawings for the grading and drainage facilities shall be accompanied by a basis of design report to convey and support the design approach. To prepare the grading and drainage facilities drawings and accompanying basis of design report, the project owner shall do the following:

1. Conduct an analysis to quantify the design discharges and associated volumes of water, debris, and sediment associated with the 100-year storm at the apex of the fan under current watershed conditions.

2. Conduct a geomorphic and hydraulic analysis to determine the maximum design storm that can be routed through the site utilizing existing fluvial washes that will not result in significant damage to proposed site infrastructure.

3. Conduct a geomorphic and biologic analysis to determine the minimum design storm that can be routed through the site utilizing existing fluvial washes that will provide the necessary sediment load through the site and "downstream areas" to maintain existing sensitive habitat needs, as described in the *Geomorphic Assessment of Calico Solar Project Site*. This analysis must consider and address the need for fine sand to support the existing sensitive habitat and the potential episodic nature of the associated dune complex evolution that depends upon El Niño events (i.e., wet winters occurring approximately every 3 to 7 years) delivering sediment to the lower fan and the accompanying La Niña events (i.e., dry winters occurring approximately every 3 to 7 years) eroding and transporting fine sands to these dunes through wind action.

4. Determine the pass through design storm that can be routed through the site unimpeded to deliver the necessary sediment load through the site to maintain existing sensitive habitat needs in "downstream areas" and not result in significant damage to proposed site infrastructure.

5. Size, locate, and design each detention basin to allow the pass through design storm to move through the site unimpeded while capturing larger design storm flows and related sediment and debris to protect the proposed infrastructure.

6. Convey design of each basin by showing supporting calculations and design drawings to convey the basin in plan view, cross-sections, depth to spillway, amount of freeboard to top of basin, basin volume to spillway, description of sidewall slopes, method of providing pass through design

storm and related sediment unimpeded, method of providing erosion protection of basin side walls, inlet design, outlet design, spillway design, spillway erosion control, combined outlet maximum flow, transition from outlet to existing downstream fluvial wash, tortoise fence location and design, maintenance of tortoise fence, maintenance of basin, maintenance of excess sediment in basin from larger flood flows.

7. The project owner shall request comments from the Department of Water Resources Division of Safety of Dams (DSOD) for the plans and specifications for the construction of any dam(s) or reservoir(s) that are under DSOD jurisdiction prior to beginning construction, and forward all comments to the CPM.

8. For all flood control basin dams, the project owner shall provide at a minimum:

   - specific locations of basins and dams on appropriate scale map,
   - configuration of all basins and dams including basin-specific cross sections,
   - a description of all materials designed to be used in the construction of the dams,
   - footings designs,
   - designs of cutoff walls,
   - designs of keyways,
   - description and design of drainage pass though methods,
   - flow metering (ability to maintain maximum discharge to that of the maximum on-site flow design) technique and design,
   - method of and design of debris deflection (i.e. trash racks) for each basin,
   - emergency spillway design,
   - pass through pipe outlet energy dissipation method and design, and
   - basin inlet erosion protection.

9. In addition to the criteria discussed above, the basis of design report shall also follow the procedures outlined in the following documents as far as is applicable:

~~a.~~

<SOIL&WATER-8: The project shall achieve the following performance standards:**>**

<1. Project construction shall not alter the existing drainage watershed boundaries.>

<2. Project construction shall not adversely affect any single railroad structure through changes in the volume of water or velocity of storm water runoff reaching the railroad structure.>

<3. No SunCatcher shall be placed within a wash where the 100-year, 24-hour water surface elevation would be more than 1.5 feet above the base of the pedestal.>

<4. No SunCatcher shall be placed within a wash where the local plus general scour exceeds four feet in depth.>

<5. Post development runoff shall be equal to or less than predevelopment runoff.>

<6. The project and reports prepared for the project shall comply with the requirements of the >San Bernardino County Drainage Manual ~~and 2007 Development Code (amended, March 25, 2010).~~

~~b. Federal Emergency Management Agency Guidelines for Determining Flood Hazards on Alluvial Fans and Guidelines and Specifications for Flood Hazard Mapping Partners.~~

~~The project owner shall prepare a set of design specifications to supplement the 90-percent design drawings. Plans, specifications, computations and other data shall be prepared by persons properly licensed by the State of California. If the 60-percent plans or 90-percent plans and specifications do not comply with the appropriate Conditions of Certification, the necessary changes or revisions to the plans shall be made by the project owner. If the CPM finds that the work described in the plans and specifications conform to the Conditions of Certifications in the Energy Commission Decision and other pertinent LORS, then the project owner shall submit two (2) copies of the 100- percent set for CPM review and approval. All design drawings must be submitted on bound or stapled 24" x 36" size paper.~~<(SBCDM), including requirements for the retention basins for the Main Services Complex. >

<7. The project shall not significantly alter sediment transport through the project site.>

<To ensure achievement of these performance standards>, the project owner shall do the following:

<A. Prior to installing any SunCatcher dishes, the project owner shall submit a final hydrology report to the CPM that demonstrates compliance with the seven performance standards listed above. The report shall include a HEC-RAS study for each of the significant washes that contains enough cross sections to adequately describe the water surface elevations and floodplain boundaries; shall address sediment transport issues as a result of project improvements, i.e., increases or decreases to local areas and the general area within the development; and shall be prepared pursuant to local standards of practice and the SBCDM.>

<B. >Prior to installing any SunCatcher dishes ~~or construction of the detention basins,~~<, the final hydrology report described above shall be made available to BNSF for review. If BNSF so requests, following review of the final hydrology report, the> project owner shall pay for, and submit to <BNSF and >the CPM, a <revised final >hydrology ~~study, commissioned by BNSF, which will determine the impact, if any, on rail safety and BNSF operations of its planned placement of SunCatcher dishes and detention basins and determine appropriate mitigation measures, if necessary, to be paid for by project owner~~<report, which will address and evaluate the BNSF comments and concerns, if any, concerning the SunCatcher field affects on the existing drainage system to ensure that current performance standards with respect to the BNSF facilities are met.>

<C. The Project Owner shall submit 60-percent and 90-percent design drawings for the grading and drainage facilities to the CPM for review and comment. The 60-percent and 90-percent drawings> shall be accompanied by a basis of design report to convey and support the design approach.

Verification: ~~Prior to site mobilization, the project owner shall prepare preliminary (30-percent) grading and drainage facilities drawings and accompanying basis of design report for CPM review and approval. No later than 30~~<No later than 90> days after publication of the Energy Commission Decision, the 60-percent set of design drawings and accompanying basis of design report shall be submitted to the CPM for review and approval. The project owner shall submit the 90-percent design drawings and accompanying basis of design report to the CPM for review and approval after the person who originally drew the plan or their duly authorized agent addresses the CPM's 60-percent submittal comments and required changes. ~~The 100-percent design drawings and specifications (construction documents) shall be signed and sealed by a Registered Professional Engineer in the State of California and submitted as the final, approved set of construction documents prior to site mobilization. Prior to initiation of site construction~~< Prior to installing any SunCatchers>, the 100-percent design drawings and specifications (construction documents) shall be submitted along with the final basis of design report signed and sealed by a Registered Professional Engineer

~~and a Registered Professional Geologist~~ in the State of California ~~to the CPM for review and approval.~~

~~Thirty (30) days prior to initiation of construction of any dams that would be considered under the jurisdiction of DSOD, the project owner shall receive approval for dam construction from the CPM based on comments the CPM has received from the DSOD for dam design adequacy. Prior to installing any SunCatcher dishes or construction of the detention basins, project owner shall submit the hydrology study, commissioned by BNSF~~<, as well as the final hydrology report>, to <the >CPM for review and ~~comment~~<approval>.

WORKER SAFETY-7 The project owner shall either:

(1) Reach an agreement, either individually or in conjunction with a power generation industry association or group that negotiates on behalf of its members, with the San Bernardino County Fire Department (SBCFD) regarding funding of its project-related share of capital and operating costs to build and operate new fire protection/response infrastructure and provide appropriate equipment as mitigation of project-related impacts on fire protection services within the jurisdiction.

or

(2) Shall fund its share of the capital costs in the amount of $~~1,187,000~~<876,470 ($47,500 for Phase 1a, $308,940 for Phase 1b, and $520,030 for Phase 2)> and provide an annual payment of $~~1,095,000~~<876,470 ($44,000 for Phase 1a, $286,176 for Phase 1b, $481,712 for Phase 2)> to the SBCFD for the support of new fire department staff and operations and maintenance commencing with the start of construction and continuing annually thereafter on the anniversary until the final date of power plant decommissioning.

or

(3) The Project Owner shall fund a Fire Needs Assessment and Risk Assessment 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 Fire Needs Assessment would address emergency response and equipment/staffing/location needs while the Risk Assessment would be used to establish the risk (chances) of significant impacts occurring. In no event shall the Project Owner's cost responsibility under this option exceed that under option (2), above.

Should the applicant pursue option (3), above, the Fire Needs Assessment and Risk Assessment shall evaluate the following:

(a) Potential for impacts on the SBCFD and the project allocated costs of new and/or enhanced fire protection/emergency response services (which shall include services for inspections, permitting, fire response, hazardous materials spill/leak response, rescue, and emergency medical services) necessary to mitigate such impacts;

(b) The risk of impact on the local population that could result from potential unmitigated impacts on local fire protection and emergency services (i.e. "drawdown" of emergency response resources);

(c) The extent that the project's exemption from local taxes will impact local fire protection and emergency response services; and

(d) Recommendation of an amount of funding that should be provided to mitigate any identified significant impacts on local fire protection and emergency response services.

Compliance Protocols for the Fire Needs Assessment and Risk Assessment shall be as follows

(a) The Fire Needs Assessment and Risk Assessment shall be conducted by an independent consultant(s) selected and approved by the CPM;

(b) The Fire Needs Assessment and Risk Assessment shall be fully funded by the project owner. The independent consultant(s) preparing the Fire Needs Assessment and Risk Assessment shall work directly for the Energy Commission;

(c) The project owner shall provide the protocols for conducting the independent fire needs assessment for review and comment by the SBCFD and review and approval by the CPM prior to the independent consultant's commencement of the fire needs assessment;

(d) The CPM shall be copied in any correspondence including emails or letters and included in any conversations between the project owner and consultant; and

(e) The CPM shall verify that the Fire Needs Assessment and Risk Assessment are prepared consistent with the approved fire needs assessment protocols and a risk assessment protocols.

No construction of permanent above ground structures shall occur until full funding of mitigation occurs either (i) pursuant to an agreement reached between the project owner (or a power generation industry association or group that includes the project owner) and the SBCFD, or (ii) after payment of the fees described above for capital improvements and the first annual payment, or (iii) pursuant to the independent Fire Needs and Risk Assessments conducted by an independent consultant approved by the CPM.

Verification: Prior to November 30, 2010, the project owner shall provide to the CPM:

(1) A copy of the individual agreement with the SBCFD or, if the owner joins a power generation industry association, a copy of the bylaws and group's agreement/contract with the SBCFD 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) In relation to Phase 1a, documentation that the amount of $47,500 (250 acres x $190 per acre) has been paid to the SBCFD and documentation that the prorated portion of first annual payment, which is $44,000 (250 acres x $176 per acre), has been made,

a) At least thirty (30) days prior to the start of site mobilization for Phase 1b, the project owner shall provide to the CPM, documentation that the amount of $~~394,630~~<308,940> (~~2,077~~<1,626> acres x $190 per acre) has been paid to the SBCFD.

B At least thirty (30) days prior to the start of site mobilization for Phase 2, the project owner shall provide to the CPM, documentation that the amount of $~~738,720~~<520,030> (~~3,888~~<2,737> acres x $190 per acre) has been paid to the SBCFD.

Annually thereafter, the owner shall provide the CPM with evidence in each January Monthly Compliance Report during construction and the Annual Compliance Report during operation that subsequent annual payments have been made.

or

(3) A protocol, scope and schedule of work for the independent Fire Needs Assessment and Risk Assessment and the qualifications of proposed contractor(s) for review and approval by the CPM; a copy of the completed Fire Needs Assessment and Risk Assessment showing 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 San Bernardino County Fire Department for required fire protection services mitigation pursuant to the agreement with the Fire Department or the CPM approved independent fire needs assessment.

WORKER SAFETY-8 In the event that no agreement with the San Bernardino County Fire Department is reached, the project owner shall pay to SBCFD (a) $91,750 (250 acres x $367 per acre) prior to the start of construction for Phase 1a; (b) $~~762,259~~<596,742> (~~2,077~~<1,626> acres x $367 per acre) prior to the start of construction for Phase 1b; and (c) $~~1,426,896 (3,888~~<1,004,479 (2,737> acres x $367 per acre) prior to the start of construction for Phase 2. This funding shall off-set any initial funding required by **WORKER SAFETY-7** above until the funds are exhausted. This offset will be based on a full accounting by the SBCFD regarding the use of these funds.

Verification: For Phase 1a, prior to November 30, 2010 (and at least 10 days prior to the start of site mobilization for Phase 1b and Phase 2, respectively), the project owner shall provide to the CEC CPM either:

a. documentation that the payment described above has been made;

or

b. that payment has been made pursuant to a contractual agreement with the SBCFD.

The CEC CPM shall adjust any payments initially required by **WORKER SAFETY-7** based upon the accounting provided by the SBCFD.

This Page Intentionally Left Blank

ATTACHMENT D

CALICO SCENARIO 6

REVISED CONDITIONS AS REVISED BY APPLICANT

ATTACHMENT D

CALICO SCENARIO 6

REVISED CONDITIONS AS REVISED BY APPLICANT

MOJAVE FRINGE-TOED LIZARD MITIGATION

BIO-13 The project owner shall provide compensatory land to mitigate for habitat loss and direct impacts to Mojave fringe-toed lizards based on estimates of suitable Mojave fringe-toed lizard habitat on-site. The project owner shall provide compensatory mitigation at a 3:1 ratio for impacts to breeding habitat (i.e., dune, sand ramp, or fine-sandy wash habitat), and at a 1:1 ratio for impacts to adjacent suitable foraging and cover habitat, such as thin aeolian sand overlying bajada surfaces, or foraging habitat surrounding the breeding habitat. CEC staff estimated breeding habitat on site as 21.4 acres, and surrounding suitable foraging and cover habitat (i.e., 45 meter buffer) as 143.3 acres. Therefore, CEC staff anticipated this condition would require the acquisition and dedication in perpetuity of at 207.5 acres of habitat. The project owner shall provide funding for the acquisition, initial habitat improvements, and long-term management of the compensation lands, as described below.

Biological Resources Table 17
Mojave Fringe-toed Lizard Compensation Acreage Summary

Habitat Function	Project Impact Acreage	Mitigation Ratio	Compensation Acreage
Foraging and cover	143.3 acres	1:1	143.3 acres
Breeding	21.4 acres	3:1	64.2 acres
Total	164.7 acres		207.5 acres

This compensation acreage may be included (“nested”) within the acreage acquired and managed as desert tortoise habitat compensation (Condition of Certification **BIO-17**) only if:

- Adequate acreage of qualifying desert tortoise compensation lands also meet the Selection Criteria (below) as habitat for Mojave fringe-toed lizard;

- The desert tortoise habitat compensation lands are acquired and dedicated as permanent conservation lands within 18 months of the start of project construction.

If these two criteria are not met, then the project owner shall provide the required number of acres of Mojave fringe-toed lizard habitat compensation

lands, adjusted to reflect the final project footprint and additional delineation of suitable habitat, independent of any compensation land required under other conditions of certification, and shall also provide funding for the initial improvement and long-term maintenance and management of the acquired lands, and shall comply with other related requirements of this condition.

Implementation and funding of this mitigation shall be phased to ensure that appropriate compensation lands and/or funding reflect the phasing of actual project impacts and will ensure that all impacts are fully compensated prior to occurring.

COMPENSATORY MITIGATION LAND ACQUISITION

1. **Method of Acquisition**. Compensation lands required to meet this condition shall be acquired in whole or in part either:

    a. By the project owner for donation, as approved by the CPM, to a state or federal land management agency or non-profit land management organization,

    b. By BLM with funds provided by the project owner,

    c. By a third party approved by the CPM to acquire or donate the lands with funds provided by the project owner, or

    d. By the National Fish and Wildlife Foundation (NFWF) with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account.

If the project owner chooses to delegate responsibility for acquisition of all or portions of compensation lands to a third party such as a nongovernmental organization supportive of desert habitat conservation, such delegation shall be subject to approval by the CPM, in consultation with the project owner and CDFG, BLM and USFWS, prior to land acquisition, enhancement or management activities. The CPM shall provide a written response and explanation to the project owner within 30 days of receiving the proposal. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be executed and implemented within 18 months of the Energy Commission's certification of the project or initiation of each phase of the project.

2. **Selection Criteria for Compensation Lands**. The compensation lands selected for acquisition to meet Energy Commission requirements shall:

    a. Be sand dune or partially stabilized sand dune habitat with potential to contribute to Mojave fringe-toed lizard habitat connectivity and build linkages between known populations of Mojave fringe-toed lizards and preserve lands with suitable habitat;

b. Be biologically contiguous to lands currently occupied by Mojave fringe-toed lizard;

c. Be near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long-term by a public resource agency or a non-governmental organization dedicated to habitat preservation;

d. Provide quality habitat for Mojave fringe-toed lizard, that has the capacity to regenerate naturally when disturbances are removed;

e. Not have a history of intensive recreational use or other disturbance that might make habitat recovery and restoration infeasible;

f. Not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration;

g. Not contain hazardous wastes;

h. Have water and mineral rights included as part of the acquisition, unless the CPM, in consultation with CDFG, BLM and USFWS, agrees in writing to the acceptability of land without these rights; and

i. Be on land for which long-term habitat management for Mojave fringe-toed lizard and other native biological resources is feasible.

These requirements may be adjusted upon mutual agreement with the resource agencies (CEC, CDFG, BLM, and USFWS) depending on the specific lands available and in consideration of larger fringe-toed lizard mitigation efforts.

3. **Review and Approval of Compensation Lands Prior to Acquisition**. If the project owner assumes responsibility for acquiring the compensation lands, the project owner shall submit a formal acquisition proposal to the CPM describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands for Mojave fringe-toed lizard in relation to the criteria listed above and must be approved by the CPM. The CPM will share the proposal with and consult with CDFG, BLM, and the USFWS before deciding whether to approve or disapprove the proposed acquisition. The CPM shall provide a written response and explanation to the project owner within 30 days of receiving the proposal.

4. **Compensation Lands Acquisition Conditions**: If the project owner assumes responsibility to acquire the compensation lands to meet Energy Commission and CESA requirements, the project owner shall comply with the following conditions relating to acquisition of the compensation lands

after the CPM, in consultation with CDFG, BLM and the USFWS, has approved the proposed compensation lands:

a. Preliminary Report: The Project owner, or approved third party, shall provide a recent preliminary title report, initial hazardous materials survey report, biological analysis, and other necessary documents for the proposed compensation land to the CPM. All documents conveying or conserving compensation lands and all conditions of title are subject to review and approval by the CPM, in consultation with CDFG, BLM and the USFWS. For conveyances to the State, approval may also be required from the California Department of General Services, the Fish and Game Commission and the Wildlife Conservation Board.

b. Title/Conveyance: The Project owner shall acquire and transfer fee title to the compensation lands, a conservation easement over the lands, or both fee title and conservation easement as required by the CPM in consultation with CDFG. Any transfer of a conservation easement or fee title must be to CDFG, a non-profit organization qualified to hold title to and manage compensation lands (pursuant to California Government Code section 65965), or to BLM or other public agency approved by the CPM in consultation with CDFG.

c. Property Analysis Record. Upon identification of the compensation lands, the Project owner shall conduct a Property Analysis Record (PAR) or PAR-like analysis to establish the appropriate amount of the long-term maintenance and management fund to pay the in-perpetuity management of the compensation lands. The PAR or PAR-like analysis must be approved by the CPM, in consultation with CDFG, before it can be used to establish funding levels or management activities for the compensation lands.

5. **Compensation Lands Acquisition Costs**: If the project owner assumes responsibility to acquire all or a part of the compensation lands to meet Energy Commission and CESA requirements, the project owner shall fund the following items in addition to actual land costs:

a. Level 1 Environmental Site Assessment,

b. Appraisal,

c. Closing and Escrow costs,

d. Biological survey for determining mitigation value of the land, and

e. Agency costs to accept the land.

If the project owner uses BLM to acquire all or a portion of the compensation lands, the project owner shall provide the BLM with funds for items a. to e. above as well as actual land costs.

If the project owner uses in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF) to acquire some or all of the compensation lands, the project owner shall provide funds for items a. to e. above as well as actual land costs and third party administrative costs. If the Project owner elects to use the REAT Account with NFWF, the Project owner will be responsible for providing sufficient funds to cover actual acquisition costs and fees

Estimated costs associated with acquisition of compensation lands are:

ESTIMATED LAND ACQUISITION COSTS PER ACRE OR PARCEL

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Land cost/acre	Covered by Owner	$500	$500
Level 1 Environmental Site Assessment / parcel	Covered by Owner	$3,000	$3,000
Appraisal/parcel	Covered by Owner	$5,000	$5,000
Closing and Escrow Costs/parcel	Covered by Owner	$5,000	$5,000
Biological Survey/parcel	Covered by Owner	$5,000	$5,000
3rd Party Admin. Costs/parcel	$0	$0	10% of land cost
Agency Cost to Accept	17.6% of land cost	17.6% of land cost	17.6% of land cost

These costs are current estimates and shall be modified based on actual costs or with the concurrence of the REAT agencies. The land cost per acre is based on actual acquisition costs by the BLM in San Bernardino County. The number of parcels is estimated based on 640 acres per parcel.

TOTAL ESTIMATED LAND ACQUISITION COSTS

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	207.5	207.5	207.5
Parcels Purchased	0.3	0.3	0.3
Land cost	$103,750	$103,750	$103,750
Level 1 Environmental Site Assessment	$324	$973	$973
Appraisal	$811	$1,621	$1,621
Closing and Escrow Costs	$811	$1,621	$1,621
Biological Survey	$811	$1,621	$1,621
3rd Party Admin. Costs	$0	$0	$5,188
Agency Cost to Accept	$18,208	$0	$18,208
TOTAL	$124,415	$127,846	$138,169

COMPENSATORY MITIGATION LAND IMPROVEMENT

1. **Land Improvement Requirements**: The Project owner shall fund activities that the CPM, in consultation with the CDFG, USFWS and BLM, requires for the initial protection and habitat improvement of the compensation lands. These activities will be implemented by the state or federal land management agency or non-profit organization holding the land or their representative. The specific activities will vary depending on the condition and location of the land acquired but may include:

    - Installation of signs,
    - Removal of trash,
    - Construction and repair of fences,
    - Surveys of boundaries and property lines,
    - Removal of invasive plants,
    - Removal of roads,
    - And similar measures to protect habitat and improve habitat quality.

    A non-profit organization, CDFG or another public agency may hold and expend the habitat improvement funds if it is qualified to manage the compensation lands (pursuant to California Government Code section 65965), if it meets the approval of the CPM in consultation with CDFG, and if it is authorized to participate in implementing the required activities on the compensation lands. If CDFG takes fee title to the compensation lands, the habitat improvement fund must be paid to CDFG or its designee.

2. **Compensation Lands Improvement Costs**: Land improvement costs will vary depending on the activities undertaken. The cost of those actions are estimated to be $250 per acre but will vary depending on the measures that are required for the compensation lands. Assuming all of the compensation is met with land acquisition, the total land improvement costs are estimated to cost $51,875.

COMPENSATORY MITIGATION LAND LONG-TERM MANAGEMENT

1. **Long-term Management Requirements**: Long-term management is required to ensure that the compensation lands are managed and maintained to protect desert tortoise. This may include maintenance of signs, fences, removal of invasive weeds, and elimination of unauthorized use.

2. **Long-term Management Plan:** The owner of or the entity responsible for management of the compensation lands shall prepare a Management Plan for the compensation lands. The Management Plan shall reflect site-specific enhancement measures on the acquired compensation lands. The plan shall be submitted for approval of the CPM, in consultation with CDFG, BLM and USFWS.

3. **Long-term Management Costs:** For those compensation lands that are donated to or owned by the BLM, the long-term management costs will be determined by BLM in consultation with the CDFG, CEC, and USFWS.

   For those compensation lands that are donated to or owned by a state land management agency or a non-profit organization, the Project owner shall provide money to establish an account with a non-wasting capital that will be used to fund the long-term maintenance and management of the compensation lands. The amount of money to be paid will be determined through an approved PAR or PAR-like analysis conducted for the compensation lands.

   The CPM will consult with the project owner and CDFG before deciding whether to approve an entity to hold the project's long-term maintenance and management funds on any lands. For any compensation lands that are not managed by a federal land management agency, the CPM, in consultation with the project owner and CDFG, will designate another state agency or non-profit organization to hold the long-term maintenance and management fee if the organization is qualified to manage the compensation lands in perpetuity.

   If CDFG takes fee title to the compensation lands, CDFG shall determine whether it will hold the long-term management fee in the special deposit fund, leave the money in the REAT Account, or designate another entity to manage the long-term maintenance and management fee for CDFG and with CDFG supervision.

   The long-term maintenance and management fee holder/manager shall be subject to the following conditions:

   I. Interest. Interest generated from the initial capital shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action approved by CDFG designed to protect or improve the habitat values of the compensation lands.

II. Withdrawal of Principal. The long-term maintenance and management fee principal shall not be drawn upon unless such withdrawal is deemed necessary by the CPM, in consultation with CDFG, or the approved third-party long-term maintenance and management fee manager to ensure the continued viability of the species on the compensation lands. If CDFG takes fee title to the compensation lands, monies received by CDFG pursuant to this provision shall be deposited in a special deposit fund established solely for the purpose to manage lands in perpetuity unless CDFG designates NFWF or another entity to manage the long-term maintenance and management fee for CDFG.

III. Pooling Funds. A CPM- approved non-profit organization qualified to hold long-term maintenance and management fees solely for the purpose to manage lands in perpetuity, may pool the fund with other funds for the operation, management, and protection of the compensation lands for local populations of desert tortoise. However, for reporting purposes, the long-term maintenance and management fee fund must be tracked and reported individually to the CDFG and CPM.

IV. Reimbursement Fund. The project owner shall provide reimbursement to CDFG or an approved third party for reasonable expenses incurred during title, easement, and documentation review

Long-term management on compensatory lands required for the Energy Commission and CESA is estimated to be $692 per acre based on comparable costs. If 207.5 acres are acquired and donated to a state land management agency or non-profit organization for long-term management, the total cost of this activity is estimated to be $51,875. This amount shall be adjusted based on final analysis and/or a PAR analysis.

If the compensation lands required for the Energy Commission and CESA are administered with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the project owner shall pay the following additional fees:

1. Project Specific Account Establishment - $12,000

2. Pre-proposal RFP or RFP procession - $30,000

3. Management fee for acquisition and enhancement – 3% of all acquisition and enhancement costs

4. Management fee for long-term management account – 1% of long-term management costs

COMPENSATORY MITIGATION LAND FUNDS

1. **Compensation Mitigation Fund**: The project owner shall provide funding for acquisition, improvement, and long-term management of desert tortoise compensation land. The current estimated funding shall be $ based on the costs itemized below and assuming all mitigation is provided by land acquisition and NFWF is responsible for long-term management. This amount shall be updated and verified prior to payment and shall be adjusted to reflect actual costs or more current estimates during phasing.

EXAMPLE of TOTAL COMPENSATION LAND COSTS

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	207.5	207.5	207.5
Parcels Purchased	0.3	0.3	0.3
Land Acquisition Cost	$124,278	$127,846	$138,169
Land Improvement Cost	$51,875	$51,875	$51,875
Long-term Management Cost	$143,590	$143,590	$143,590
NFWF Fees	$47,163	$0	$47,581
TOTAL	$366,855	$323,311	$381,215

2. **Fund Payment**: Because the project is phased, the mitigation funding will also be phased. The phasing of funding will ensure that the security is in place to ensure mitigation for any impact before it occurs. This will be accomplished by requiring funding for all the mitigation necessary to mitigate the impacts associated with a specific phase. Specific payments shall reflect the approach chosen by the project owner for land acquisition and shall include funds for land enhancement and long-term management consistent with the amount of land to be disturbed during each phase. The project owner shall make the following compensatory mitigation payments based on the following project phasing.

TIME	PROJECT ACTIVITY	MITIGATION PAYMENT
Phase 1a – October 2010	Start of construction, no more than 250 acres of site disturbance activities. (Note: No MFTL habitat will be impacted.)	$0
Phase 1b	Completion ~~on~~<of> Phase 1 construction (275 MW on ~~2,077~~<1,626> additional acres) (Note: No MFTL habitat will be impacted.)	$0
Phase 2	Initiation and completion of Phase 2 (~~575~~<the remaining> MW on ~~3,888~~<2,368> acres)	$381,215 less adjustments for land acquisition method, and land improvement costs

3. **REAT/NFWF Payment**: If the project owner elects to comply with the requirements in this condition for acquisition, initial improvement, long-term maintenance and management, or any combination of these three requirements by providing funds to implement those measures into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the Project owner shall make an initial deposit to the REAT Account in an amount equal to the estimated costs of administering these requirements.

   If the actual cost of the acquisition, initial protection and habitat improvements, or long-term funding is more than the estimated amount initially paid by the project owner, the project owner shall make an additional deposit into the REAT Account sufficient to cover the actual acquisition costs, the actual costs of initial protection and habitat improvement on the compensation lands, or the long-term funding requirements as established in an approved PAR or PAR-like analysis. If those actual costs or PAR projections are less than the amount initially transferred by the applicant, the remaining balance shall be returned to the project owner.

4. **Security**: The Project owner shall provide financial assurances to the CPM with copies of the document(s) to BLM, CDFG and the USFWS, to guarantee that an adequate level of funding is available to implement the mitigation required by this condition is available prior to the start of ground-disturbing activities for each phase of the project discussed in the described in section 2 immediately above.

   The CPM may use money from the Security solely for implementation of the requirements of this condition or if nesting of mitigation is obtained, to satisfy the conditions of BIO-12 and BIO-17. The CPM's use of the security to implement measures in this condition may not fully satisfy the Project owner's obligations under this condition. Any amount of the Security that is not used to carry out mitigation shall be returned to the Project owner upon successful completion of the associated requirements in this condition. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the Project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security.

   The amount of the Security shall correspond to the mitigation fund payments described in "fund payment" above.

5. **Audit**: The project owner may request the CPM to for an independent audit of the compensatory mitigation funds.

Verification: The project owner shall provide the CPM with written notice of intent to start ground disturbance at least 30 days prior to the start of ground-disturbing activities on the project site.

If the mitigation actions required under this condition are not completed prior to the start of ground-disturbing activities, the Project owner shall provide the CPM and CDFG with an approved Security in accordance with this condition of certification 30 days prior to beginning Project ground-disturbing activities. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security. The project owner, or an approved third party, shall complete and provide written verification to the CPM, CDFG, BLM and USFWS of the compensation lands acquisition and transfer within 18 months of the start of Project ground-disturbing activities.

No later than 12 months after the start of any phase of ground-disturbing project activities, the project owner shall submit a formal acquisition proposal to the CPM describing the parcels intended for purchase, and shall obtain approval from the CPM, in consultation with CDFG, BLM and USFWS, prior to the acquisition. If NFWF or another approved third party is handling the acquisition, the project owner shall fully cooperate with the third party to ensure the proposal is submitted within this time period. The project owner or an approved third party shall complete the acquisition and all required transfers of the compensation lands, and provide written verification to the CPM, CDFG, BLM and USFWS of such completion, no later than 18 months after the issuance of the Energy Commission Decision. If NFWF or another approved third party is being used for the acquisition, the project owner shall ensure that funds needed to accomplish the acquisition are transferred in timely manner to facilitate the planned acquisition and to ensure the land can be acquired and transferred prior to the 18-month deadline.

The project owner shall complete and submit to the CPM a PAR or PAR-like analysis no later than 60 days after the CPM approves compensation lands for acquisition associated with any phase of construction. The project owner shall fully fund the required amount for long-term maintenance and management of the compensation lands for that phase of construction no later than 30 days after the CPM approves a PAR or PAR-like analysis of the anticipated long-term maintenance and management costs of the compensation lands. Written verification shall be provided to the CPM and CDFG to confirm payment of the long-term maintenance and management funds.

No later than 60 days after the CPM determines what activities are required to provide for initial protection and habitat improvement on the compensation lands for any phase of construction, the project owner shall make funding available for those activities and provide written verification to the CPM of what funds are available and how costs will be paid. Initial protection and habitat improvement activities on the compensation lands for that phase of construction shall be completed, and written verification provided to the

CPM, no later than six months after the CPM's determination of what activities are required on the compensation lands.

If a third party is responsible for management of the compensation lands shall provide the CPM, they shall provide the CDFG, BLM and USFWS with a management plan for the compensation lands associated with any phase of construction within 180 days of the land or easement purchase, as determined by the date on the title. The CPM, in consultation with CDFG, BLM and the USFWS, shall approve the management plan after its content is acceptable to the CPM.

Within 90 days after completion of all project related ground disturbance, the project owner shall provide to the CPM, CDFG, BLM and USFWS an analysis, based on aerial photography, with the final accounting of the amount of habitat disturbed during Project construction. This shall be the basis for the final number of acres required to be acquired.

DESERT TORTOISE COMPENSATORY MITIGATION

BIO-17 To fully mitigate for habitat loss and potential take of desert tortoise, the project owner shall acquire, protect, and transfer no fewer than ~~14,365~~<8,452> acres of desert tortoise habitat lands, shall provide funding for the initial improvement and long-term maintenance and management of the acquired lands for protection of the desert tortoise, and comply with other related requirements of this condition. This acreage was calculated as follows: a ratio of 1:1 for the entire project area (~~6,215~~<4,244 acres) and an additional 2:1 ratio for ~~4,075~~<2,104> acres of the project area north of the BNSF railroad tracks (i.e., a total ratio of 1:1 on 2,140 acres and a total ratio of 3:1 on ~~4,075~~<2,104> acres).

Desert Tortoise Compensation Acreage Summary

Location	Project Impact Acreage	Mitigation Ratio	Compensation Acreage
South of BNSF RR	2,140 acres	1:1	2,140 acres
North of BNSF RR	~~4,075~~<2,104> acres	3:1	~~12,225~~<6,312> acres
Total	~~6,215~~<4,244> acres		~~14,365~~<8,452> acres

Of this compensatory mitigation, ~~6,215~~<4,244> acres meet requirements of BLM and ~~8,150~~<4,208> acres represent additional requirements of the State of California.

These impact acreages shall be adjusted to reflect the final project footprint. For purposes of this condition, the Project footprint means all lands disturbed in the construction and operation of the Calico Solar Project, including all linear project components, as well as undeveloped areas inside the Project's boundaries that will no longer provide viable long-term habitat for the desert tortoise.

These impact acreages may also be adjusted to reflect approval by BLM to meet their portion of the compensatory mitigation requirements, in whole or in part, through "habitat enhancement actions" rather than the purchase and donation of compensation lands.

Implementation and funding of this mitigation shall be phased to ensure that appropriate compensation lands and/or funding reflect the phasing of actual project impacts and will ensure that all impacts are fully compensated prior to occurring.

COMPENSATORY MITIGATION LAND ACQUISITION

1. **Method of Acquisition.** To the extent that these mitigation requirements are met through the purchase of compensation lands, these lands shall be acquired in whole or in part either by:

a. The project owner for donation, as approved by the BLM for BLM required mitigation and the CPM for state required mitigation, to a state or federal land management agency or non-profit land management organization,

b. The BLM with funds provided by the project owner,

c. A third party approved by the BLM to acquire or donate the lands with funds provided by the project owner, or

d. The National Fish and Wildlife Foundation (NFWF) with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account.

If the project owner chooses to delegate responsibility for acquisition of all or portions of compensation lands to a third party such as a nongovernmental organization supportive of desert habitat conservation, such delegation shall be subject to approval by the CPM, in consultation with the project owner and CDFG, BLM and USFWS, prior to land acquisition, enhancement or management activities. The CPM shall indicate their approval or disapproval within 30 days of receipt of the project owner's delegation proposal. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be executed and implemented within 18 months of the Energy Commission's certification of the project or initiation of each phase of the project.

2. **Selection Criteria for Compensation Lands**. The compensation lands selected for acquisition to meet BLM requirements and to meet Energy Commission and CESA requirements shall be equal to or better than the quality and function of the desert tortoise habitat impacted and:

a. Be within the Western Mojave Recovery Unit, with potential to contribute to desert tortoise habitat connectivity and build linkages between desert tortoise designated critical habitat, known populations of desert tortoise, and/or other preserve lands;

b. Provide habitat for desert tortoise with capacity to regenerate naturally when disturbances are removed;

c. Be near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long-term by a public resource agency or a non-governmental organization dedicated to habitat preservation;

d. Be contiguous and biologically connected to lands currently occupied by desert tortoise, ideally with populations that are stable, recovering, or likely to recover;

e. Not have a history of intensive recreational use or other disturbance that might cause future erosion damage or other habitat damage, and make habitat recovery and restoration infeasible;

f. Not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration; and

g. Not contain hazardous wastes that cannot be removed to the extent that the site could not provide suitable habitat; and

h. Have water and mineral rights included as part of the acquisition, unless the CPM, in consultation with CDFG, BLM and USFWS, agrees in writing to the acceptability of land without these rights.

These requirements may be adjusted upon mutual agreement with the resource agencies (CEC, CDFG, BLM, and USFWS) depending on the specific lands available and in consideration of larger desert tortoise mitigation efforts.

3. **Review and Approval of Compensation Lands Prior to Acquisition**. If the project owner assumes responsibility for acquiring the compensation lands to meet Energy Commission and CESA requirements, the project owner shall submit a formal acquisition proposal to the CPM describing the parcel(s) intended for purchase. This acquisition proposal shall discuss the suitability of the proposed parcel(s) as compensation lands for desert tortoise in relation to the criteria listed above and must be approved by the CPM. The CPM will share the proposal with and consult with CDFG, BLM and the USFWS before deciding whether to approve or disapprove the proposed acquisition. The CPM shall provide a written response and explanation to the project owner within 30 days of receiving the proposal.

4. **Compensation Lands Acquisition Conditions**: If the project owner assumes responsibility to acquire the compensation lands to meet Energy Commission and CESA requirements, the project owner shall comply with the following conditions relating to acquisition of the compensation lands after the CPM, in consultation with CDFG, BLM and the USFWS, has approved the proposed compensation lands:

   a. Preliminary Report: The Project owner, or approved third party, shall provide a recent preliminary title report, initial hazardous materials survey report, biological analysis, and other necessary documents for the proposed compensation land to the CPM. All documents conveying or conserving compensation lands and all conditions of title are subject to review and approval by the CPM, in consultation with CDFG, BLM and the USFWS. For conveyances to the State, approval may also be

required from the California Department of General Services, the Fish and Game Commission and the Wildlife Conservation Board.

b. Title/Conveyance: The Project owner shall acquire and transfer fee title to the compensation lands, a conservation easement over the lands, or both fee title and conservation easement as required by the CPM in consultation with CDFG. Any transfer of a conservation easement or fee title must be to CDFG, a non-profit organization qualified to hold title to and manage compensation lands (pursuant to California Government Code section 65965), to the BLM, or other public agency approved by the CPM in consultation with CDFG. If an approved nonprofit organization holds fee title to the compensation lands, a conservation easement shall be recorded in favor of CDFG or another entity approved by the CPM.

c. Property Analysis Record. Upon identification of the compensation lands, the Project owner shall conduct a Property Analysis Record (PAR) or PAR-like analysis to establish the appropriate amount of the long-term maintenance and management fund to pay the in-perpetuity management of the compensation lands. The PAR or PAR-like analysis must be approved by the CPM, in consultation with CDFG, before it can be used to establish funding levels or management activities for the compensation lands.

5. **Compensation Lands Acquisition Costs**: If the project owner assumes responsibility to acquire all or a part of the compensation lands to meet Energy Commission and CESA requirements, the project owner shall fund the following items in addition to actual land costs:

   a. Level 1 Environmental Site Assessment,

   b. Appraisal,

   c. Closing and Escrow costs,

   d. Biological survey for determining mitigation value of the land, and

   e. Agency costs to accept the land.

   If the project owner uses BLM to acquire all or a portion of the compensation lands, the project owner shall provide the BLM with funds for items a. to e. above as well as actual land costs.

   If the project owner uses in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF) to acquire some or all of the compensation lands, the project owner shall provide funds for items a. to e. above as well as actual land costs and third party administrative costs.

The project owner shall provide reimbursement to CDFG or an approved third party for reasonable expenses incurred during title, easement, and documentation review; expenses incurred by other State or State-approved outside consultants.

Estimated costs associated with acquisition of compensation lands are:

ESTIMATED LAND ACQUISITION COSTS PER ACRE OR PARCEL

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Land cost/acre	Covered by Owner	$500	$500
Level 1 Environmental Site Assessment / parcel	Covered by Owner	$3,000	$3,000
Appraisal/parcel	Covered by Owner	$5,000	$5,000
Closing and Escrow Costs/parcel	Covered by Owner	$5,000	$5,000
Biological Survey/parcel	Covered by Owner	$5,000	$5,000
3rd Party Admin. Costs/parcel	$0	$0	10% of land cost
Agency Cost to Accept	$17.6% of land cost	$17.6% of land cost	17.6% of land cost

These costs are current estimates and shall be modified based on actual costs or with the concurrence of the REAT agencies. The land cost per acre is based on actual acquisition costs by the BLM in San Bernardino County. The number of parcels are estimated based on 640 acres per parcel.

TOTAL ESTIMATED LAND ACQUISITION COSTS
(based on agency estimated costs)

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	~~14,365~~<8,452>	~~14,365~~<8,452>	~~14,365~~<8,452>
Parcels Purchased	~~22.4~~<13.2>	~~22.4~~<13.2>	~~22.4~~<13.2>
Land cost	Covered by Owner ($~~7,182,500~~<4,226,000>)	$~~7,182,500~~<4,226,000>	$~~7,182,500~~<4,226,000>
Level 1 Environmental Site Assessment	Covered by Owner ($~~22,445~~<39,619>)	$~~67,336~~<39,619>	$~~67,336~~<39,619>
Appraisal	Covered by Owner ($~~56,113~~<66,031>)	$~~112,227~~<66,031>	$~~112,227~~<66,031>
Closing and Escrow Costs	Covered by Owner ($~~56,113~~<66,031>)	$~~112,227~~<66,031>	$~~112,227~~<66,031>
Biological Survey	Covered by Owner ($~~56,113~~<66,031>)	$~~112,227~~<66,031>	$~~112,227~~<66,031>
3rd Party Admin. Costs	$0	$0	$~~718,250~~<422,600>
Agency Cost to Accept	$~~1,260,529~~<741,663>	$~~1,264,120~~<741,663>	$~~1,260,529~~<741,663>
TOTAL	$~~8,600,146~~<5,205,376>	$~~8,850,636~~<5,205,376>	$~~9,565,294~~<5,627,976>

COMPENSATORY MITIGATION LAND IMPROVEMENT

1. **Land Improvement Requirements**: The Project owner shall fund activities that the CPM, in consultation with the CDFG, USFWS and BLM, requires for the initial protection and habitat improvement of the compensation lands. These activities will be implemented by the state or federal land management agency or non-profit organization holding the land or their representative. The specific activities will vary depending on the condition and location of the land acquired but may include:

    - Installation of signs,
    - Removal of trash,
    - Construction and repair of fences,
    - Surveys of boundaries and property lines,
    - Removal of invasive plants,
    - Removal of roads,
    - And similar measures to protect habitat and improve habitat quality.

2. **Compensation Lands Improvement Costs**: Land improvement costs will vary depending on the activities undertaken. The cost of those actions may range between $25 per acre to $250 per acre and are estimated to be $250 per acre for this project.

    Assuming all of the compensation is met with land acquisition, the total land improvement costs are estimated to be $~~3,591,250.~~<2,113,000.> This amount will be reduced to the extent that direct habitat enhancements are used to satisfy some or all of the BLM's compensatory mitigation requirements.

COMPENSATORY MITIGATION LAND LONG-TERM MANAGEMENT

1. **Long-term Management Requirements**: Long-term management is required to ensure that the compensation lands are managed and maintained to protect desert tortoise. This may include maintenance of signs, fences, removal of invasive weeds, and elimination of unauthorized use.

2. **Long-term Management Plan:** The owner of or the entity responsible for the management of the compensation lands shall prepare a Management Plan for the compensation lands. The Management Plan shall reflect site-specific enhancement measures on the acquired compensation lands. The

plan shall be submitted for approval of the CPM, in consultation with CDFG, BLM and USFWS.

3. **Long-term Management Costs:** For those compensation lands that are donated to or owned by the BLM, the long-term management costs will be determined by BLM in consultation with the CDFG, CEC, and USFWS.

   For those compensation lands that are donated to or owned by a state land management agency or a non-profit organization, the Project owner shall provide money to establish an account with a non-wasting capital that will be used to fund the long-term maintenance and management of the compensation lands. The amount of money to be paid will be determined through an approved PAR or PAR-like analysis conducted for the compensation lands.

   The CPM will consult with the project owner and CDFG before deciding whether to approve an entity to hold the project's long-term maintenance and management funds on any lands. For any compensation lands that are not managed by a federal land management agency, the CPM, in consultation with the project owner and CDFG, will designate another state agency or non-profit organization to hold the long-term maintenance and management fee if the organization is qualified to manage the compensation lands in perpetuity.

   If CDFG takes fee title to the compensation lands, CDFG shall determine whether it will hold the long-term management fee in the special deposit fund, leave the money in the REAT Account, or designate another entity to manage the long-term maintenance and management fee for CDFG and with CDFG supervision.

   The following conditions shall apply to the long-term maintenance and management funds:

   I. Interest. Interest generated from the initial capital shall be available for reinvestment into the principal and for the long-term operation, management, and protection of the approved compensation lands, including reasonable administrative overhead, biological monitoring, improvements to carrying capacity, law enforcement measures, and any other action approved by CDFG designed to protect or improve the habitat values of the compensation lands.

   II. Withdrawal of Principal. The long-term maintenance and management fee principal shall not be drawn upon unless such withdrawal is deemed necessary by the CPM, in consultation with CDFG, or the approved third-party long-term maintenance and management fee manager to ensure the continued viability of the species on the compensation lands. If CDFG takes fee title to the

compensation lands, monies received by CDFG pursuant to this provision shall be deposited in a special deposit fund established solely for the purpose to manage lands in perpetuity unless CDFG designates NFWF or another entity to manage the long-term maintenance and management fee for CDFG.

III. Pooling Funds. A CPM- approved non-profit organization qualified to hold long-term maintenance and management fees solely for the purpose to manage lands in perpetuity, may pool the fund with other funds for the operation, management, and protection of the compensation lands for local populations of desert tortoise. However, for reporting purposes, the long-term maintenance and management fee fund must be tracked and reported individually to the CDFG and CPM.

Long-term management on compensatory lands is estimated to be $692 per acre based on comparable cases. If ~~14,365~~<8,452> acres are acquired, the total cost of this activity is estimated to be $~~9,940,580.~~<5,848,784.> This amount shall be adjusted based on final analysis and/or a PAR analysis.

If the compensation lands required for the Energy Commission and CESA are administered with in lieu funds deposited into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the project owner shall pay the following additional fees:

1. Project Specific Account Establishment - $12,000

2. Pre-proposal RFP or RFP procession - $30,000

3. Management fee for acquisition and enhancement – 3% of all acquisition and enhancement costs

4. Management fee for long-term management account – 1% of long-term management costs

COMPENSATORY MITIGATION LAND FUNDS

1. **Compensation Mitigation Fund**: The project owner shall provide funding for acquisition, improvement, and long-term management of desert tortoise compensation land. The current estimated funding shall be $~~34,523,046~~<13,859,087> based on the costs itemized below and assuming all mitigation is provided by land acquisition and NFWF is responsible for long-term management. This amount shall be updated and verified prior to payment and shall be adjusted to reflect actual costs or more current estimates during phasing.

EXAMPLE of TOTAL COMPENSATION LAND COSTS

	ACQUISITION METHOD		
COST ITEM	**PROJECT OWNER**	**BLM**	**REAT/NFWF**
Acres Purchased	~~14,365~~<8,452>	~~6215~~<8,452>	~~8150~~<8,452>
Parcels Purchased	~~22.4~~<13.2>	~~22.4~~<13.2>	~~22.4~~<13.2>
Land Acquisition Cost	$~~8,600,146~~<5,205,376>	$~~8,850,636~~<5,205,376>	$~~9,565,294~~<5,627,976>
Land Improvement Cost	$~~3,591,250~~<2,113,000>	$~~3,591,250~~<2,113,000>	$~~3,591,250~~<2,113,000>
Long-term Management Cost	$~~9,940,580~~<5,848,784>	$~~9,940,580~~<5,848,784>	$~~9,940,580~~<5,848,784>
NFWF Fees	$~~399,410~~<256,649>	$0	$~~428,365~~<269,327>
TOTAL	$~~22,531,386~~<13,423,809>	$~~22,382,466~~<13,167,160>	$~~23,525,489~~<13,859,087>

2. **Fund Payment**: Because the project is phased, the mitigation funding will also be phased. The phasing of funding will ensure that the security is in place to ensure mitigation for any impact before it occurs. This will be accomplished by requiring funding for all the mitigation necessary to mitigate the impacts associated with a specific phase. Specific payments shall reflect the approach chosen by the project owner for land acquisition and shall include funds for land enhancement and long-term management consistent with the amount of land to be disturbed during each phase. The project owner shall make the following compensatory mitigation payments based on the following project phasing:

TIME	PROJECT ACTIVITY	MITIGATION PAYMENT
Phase 1a – October 2010	Start of desert tortoise translocation followed by no more than 250 acres of site disturbance activities<. 56 acres to be mitigated at a 1:1 ratio and 194 acres> to be mitigated at a 3:1 ratio for a total of ~~750~~<638> acres or ~~1.2~~<1.0> ~~parcels~~<parcel>	$~~1,268,078~~<1,084,984>
Phase 1b (Estimated to occur after the Close of Financing during the 1st quarter 2011)	Completion on Phase 1 construction of 275 MW on an ~~2,077~~<1,626> additional acres to be mitigated at a 3:1 ratio for a total of ~~6,231~~<4,878> additional acres or ~~9.7~~<7.6> parcels	$~~10,186,260~~<7,974,414> less adjustments from ~~phase~~<Phase> 1a and for ~~phase~~<Phase> 1 b for land acquisition method, and land improvement, long-term management costs, and habitat enhancement actions
Phase 2	Initiation and completion of Phase 2 (~~575~~<remaining> MW<)> on ~~3,888~~<2084> acres~~)~~< to be mitigated at a 1:1 ratio, 284 acres to be mitigated at a 3:1 ratio for a total of 2,936 acres or 4.6 parcels>	$~~12,071,151~~<4,799,688> less adjustments from ~~phase~~<Phase> 1 b for habitat enhancement actions, land acquisition method, and land improvement costs

3. **REAT/NFWF Payment**: If the project owner elects to comply with the requirements in this condition for acquisition, initial improvement, long-term maintenance and management, or any combination of these three requirements by providing funds to implement those measures into the

Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), the Project owner shall make an initial deposit to the REAT Account in an amount equal to the estimated costs of administering these requirements.

If the actual cost of the acquisition, initial protection and habitat improvements, or long-term funding is more than the estimated amount initially paid by the project owner, the project owner shall make an additional deposit into the REAT Account sufficient to cover the actual acquisition costs, the actual costs of initial protection and habitat improvement on the compensation lands, or the long-term funding requirements as established in an approved PAR or PAR-like analysis. If those actual costs or PAR projections are less than the amount initially transferred by the applicant, the remaining balance shall be returned to the project owner.

4. **Security**: The Project owner shall provide financial assurances to the CPM with copies of the document(s) to BLM, CDFG and the USFWS, to guarantee that an adequate level of funding is available to implement the mitigation required by this condition is available prior to the start of ground-disturbing activities for each phase of the project discussed in the described in section 2 immediately above.

   The CPM may use money from the Security solely for implementation of the requirements of this condition or if nesting of mitigation is obtained, to satisfy the conditions of BIO-12 and BIO-13. The CPM's use of the security to implement measures in this condition may not fully satisfy the Project owner's obligations under this condition. Any amount of the Security that is not used to carry out mitigation shall be returned to the Project owner upon successful completion of the associated requirements in this condition. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the Project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security.

   The amount of the Security shall correspond to the mitigation fund payments described in "fund payment" above.

5. **Audit**: The project owner may request the CPM to for an independent audit of the compensatory mitigation funds.

Verification: The project owner shall provide the CPM with a description of the phasing of the project's construction and ground disturbing activities at least 30 days prior to ground disturbing activities.

The project owner shall provide written notice of intent to start ground disturbance for any phase of project construction at least 30 days prior to the start of those activities on the project site.

If the mitigation actions required under this condition are not completed prior to the start of ground-disturbing activities, the Project owner shall provide the CPM and CDFG with an approved Security in accordance with this condition of certification prior to beginning Project ground-disturbing activities. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security"). Prior to submitting the Security to the CPM, the project owner shall obtain the CPM's approval, in consultation with CDFG, BLM and the USFWS, of the form of the Security. The project owner, or an approved third party, shall complete and provide written verification to the CPM, CDFG, BLM and USFWS of the compensation lands acquisition and transfer within 18 months of the start of Project ground-disturbing activities.

No later than 12 months after the start of any phase of ground-disturbing project activities, the project owner shall submit a formal acquisition proposal to the CPM describing the parcels intended for purchase, and shall obtain approval from the CPM, in consultation with CDFG, BLM and USFWS, prior to the acquisition. If NFWF or another approved third party is handling the acquisition, the project owner shall fully cooperate with the third party to ensure the proposal is submitted within this time period. The project owner or an approved third party shall complete the acquisition and all required transfers of the compensation lands, and provide written verification to the CPM, CDFG, BLM and USFWS of such completion, no later than 18 months after the issuance of the Energy Commission Decision. If NFWF or another approved third party is being used for the acquisition, the project owner shall ensure that funds needed to accomplish the acquisition are transferred in timely manner to facilitate the planned acquisition and to ensure the land can be acquired and transferred prior to the 18-month deadline.

The project owner shall complete and submit to the CPM a PAR or PAR-like analysis no later than 60 days after the CPM approves compensation lands for acquisition associated with any phase of construction. The project owner shall fully fund the required amount for long-term maintenance and management of the compensation lands for that phase of construction no later than 30 days after the CPM approves a PAR or PAR-like analysis of the anticipated long-term maintenance and management costs of the compensation lands. Written verification shall be provided to the CPM and CDFG to confirm payment of the long-term maintenance and management funds.

No later than 60 days after the CPM determines what activities are required to provide for initial protection and habitat improvement on the compensation lands for any phase of construction, the project owner shall make funding available for those activities and provide written verification to the CPM of what funds are available and how costs will be paid. Initial protection and habitat improvement activities on the compensation lands for that phase of construction shall be completed, and written verification provided to the

CPM, no later than six months after the CPM's determination of what activities are required on the compensation lands.

The land management entity, shall provide the CPM, CDFG, BLM and USFWS with a management plan for the compensation lands associated with any phase of construction within 180 days of the land or easement purchase, as determined by the date on the title. The CPM, in consultation with CDFG, BLM and the USFWS, shall approve the management plan after its content is acceptable to the CPM.

Within 90 days after completion of all project related ground disturbance, the project owner shall provide to the CPM, CDFG, BLM and USFWS an analysis, based on aerial photography, with the final accounting of the amount of habitat disturbed during Project construction. This shall be the basis for the final number of acres required to be acquired.

RAVEN MONITORING, MANAGEMENT, AND CONTROL PLAN

BIO-18 The project owner shall design and implement a Raven Monitoring, Management, and Control Plan (Raven Plan) that is consistent with the most current USFWS-approved raven management guidelines and that meets the approval of the USFWS, CDFG, and the CPM. Any subsequent modifications to the approved Raven Plan shall be made only with approval of the CPM in consultation with USFWS and CDFG. The Raven Plan shall include but not be limited to a program to monitor increased raven presence in the Project vicinity and to implement raven control measures as needed based on that monitoring. The purpose of the plan is to avoid any Project-related increases in raven numbers during construction, operation, and decommissioning. The threshold for implementation of raven control measures shall be any increases in raven numbers from baseline conditions, as detected by monitoring to be proposed in the Raven Plan. Regardless of raven monitoring results, the project owner shall be responsible for all other aspects of the Raven Plan, including avoidance and minimization of project-related trash, water sources, or perch/roost sites that could contribute to increased raven numbers. In addition, to offset the cumulative contributions of the Project to desert tortoise from increased raven numbers, the Project owner shall also contribute to the USFWS Regional Raven Management Program. The Project owner shall do all of the following:

1. Prepare and Implement a Raven Management Plan that includes the following:

    a. Identify conditions associated with the Project that might provide raven subsidies or attractants;

    b. Describe management practices to avoid or minimize conditions that might increase raven numbers and predatory activities;

    c. Describe control practices for ravens;

    d. Address monitoring and nest removal during construction and for the life of the Project, and;

    e. Discuss reporting requirements.

2. Contribute to the USFWS Regional Raven Management Program. The project owner shall submit a one-time or annual payments to the project sub-account of the REAT Account held by the National Fish and Wildlife Foundation (NFWF) to support the USFWS Regional Raven Management Program. For each phase, the amount of the one-time payment shall be $105 per acre of permanent disturbance ($~~652,175~~<26,250 for Phase 1a, $170,730 for Phase 1b, and $248,640 for Phase 2>). If project owner

chooses to make annual payments instead of the one-time payment, the annual payment per acre of permanent disturbance, for each phase, shall be calculated each year by USFWS and the initial annual payment is estimated to be $7.50 per acre of permanent disturbance.

Verification: No later than 30 days prior to the start of construction, the project owner shall provide written verification to the CPM that NFWF has received and accepted payment into the project's sub-account of the REAT Account to support the USFWS Regional Raven Management Program.

No later than 30 days prior to any construction-related ground disturbance activities, the Project owner shall provide the CPM, USFWS, and CDFG with the final version of a Raven Plan. All modifications to the approved Raven Plan shall be made only with approval of the CPM in consultation with USFWS and CDFG.

Within 30 days after completion of Project construction, the Project owner shall provide to the CPM for review and approval, a written report identifying which items of the Raven Plan have been completed, a summary of all modifications to mitigation measures made during the Project's construction phase, and which items are still outstanding.

On January 31st of each year following construction the Designated Biologist shall provide a report to the CPM that includes: a summary of the results of raven management and control activities for the year; a discussion of whether raven control and management goals for the year were met; and recommendations for raven management activities for the upcoming year.

BURROWING OWL IMPACT AVOIDANCE AND MINIMIZATION MEASURES

BIO-21 The Project owner shall implement the following measures to avoid, minimize and offset impacts to burrowing owls. Nothing in this condition requires the project owner to conduct burrowing owl surveys by entering private lands adjacent to the project site when the project owner has made reasonable attempts to obtain permission to enter the property for survey work but was unable to obtain such permission. In this situation only, the project owner may substitute binocular surveys for protocol field surveys.

1. Pre-Construction Surveys. The Designated Biologist or Biological Monitor shall conduct pre-construction surveys for burrowing owls no more than 30 days prior to initiation of construction activities. Surveys shall be focused exclusively on detecting burrowing owls, and shall be conducted from two hours before sunset to one hour after or from one hour before to two hours after sunrise. The survey area shall include the Project Disturbance Area and surrounding 500 foot survey buffer.

2. Implement Avoidance Measures. If an active burrowing owl burrow is detected within 500 feet from the Project Disturbance Area the following avoidance and minimization measures shall be implemented:

    a. Establish Non-Disturbance Buffer. Fencing shall be installed at a 250-foot radius from the occupied burrow to create a non-disturbance buffer around the burrow. The non-disturbance buffer and fence line may be reduced to 160 feet if all Project-related activities that might disturb burrowing owls would be conducted during the non-breeding season (September 1st through January 31st). Signs shall be posted in English and Spanish at the fence line indicating no entry or disturbance is permitted within the fenced buffer.

    b. Monitoring: If construction activities would occur within 500 feet of the occupied burrow during the nesting season (February 1 – August 31st) the Designated Biologist or Biological Monitor shall monitor to determine if these activities have potential to adversely affect nesting efforts, and shall implement measures to minimize or avoid such disturbance.

3. Passive Relocation of Burrowing Owls. If pre-construction surveys indicate the presence of burrowing owls within the Project Disturbance Area (the Project Disturbance Area means all lands disturbed in the construction and operation of the Genesis Project), the Project owner shall prepare and implement a Burrowing Owl Relocation and Mitigation Plan, in addition to the avoidance measures described above. The final Burrowing Owl Relocation and Mitigation Plan shall be approved by the CPM, in

consultation with USFWS, BLM and CDFG, and shall:

a. Identify and describe suitable relocation sites within 1 mile of the Project Disturbance Area, and describe measures to ensure that burrow installation or improvements would not affect sensitive species habitat or existing burrowing owl colonies in the relocation area;

b. Provide guidelines for creation or enhancement of at least two natural or artificial burrows per relocated owl, including a discussion of timing of burrow improvements, specific location of burrow installation, and burrow design. Design of the artificial burrows shall be consistent with CDFG guidelines (CDFG 1995) and shall be approved by the CPM in consultation with CDFG, BLM and USFWS;

c. Passive relocation sites shall be in areas of suitable habitat for burrowing owl nesting, and be characterized by minimal human disturbance and access. Relative cover of non-native plants within the proposed relocation sites shall not exceed the relative cover of non-native plants in the adjacent habitats;

d. Provide detailed methods and guidance for passive relocation of burrowing owls occurring within the Project Disturbance Area; and

4. Acquire Compensatory Mitigation Lands for Burrowing Owls. The following measures for compensatory mitigation shall apply only if burrowing owls that are detected within the Project Disturbance Area. The Project owner shall acquire, in fee or in easement, 19.5 acres of land for each burrowing owl that is displaced by construction of the Project. This compensation acreage of 19.5 acres per single bird or pair of nesting owls assumes that there is no evidence that the compensation lands are occupied by burrowing owls. If burrowing owls are observed to occupy the compensation lands, then only 9.75 acres per single bird or pair is required, per CDFG (1995) guidelines. If the compensation lands are contiguous to currently occupied habitat, then the replacement ratio will be 13.0 acres per pair or single bird. The Project owner shall provide funding for the enhancement and long-term management of these compensation lands. The acquisition and management of the compensation lands may be delegated by written agreement to CDFG or to a third party, such as a non-governmental organization dedicated to habitat conservation, subject to approval by the CPM, in consultation with CDFG and USFWS prior to land acquisition or management activities. Additional funds shall be based on the adjusted market value of compensation lands at the time of construction to acquire and manage habitat. In lieu of acquiring lands itself, the Project owner may satisfy the requirements of this condition by depositing funds into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF), as described in Section 3.i. of Condition of Certification BIO-17.

a. Criteria for Burrowing Owl Mitigation Lands. The terms and conditions of this acquisition or easement shall be as described in Paragraph 1 of **BIO-17** [Desert Tortoise Compensatory Mitigation], with the additional criteria to include: 1) the mitigation land must provide suitable habitat for burrowing owls, and 2) the acquisition lands must either currently support burrowing owls or be within dispersal distance from an active burrowing owl nesting territory (generally approximately 5 miles). The burrowing owl mitigation lands may be included with the desert tortoise mitigation lands ONLY if these two burrowing owl criteria are met. If the burrowing owl mitigation land is separate from the acquisition required for desert tortoise compensation lands, the Project owner shall fulfill the requirements described below in this condition.

b. Security. If burrowing owl mitigation land is separate from the acreage required for desert tortoise compensation lands the Project owner or an approved third party shall complete acquisition of the proposed compensation lands prior to initiating ground-disturbing Project activities. Alternatively, financial assurance can be provided by the Project owner to the CPM with copies of the document(s) to CDFG, BLM and the USFWS, to guarantee that an adequate level of funding is available to implement the mitigation measure described in this condition. These funds shall be used solely for implementation of the measures associated with the Project. Financial assurance can be provided to the CPM in the form of an irrevocable letter of credit, a pledged savings account or another form of security ("Security") prior to initiating ground-disturbing Project activities. Prior to submittal to the CPM, the Security shall be approved by the CPM, in consultation with CDFG, BLM and the USFWS to ensure funding. The estimated costs of enhancement and endowment are discussed in condition BIO-17. The final amount due will be determined by the PAR analysis conducted pursuant to **BIO-17.**

Verification: If pre-construction surveys detect burrowing owls within 500 feet of proposed construction activities, the Designated Biologist shall provide to the CPM, BLM, CDFG and USFWS documentation indicating that non-disturbance buffer fencing has been installed at least 10 days prior to the start of any construction-related ground disturbance activities. The Project owner shall report monthly to the CPM, CDFG, BLM and USFWS for the duration of construction on the implementation of burrowing owl avoidance and minimization measures. Within 30 days after completion of construction the Project owner shall provide to the CPM, BLM, CDFG and USFWS a written construction termination report identifying how mitigation measures described in the plan have been completed.

If pre-construction surveys detect burrowing owls within the Project Disturbance Area, the Project owner shall notify the CPM, BLM, CDFG and USFWS no less than 10 days of completing the surveys that a relocation of owls is necessary. The Project owner shall do all of the following if relocation of one or more burrowing owls is required:

a. Within 30 days of completion of the burrowing owl pre-construction surveys, submit to the CPM, CDFG and USFWS a Burrowing Owl Relocation and Mitigation Plan.

b. No less than 90 days prior to acquisition of the burrowing owl compensation lands, the Project owner, or an approved third party, shall submit a formal acquisition proposal to the CPM, CDFG, and USFWS describing the ~~39-acre~~ parcel intended for purchase. At the same time the Project owner shall submit a PAR or PAR-like analysis for the parcels for review and approval by the CPM, CDFG and USFWS.

c. Within 90 days of the land or easement purchase, as determined by the date on the title, the Project owner shall provide the CPM with a management plan for review and approval, in consultation with CDFG, BLM and USFWS, for the compensation lands and associated funds.

d. No later than 30 days prior to the start of construction-related ground disturbing activities, the Project owner shall provide written verification of Security in accordance with this condition of certification.

e. No later than 18 months after the start of construction-related ground disturbance activities, the Project owner shall provide written verification to the CPM, BLM, CDFG and USFWS that the compensation lands or conservation easements have been acquired and recorded in favor of the approved recipient.

f. On January 31st of each year following construction for a period of five years, the Designated Biologist shall provide a report to the CPM, USFWS, BLM and CDFG that describes the results of monitoring and management of the burrowing owl relocation area. The annual report shall provide an assessment of the status of the relocation area with respect to burrow function and weed infestation, and shall include recommendations for actions the following year for maintaining the burrows as functional burrowing owl nesting sites and minimizing the occurrence of weeds.

STREAMBED IMPACT MINIMIZATION AND COMPENSATION MEASURES

BIO-26 The project owner shall implement the following measures to avoid, minimize and mitigate for direct and indirect impacts to jurisdictional waters of the State and to satisfy requirements of California Fish and Game Code sections 1600 and 1607. Throughout this condition, "jurisdictional" refers to streambeds or acreages of streambed meeting CDFG criteria as waters of the State.

Section A: Acquire Off-Site State Waters:

The project owner shall acquire, in fee or in easement, a parcel or parcels of land that includes no fewer than ~~288.8~~<152.3> acres of State jurisdictional waters. ~~At least 9.9 acres must contain microphyll woodland.~~ Prior to construction the applicant shall map the vegetation with emphasis on desert wash, including mircrophyll woodland, communities within the drainages subject to project disturbance and provide a map to the CPM, CDFG and BLM. ~~Impacts to 3.3 acres of catclaw acacia or smoke tree habitat lost will be mitigated at a minimum 3:1 ratio.~~ The parcel or parcels comprising the ~~288.8~~<152.3> acres of ephemeral washes shall include the same types of vegetation as mapped in the project footprint.

This compensation acreage may be included ("nested") within the acreage acquired and managed as desert tortoise habitat compensation (Condition of Certification **BIO-17)** only if:

- Adequate acreage of qualifying state-jurisdictional streambed delineated within the desert tortoise compensation lands;
- The desert tortoise habitat compensation lands are acquired and dedicated as permanent conservation lands within 18 months of the start of project construction.

If these two criteria are not met, then the project owner shall provide no fewer than ~~288.8~~<125.7> acres of state-jurisdictional streambed compensation lands independent of any compensation land required under other conditions of certification (adjusted to reflect the final project footprint and expert's delineation of streambed on the compensation lands), and shall also provide funding for the initial improvement and long-term maintenance and management of the acquired lands, and to comply with other related requirements this condition. Costs of these requirements cannot be estimated in advance because jurisdictional streambed would make up only a small portion of any acquired parcel and might vary widely among available parcels. In general, however, the total costs are estimated to include per-acre cost of the land itself at approximately $500, pre-acquisition liability surveys, appraisal fees, and other transaction costs, appraisal fees at $3,000 per parcel, $250

per acre for initial habitat improvement, BLM internal costs for transfer of land, and $692 per acre for long-term management, and (if applicable) NFWF management fees. (For cost estimates, see BIO-17.) The terms and conditions of this acquisition or easement shall be as described in Condition of Certification **BIO-17.** Mitigation for impacts to State waters shall occur within the surrounding watersheds, as close to the project site as possible.

The project owner may elect to comply with the requirements in this condition for acquisition of compensation lands, initial protection and habitat improvement on the compensation lands, or long-term maintenance and management of the compensation lands by funding, or any combination of these three requirements, by providing funds to implement those measures into the Renewable Energy Action Team (REAT) Account established with the National Fish and Wildlife Foundation (NFWF). To use this option, the Project owner must make an initial deposit to the REAT Account in an amount equal to the estimated costs of implementing the requirement. If the actual cost of the acquisition, initial protection and habitat improvements, or long-term funding is more than the estimated amount initially paid by the project owner, the project owner shall make an additional deposit into the REAT Account sufficient to cover the actual acquisition costs, the actual costs of initial protection and habitat improvement on the compensation lands, or the long-term funding requirements as established in an approved PAR or PAR-like analysis. If those actual costs or PAR projections are less than the amount initially transferred by the applicant, the remaining balance shall be returned to the project owner.

The responsibility for acquisition of compensation lands may be delegated to a third party other than NFWF, such as a non-governmental organization supportive of desert habitat conservation, by written agreement of the Energy Commission. Such delegation shall be subject to approval by the CPM, in consultation with CDFG, BLM and USFWS, prior to land acquisition, enhancement or management activities. Agreements to delegate land acquisition to an approved third party, or to manage compensation lands, shall be executed and implemented within 18 months of the Energy Commission's certification of the project.

Management Plan for Acquired Lands: The project owner shall prepare and submit to Energy Commission CPM and CDFG a draft Management Plan that reflects site-specific enhancement measures for the drainages on the acquired compensation lands. The objective of the Management Plan shall be to enhance the wildlife value of the drainages, and may include enhancement actions such as weed control, fencing to exclude livestock, or erosion control. Where applicable, the management plan should be integrated with desert tortoise compensation land habitat management planning requirements as described in **BIO-17.**

Section B: On-site Measures:

1. Copies of Requirements, Stop Work Authority: The project owner shall provide a copy of the Streambed Impact Minimization and Compensation Measures to all contractors, subcontractors, and the applicant's project supervisors. Copies shall be readily available at work sites at all times during periods of active work and must be presented to any CDFG personnel or personnel from another agency upon demand. The CPM reserves the right to issue a stop work order after giving notice to the project owner, if the CPM, in consultation with CDFG, determines that the project owner is not in compliance with any of the requirements of this condition, including but not limited to the existence of any of the following:

    a. The information provided by the applicant regarding streambed alteration is incomplete or inaccurate;

    b. New information becomes available that was not known to the Energy Commission at the time of project certification; or

    c. The project or project activities as described in the Supplemental Staff Assessment/Final Environmental Impact Statement have changed.

2. Best Management Practices: The project owner shall comply with the following conditions to protect drainages near the Project Disturbance Area:

    a. The project owner shall not operate vehicles or equipment in ponded or flowing water except as described in this condition.

    b. With the exception of the retention basins and drainage control system installed for the project the installation of bridges, culverts, or other structures shall be such that water flow (velocity and low flow channel width) is not impaired. Bottoms of temporary culverts shall be placed at or below stream channel grade.

    c. When any activity requires moving of equipment across a flowing drainage, such operations shall be conducted without substantially increasing stream turbidity.

    d. Vehicles driven across ephemeral drainages when water is present shall be completely clean of petroleum residue and water levels shall be below the vehicles' axels.

    e. The project owner shall minimize road building, construction activities and vegetation clearing within ephemeral drainages to the extent feasible.

    f. The project owner shall not allow water containing mud, silt, or other pollutants from grading, aggregate washing, or other activities to enter

ephemeral drainages or be placed in locations that may be subjected to high storm flows.

g. The project owner shall comply with all litter and pollution laws. All contractors, subcontractors, and employees shall also obey these laws, and it shall be the responsibility of the project owner to ensure compliance.

h. Spoil sites shall not be located at least 30 feet from the boundaries and drainages or in locations that may be subjected to high storm flows, where spoils might be washed back into drainages.

i. Raw cement/concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances that could be hazardous to vegetation or wildlife resources, resulting from project-related activities, shall be prevented from contaminating the soil and/or entering waters of the State. These materials, placed within or where they may enter a drainage by the project owner or any party working under contract or with the permission of the project owner, shall be removed immediately.

j. No broken concrete, debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or washings thereof, oil or petroleum products or other organic or earthen material from any construction or associated activity of whatever nature shall be allowed to enter into, or placed where it may be washed by rainfall or runoff into, waters of the State.

k. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high water mark of any drainage.

l. No equipment maintenance shall occur within 150 feet of any ephemeral drainage where petroleum products or other pollutants from the equipment may enter these areas under any flow.

m. Stationary equipment such as motors, pumps, generators, and welders, located within or adjacent to a drainage shall be positioned over drip pans. Stationary heavy equipment shall have suitable containment to handle a catastrophic spill/leak. Clean up equipment such as booms, absorbent pads, and skimmers, shall be on site prior to the start of construction.

n. The cleanup of all spills shall begin immediately. The CDFG, BLM Wildlife Biologist, and CPM shall be notified immediately by the project owner of any spills and shall be consulted regarding clean-up procedures.

3. Non-Native Vegetation Removal. The owner shall remove any non-native vegetation (Consistent with the Weed Management Plan, see Condition of Certification **BIO-1 1)** from any on-site portion of any drainage that requires the placement of a bridge, culvert or other structure. Removal shall be done at least twice annually (Spring/Summer) throughout the life of the Project.

4. Reporting of Special-Status Species: If any special-status species are observed on or in proximity to the project site, or during project surveys, the project owner shall submit California Natural Diversity Data Base (CNDDB) forms and maps to the CNDDB within five working days of the sightings and provide the regional CDFG office with copies of the CNDDB forms and survey maps. The CNDDB form is available online at http://www. dfg.ca.gov/whdab/pdfs/natspec.pdf. This information shall be mailed within five days to: California Department of Fish and Game, Natural Diversity Data Base, 1807 13th Street, Suite 202, Sacramento, CA 95814, (916) 324-3812. A copy of this information shall also be mailed within five days to CDFG, BLM Wildlife Biologist, and the CPM.

5. Notification: Prior to any activities that cross or have the potential to impact any jurisdictional drainage, the project owner shall provide a detailed map to the CDFG, BLM Wildlife Biologist, and CPM in a GIS format that identifies all potential crossings of jurisdictional habitats including retention basins, detention basins, reconfigured channels and culverts. The maps shall identify the type of crossing proposed by the owner such as bridges, culverts, or other mechanism and the best management practices that would be employed. The project owner shall notify the CPM, BLM Wildlife Biologist, and CDFG, in writing, at least five days prior to initiation of project activities in jurisdictional areas and at least five days prior to completion of project activities in jurisdictional areas. The project owner shall notify the CPM, BLM Wildlife Biologist, and CDFG of any change of conditions to the project, the jurisdictional impacts, or the mitigation efforts, if the conditions at the site of the proposed project change in a manner which changes risk to biological resources that may be substantially adversely affected by the proposed project. The notifying report shall be provided to the CPM, BLM Wildlife Biologist, and CDFG no later than 7 days after the change of conditions is identified. As used here, change of condition refers to the process, procedures, and methods of operation of a project; the biological and physical characteristics of a project area; or the laws or regulations pertinent to the project, as described below. A copy of the notifying change of conditions report shall be included in the annual reports.

    a. Biological Conditions: a change in biological conditions includes, but is not limited to, the following: 1) the presence of biological resources within or adjacent to the project area, whether native or non-native, not previously known to occur in the area; or 2) the presence of biological

resources within or adjacent to the project area, whether native or non-native, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations.

b. Physical Conditions: a change in physical conditions includes, but is not limited to, the following: 1) a change in the morphology of a river, stream, or lake, such as the lowering of a bed or scouring of a bank, or changes in stream form and configuration caused by storm events; 2) the movement of a river or stream channel to a different location; 3) a reduction of or other change in vegetation on the bed, channel, or bank of a drainage, or 4) changes to the hydrologic regime such as fluctuations in the timing or volume of water flows in a river or stream.

c. Legal Conditions: a change in legal conditions includes, but is not limited to, a change in Regulations, Statutory Law, a Judicial or Court decision, or the listing of a species, the status of which has changed to endangered, rare, or threatened, as defined in section 15380 of Title 14 of the California Code of Regulations.

Verification: No fewer than 30 days prior to the start of any site or related facilities mobilization activities, the project owner shall implement the mitigation measures described in this condition. No fewer than 30 days prior to the start of work potentially affecting waters of the State, the project owner shall provide written verification (i.e., through incorporation into the BRMIMP) to the CPM and BLM Wildlife Biologist that the above best management practices will be implemented and provide a discussion of work in waters of the State in Compliance Reports for the duration of the project.

Within 30 days after completion of the first year of project construction, the project owner shall provide to the CPM for review and approval a report identifying that appropriate mitigation lands have been obtained, verification of the acreage of state jurisdictional streambeds on the compensation lands (to be delineated using methodology identical to the delineation of on-site jurisdictional streambeds), a draft Management Plan for review and approval by the CPM and CDFG, and verification on ongoing enhancement techniques, and a summary of all modifications made to the existing channels on the project site.

GEO-2 Because of the embankments on the downhill side, the proposed storm water detention basins constitute detention dams, some of which may be large enough to be under the jurisdiction of the State of California, Department of Water Resources, Division of Safety of Dams. Each detention dam site shall be characterized in a geotechnical investigation to establish foundation conditions and assess geologic hazards that affect embankment design. Appropriate geotechnical recommendations shall be provided for use in design and construction of the embankments and the associated storage area. All dams must be designed by a California licensed geotechnical or civil engineer familiar with design of small dams.

Verification: At least 60 days prior to ground breaking for the detention basins, the project owner shall submit a geotechnical investigation report covering each proposed detention basin. Appropriate geotechnical recommendations and specifications shall be provided for use in design and construction of the embankments and the associated storage area. All detention facilities can be included in a single report or in the overall final project geotechnical report. One set of stamped design drawings, typical of the detention dams, must be submitted by the project owner, prior to starting detention dam construction.

GEOLOGY AND PALEONTOLOGICAL RESOURCES

GEO-3 The California Department of Water Resources, Division of Safety of Dams reviews plans for all dams that impound 50 acre-feet of water or more. Embankments 6 feet high or less are excluded, regardless of storage capacity and embankments impounding less than 15 acre-feet of water are excluded, regardless of height. Any detention basin meeting the Division of Safety of Dams jurisdictional criteria for a dam shall be approved by the CPM after review by the Division of Safety of Dams.

Verification: If final detention basin design results in no jurisdictional dams, the project owner shall submit a letter of verification from the design engineer. If one or more detention basins fall within the jurisdictional criteria of the Division of Safety of Dams, the project owner shall submit copies of the design plans to the Division of Dams Safety of Dams. Upon completion of construction of jurisdictional dams, the project owner shall submit copies of as-built drawings to the Division of Safety of Dams.

STORMWATER CONTROL/FLOOD PROTECTION DESIGN PLANS

SOIL&WATER-8: The project owner shall submit two (2) copies of the 30-percent, 60-percent and 90-percent design drawings for the grading and drainage facilities to the CPM for review and comment. The 30-percent, 60-percent and 90-percent design drawings for the grading and drainage facilities shall be accompanied by a basis of design report to convey and support the design approach. To prepare the grading and drainage facilities drawings and accompanying basis of design report, the project owner shall do the following:

1. Conduct an analysis to quantify the design discharges and associated volumes of water, debris, and sediment associated with the 100-year storm at the apex of the fan under current watershed conditions.

2. Conduct a geomorphic and hydraulic analysis to determine the maximum design storm that can be routed through the site utilizing existing fluvial washes that will not result in significant damage to proposed site infrastructure.

3. Conduct a geomorphic and biologic analysis to determine the minimum design storm that can be routed through the site utilizing existing fluvial washes that will provide the necessary sediment load through the site and "downstream areas" to maintain existing sensitive habitat needs, as described in the *Geomorphic Assessment of Calico Solar Project Site*. This analysis must consider and address the need for fine sand to support the existing sensitive habitat and the potential episodic nature of the associated dune complex evolution that depends upon El Niño events (i.e., wet winters occurring approximately every 3 to 7 years) delivering sediment to the lower fan and the accompanying La Niña events (i.e., dry winters occurring approximately every 3 to 7 years) eroding and transporting fine sands to these dunes through wind action.

4. Determine the pass through design storm that can be routed through the site unimpeded to deliver the necessary sediment load through the site to maintain existing sensitive habitat needs in "downstream areas" and not result in significant damage to proposed site infrastructure.

5. Size, locate, and design each detention basin to allow the pass through design storm to move through the site unimpeded while capturing larger design storm flows and related sediment and debris to protect the proposed infrastructure.

6. Convey design of each basin by showing supporting calculations and design drawings to convey the basin in plan view, cross-sections, depth to spillway, amount of freeboard to top of basin, basin volume to spillway, description of sidewall slopes, method of providing pass through design

storm and related sediment unimpeded, method of providing erosion protection of basin side walls, inlet design, outlet design, spillway design, spillway erosion control, combined outlet maximum flow, transition from outlet to existing downstream fluvial wash, tortoise fence location and design, maintenance of tortoise fence, maintenance of basin, maintenance of excess sediment in basin from larger flood flows.

7. The project owner shall request comments from the Department of Water Resources Division of Safety of Dams (DSOD) for the plans and specifications for the construction of any dam(s) or reservoir(s) that are under DSOD jurisdiction prior to beginning construction, and forward all comments to the CPM.

8. For all flood control basin dams, the project owner shall provide at a minimum:

   - specific locations of basins and dams on appropriate scale map,
   - configuration of all basins and dams including basin-specific cross sections,
   - a description of all materials designed to be used in the construction of the dams,
   - footings designs,
   - designs of cutoff walls,
   - designs of keyways,
   - description and design of drainage pass though methods,
   - flow metering (ability to maintain maximum discharge to that of the maximum on-site flow design) technique and design,
   - method of and design of debris deflection (i.e. trash racks) for each basin,
   - emergency spillway design,
   - pass through pipe outlet energy dissipation method and design, and
   - basin inlet erosion protection.

9. In addition to the criteria discussed above, the basis of design report shall also follow the procedures outlined in the following documents as far as is applicable:

~~a.~~

<SOIL&WATER-8: The project shall achieve the following performance standards:**>**

<1. Project construction shall not alter the existing drainage watershed boundaries.>

<2. Project construction shall not adversely affect any single railroad structure through changes in the volume of water or velocity of storm water runoff reaching the railroad structure.>

<3. No SunCatcher shall be placed within a wash where the 100-year, 24-hour water surface elevation would be more than 1.5 feet above the base of the pedestal.>

<4. No SunCatcher shall be placed within a wash where the local plus general scour exceeds four feet in depth.>

<5. Post development runoff shall be equal to or less than predevelopment runoff.>

<6. The project and reports prepared for the project shall comply with the requirements of the >San Bernardino County Drainage Manual ~~and 2007 Development Code (amended, March 25, 2010).~~

~~b. Federal Emergency Management Agency Guidelines for Determining Flood Hazards on Alluvial Fans and Guidelines and Specifications for Flood Hazard Mapping Partners.~~

~~The project owner shall prepare a set of design specifications to supplement the 90-percent design drawings. Plans, specifications, computations and other data shall be prepared by persons properly licensed by the State of California. If the 60-percent plans or 90-percent plans and specifications do not comply with the appropriate Conditions of Certification, the necessary changes or revisions to the plans shall be made by the project owner. If the CPM finds that the work described in the plans and specifications conform to the Conditions of Certifications in the Energy Commission Decision and other pertinent LORS, then the project owner shall submit two (2) copies of the 100- percent set for CPM review and approval. All design drawings must be submitted on bound or stapled 24" x 36" size paper.~~<(SBCDM), including requirements for the retention basins for the Main Services Complex. >

<7. The project shall not significantly alter sediment transport through the project site.>

<To ensure achievement of these performance standards>, the project owner shall do the following:

<A. Prior to installing any SunCatcher dishes, the project owner shall submit a final hydrology report to the CPM that demonstrates compliance with the seven performance standards listed above. The report shall include a HEC-RAS study for each of the significant washes that contains enough cross sections to adequately describe the water surface elevations and floodplain boundaries; shall address sediment transport issues as a result of project improvements, i.e., increases or decreases to local areas and the general area within the development; and shall be prepared pursuant to local standards of practice and the SBCDM.>

<B. >Prior to installing any SunCatcher dishes ~~or construction of the detention basins,~~<, the final hydrology report described above shall be made available to BNSF for review. If BNSF so requests, following review of the final hydrology report, the> project owner shall pay for, and submit to <BNSF and >the CPM, a <revised final >hydrology ~~study, commissioned by BNSF, which will determine the impact, if any, on rail safety and BNSF operations of its planned placement of SunCatcher dishes and detention basins and determine appropriate mitigation measures, if necessary, to be paid for by project owner~~<report, which will address and evaluate the BNSF comments and concerns, if any, concerning the SunCatcher field affects on the existing drainage system to ensure that current performance standards with respect to the BNSF facilities are met.>

<C. The Project Owner shall submit 60-percent and 90-percent design drawings for the grading and drainage facilities to the CPM for review and comment. The 60-percent and 90-percent drawings> shall be accompanied by a basis of design report to convey and support the design approach.

Verification: ~~Prior to site mobilization, the project owner shall prepare preliminary (30-percent) grading and drainage facilities drawings and accompanying basis of design report for CPM review and approval. No later than 30~~<No later than 90> days after publication of the Energy Commission Decision, the 60-percent set of design drawings and accompanying basis of design report shall be submitted to the CPM for review and approval. The project owner shall submit the 90-percent design drawings and accompanying basis of design report to the CPM for review and approval after the person who originally drew the plan or their duly authorized agent addresses the CPM's 60-percent submittal comments and required changes. ~~The 100-percent design drawings and specifications (construction documents) shall be signed and sealed by a Registered Professional Engineer in the State of California and submitted as the final, approved set of construction documents prior to site mobilization. Prior to initiation of site construction~~< Prior to installing any SunCatchers>, the 100-percent design drawings and specifications (construction documents) shall be submitted along with the final basis of design report signed and sealed by a Registered Professional Engineer

~~and a Registered Professional Geologist~~ in the State of California ~~to the CPM for review and approval.~~

~~Thirty (30) days prior to initiation of construction of any dams that would be considered under the jurisdiction of DSOD, the project owner shall receive approval for dam construction from the CPM based on comments the CPM has received from the DSOD for dam design adequacy. Prior to installing any SunCatcher dishes or construction of the detention basins, project owner shall submit the hydrology study, commissioned by BNSF~~<, as well as the final hydrology report>, to <the >CPM for review and ~~comment~~<approval>.

WORKER SAFETY-7 The project owner shall either:

(1) Reach an agreement, either individually or in conjunction with a power generation industry association or group that negotiates on behalf of its members, with the San Bernardino County Fire Department (SBCFD) regarding funding of its project-related share of capital and operating costs to build and operate new fire protection/response infrastructure and provide appropriate equipment as mitigation of project-related impacts on fire protection services within the jurisdiction.

or

(2) Shall fund its share of the capital costs in the amount of $~~1,187,000~~<806,360 ($47,500 for Phase 1a, $308,940 for Phase 1b, and $449,920 for Phase 2)> and provide an annual payment of $~~1,095,000~~<746,944 ($44,000 for Phase 1a, $286,176 for Phase 1b, $416,768 for Phase 2)> to the SBCFD for the support of new fire department staff and operations and maintenance commencing with the start of construction and continuing annually thereafter on the anniversary until the final date of power plant decommissioning.

or

(3) The Project Owner shall fund a Fire Needs Assessment and Risk Assessment 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 Fire Needs Assessment would address emergency response and equipment/staffing/location needs while the Risk Assessment would be used to establish the risk (chances) of significant impacts occurring. In no event shall the Project Owner's cost responsibility under this option exceed that under option (2), above.

Should the applicant pursue option (3), above, the Fire Needs Assessment and Risk Assessment shall evaluate the following:

(a) Potential for impacts on the SBCFD and the project allocated costs of new and/or enhanced fire protection/emergency response services (which shall include services for inspections, permitting, fire response, hazardous materials spill/leak response, rescue, and emergency medical services) necessary to mitigate such impacts;

(b) The risk of impact on the local population that could result from potential unmitigated impacts on local fire protection and emergency services (i.e. "drawdown" of emergency response resources);

(c) The extent that the project's exemption from local taxes will impact local fire protection and emergency response services; and

(d) Recommendation of an amount of funding that should be provided to mitigate any identified significant impacts on local fire protection and emergency response services.

Compliance Protocols for the Fire Needs Assessment and Risk Assessment shall be as follows

(a) The Fire Needs Assessment and Risk Assessment shall be conducted by an independent consultant(s) selected and approved by the CPM;

(b) The Fire Needs Assessment and Risk Assessment shall be fully funded by the project owner. The independent consultant(s) preparing the Fire Needs Assessment and Risk Assessment shall work directly for the Energy Commission;

(c) The project owner shall provide the protocols for conducting the independent fire needs assessment for review and comment by the SBCFD and review and approval by the CPM prior to the independent consultant's commencement of the fire needs assessment;

(d) The CPM shall be copied in any correspondence including emails or letters and included in any conversations between the project owner and consultant; and

(e) The CPM shall verify that the Fire Needs Assessment and Risk Assessment are prepared consistent with the approved fire needs assessment protocols and a risk assessment protocols.

No construction of permanent above ground structures shall occur until full funding of mitigation occurs either (i) pursuant to an agreement reached between the project owner (or a power generation industry association or group that includes the project owner) and the SBCFD, or (ii) after payment of the fees described above for capital improvements and the first annual payment, or (iii) pursuant to the independent Fire Needs and Risk Assessments conducted by an independent consultant approved by the CPM.

Verification: Prior to November 30, 2010, the project owner shall provide to the CPM:

(1) A copy of the individual agreement with the SBCFD or, if the owner joins a power generation industry association, a copy of the bylaws and group's agreement/contract with the SBCFD 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) In relation to Phase 1a, documentation that the amount of $47,500 (250 acres x $190 per acre) has been paid to the SBCFD and documentation that the prorated portion of first annual payment, which is $44,000 (250 acres x $176 per acre), has been made,

a) At least thirty (30) days prior to the start of site mobilization for Phase 1b, the project owner shall provide to the CPM, documentation that the amount of $~~394,630~~<308,940> (~~2,077~~<1,626> acres x $190 per acre) has been paid to the SBCFD.

B At least thirty (30) days prior to the start of site mobilization for Phase 2, the project owner shall provide to the CPM, documentation that the amount of $~~738,720~~<449,920> (~~3,888~~<2,368> acres x $190 per acre) has been paid to the SBCFD.

Annually thereafter, the owner shall provide the CPM with evidence in each January Monthly Compliance Report during construction and the Annual Compliance Report during operation that subsequent annual payments have been made.

or

(3) A protocol, scope and schedule of work for the independent Fire Needs Assessment and Risk Assessment and the qualifications of proposed contractor(s) for review and approval by the CPM; a copy of the completed Fire Needs Assessment and Risk Assessment showing 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 San Bernardino County Fire Department for required fire protection services mitigation pursuant to the agreement with the Fire Department or the CPM approved independent fire needs assessment.

WORKER SAFETY-8 In the event that no agreement with the San Bernardino County Fire Department is reached, the project owner shall pay to SBCFD (a) $91,750 (250 acres x $367 per acre) prior to the start of construction for Phase 1a; (b) $~~762,259~~<596,742> (~~2,077~~<1,626> acres x $367 per acre) prior to the start of construction for Phase 1b; and (c) $~~1,426,896 (3,888~~<869,056 (2,368> acres x $367 per acre) prior to the start of construction for Phase 2. This funding shall off-set any initial funding required by **WORKER SAFETY-7** above until the funds are exhausted. This offset will be based on a full accounting by the SBCFD regarding the use of these funds.

Verification: For Phase 1a, prior to November 30, 2010 (and at least 10 days prior to the start of site mobilization for Phase 1b and Phase 2, respectively), the project owner shall provide to the CEC CPM either:

a. documentation that the payment described above has been made;

or

b. that payment has been made pursuant to a contractual agreement with the SBCFD.

The CEC CPM shall adjust any payments initially required by **WORKER SAFETY-7** based upon the accounting provided by the SBCFD.

This Page Intentionally Left Blank

ATTACHMENT E

Proposed Revisions to Soil and Water 8

This Page Intentionally Left Blank

ATTACHMENT E

SOIL&WATER-8

The project shall achieve the following performance standards:

1. Project construction shall not alter the existing drainage watershed boundaries.

2. Project construction shall not adversely affect any single railroad structure through changes in the volume of water or velocity of storm water runoff reaching the railroad structure.

3. No SunCatcher shall be placed within a wash where the 100-year, 24-hour water surface elevation would be more than 1.5 feet above the base of the pedestal.

4. No SunCatcher shall be placed within a wash where the local plus general scour exceeds four feet in depth.

5. Post development runoff shall be equal to or less than predevelopment runoff.

6. The project and reports prepared for the project shall comply with the requirements of the San Bernardino County Drainage Manual (SBCDM), including requirements for the retention basins for the Main Services Complex.

7. The project shall not significantly alter sediment transport through the project site.

To ensure achievement of these performance standards, the project owner shall do the following:

A. Prior to installing any SunCatcher dishes, the project owner shall submit a final hydrology report to the CPM that demonstrates compliance with the seven performance standards listed above. The report shall include a HEC-RAS study for each of the significant washes that contains enough cross sections to adequately describe the water surface elevations and floodplain boundaries; shall address sediment transport issues as a result of project improvements, i.e., increases or decreases to local areas and the general area within the development; and shall be prepared pursuant to local standards of practice and the SBCDM.

B. Prior to installing any SunCatcher dishes, the final hydrology report described above shall be made available to BNSF for review. If BNSF so requests, following review of the final hydrology report, the project owner shall pay for, and submit to BNSF and the CPM, a revised final hydrology report, which will address and evaluate the BNSF comments and concerns, if any, concerning the SunCatcher field affects on the existing drainage system to ensure that current performance standards with respect to the BNSF facilities are met.

C. The Project Owner shall submit 60-percent and 90-percent design drawings for the grading and drainage facilities to the CPM for review and comment. The 60-percent and 90-percent drawings shall be accompanied by a basis of design report to convey and support the design approach.

Verification: No later than 90 days after publication of the Energy Commission Decision, the 60-percent set of design drawings and accompanying basis of design report shall be submitted to the CPM for review and approval. The project owner shall submit the 90-percent design drawings and accompanying basis of design report to the CPM for review and approval after the person who originally drew the plan or their duly authorized agent addresses the CPM's 60-percent submittal comments and required changes. Prior to installing any SunCatchers, the 100-percent design drawings and specifications (construction documents) shall be submitted along with the final basis of design report signed and sealed by a Registered Professional Engineer in the State of California, as well as the final hydrology report, to the CPM for review and approval.

EXHIBIT 115

Declaration of Patrick J. Mock, PhD

This Page Intentionally Left Blank

DECLARATION OF PATRICK J. MOCK, PhD

I, Patrick J. Mock, declare:

1. I am employed by URS Corporation as a Principal Scientist. I have participated in and managed URS's analysis of biological resources on behalf of Calico Solar, LLC for the Calico Solar Project since 2007. I have previously testified in this proceeding in writing and at hearings and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe the impacts to biological resources, including wildlife, vegetation and aquatic resources associated with Scenarios 5.5 and 6. Overall, as compared to the 6,215-acre, 850 MW project analyzed in the SSA (the "850 MW Project"), both Scenarios would substantially lessen overall impacts to biological resources. Most significantly, both Scenarios would result in substantially reduced impacts to the federally and state-listed desert tortoise, Nelson's bighorn sheep, jurisdictional waters of the State, and native vegetation.

4. The SSA identifies significant, less than significant, and cumulatively considerable impacts to biological resources resulting from the 850 MW Project. With the 30 Conditions of Certification identified, Staff concludes that the 850 MW Project would cause only one significant unavoidable impact to biological resources, consisting of cumulative impacts to Mojave fringe-toed lizard habitat and interruption of east-west movement. As I have testified, I

agree with Staff's conclusions that the 850 MW project, with mitigation incorporated, would not result in any project level significant impact. As I have also testified previously, I disagree with Staff's conclusion that the 850 MW would result in significant impacts to the Mojave fringe-toed lizard habitat. I believe that the provision of 3:1 MFTL habitat mitigation as well as the more than 25,600 acres of MFTL habitat already preserved in the project's vicinity is sufficient to ensure that there are no project level or cumulatively considerable impacts to this species. See Exhibit 87 at A6.

5. The following paragraphs of this Declaration describe how the impacts of Scenarios 5.5 and 6 would compare to the impacts of the 850 MW Project. Generally speaking, Scenarios 5.5 and 6 would cause impacts to the same biological resources as would the 850 MW Project. Conditions of Certification identified for the 850 MW Project would also apply to Scenarios 5.5 and 6, except that acreages and financial commitments for compensatory mitigation would be reduced for waters of the State, microphyll woodlands, desert tortoise, raven management, and burrowing owl. Revised Conditions of Certification for Scenarios 5.5 and 6 relating to these resources are attached to the Testimony of Felicia Bellows.

6. Scenarios 5.5 and 6 have been designed primarily to reduce impacts to desert tortoise. This was accomplished by minimizing (Scenario 5.5) or avoiding (Scenario 6) impacts to the highest quality tortoise habitat. A detailed assessment of these scenarios with respect to desert tortoise is provided in the Declaration of Theresa Miller, who worked under my supervision. Based on my experience and my participation in the analysis of desert tortoise impacts for the 850 MW Project, Scenario 5.5 and Scenario 6, I conclude that the boundaries between high, medium and low quality desert tortoise habitat are well supported and that the benefits of Scenarios 5.5 and 6 to the tortoise are as described in the Miller Declaration.

7. Scenarios 5.5 and 6 would also reduce impacts to Nelson's bighorn sheep. As described in the SSA, Staff concluded that the impacts to Nelson's bighorn sheep would be potentially significant with respect to disturbance and less than significant with respect to foraging habitat and intermountain movement. With mitigation, the SSA found that all Nelson's bighorn sheep impacts would be less than significant. The sightings of Nelson's bighorn sheep and other evidence (see SSA Figure 6 and Epps, et al., 2007) indicate that the likely routes for Nelson's bighorn sheep inter-mountain movement are east of the 850 MW Project site. However, by moving the project boundary further from the base of the Cady Mountains than did the 850 MW Project, Scenarios 5.5 and 6 would increase potential early spring foraging and east-west movement opportunities for Nelson's bighorn sheep. Under the 850 MW Project, the project boundary would be on average 4,000 feet from the base of the Cady Mountains. Under Scenario 5.5, the project boundary would be 6,865 feet from the base of the Cady Mountains. Under Scenario 6, the project boundary would be 8,025 feet from the base of the Cady Mountains. The reduction of the project, particularly along its northern boundary, would also reduce potential disturbance to Nelson's bighorn sheep from project construction and operations activities.

8. Scenario 5.5 and 6 would substantially lessen impacts to jurisdictional waters of the State because the avoided northern portion of the site supports the highest density of jurisdictional waters, significantly higher than the areas found in the southern portion of the site. See SSA Biological Resources Figure 7. Impacts to waters of the State would be approximately 152 acres under Scenario 5.5 and approximately 126 acres under Scenario 6. The 850 MW Project would result in impacts to 282.2 acres of State jurisdictional waters. SSA at C.2-102.

9. At 4,613 and 4,224 acres, respectively, Scenarios 5.5 and 6 would directly and indirectly affect less native vegetation than would the 6,215-acre 850 MW Project. With regard to indirect

habitat impacts due to edge effects, the 850 MW Project would affect 1,880.6 acres, Scenario 5.5 would affect 1,582.1 acres, and Scenario 6 would affect 1,421.4 acres. Edge affected habitat was estimated as acreage within 1000 feet of the project boundary that was not already affected by existing development (highway, railroad or transmission line).

10. In terms of the types of vegetation communities that would be affected by Scenarios 5.5 and 6 compared to the 850 MW Project, the new scenarios avoid more of the desert washes and bajadas nearer to the Cady Mountains, impacts to habitat supporting microphyll species would be avoided. The drainages avoided under both scenarios also support a higher diversity and density of species than is found on the southern portion of the site and the avoidance of this habitat will also substantially reduce the project's overall impact on vegetation communities.

11. By eliminating sedimentation basins, Scenarios 5.5 and 6 would eliminate the potential for long-term effects to nearby vegetation from modified flow and sedimentation regimes.

12. The reduced footprints of Scenarios 5.5 and 6 would proportionately reduce the potential for invasive, non-native and noxious weed impacts compared to the 850 MW Project.

13. As with the 850 MW Project, neither Scenarios 5.5 and 6 would involve any impacts to federally or state listed plant species. Scenarios 5.5 and 6 incorporate the avoidance measures proposed in the 850 MW Project and therefore would not result in any impacts to white-margined beardtongue. Both scenarios would also avoid the same occurrences of Utah vine milkweed on the 850 MW Project site, thus reducing the 850 MW Project's less-than-significant impact to Utah vine milkweed. As with the 850 MW project, both scenarios would have impacts to small-flowered androstephium, but that impact would be less than significant. See SSA Biological Resources Figure 2.

14. Scenarios 5.5 and 6 would benefit common wildlife species compared to the 850 MW Project. Generally speaking, the northern portion of the 850 MW Project site represents superior wildlife habitat because it is not traversed by a highway and a railroad, as is the southern portion of the site. Therefore, the benefits of the reduced footprints of Scenarios 5.5 and 6 in terms of ground disturbance, fencing, noise and lighting would be somewhat greater because the site reduction represented by these scenarios occurs in the north rather than the southern portion of the 850 MW Project site where edge effects already occur.

15. Scenarios 5.5 and 6 would have the same direct impacts to Mojave fringe-toed lizards as the 850 MW project because all MFTL habitat and sightings are located within the footprints of Scenarios 5.5 and 6 as well. Potential indirect impacts to MFTL from loss of sediment transport would be reduced equally by both scenarios due to the elimination of detention basins under Scenarios 5.5 and 6.

16. Although Gila monsters were not observed during biological surveys conducted in 2007, 2008, or 2010, the Project site includes potentially suitable habitat and there is a low potential for occurrence of this species in the project area. Scenarios 5.5 and 6 would have similar impacts to potential Gila monster habitat as the 850 MW project, because the potential habitat occurs within the southern portion of the site.

17. Bird species that may use the Project site for foraging, but not nesting, include Swainson's Hawk and Golden Eagle. Scenarios 5.5 and 6 would reduce foraging impacts to these species proportionate to their respective reductions in acreage compared to the 850 MW Project.

18. Burrowing owls are known to occur within the Project site. The 850 MW Project would affect two burrowing owl sighting locations and 11 potential owl burrows. Scenario 5.5 would

affect one burrowing owl sighting location and eight potential owl burrows. Scenario 6 would affect one sighting location and five potential owl burrows. Accordingly, the new scenarios would reduce impacts to burrowing owls.

19. The SSA found that other migratory and special-status birds may lose nesting and foraging habitat as a result of the project, and that all bird species present could be disturbed by project activities, could collide with SunCatchers or be electrocuted by transmission lines, and could be exposed to toxins in evaporation ponds. As noted above, mitigation identified in the SSA would reduce all of these impacts to less-than-significant. Scenarios 5.5 and 6, because they are smaller than the 850 MW Project, would proportionately reduce direct habitat loss, disturbance from project activities, and SunCatcher collision risk. Scenarios 5.5 and 6 would not reduce potential transmission line electrocution or evaporation pond risks, but would be subject to the same mitigation measures that would reduce these impacts to less-than-significant under the 850 MW Project.

20. Impacts to habitat for wide-ranging mammals in the project area, including American badger, desert kit fox, and special-status bats, would be reduced in proportion to the reduced footprints of Scenarios 5.5 and 6. Thus Scenario 5.5 would reduce these impacts by 1,602 acres and Scenario 6 would reduce these impacts by 1,971 acres compared to the 850 MW Project.

21. The SSA identifies impacts to both east-west and north-south wildlife movement from the 850 MW Project. The SSA concludes that these impacts would be less than significant with mitigation. As the SSA states, the earlier reduction of the project footprint from 8,230 to 6,215 acres created a substantial east-west wildlife movement area north of the 850 MW Project site. Scenarios 5.5 and 6 would further enhance east-west wildlife movement opportunities. As stated above, whereas the northern boundary of the 850 MW Project is on average 4,000 feet from the

base of the Cady Mountains, the northern boundaries of Scenarios 5.5 and 6 are 6,865 feet and 8,025 feet, respectively, from the base of the mountains.

22. The SSA examined cumulative impacts of the 850 MW Project combined with other past, present and reasonably foreseeable future projects. The SSA concluded that after mitigation, the project's cumulative contribution to MFTL habitat and movement area losses would be significant and unavoidable, a conclusion with which I disagree (see Paragraph 4 above). Scenarios 5.5 and 6 would reduce the project's contributions to all cumulative impacts to biological resources except for direct impacts to white-margined beardtongue, small-flowered androstephium and MFTL, which would be the same under the new scenarios as under the 850 MW Project. All indirect contributions to cumulative impacts to biological resources, including edge effects, would be reduced under Scenarios 5.5 and 6.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at San Diego, California on September 13, 2010.

_____

Patrick J. Mock, PhD

This Page Intentionally Left Blank

EXHIBIT 116

Declaration of Theresa Miller

This Page Intentionally Left Blank

DECLARATION OF THERESA MILLER

I, Theresa Miller, declare:

1. I am employed by URS Corporation as a Senior Biologist. I have participated in the analysis of desert tortoise impacts and in the preparation of the draft Desert Tortoise Translocation Plan (Exhibit 93) on behalf of Calico Solar, LLC for the Calico Solar Project since 2007. I have previously testified in this proceeding in writing and at hearings and my resume, previously entered into evidence remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing the two new project scenarios developed by Calico Solar pursuant to Committee's September 3, 2010 Order: a) Scenario 6, docketed on September 8, 2010; and b) Scenario 5.5 docketed on September 10, 1010.

3. The purpose of this Declaration is to describe how the habitat quality was mapped as shown in the Desert Tortoise Translocation Plan, how the northern boundaries were revised for Scenarios 6 and 5.5 and how each of the Scenarios reduces the impacts to desert tortoise.

ASSESSMENT OF HABITAT QUALITY

4. URS evaluated the Project site to determine the quality of the desert tortoise habitat found there. Based on a desktop habitat model, extensive site evaluations and protocol level surveys on the entire site (described below), URS determined that the site includes a diversity of soil types, slopes, vegetation and other features that create a variety of desert tortoise habitat, ranging from high quality to low quality. Using accepted criteria and best available data, URS mapped the quality of the habitat found on both the Project site and on potential translocation recipient sites (as shown in Figure 9 of the Desert Tortoise Translocation Plan).

5. URS first performed desktop habitat modeling to assess habitat based upon slope, soils, vegetation, land use/transmission line information and past desert tortoise survey results. The desktop modeling indicated that the highest quality habitat was located in the northern portion of the site. Moving further south, the model predicted that the quality of the habitat would decrease as the soils and vegetation became less conducive to desert tortoise and where there are more disturbances present. The model predicted that the southern portion of the site would provide only low quality habitat.

6. Data that was prepared by URS for the desktop habitat modeling is available and can be obtained by emailing Camille Lill at URS (camille_lill@urscorp.com) and requesting the specific data layers. Additionally, data that was created by URS and provided to BLM has been released for public use by BLM and can be requested from Camille Lill. These data layers will be provided either by email or via secure folder transfer, depending on the size of the data. URS cannot release the CNDDB and PowerMap data (referenced below) because these databases are restricted from sharing. Public domain data is available on-line and can be downloaded at any time.

7. URS also supervised protocol level surveys of the entire site during which biologists with a minimum of one season of desert tortoise survey experience walked the entire site using 10-meter transects. The site was broken in to a grid of survey cells that were approximately 50 acres each. A team of 4 to 5 biologists surveyed each cell using the USFWS 100% coverage protocol. Survey leads were tasked with assessing the habitat found within each survey cell by (1) noting the soil type and substrates, (2) assessing the presence and amount of scrub cover, (3) noting and evaluating the quality and density of forage present; (4) observing the amount of native v. non-native vegetation; (5) looking for desert tortoise and assessing the heath of any

8. To identify and evaluate potential desert tortoise habitat, URS used the USGS' desert tortoise habitat suitability model (USGS 2009), the same model used by the US Fish & Wildlife Service (USFWS). This model takes into account the following parameters at a landscape level: soils (soil depth, rockiness, bulk density), landscape (surface roughness, slope, aspect, elevation), climate (winter precipitation, summer precipitation, variance of precipitation), biotic (perennial plant cover and annual plant cover), and tortoise presence. The data from each of these areas is translated into a standardized 1-km grid and merged. This merged grid data is then run through the Maxent habitat modeling algorithm. The output from the model is a statistical probability of an area supporting desert tortoise and is used to map potential areas of desert tortoise habitat. An area receives a score between 0 and 1, and the USFWS generally considers an area that has a score greater than 0.7 to be potential desert tortoise habitat. This information is not ground-truthed and provides a regional level habitat assessment. Using this model, the project site received a score of 0.9 for the majority of the site, and a score of 0.8 in areas south of the railroad tracks.

9. In addition to the slope data already used in the USGS model, URS evaluated publically available USGS topographic data (including slope and general landform type) (2001) to create a digital elevation model. From this model, all areas with slopes greater than 20% were identified

10. URS looked at USDA STATSGO soil information (2001) to obtain a general understanding of the soils in the Calico project area. To support desert tortoise, soils need to be of sufficient strength to accommodate burrows without collapsing, but friable enough to allow excavation by the tortoise. Loamy sand, cobbled and rocky gravel as well as coarse, sandy soils associated with the washes in the northern portion of the project site are generally considered the best soils for supporting desert tortoise. Soil type is important because desert tortoise burrow in the ground, and therefore if the soil is too sandy, animals cannot build durable burrows. Additionally, the type of soil affects the vegetation that desert tortoises use for forage and cover. If desert pavement has formed or if the soil is too rocky, forage is generally not sufficient to be considered high quality habitat. The soils in the washes are less compacted and generally provide better forage because they support annual vegetation. A combination of rocky soil with scrub, which is good for burrowing, near washes supporting a robust vegetation variety are generally considered good desert tortoise habitat.

11. As previously noted, during the desert tortoise surveys, the surveyors gathered site specific information and made general habitat assessments based upon qualitative observation, including soil type. On the Calico site, the surveys revealed that there is a transition between very sandy soils near the railroad tracks to rocky and cobbly soils further north. The demarcation between the sandy soils in the south and the more rocky and cobbly was one of the

12. Vegetation is critical to the desert tortoise and is one of the most important factors in assessing habitat suitability. Appropriate vegetation is necessary to provide forage for desert tortoise and also to provide cover. Desert tortoises forage on annual plants and grasses, and also perennial plants such as cacti and native forbs when available. Certain non-native plants, such as *Schismus barbatus,* and *Erodium cicutarium***,** are also eaten. Additionally, desert tortoises use bushes, such as creosote, cheesebush, and ambrosia for shelter when moving above ground and often dig their burrows at the base of these bushes. Washes typically have more diversity in types of forage and this was observed in the northern portions of the Calico site. Density and diversity of vegetation are taken into account when assessing habitat. An area that has a high diversity and dense coverage of annual and perennial species for foraging is characteristic of higher quality habitat whereas medium and lower quality habitat is more sparse. Likewise, dense coverage of scrub (50-70%) is considered higher quality habitat, which was observed in the area identified as high quality habitat on the project site.

13. Similar to the multi-step process of modeling, surveying, verifying results and ground-truthing the models for soil, URS began its study of vegetation by reviewing vegetation information mapped previously by URS (2008) and information gathered during the botanical surveys in spring 2010, in which herbaceous forage, relative cover, and species diversity were observed.

14. During the desert tortoise surveys, surveyors noted when typical forage was present or available. At the Calico site, the forage in the southern portion of the site is sparse (less than 40%). North of the railroad tracks the density of forage becomes less sparse (between 50-60%

15. URS reviewed data from CNDDB and other sensitive plant and animal locations (2008) to determine previous tortoise presence, which was then used as background to help identify likely habitat. URS also looked at potential wildlife crossing locations (existing bridges, culverts, trestles (URS 2008)), TIGER data (including baseline data such as railroad and road information) (2000), BLM road information (open, closed, undefined road layer) (2004), and POWERmap transmission line information (2009) to determine level of disturbance in the area as well as potential edge effects. This information was also used to determine receptor sites for the Desert Tortoise Translocation Plan.

16. Initial desert tortoise surveys (sample plot surveys) were conducted in 2007 and 2008, and URS conducted 100% protocol surveys in 2010. Survey results showing higher numbers of tortoises and burrows indicated higher quality habitat. The locations of actual tortoise and burrow sightings were consistent with the expectation based upon the modeling and the previous observations on the site.

17. The surveys were conducted by five teams of at least 4-5 surveyors, each of whom had a biology degree and a minimum of one season of prior desert tortoise survey experience (and most had 3 or more years of survey experience). Each team had a team leader, who had extensive desert tortoise survey experience and had demonstrated knowledge of survey protocol and ability to identify tortoise burrows, tortoise, and tortoise sign. In addition, health assessments were conducted by biologists that had extensive experience looking for signs of disease in desert tortoise. The survey coordinator identified the survey areas and collected data

18. The surveys consisted of surveyors walking transects and noting for each approximately 50-acre cell the location, weather, number of tortoises, number of burrows, scat (noting this year's scat and last year's scat), carcasses, scutes, other signs of desert tortoise, including an assessment of the age of the sign, and habitat characterization (based on soil, presence of native or non-native vegetation (weed infestation), cover of forage (annual and perennial plant species), and evidence of disturbance (e.g. grazing, agriculture or roads)). In addition, at least one photograph was taken of each cell. For each tortoise that was observed during the surveys and with the assistance of at least one surveyor, the team leader completed a separate tortoise observation data sheet, which included the following:

- Description of tortoise to the extent possible without handling or harassing the animal (size, gender, health (whether exhibiting disease))
- Habitat (vegetation, topography, soils)
- Photos of tortoise

19. At the URS office, the desert tortoise survey data underwent quality assurance/quality control (QA/QC) and was cross checked with the modeling information to ground-truth the model.

20. Based upon the modeling and the surveys, URS set the lines showing an approximate gradation between lower quality habitat, medium quality habitat and higher quality habitat (shown in Figure 9 of the Desert Tortoise Translocation Plan).

21. Higher quality habitat areas are located north of the demarcation between sandy soils and more gravelly, rocky and cobbly soils in the transition zones between the foothills of the Cady

22. Medium quality habitat and lower quality habitat are located south of the soil demarcation and exhibited much finer sands, which are considered lower quality due to the lack of suitable substrate for burrows and lower quality forage habitat. Consistent with the habitat assessment, fewer desert tortoise sightings and burrows were found in the medium quality and lower quality habitat. A more detailed distinction between low, medium and high quality habitat is provided on pages 2-2 and 2-3 of the draft Desert Tortoise Translocation Plan.

BOUNDARIES OF SCENARIO 5.5 and SCENARIO 6

23. The northern boundary for Scenario 5.5 was based upon the line between high quality habitat and medium quality habitat, but includes 369 acres of high quality habitat (otherwise referred to as 5:1 mitigation area). These 369 acres were included in the Scenario 5.5 footprint in order to balance the impacts to desert tortoises with megawatts and project acreage. The boundary for Scenario 5.5 was developed in consultation with representatives of the BLM, CDFG and USFWS, to avoid the most active desert tortoise burrows, to minimize impacts to the northern edge of the site, and to minimize the edge effects that would occur to the avoided high quality habitat and the adjacent ACEC boundary.

24. The northern boundary for Scenario 6 is the same as the line between high quality habitat and the medium quality habitat.

IMPACTS TO DESERT TORTOISE UNDER SCENARIO 5.5

25. The actual number of desert tortoises on the project site cannot be determined from field survey data alone, due to the likelihood that some tortoises may have been overlooked during surveys (e.g., they may have been in deep burrows where they could not be seen) and some may have been counted twice (e.g., a tortoise may have been counted on one transect line, then moved to an adjacent one where it may have been re-counted). The USFWS provides a mathematical formula for estimating actual numbers of adult and sub-adult desert tortoises based upon the numbers of tortoises counted during field surveys. Statistical analysis provides further estimates of minimum and maximum numbers of tortoises expected, within a 95% confidence interval.

26. Based upon the 6 adult/subadult tortoises observed within the Scenario 5.5 footprint, the estimated number of adult/subadult desert tortoises based on the USFWS formula is 11, with a 95% confidence interval of 4-29 adults and subadults. I note that 4 juvenile tortoises were also observed within the Scenario 5.5 footprint; however, observed juveniles are not a factor in the USFWS estimation formula.

27. Additionally, most juvenile tortoises and tortoise eggs are not detected during field surveys and so it is necessary to estimate these numbers. Juveniles are expected to account for approximately 31.1 to 51.1 percent of the overall tortoise population. Using this range and the estimate of 11 adult tortoises, the project site may support between 5 to 10 juvenile tortoises, for a total population of 9-39 adults, subadults, and juveniles within the Scenario 5.5 footprint.

28. The number of tortoise eggs that could be present on the proposed project site was conservatively estimated based on the assumption of a 1:1 sex ratio (i.e., 5.5 of the 11 adult desert tortoises on site are assumed to be reproductive females) and that all females present would lay eggs (clutch) in a given year. Using the average clutches per reproductive female in a

29. It is assumed that Scenario 5.5 would result in direct mortality to all 51 eggs and up to 10 juvenile tortoises that may occur in the project area. Therefore, based on the USFWS calculation estimate, approximately 21 tortoises (11 adults/subadults and 10 juveniles) will require translocation, and because a resident and control animal is handled, radio tagged, and disease tested for each translocated animal, a total of 63 tortoises (21 tortoises*3) would be affected.

30. CEC staff has stated that should the number of tortoises detected on the project site during the translocation events exceed 107 tortoises, Calico Solar would be required to cease translocation efforts. (Energy Commission Staff's Second Errata to the Supplemental Staff Assessment for the Calico Solar Project, Exhibit 310, at 25.) Based on the number of tortoises expected to occur in the reduced project area for Scenario 5.5 (39 tortoises) and the capacity of proposed translocation sites to accept a maximum of 107 tortoises, the translocation areas previously identified and studied will be sufficient to accommodate the number of tortoise that may require translocation and there will be no need to identify any additional translocation sites. The total number of tortoises on the project site could be as low as 9 or as high as 39 adult/subadult and juvenile tortoises. Should tortoise numbers be lower than assumed, the associated impacts to adults, juveniles, eggs and tortoises at the proposed host and translocation sites would be correspondingly lower as well.

Desert Tortoise Estimates – Scenario 5.5

Estimated Number of Tortoises				
Project Feature	Adult/Sub-adult* (Min-Max)	Juveniles** (Min-Max)	Eggs***	Total Adult/Sub-adult and Juvenile
Direct Effects				
Project site[1]	11 (4-29)	10 (5-10)	51	21 (9-39)
Translocation Area[2]	11 (4-29)	10 (5-10)	N/A	21 (9-39)
Control Area[3]	11 (4-29)	10 (5-10)	N/A	21 (9-39)
Subtotal	**33 (12-87)**	**30 (15-30)**	**N/A**	**63 (27-117)**
Indirect Effects				
Buffer Area_	37	39 (17-39)	N/A	76 (17-39)
NAP Area A_	24	15 (11-15)	N/A	39 (11-15)
Subtotal	**61**	**54 (28-54)**	**N/A**	**115 (28-54)**
Total Direct and Indirect	**94 (12-87)**	**84 (43-84)**	**51**	**178 (55-171)**

*Assumes based on USFWS formula.
**Table assumes high end of juveniles present.
***Assumes a 1:1 sex ratio.
1. Includes 4,613 acres project site.
2. Assumes one tortoise will be handled at the translocation site for each tortoise subject to the translocation effort.
3. Assumes one tortoise will be handled at the control site for each tortoise subject to the translocation effort.

31. The acquisition of compensation land will fully mitigate the direct and indirect impacts to the desert tortoise. The Applicant plans to acquire compensation land to fulfill the CEC staff's proposed compensation at a 5:1 ratio for loss of desert tortoise habitat north of the BNSF Railroad within high-quality habitat, at a 3:1 ratio for loss of medium-quality desert tortoise habitat north of the BNSF Railroad and south of the high quality habitat, and at a 1:1 ratio for habitat south of the railroad to achieve full mitigation under CESA and to mitigate under CEQA for habitat loss and other significant impacts to desert tortoises. Based on these ratios, the total acreage of desert tortoise compensation land acquisition and protection would be 10,295 acres. Concurrently, the Applicant will satisfy BLM's requirement for mitigation at a 1:1 ratio and will

provide funding for BLM to implement desert tortoise habitat enhancement projects on BLM land.

IMPACTS TO DESERT TORTOISE UNDER SCENARIO 6

32. Based upon the 1 adult/subadult tortoise observed within the Scenario 6 footprint, the estimated number of adult/subadult desert tortoises based on the USFWS formula is 2, with a 95% confidence interval of 0-10 adults and subadults. I note that 2 juvenile tortoises were also observed within the Scenario 6 footprint; however, observed juveniles are not a factor in the USFWS estimation formula.

33. Additionally, most juvenile tortoises and tortoise eggs are not detected during field surveys and so it is necessary to estimate these numbers. Juveniles are expected to account for approximately 31.1 to 51.1 percent of the overall tortoise population. Using this range and the estimate of 2 adult tortoises, the project site may support between 1 to 3 juvenile tortoises, for a total population of 3-13 adults, subadults, and juveniles within the Scenario 6 footprint.

34. The number of tortoise eggs that could be present on the proposed project site was conservatively estimated based on the assumption of a 1:1 sex ratio (i.e., 1 of the 2 estimated adult desert tortoises on site is assumed to be a reproductive female) and that this female would lay eggs (clutch) in a given year. Using the average clutches per reproductive female in a given year (i.e., 1.6, see Turner et al. 1984), multiplied by the average number of eggs found in a clutch (i.e., 5.8; see Service 1994); approximately 9 eggs would be expected on the Scenario 6 site in a given year. However, fewer eggs are likely to be on site at any given time because it is likely that not all females are of reproductive age. This formula used by the resource agencies provides a conservative estimate for the number of eggs on-site. The formula assumes that half the tortoise on site are female, that all of them are of reproductive age and lay clutches.

35. It is assumed that Scenario 6 would result in direct mortality to the 9 eggs and the 3 juvenile tortoises that may occur in the project area. Therefore, based on the USFWS calculation estimate, approximately 5 tortoises (2 adult/subadult and 3 juveniles) will require translocation, and because a resident and control animal is handled, radio tagged, and disease tested for each translocated animal, a total of 15 tortoises (5 tortoises*3) would be affected.

36. CEC staff has stated that should the number of tortoises detected on the project site during the translocation events exceed 107 tortoises, Calico Solar would be required to cease translocation efforts. (Energy Commission Staff's Second Errata to the Supplemental Staff Assessment for the Calico Solar Project, Exhibit 310, at 25.) Based on the number of tortoises expected to occur in the reduced project area for Scenario 6 (11 tortoises) and the capacity of proposed translocation sites to accept a maximum of 107 tortoises, the identified translocation site will accommodate the number of tortoises that may require translocation and there will be no need to identify additional translocation sites. The total number of tortoises on the project site could be as low as 0 or as high as 11 adult/subadult and juvenile tortoises. Should tortoise numbers be lower than assumed, the associated impacts to adults, juveniles, eggs and tortoises at the proposed host and translocation sites would be correspondingly lower as well.

Desert Tortoise Estimates – Scenario 6

Estimated Number of Tortoises				
Project Feature	Adult/Sub-adult* (Min-Max)	Juveniles** (Min-Max)	Eggs***	Total Adult/Sub-adult and Juvenile
Direct Effects				
Project site[1]	2 (0-10)	3 (1-3)	9	5 (1-13)
Translocation Area[2]	2 (0-10)	3 (1-3)	N/A	5 (1-13)
Control Area[3]	2 (0-10)	3 (1-3)	N/A	5 (1-13)
Subtotal	**6 (0-30)**	**9 (3-9)**	**9**	**15 (3-39)**
Indirect Effects				
Buffer Area_	37	39 (17-39)	N/A	76 (17-39)
NAP Area A_	24	15 (11-15)	N/A	39 (11-15)
Subtotal	**61**	**54 (28-54)**	**N/A**	**115 (28-54)**
Total Direct and Indirect	**67 (0-30)**	**63 (31-63)**	**9**	**130 (31-93)**

*Assumes based on USFWS formula.
**Table assumes high end of juveniles present.
***Assumes a 1:1 sex ratio.
1. Includes 4,244 acres project site.
2. Assumes one tortoise will be handled at the translocation site for each tortoise subject to the translocation effort.
3. Assumes one tortoise will be handled at the control site for each tortoise subject to the translocation effort.

37. The acquisition of compensation land will fully mitigate the direct and indirect impacts to the desert tortoise. The Applicant plans to acquire compensation land to fulfill the CEC staff's proposed compensation at a 3:1 ratio for loss of medium-quality desert tortoise habitat north of the BNSF Railroad and at a 1:1 ratio for habitat south of the railroad to achieve full mitigation under CESA and to mitigate under CEQA for habitat loss and other significant impacts to desert tortoises. Based on these ratios, the total acreage of desert tortoise compensation land acquisition and protection would be 8,452 acres. Concurrently, the Applicant will satisfy BLM's requirement for mitigation at a 1:1 ratio and will provide funding for BLM to implement desert tortoise habitat enhancement projects on BLM land.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and that this Declaration was executed at San Diego, California on September 13, 2010.

_____

Theresa Miller

EXHIBIT 117

Declaration of Howard H. Chang, PhD

This Page Intentionally Left Blank

DECLARATION OF HOWARD H. CHANG

I, Howard H. Chang, declare:

1. My name is Dr. Howard H. Chang. I am a Professor Emeritus Professor of Civil and Environmental Engineering in the Department of Civil and Environmental Engineering at San Diego State University after having been a professor for forty years. Since 1967, I have also been a professional consultant in the areas of flood plain mapping, channel design, hydrological simulation, watershed analysis, and river channel erosion and sedimentation. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. Attached hereto as Attachment A is a true and correct copy of my resume.

3. Attached hereto as Attachment B is a true and correct copy of my Assessment of Detention Basins / Debris Basins and Suncatcher Impacts for Calico Solar Site. The contents of Attachment B are incorporated into this Declaration and declared as though fully stated herein.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at Rancho Santa Fe, California on September 13, 2010.

Howard H. Chang

This Page Intentionally Left Blank

ATTACHMENT A

Résumé Howard H. Chang, Phd, P.E.

This Page Intentionally Left Blank

Howard H. Chang, Ph.D., P.E.
Professor Emeritus, San Diego State University
President, Chang Consultants

Address: P. O. Box 9492, 6001 Avenida Alteras
Rancho Santa Fe, CA 92067-4492

Telephone: (858) 756-9050 (office) ; (858) 692-0761 (mobile)
FAX: (858) 756-9460

e-mail: changh@cox.net; Web site: http//chang.sdsu.edu/

I. EDUCATION

B.S. in Civil Engineering, National Cheng Kung University, Taiwan, China, 1962.
M.S. in Civil Engineering, Colorado State University, 1965.
Ph.D. in Civil Engineering (Hydraulics, Hydrology, Sedimentation), Colorado State University, 1967.

II. MEMBERSHIP IN HONORARY AND PROFESSIONAL SOCIETIES

Chi Epsilon Fraternity (Civil Engineering Honorary)
Tau Beta Pi Society (Engineering Honorary)
Sigma Xi (Scientific Research)
Phi Kappa Phi (Scholarship)
Phi Beta Delta (International Scholars)
American Men of Science (1971)
American Society of Civil Engineers
American Institute of Aeronautics and Astronautics: Member 1968, Associate Fellow, 1972
Professional Civil Engineer, California and Arizona
American Academy of Water Resources Engineers
Sedimentation Committee of the American Society of Civil Engineers, 1977-1981
Chairman of the Civil Engineering Department, San Diego State University, 1976-1979
Who's Who in Technology Today, 1982-83
International Who's Who in Engineering, 1st Edition, Cambridge, England, 1984
Who's Who in California, 1989
National Research Council, National Academy of Sciences, 1984-1987
Associate Editor, Journal of Hydraulic Engineering, ASCE, 1985-1987
Task Committee on Flood Hazard Analysis on Alluvial Fans, ASCE, 1987-1989;
Chairman of subcommittee on erodible channels
International Scientific Committee, International Symposium on Sediment Transport Modeling, 1989
Conference Chair, 1990 National Conference on Hydraulic Engineering, ASCE, San Diego, CA
Expert Consultant to Committee on Glen Canyon Environmental Studies, Water Resources and Technology Board, National Academy of Sciences, Washington, D.C. 1991
Committee on Drainage Manual Revision for City of San Diego, 1993
Ph.D. Examination Committee, Hydraulic Engineering, Royal Institute of Technology, Sweden,

May 1993

Member of National Cooperative Highway Research Program Project Panel E24-8, National Research Council, 1994-95

Panel member of National Cooperative Highway Research Program Project "Expert System for Bridge Scour and Stream Stability", National Research Council, 1995-97

Organizing Committee member of the 20th Annual Conference for the Association of State Floodplain Managers, June 10-14, 1996, San Diego

Member of Scientific Advisory Group on Flooding to the San Diego County Board of Supervisors, 997-98

Chair of National Cooperative Highway Research Program Project Panel 24-16 on Methodology for Migration of River Channels, National Research Council, 1997-99

Member of the Federal Emergency Management Agency committee on Riverine Erosion Hazard Area, 1998-1999

Honorary Faculty of the Wuhan University of Hydraulic and Electrical Engineering, Wuhan, China, 1998

Expert Consultant to the Yangtze Science Institute in Wuhan, China, technology transfer for studying river channel changes affected by the Three Gorges Dam Project which is the largest engineering project in the world, 1998

Member of the Editorial Board, International Journal of Sediment Research, since 1999, Beijing, China

Honorary Faculty of Sichuan University, Chengdu, China, 1999-2003

Member of the Editorial Board, Journal of Floodplain Management, since 1999, Costa Mesa, California

Consultant for World Bank loaned Yangtze River Dike Strengthening Project, Wuhan, China, 2004

Director of the Fairbanks Ranch Community Services District, 2004

III. AWARDS

Outstanding Faculty Award (for teaching excellence) by the Tau Beta Pi Society, School of Engineering, San Diego State University, Dec. 1969.

Outstanding Contribution to Aerospace Engineering Award (for research achievements in fluid dynamics and aerodynamics) by the San Diego Section of AIAA, May 1970.

Outstanding Contribution to the Institute at the Sectional Level (for outstanding services), AIAA, San Diego Section, May 1973.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1981.

Outstanding Faculty Award of the University, Selected by the University President upon recommendation of the faculty Senate, awarded by the San Diego State University Alumni and Associates, 1981.

Outstanding Civil Engineering Achievement Award, co-recipient of this award with the Flood Plain Management Program of the County of San Diego, awarded by the San Diego Section of ASCE, 1982.

Exceptional Merit Service Award, monetary award by the President of San Diego State University for the 1982-83 academic year.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1984.

Outstanding Service Award, for service on the Board of Directors of the San Diego State University Foundation, October 1985.

Meritorious Performance and Professional Promise Award, monetary award by the President of San Diego State University, 1986, 1987, 1989.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1988.

Outstanding Civil Engineering Project Award, on the hydraulic design of environmental flood control channel *First San Diego River Improvement Project*, awarded by the San Diego Section of ASCE, 1990.

Outstanding Advising Award, selected by students of Chi Epsilon Honorary Society for Civil Engineering at San Diego State University, May 1991

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1991.

Outstanding Advising Award, selected by students of Chi Epsilon Honorary Society for Civil Engineering at San Diego State University for 1991-92, December 1992

Orchid Award for environmental solution to the First San Diego River Improvement Project, by American Institute of Architects, et al., November, 1992

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1993.

Outstanding Faculty Award of the University, Selected by the University President upon recommendation of the faculty Senate, awarded by the San Diego State University Alumni and Associates, 1994.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1994.

Keynote speaker at the International Symposium on River Waterfront Development on Computer-Aided Design for River Channel Stabilization, Nile Research Institute, Egypt, Sept. 16, 1994.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1995.

Best Paper Award, for the paper "Operation Rule to Maintain Long-Term Sediment Balance in

Reservoirs", with Tu, Geary, and Lee, at the Hydro Power of 95 Conference, San Francisco, May, 1995.

Outstanding Civil Engineering Project Award of Merit, on the hydraulic design of *Flood Control Stabilization Structure*, awarded by the San Diego Section of ASCE, June 1995.

Achievement in Academics Award, recognizing contributions to engineering through education, leadership and service, awarded by the College of Engineering, Colorado State University, September, 1995.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1996.

Outstanding Civil Engineering Project Award, on the hydraulic design of Labaja Bridge, awarded by the San Diego Section of ASCE, June 1996.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1997.

Outstanding Faculty Award, in recognition of the selection as the most influential university professor in Civil Engineering, San Diego State University, May 1998.

Outstanding Teaching Award, College of Engineering, San Diego State University, May 1998.

Outstanding Project Award for Rose Creek Bridge replacement, co-recipient of the award with Simon Wong Engineering, awarded by the San Diego Section of ASCE, May 2003.

Honorary Member (for Technical Leadership and Teaching Skills), San Diego Section of the American Society of Civil Engineers, 2007.

Lifetime Achievement Award in the State of California, given by the American Society of Civil Engineers, at the Annual Awards Banquet in Sacramento, CA, February 24, 2009.

Outstanding Alumni Award, awarded by the National Cheng Kung University in Taiwan, 2009.

IV. TEACHING

Courses Taught at San Diego State University

E 120 Engineering Problem Analysis (Digital Computers);
E 420 Intermediate Engineering Problem Analysis;
E 510 Methods of Analysis;
EM 340 Fluid Mechanics;
EM 341 Fluid Mechanics Laboratory;
EM 540 Intermediate Fluid Mechanics;
EM 541 Hydrodynamics;
CE 444 Applied Hydraulics;

CE 445 Applied Hydrology;
CE 495 Civil Engineering Design
CE 499 Special Study;
CE 530 Open Channel Hydraulics;
CE 600 Seminars in Water Resources Engineering;
AE 612 Supersonic Flow Theory;
CE 638 Sedimentation and River Engineering;
EM 744 Advanced Fluid Mechanics II;
Review for Engineering Registration

Laboratory Development: Fluid Mechanics Laboratory from September 1967 to September 1973. Some major pieces of equipment were acquired, including the water table, the Coanda table, the hydraulic bench, the small wind tunnel, the spin table, etc. Several new experiments were developed and added to the instructional program.

Soil Erosion Research Laboratory from January 1998 to present. The 2,000 square feet indoor space houses a test bed 3 m by 10 m with artificial rainfall, designed to emulate the natural rainfall with respect to drop-size distribution, drop fall velocity, and rainfall intensity and duration. The slope of the test bed can be raised up to 26.6^0. The experimental study covers erosion rates of various soils and surface conditions.

V. DEVELOPMENT OF COMPUTER MODELS

Dr. Chang is the developer of the FLUVIAL-12 model for river sedimentation and channel changes. The model has been extensively tested and calibrated by field data. It has been applied to over 100 river studies. This model is also adopted by the Chinese National Academy of Sciences for use on the Yangtze River.

Dr. Chang has also developed models for sediment yield analysis, hydrologic simulation, and culvert hydraulics.

VI. BOOKS AND CHAPTERS

Chang, H. H., *Fluvial Processes in River Engineering*, John Wiley & Sons, February 1988, 432 pp. Known adoptions as a graduate text: Johns Hopkins University, Purdue University, McGill University in Canada, University of Iowa, University of Colorado, Clarkson University, University of Canterbury in New Zealand, South Dakota State University, Chengdu University, Washington State University, Brigham Young University, Clemson University, University of Nebraska, University of Kentucky, University of Maryland, University of Alaska, Concordia University in Montreal Canada, Virginia Tech, Oregon State University, University of Idaho, Tennessee Technological University, Ferdowsi University and Tarbiat Modares University in Iran, National University of Lisbon in Portugal, California State University at Fullerton, California State University at Long Beach, Technical University of Nova Scotia, Universiti Sains Malaysia, and Taiwan Chung Hsing University. The Chinese translation is published by the Science Press, Beijing, 1990.

Chang, H. H. and Hill, J. C., Editors, *Hydraulic Engineering*, Proceedings of the 1990 National Conference on Hydraulic Engineering, American Society of Civil Engineers, New York, NY, 1204 pp.

Chang, H. H., and McCraken, H., 1975, "Bucket Rotor Wind-Driven Generator", *Energy Book No.1*, edited by John Prenis, Running Press, p.27. Also in Wind Energy Conversion Systems, NSF/RA/W-73-006, December 1973. Also presented at NSF/NASA Wind Energy Workshop, June 11-13, 1973, Washington, D. C.,

Chang, H. H., 1987, "Modeling Fluvial Processes in Streams with Gravel Mining," in *Sediment Transport in Gravel-Bed Rivers*, Thorne, et al. editors, John Wiley & Sons, pp. 977-988. Also presented at the Intern. Workshop on Problems of Sediment Transport in Gravel-Bed River, Colorado State University, August 12-17, 1985.

Chang, H. H., Moncrief, J., and Dyck, R. I. J., "Changes in Channel Morphology Induced Sand Mining", *Recent Research Developments in Hydrology, Research Signpost*, Trivandrum, Kerala State, India ,1996.

Thomas, W. A., and Chang, H. H., "Computational Modeling of Sedimentation Processes", Chapter 14, *Sedimentation Engineering*, ASCE Manuals and Reports for Engineering Practice, No. 110, 2008.

VII. REFEREED JOURNAL PUBLICATIONS

Chang, H. H., and Waidelich, J. P., 1970, "A Mathematical Model for the Behavior of Thrust Reversers", *Journal of Aircraft*, 164-168. Also presented at the AIAA 7th Aerospace Sciences Meeting, New York, Jan. 1969.

Chang, H. H., and Simons, D. B., 1970, "Bed Configuration of Straight Alluvial Channels When the Flow is Nearly Critical", *Journal of Fluid Mechanics*, 42(3), 491-495.

Chang, H. H., Simons, D. B., and Woolhiser, D. A., 1971, "Flume Experiments on Alternate Bar Formation", *Journal of the Waterways, Harbors and Coastal Engineering Division*, ASCE, 97(WW1), 155-165. Closure in 99(WW1), 1973, 127-128.

Chang, H. H., and Conly, J. F., 1971, "Potential Flow of Segmental Jet Deflectors", *Journal of Fluid Mechanics*, 46(3), 465-475.

Chang, H. H., and Hill, J. C., 1976, "Computer Modeling of Erodible Flood Channels and Deltas", *Journal of the Hydraulics Division*, ASCE, 102(HY10), 1461-77. Closure in 104(HY9), 1978, 1355-6.

Chang, H. H., and Hill, J. C., 1977, "Minimum Stream Power for Rivers and Deltas", *Journal of the Hydraulics Division*, ASCE, 103(HY12), 1375-89. Closure in 104(HY12), 1978, 1678-81.

Chang, H. H., 1978, Discussion of "Mathematical Modeling of Scour and Deposition", *Journal of the Hydraulics Division*, ASCE, 104(HY9), 1360-61.

Chang, H. H., 1979, "Geometry of Rivers in Regime", *Journal of the Hydraulics Division*, ASCE, 105(HY6), 691-706.

Chang, H. H., 1979, "Minimum Stream Power and River Channel Patterns", *Journal of Hydrology*, 41, Elsevier Scientific Publishing Co., Amsterdam, The Netherlands, 303-327.

Chang, H. H., 1980, "Stable Alluvial Canal Design", *Journal of the Hydraulics Division* ASCE, 106(HY5), 873-891.

Chang, H. H., 1980, "Geometry of Gravel Streams", *Journal of the Hydraulics Division*, ASCE, 106(HY9), 1443-56. Closure in 108(HY2), 1982, P. 298.

Chang, H. H., 1982, "Mathematical Model for Erodible Channels", *Journal of the Hydraulics Division*, ASCE, 108(HY5), 678-689. Closure in 109(HY4), 655-656.

Chang, H. H., 1982, "Fluvial Hydraulics of Deltas and Alluvial Fans", *Journal of the Hydraulics Division*, ASCE, 108(HY11), 1282-1295.

Lane, L. J., Chang, H. H., Graf, W. L., Grissinger, E. H., Guy, H. P., Osterkamp, W. R., Parker, G., and Trimble, S. W., 1982, "Relationships between Morphology of Small Streams and Sediment Yield", *Journal of the Hydraulics Division*, ASCE, 108(HY11), 1328-65.

Chang, H. H., 1983, "Energy Expenditure in Curved Open Channels", *Journal of Hydraulic Engineering*, ASCE, 109(7), 1012-22. Closure in 110(6), 1984, p. 865.

Chang, H. H., 1984, "Analysis of River Meanders", *Journal of Hydraulic Engineering*, ASCE, 110(1), 37-50.

Chang, H. H., 1984, "Modeling of River Channel Changes", *Journal of Hydraulic Engineering*, ASCE, 110(2), 157-172. Closure in 113(2), 1987, 265-267.

Chang, H. H., 1984, "Modeling General Scour at Bridge Crossings", *Transportation Research Record*, 950, Vol. 2, 238-243. Also presented at the Second Bridge Engineering Conference, Transportation Research Board, Minneapolis, Minnesota, September 24-26, 1984.

Chang, H. H., 1984, "Regular Meander Path Model", *Journal of Hydraulic Engineering*, ASCE, 110(10), 1398-1411. Closure in 113(3), 1987, 407-409.

Chang, H. H., 1984, Comment on "Extremal Hypotheses for River Regime: An Illusion of Progress," by George A. Griffiths, *Water Resources Research*, 20(11), 1767-68.

Chang, H. H., 1984, "Variation of Flow Resistance through Curved Channels", *Journal of Hydraulic Engineering*, ASCE, 110(12), 1772-82.

Chang, H. H., 1984, "Meandering of Underfit Streams", *Journal of Hydrology*, Elsevier Science Publishers B.V., Amsterdam, 75, 311-322.

Chang, H. H., 1985, "River Morphology and Thresholds", *Journal of Hydraulic Engineering*, ASCE, 111(3), 503-519.

Chang, H. H., 1985, "Design of Stable Alluvial Canals in a System", *Journal of Irrigation and*

Drainage Engineering, ASCE, 111(2), 36-44.

Chang, H. H., 1985, "Water and Sediment Routing through Curved Channels", *Journal of Hydraulic Engineering*, ASCE, 111(4), 644-658.

Chang, H. H., 1985, "Channel Width Adjustment during Scour and Fill", *Journal of Hydraulic Engineering*, ASCE, 111(10), 1368-70.

Chang, H. H., 1985, "Formation of Alternate Bars", *Journal of Hydraulic Engineering*, ASCE, 111(11), 1412-20.

Chang, H. H., 1986, "River Channel Changes: Adjustments of Equilibrium", *Journal of Hydraulic Engineering*, ASCE, 112(1), 43-55.

Stow, D. A., and Chang, H. H., 1987, "Coarse Sediment Delivery by Coastal Streams to the Oceanside Littoral Cell, California," Journal of the American *Shore and Beach* Preservation Association, 55(1), 30-40.

Chang, H. H., 1987, Comment on "Modeling of Alluvial Channels", by Dawdy and Vanoni, *Water Resources Research*, 23(11), 2153-2155.

Stow, D. A., and Chang, H. H., 1987, "Magnitude-Frequency Relationship of Coastal Sand Delivery by a Southern California Stream", *Geo-Marine Letters*, an International Journal of Marine Geology, 23(1), 217-222.

Chang, H. H. and Stow, D., 1988, "Sediment Transport Characteristics of a Coastal Stream", *Journal of Hydrology*, Elsevier Science Publishers B. V., Amsterdam, 99, 201-214.

Chang, H. H. and Osmolski, Z., 1988, "Fluvial Design of River Bank Protection", *Hydrosoft*, Computational Mechanics Publications, U. K. 1(2), 88-92.

Chang, H. H. and Osmolski, Z., 1988, "Computer-Aided Design for Channelization", *Journal of Hydraulic Engineering*, ASCE, 114(11), 1377-1389.

Chang, H. H. and Stow, D., 1989, "Mathematical Modeling of Fluvial Sediment Delivery", *Journal of Waterway, Port, Coastal, and Ocean Engineering*, ASCE, 115(3), 311-326.

Chang, H. H., 1990, "Hydraulic Design of Erodible-Bed Channels", *Journal of Hydraulic Engineering*, ASCE, 116(1), 87-101.

Webb, C. K., Stow, D. A., and Chang, H. H., 1991, "Morphodynamics of Southern California Inlets", *Journal of Coastal Research*, 7(1), 167-187.

Zhou, J., Chang, H.H., and Stow, D., 1993, "A Model for Phase Lag of Secondary Flow in River Meanders", *Journal of Hydrology*, 146, pp. 73-88.

Chang, H. H., 1994, "Selection of Gravel-Transport Formula for Stream Modeling", *Journal of Hydraulic Engineering*, ASCE, Vol. 120, No. 5, May, pp. 646-651.

Chang, H. H., Harrison, L., Lee, W., and Tu, S., 1996, "Numerical Modeling for Sediment-Pass-Through Reservoirs", *Journal of Hydraulic Engineering*, ASCE, Vol. 122, No. 7, pp. 381-388.

Chang, H. H., 1997, "Modeling Fluvial Processes in Tidal Inlet", *Journal of Hydraulic Engineering*, ASCE, Vol. 123, No. 12, pp. 1161-1165.

Chang, H. H., 1998, "Riprap Stability on Steep Slopes", *International Journal of Sediment Research*, Beijing, China, Vol. 13, No. 2, June, pp. 40-49.

Chang, H.H., "River Engineering", *Encyclopedia of Science & Technology*, McGraw-Hill Inc., New York, NY, 2000.

Chang, H. H., Grove, R., and Pearson, D., 2001, "Modeling Changes in an Ephemeral Coastal River", *Journal of Floodplain Management*, Floodplain Management Association, Vol. 2, No. 2, April, pp. 17-28.

Chang, H. H., Pearson, D., and Tanious, S., "Lagoon Restoration near an Ephemeral River Mouth", *Journal of Waterways, Ports and Coastal Engineering*, ASCE, March 2002, pp79-87.

Chang, H. H., "Sediment Transport Modeling for Stream Channel Scour Below a Dam", *Applied Engineering in Agriculture*, Vol 17(6), ASAE, Paper No. SW3684, 2002, pp94-96.

Chang, H. H., Tanious, S., and Pearson, D., "Flood Level Computation for Ephemeral Coastal Streams", *Journal of Floodplain Management*, Floodplain Management Association, Vol. 3, No. 1, June 2002, pp. 9-16.

Huang, H. Q., Chang, H. H., and Nanson, G. C., "Minimum Energy as the General Form of Critical Flow and Maximum Flow Efficiency, and for Explaining Variations in River Channel Patterns", *Water Resources Research*, Vol. 40, W04502, 2004.

Huang, H. Q. and Chang, H. H., "The Scale Independent Linear Behavior of Alluvial Channel Flow", *Journal of Hydraulic Engineering*, ASCE, Vol. 132, No. 7, Technical Paper 722, July 2006.

Chang, H.H., "A Case Study of Fluvial Modeling of River Responses to Dam Removal", *Journal of Hydraulic Engineering*, ASCE, Vol. 134, No. 3, March 1, 2008, pp. 295-302.

Chang, H.H., "River Morphology and River Channel Changes", Transactions *of Tianjin University*, Volume 14, November 4, August, 2008, pp254-262, ISSN 1006-4982 (print), 1995-8196 (online).

VIII. CONFERENCE PROCEEDING PUBLICATIONS

Chang, H. H., Simons, D. B., and Brooks, R. H., 1967, "The Effect of Water Detention Structures on River and Delta Morphology", *Proceedings* of the 14th General Assembly, International Union of Geodesy and Geophysics, Berne, Switzerland, 438-448. Also presented at the Assembly.

Chang, H. H., Simons, D. B., and Brooks, R. H., 1974, "Laboratory Study of Delta Formation",

ASCE Annual and Environmental Engineering Convention, Kansas City, Missouri, Meeting Preprint 2381, 21 pp.

Chang, H. H., and Hill, J. C., 1978, "Morphology of Rivers and Delta Using Energy Method", *Proceedings* of the International Conference on Water Resources Engineering, January 10-13, Bangkok, Thailand, 255-275.

Chang, H. H., 1979, "Floods and Changing Streams", *Earthquakes and Other Perils of San Diego Region*, edited by Abbott, P. L., and Elliott, W. J., prepared for Geological Society of America field trip by San Diego Association of Geologists, 151-158.

Chang, H. H., 1979, "Sediment Yield in Relation to Stream Morphology", *Proceedings* of the 18th Congress, 5, International Association for Hydraulic Research, Cagliari, Italy, September 10-14, 11-21.

Chang, H. H., 1980, "Stream Bed Erosion and Sedimentation in Southern California, U.S.A.", *Proceedings* of the International Symposium on River Sedimentation, Vol. 1, Beijing, China, March 24-29, 529-542.

Chang, H. H., 1981, "Evaluation of Downstream Changes for the Elk River", *Proceedings* of Downstream River Channel Changes from Diversion or Reservoir Construction, Research Institute of Colorado, Ft. Collins, Colorado, August, 27-29, 193-199.

Chang, H. H., and Hill, J. C., 1982, "Modeling River channel Changes Using Energy Approach", *Applying Research to Hydraulic Practice, Proceedings* of the Hydraulics Division Specialty Conference, ASCE, Jackson, Miss., August 17-20, 454-465.

Chang, H. H., 1982, "Analysis of Alluvial Stream Geometry, Channel Patterns and Channel Types", *Proceedings* of the Third Congress of the Asian and Pacific Regional Division of the International Association for Hydraulic Research, Bandung, Indonesia, Volume C, August, 308-322.

Chang, H. H., 1983, "Meander Path Model", *Proceedings* of the D. B. Simons Symposium on Erosion and Sedimentation, Colorado State University, Ft. Collins, Colo., July 27-29, pp. 3.35-3.51.

Chang, H. H., 1983, "Plan Geometry of River Meanders", *Frontiers in Hydraulic Engineering, Proceedings* of the Hydraulics Division Specialty Conference, ASCE, Massachusetts Institute of Technology, August 9-12, 133-140.

Chang, H. H., 1983, "Width Formation of Alluvial Rivers", *Proceedings* of the Second International Symposium on River Sedimentation, Nanjing Hydraulic Research Institute, Nanjing, China, October 11-16, 724-729.

Chang, H. H., Osmolski, Z., and Smutzer, D., 1985, "Computer-Based Design of River Bank Protection", in *Hydraulics and Hydrology in the Small Computer Age, Proceedings* of Hydraulics Division Conference, ASCE, Orlando, Florida, August 13-16, 426-431.

Chang, H. H., 1986, "River Channel Responses during Floods," *Proceedings* of the Third International Symposium on River Sedimentation, Jackson, Miss., April, 144-149.

Chang, H. H., and Osmolski, Z., 1987, "Fluvial Design of Structural Flood Control for Santa Cruz River", *Proceedings* of Computational Hydrology '87, Lighthouse Publications, pp. B1-B5.

Chang, H. H., and MacArthur, R. C., 1987, "Modeling Sediment Yield Affected by In-Stream Sand Mining", *Hydraulic Engineering, Proceedings* of National Conference on Hydraulic Engineering and Engineering Hydrology Symposium, pp. 451-456, August 3-7, Williamsburg, Virginia.

Chang, H. H., Jennings, M. E., and Jordan, P. R., 1988, "Use of Calibrated Model for Continuous Record of Fluvial Sediment Load", *Professional Paper*, U. S. Geological Survey.

Chang, H. H., 1988, "On the Cause of River Meandering", *Proceedings* of the Intern. Conf. on River Regime, May 18-20, Wallingford, England, 83-94.

Chang, H. H., 1988, "Introduction to FLUVIAL-12 - Mathematical Model for Erodible Channels", in *Twelve Selected Computer Stream Sedimentation Models Developed in the U. S.*, S. S. Fan, Editor, Published by Federal Energy Regulatory Commission, 353-412.

Thorne, C. R., Chang, H. H., and Hey, R. D., 1988, "Prediction of Hydraulic Geometry of Gravel-Bed Streams Using the Minimum Stream Power Concept", *Proceedings* of Intern. Conf. on River Regime, May 18-20, Wallingford, England, 29-40.

Chang, H. H., 1988, "Simulation of River Channel Changes Induced by Sand Mining", *Proceedings* of Intern. Conf. on Fluvial Hydraulics, IAHR, May 30-June 3, Budapest, Hungary.

Cao, S-Y and Chang, H. H., 1988, "Entropy as a Probability Concept in Energy-Gradient Distribution", *Proceedings* of the National Conference on Hydraulic Engineering, August 8-12, Colorado Springs, CO.

Yang, X-Q. and Chang, H. H., 1988, "Mathematical Modeling of Compound Channel with High Sediment Concentration", *Proceedings* of the National Conference on Hydraulic Engrg., August 8-12, Colorado Springs, CO.

Chang, H. H., 1988, "Processes Governing Meander Bend Migration", *Proceedings* of the National Conference on Hydraulic Engrg., August 8-12, Colorado Springs, CO.

Chang, H. H. and Osmolski, Z., 1988, "Fluvial Design of River Bank Protection", *Hydrosoft*, Computational Mechanics Publications, U. K. 1(2), 88-92.

Chang, H. H., 1989, "Background and Applications of FLUVIAL-12", *Sediment Transport Modeling, Proceedings* of the 1989 National Conference on Hydraulic Engineering, August 14-18, New Orleans, 648-652.

Chang, H. H., Dawdy, D., Edwards, K., Faltas, M., James, D., Korsten, E., Lenaburg, R., and Slosson, J., "Erodible Channel Models: State of the Art Review", *Proceedings* of the International Symposium on the Hydraulics and Hydrology of Arid Lands, July 30-Aug. 3, 1990, San Diego, CA.

Chang, H. H., 1991, "Simulation of Bed Topography in a Meandering River", *Proceedings* of the

Fifth Interagency Sedimentation Conference, Las Vegas, NV, March 21-28.

Chang, H. H., 1991, "Computer Simulation of River Channel Changes Induced by Sand Mining", *Proceedings* of International Conference on Computer Applications in Water Resources, July 3-6, Taipei, Taiwan, Vol. 1, 226-234.

Jones, N. and Chang, H. H., 1991, "Fluvial Recharge of Sand Mining Pit", *Proceedings* of the 1991 National Conference on Hydraulic Engineering, Nashville, TN, July 29-August 2.

Chang, H. H., 1992, "Overview of Erodible Channel Models", *Proceedings* of Seminar on Mathematical Modeling of Alluvial Rivers, UNDP/UNESCO, Kathmandu, Nepal, April 14-18, 1992.

Chang, H. H., Jennings, M. E., and Olona, S., 1992, "Computer Simulation of River Channel Changes on a Point Bar", *Proceedings* of the 1992 National Conference on Hydraulic Engineering, Baltimore, MD, August 3-5.

Bakall E., Moncrief, J., Walters, J., and Chang, H. H., 1993, "Emergency Protection, San Luis Rey River Aqueducts", *Proceedings* of the 1993 National Conference on Hydraulic Engineering, San Francisco, CA, July 25-30, pp. 962-967.

Chang, H. H., Harris, C., Lindsay, W., Nakao, S. S., and Kia, R., 1993, "Selecting Sediment Transport Equation for Scour Simulation at Bridge Crossing", *Proceedings* of the 1993 National Conference on Hydraulic Engineering, San Francisco, CA, July 25-30, pp. 1744-1949.

Thomas, W. A., Chang, H. H., and Holly, F. M., 1993, "Computational Modeling of Sedimentation Processes", *Proceedings* of the 1993 National Conference on Hydraulic Engineering, San Francisco, CA, July 25-30.

Chang, H. H., Ergun, B., Moncrief, J., and Friehauf, D., "Fluvial Evaluation of Design for Aqueduct Protection", *Proceedings* of the International Symposium, Eat-West, North-South Encounter on the State-of-the-Art in River Engineering Methods and Design Philosophies, Vol. 1, pp. 325-333, May 16-20, 1994, State Hydrologic Institute, St. Petersburg, Russia.

Chang, H. H., Harrison, L., Lee, W., and Tu, S., 1994, "Numerical Modeling for Sediment-Pass-Through Operations of Reservoirs", *Proceedings* of the 1994 National Conference on Hydraulic Engineering, Buffalo, NY, August 1-5.

Chang, H. H., Grove, R., and Pearson, D. C., 1994, "Fluvial Simulation of an Ephemeral River", *Proceedings* of the International Symposium on River Waterfront Development, Nile Research Institute, Egypt, Sept. 15-17.

Tu, S., Geary, G., Lee, W., and Chang, H. H., 1995, "Operation Rule to Maintain Long-Term Sediment Balance in Reservoirs", *Proceedings* of Hydro Power of 95.

Tu, S., Geary, G., Lee, W., and Chang, H. H., 1995, "Development of Reservoir Operation Rules to Control Sedimentation, A Numerical Model Study", *Proceedings* of the 15th United States Committee on Large Dams Annual Meeting, San Francisco, May 15-19, 1995

Chang, H. H., Harrison, L., Lee, W., and Tu, S., 1995, "Fluvial Modeling for Sediment-Pass-Through Operations of Reservoirs", *Water Resources Engineering, Proceedings* of the First International Conference on Water Resources Engineering, pp. 1178-1183, San Antonio, Texas, August 14-18.

Chang, H. H., Dunn, D. D., and Vose, J., 1995, "Simulation of General Scour at US-59 Bridge Crossing on the Trinity River in Texas", *Water Resources Engineering, Proceedings* of the First International Conference on Water Resources Engineering, pp. 623-628, San Antonio, Texas, August 14-18.

Chang, H. H. and Pearson, Daniel, 1995, "Flushing and Recharge of Inlet Channel for an Ephemeral Coastal River", *Proceedings* of the 4th International Conference on Estuarine and Coastal Modeling, October 26-28, San Diego.

Chang, H. H and Fan, S-S., 1996, "Reservoir Erosion and Sedimentation for Model Calibration", *Proceedings* of the Sixth Interagency Sedimentation Conference, Las Vegas. This paper is also in *Reservoir Sedimentation, Proceedings* of the St. Petersburg Workshop, Bruk and Zebidi, Editors, UNESCO, Paris, 1996, pp. 265-272.

Chang, H. H., 1966, "Scour Study for Bridge Design on Temecula Creek", *Proceedings* of North American Water and Environment Congress '96, June 22-28, Anaheim, California.

Chang, H. H., 1966, "Simulation of Channel Changes Induced by a Reservoir", *Proceedings* of North American Water and Environment Congress '96, June 22-28, Anaheim, California.

Chang, H. H., 1997, "Modeling of Reservoir Sedimentation", *Proceedings* of the Third Conference on Exchanging Technologies and Information in Water Resources Across the Taiwan Strait, July 28-30, Beijing, China, pp543-552.

Chang, H. H., 1997, "Routing of Tailings in a Stream Channel", *Proceedings* of the 27th International Association for Hydraulic Research Congress, August, 1997, San Francisco.

Chang, H. H., 1998, "Evaluation of Flood Impacts", Proceedings of the Annual Conference for the State Floodplain Managers Association, San Diego, CA, March 1998.

Wight, J., Chang, H. H., and Walters, J, "GIS Provides SDG&E Speedy Assessment of El Nino Flood Damage Potential", *Proceedings* of the Annual Conference for the State Floodplain Managers Association, San Diego, CA, March 1998.

Chang, H. H. and Abcarius, Jack, "Hydraulic Design of Bridge with Erodible Road Embankments", *Proceedings* of the 1998 International Water Resources Engineering Conference, Memphis, Tennessee, August, 1998.

Chang, H. H., "Modeling Floodplain Changes Below Seven Oaks Dam", *Proceedings* of the 2000 Water Resources Engineering Conference, ASCE, Minneapolis, Minnesota, August, 2000.

Harding, M.V., Forrest, C.L., and Chang, H.H., "Caltrans Erosion Control Pilot Study", *Proceedings*

of Soil Erosion Research for the 21st Century, ASAE, January 3-5, 2001, Honolulu, Hawaii.

Chang, H.H., "Sediment Transport Modeling for Stream Channel Scour Below a Dam", *Proceedings* of Soil Erosion Research for the 21st Century, ASAE, January 3-5, 2001, Honolulu, Hawaii.

Chang, H.H., "Modeling of Morphological Changes of an Ephemeral Stream", *Proceedings* of the Seventh Federal Interagency Sedimentation Conference, Reno, Nevada, March 25-29, 2001.

Harding, M.V., Forrest, C.L., and Chang, H.H., "The Effects of Soil Roughness on Rainfall-Induced Erosion", *Proceedings* of 33rd Annual Conference and Expo, International Erosion Control Association, Feb. 25 - March 1, 2002, Orlando, Florida.

Forrest, C.L., Harding, M.V., Gardner, N., and Chang, H.H., "Caltrans Erosion Control Pilot Study", *Proceedings* of 33rd Annual Conference and Expo, International Erosion Control Association, Feb. 25 - March 1, 2002, Orlando, Florida.

Chang, H. H., "Fluvial Modeling of Ventura River Responses to Matilija Dam Removal", *Proceedings* of the ASCE 2005 Watershed Management Conference, Williamsburg, Virginia, July 2005.

Chang, H. H., "River Morphology and River Channel Changes", *Proceedings* of the Conference on River and Coastal Investigation and Planning, Taichung, Taiwan, September 7-10, 2005.

IX. TECHNICAL REPORTS

Chang, H. H., 1967, "Hydraulics of Rivers and Deltas", Ph.D. Dissertation, Colorado State University, Ft. Collins, Colorado, 176 pp.

Chang, H. H., 1968, "Flow Analysis Inside Thrust Reversers", Engineering Report 24-2287, Rohr Corp., Chula Vista, California.

Chang, H. H., and Scotchie, J. P., 1969, "Analysis of Subsonic Flow Surrounding a Fully Deployed Thrust Reverser", Engineering Report 24-2288, Rohr Corp., Chula Vista, California.

Chang, H. H., 1969, "Work Statement and Technical Approach of In-Flight Thrust Reversers", Engineering Report 24-2299, Rohr Corp., Chula Vista, California.

Chang, H. H., 1969, "Development of the Rohr/SDSU Water Table as an Experimental Tool for Compressible Flows", Engineering Report 24-2297, Rohr Corp., Chula Vista, California.

Chang, H. H., 1970, "Analysis of Thrust Reverser Internal Flow and Aerodynamic Loads", Engineering Report 832-318, Rohr Corp., Chula Vista, California.

Chang, H. H., and Cummings, D. P., 1970, "Water Table Experimental Study of Cascade Thrust Reverser Parameters", TN 823-033, Rohr Corp., Chula Vista, California.

Chang, H. H., Simons, D. B., and Brooks, R. H., 1970, "Mechanics of Aggrading and Degrading

Channels", National Fall Meeting, American Geophysical Union, San Francisco.

Duvvuri, T., Chang H. H., and Prior, B. W., 1972, "Analytical Study of In-Flight Thrust Reversers, Vol. 1 - Final Technical Report and Vol. 2 - User's Manual and Source Listings for Computer Programs", Technical Report AFFDL- TR-72, Air Force Flight Dynamics Lab., Air Force Systems Command, Wright Patterson Air Force Base, Ohio.

Chang, H. H., 1972, "Design Manual for Stable Earth Channel", Dept. of Sanitation and Flood Control, Public Works Agency, County of San Diego.

Chang, H. H., 1972, "Evaluation of Sedimentation and Erosion in the Flood Plains of San Diego County", Dept. of Sanitation and Flood Control, Public Works Agency, County of San Diego.

Chang, H. H., 1974, "Flood Plain Sedimentation and Erosion, Phase III", Dept. of Sanitation and Flood Control, Public Works Agency, County of San Diego, 78 pp.

Chang, H. H., 1974, "Flood Plain Sedimentation and Erosion, Phase IV", Dept. of Sanitation and Flood Control, Public Works Agency, County of San Diego, 77 pp.

Chang, H. H., 1975, "Flood Plain Sedimentation and Erosion, Phase V", Dept. of Sanitation and Flood Control, Public Works Agency, County of San Diego, 87 pp.

Chang, H. H., and Hill, J. C., 1975, "Numerical Modeling of Flood Channel Deformation", Spring Annual Meeting, American Geophysical Union, Washington, D. C., June 16-19.

Chang, H. H., 1975, "Flood Plain Sedimentation and Erosion, Phase IV", Dept. of Sanitation and Flood Control, Public Works Agency, County of San Diego, 77 pp.

Chang, H. H., 1976, "Estimation of Sand Influx into the Ocean from a Flood Channel", Workshop on Sediment Management for Southern Calif. Mountains, Coastal Plains and Shoreline, California Institute of Technology, March 15-16.

Chang, H. H., 1976, "User's Manual for Generalized Computer Program with Versions Fluvial-1 and Fluvial-3", Dept. of Sanitation and Flood Control, Community Services Agency, County of San Diego, 52 pp.

Chang, H. H., 1977, "Dam Failure Inundation Report and Map for an Enlarged Rattle-snake Reservoir", Lowry and Associates, Irvine, Calif.

Chang, H. H., and Decker, G., 1978, "Erosion Study of San Diego River near Lakeside Sewage Treatment Plant", Dept. of Sanitation and Flood Control, Public Works Agency, County of San Diego.

Chang, H. H., 1979, "Stable Alluvial Canals for Water Conveyance", presented at the annual meeting of the Transportation Research Board, National Research Council, Washington, D. C., January 15-19.

Chang, H. H., 1979, "Evaluation and Mitigation of Stream-Bed Erosion at the Bridge Crossing of Magnolia Avenue", Report for the Dept. of Transportation, County of San Diego.

Chang, H. H., and Hill, J. C., 1981, "A Case Study for Erodible Channel Using a Mathematical Model", report for Special Study of Computer-Based Flood and Sediment Routing Models for National Research Council, National Academy of Sciences.

Chang, H. H., 1981, "Hydraulic and Sediment Transport Effects on the Lakeside Trunk Sewer", report for the Office of County Counsel, County of San Diego.

Chang, H. H., 1981, "The City of Poway Floodwater Detention Basin Study", SDSU Civil Engineering Series No. 81143, 109 pp.

Chang, H. H., 1981, "Repair Abutments at Three Bridge Sites, MCB Camp Pendleton", Graves Engineering, Inc., San Diego, Calif., 41 pp.

Chang, H. H., and Hill, J. C., 1982, "Computer-Based Flood and Sediment Routing Model", report for Committee on Hydrodynamic Models, National Research Council, National Academy of Sciences, Washington, D. C., 85 pp.

Chang, H. H., 1982, "Overview of Design Methods for Alluvial Channels", in Lecture Notes for Applied Sedimentation and River Engineering, edited by Chang, H. H., SDSU Civil Engineering Series 82121.

Chang, H. H., and LaCava, J., 1982, "Santa Margarita River Levee Study", report for Western Division, Naval Facilities Engineering Command, San Bruno, Calif.

PRC Toups and Chang, H. H., 1982, "Carmel Valley Basin Analysis", report for Carmel Valley Home and Property Owners' Assoc., 32 pp.

Chang, H. H., Editor, 1983, "Applied Sedimentation and River Engineering", SDSU Civil Engineering Series 83215.

Chang, H. H., 1983, "River Hydraulics", San Diego State University Syllabus, No. 301, 120 pp.

Chang, H. H., and Clark, R. 1983, " Proposed Sesko Sand Extraction in San Luis Rey River", PRC Toups Corp., La Jolla, Calif.

Chang, H. H., 1983, "Mathematical Modeling of Alluvial Channels", report for the National Science Foundation (Grant No. CEE-8209029), SDSU Civil Engineering Series No. 83158, 55 pp.
Chang, H. H., and Hill, J. C., 1983, "Modeling of Flood Plain Changes", Specialty Conference of the Irrigation and Drainage Division, ASCE, Jackson, Wyoming, July 20-22.

Chang, H. H., and Hu, D. P., 1983, "Computer Modeling of Width Formation for Alluvial Rivers", ASCE National Convention, Houston, Texas, October 17-21.

Chang, H. H., 1984, "Slope Protection for Mar Lado Subdivision and Bridge Pier Scour at Foussat Street, Oceanside, California", report for William Lee Company.

Chang, H. H., 1984, "Mathematical Modeling of Alluvial Channels", report for the National Science

Foundation (Grant No. CEE-8209029), SDSU Civil Engineering Series No. 84155.

Chang, H. H., 1984, "Sediment Study for Carmel Valley Village", report for Carlsberg Construction Co., Inc., 42 pp.

Chang, H. H., 1984, "Fluvial Study for Rillito River: from La Cholla to Craycroft", report for the Dept. of Transportation and Flood Control District, Pima County, Arizona, 162 pp.

Vasquez, F. M., and Chang, H. H., 1985, "Design Concept Report: Silvercroft Wash between Speedway Boulevard and Grant Road", VEA Ltd., Tucson, Arizona.

Phillips, B., and Chang, H. H., 1985, "Design Report for E7605M: Repairs to Santa Margarita River Dike", Marine Corps Air Facility, Camp Pendleton, California, A-E Contract No. N62474-85-C-8279, Robert Bein, William Frost & Associates, Newport Beach, Calif.

Chang, H. H., 1985, "Computer-Based Design of Bank Protection in Curved Channels", presented at the Hydraulic Conference for the Highway Community, Ft. Collins, Colorado, June 24-28.

Chang, H. H., 1985, "Drainage Design Report for the Channelization of the Santa Cruz River between Ina Road and Cortaro Road", Cella Barr Associates, Tucson, Arizona.

Chang, H. H., 1985, "Hydraulic and Sediment Studies for Sand Removal and Flood Channel Improvement Plan, Upper San Diego River Lakeside", report for Woodward Sand and Materials Company, 45 pp.

Chang, H. H., 1985, "Analysis of Hydrological Impacts from Proposed Development and Channel Improvements in Spring Valley", Stevens Planning Group, Inc.

Chang, H. H., 1985, "Engineering of River Sedimentation", SDSU Civil Engineering Series No. 85144, 212pp.

Chang, H. H., 1985, "Flushing of Entrance Channel for Coastal Lagoons: Mathematical Simulation", West Coast Regional Coastal Design Conference, Oakland, Calif., Nov. 6-8.

Chang, H. H., 1986, "Modeling of Movable Bed Streams", Western State High Risk Flood Areas Symposium, March 24-26, Las Vegas, Nevada.

Chang, H. H., 1986, "Dynamic Modeling of Alluvial Rivers", invited lecture at the U. S. Geological Survey, Menlo Park, Calif., 1986.

Chang, H. H., 1986, "Hydraulic Design of Flood control Channel for San Vicente Creek," report for Dept. of Public Works, County of San Diego, (County Contract No. 23278-E).

Chang, H. H., 1986, "Sediment Study for Buena Vista Creek," report for the City of Vista.

Chang, H. H., 1986, "Users Manual for Generalized Computer Program FLUVIAL-12.

Chang, H. H., 1986, "Computer-Aided Design for Santa Cruz River between Valencia and

Speedway," report for Pima County, Arizona.

Chang, H. H., 1986, "Hydraulic and Fluvial Studies for Channelization of Moosa Canyon Creek at Brookside Farms," report for Brookside Farms, Bonsall, Calif.

Stow, D. A., and Chang, H. H., 1987, "Numerical Simulation of Coastal Entrance Channel Processes in Southern California," presented at the Asso. of American Geographers Conference, Portland, Oregon, April 24.

Chang, H. H., and Osmolski, Z., 1987, "Hydraulic Design of Structural Flood Control for Santa Cruz River," presented at Floodplains '87, Conference of the State Flood Plain Managers, Seattle, Wash., June 9-12.

Chang, H. H., 1987, "Hydraulic and Fluvial Studies for Demetrie Wash", rept. for McGovern, MacVitte and Associates, Tucson, Arizona.

Cooper, A. and Chang, H. H., 1987, "Flood Plain Management Study for Moosa Canyon Creek, County of San Diego," prepared for the County of San Diego, 159 pp.

Chang, H. H. and Brown, W., 1987, "Identifying and Managing Debris-Flow Hazard and Erodible Channels in the Western U. S.", invited short course at the Arizona Floodplain Management Association meeting, Wickenburg, Arizona, September 17-18.

Chang, H. H., 1988, "Fluvial Sand Source for South Central California Coast", prepared for Beach Erosion Authority for Control Operations and Nourishment, via Noble Consultants, Irvine, Calif., 65 pp.

Chang, H. H., 1988, "Hydraulic and Fluvial Studies for Channelization of Canada del Oro Wash and Linear Park Development", prepared for McGovern, MacVittie, Lodge & Associates, Tucson, Arizona, 88 pp.

Chang, H. H., 1988, "Fluvial Study for Bank Protection of Sycamore Creek in Poway", prepared for Oceanview Development, Solana Beach, Calif., 62pp.

Chang, H. H., 1988, "Fluvial Study for Channelization of Temecula Creek at Rancho Village Assessment District", prepared for Rancho Pacific Engineering Corporation, Temecula, Calif., 123pp.

Chang, H. H., 1988, "Sediment Study for Flood Control Plan of Bullhead City, Arizona", prepared for Kaminski-Hubbard Engineering, Inc., Phoenix, 89pp.

Chang, H. H., 1988, "Test and Calibration of FLUVIAL Model Using Missouri River Data", prepared for Waterway Experiment Station, U. S. Army Corps of Engineers, Vicksburg, Mississippi.

Chang, H. H., 1988, "Fluvial Study for Channelization of Santa Gertrudis Creek", prepared for Rancho Pacific Engineering Corporation, Temecula, Calif., 113pp.

Chang, H. H., 1988, "Fluvial Study for Sand Recovery in Upper Sweetwater Reservoir", prepared

for Sweetwater Authority, Chula Vista, CA, 78pp.

Webb, C. K., Stow, D. A., and Chang, H. H., 1988, "Coastal Inlet Processes in Southern California", Annual Meeting of the Association of American Geographers, Phoenix, AZ.

Webb, C., Stow, D., and Chang, H. H., 1988, "Flushing of Tijuana Estuary - Modeling Study", presented at the 1988 Annual Meeting and Conference, California Shore and Beach Preservation Association, November 2-4, San Diego.

Chang, H. H., 1988, "Development of Bank Protection for Alisal Ranch Golf Course", prepared for the Alisal, Solvang, California.

Chang, H. H., 1989, "Drainage Study/Design for Coffee-Webb Industrial Park", prepared for Snipes-Dye Associates, Lemon CA., 33pp.

Chang, H. H., 1989, "Hydraulic Design of Drop Structures and Streambed Stabilizers for Temecula Creek", prepared for Ranpac Engineering Corp., Temecula, CA. 102pp.

Chang, H. H. and Stow, D., 1989, "Fluvial Sand Delivery by the Santa Clara River", presented at the Workshop on Coastal Sedimentation, May 22-23, Catalina Island, CA.

Stow, D. and Chang. H. H., 1989, "Inlet Dynamics - Southern California", presented at the Workshop on Coastal Sedimentation, May 22-23, Catalina Island, CA.

Chang, H. H., 1989, "Hydrology Study for Northeastern Carlsbad", prepared for Hofman Planning Group.

Chang, H. H., 1989, "Sediment Study for Calavera Lake Creek in Carlsbad, for Sediment Detention Basins at Rancho Carlsbad", prepared for Hofman Planning Group.

Chang, H. H., 1989, "Sedimentation", Chapter III, Carmel Valley Restoration and Enhancement Project, by Nolte and Associates for California Dept. of Transportation.

Chang, H. H., 1989, "Hydrological Design of Floodwater Detention Basin for La Costa Southwest", prepared for Fieldstone/La Costa Associates, Carlsbad.

Chang, H. H., 1990, "Drainage Study for Encinitas Creek", prepared for Fieldstone/La Costa Associates, Carlsbad.

Chang, H. H., 1990, "Hydrological Delineation for the Waters of the United States for Temecula Creek", prepared for Ranpac Engineering Corp., Temecula, CA.

Chang, H. H., 1990, "Hydrology Study for Coyote Wash, Imperial County, California, prepared for Jaykim Engineers, Diamond Bar, CA.

Chang, H. H. and Nolte & Associates, 1990, "Calibration Study of FLUVIAL-12 Model Using Data from San Luis Rey River", prepared for the San Diego County Water Authority, 45pp.

Chang, H. H. and Nolte & Associates, 1991, "Assessment of Sand and Gravel Mining Impacts on San Luis Rey River near Aqueduct Crossings", prepared for the San Diego County Water Authority, 186pp.

Chang, H. H., 1991, "Evaluation of Water Quality Management using Instream Flow Regulation", project report for San Diego River Live Stream Discharge Study, prepared for Environmental and Energy Services Co. and City of San Diego.

Chang, H. H., 1991, "Mathematical Modeling of Bridge Scour", invited lecture at the Region 6 Bridge Inspection and Management Conference, Federal Highway Administration, May 29-31, Arlington, TX

Chang, H. H., 1991, "Evaluation of Impacts of Proposed Sand and Gravel Extraction in Brazos River on I-59 Bridge", prepared for the Texas State Dept. of Highways and Public Transportation, Austin, TX.

Chang, H. H., 1991, "Control of Lagoon Siltation Associated with Land-Side Sediment Sources", invited lecture at San Dieguito Lagoon Restoration Technical Workshop, December 12.

Chang, H. H., 1992, "River Channel Scour at Three Proposed Pipeline Crossings on the Otay River", prepared for CWP Geosciences, San Diego, CA.

Chang, H. H., 1992, "Impacts of Proposed Sand and Gravel Extraction in the San Luis Rey River at Pala by JB Sand", prepared for JB Unlimited Sand Project, Escondido, CA, 155pp.

Chang, H. H., 1993, "Drainage Study for Ramona", prepared of the County of San Diego, 225pp.

Chang, H. H., 1993, "Design Report for Permanent Protection of the San Luis Rey River Aqueduct Crossings, Fluvial Study for Probable Maximum Flood", prepared for Parsons Brinckerhoff and San Diego County Water Authority, 77 pp.

Chang, H. H., 1994, "Numerical Modeling for Sediment-Pass-Through Operations of Reservoirs on North Fork Feather River", prepared for Pacific Gas & Electric Company, San Francisco, 225pp.

Chang, H. H., 1994, "Validation of FLUVIAL-12 Model Using Data from the San Dieguito River", prepared for Southern California Edison Company, Rosemead, California, 123pp.

Chang. H. H., 1994, "Dam Breach and Inundation Map for Eastlake Greens Reservoir", prepared for Otay Water District, 92pp.

Chang. H. H., 1995, "Hydraulic and Sedimentation Impacts of Lagoon Restoration for San Dieguito River", prepared for Southern California Edison Company, Rosemead, California, 224pp.

Chang, H. H., 1996, "Drainage Study for Rainbow", prepared for the County of San Diego, 225pp.

Chang, H. H., 1996, "Sediment Modeling for Clark Fork River and Silver Bow Creek in Montana", prepared for the Atlantic Richfield Company in connection with the case U.S. versus ARCO, et al., No. CV-89-039-BU-PGH, 232 pp.

Chang, H. H., 1997, "Hydraulic and Fluvial Study for Wetland Restoration in the San Dieguito River", prepared for the Southern California Edison Company, 155pp.

Chang, H. H., 1999, "Santa Ana River/Mentone Fan Hydrological Study", prepared for Department of Fish and Game, Conservation Planning Division, Long Beach, California, 123pp.

URS Greiner Woodward Clyde Consultants and Chang, H.H., 1999, "Laboratory Manual Soil Erosion Laboratory & Outdoor Test Plots, A January 29, 255pp.

Chang., H. H., 1999, "San Diego County Alluvial Studies", in Section 4.5, Riverine Erosion Hazard Areas - Mapping Feasibility Study published by the Hazard Study Branch, Federal Emergency Management Agency, Washington, D. C..

URS Greiner Woodward Clyde Consultants and Chang, H.H., 1999, "Soil Stabilization for Temporary Slopes, A prepared for Caltrans, Sacramento, CA, November.

Chang, H.H., 2000, "Fluvial Study for Serrano Creek (Facility No. F19)," prepared for Public Facilities and Resources Department, County of Orange, CA

Chang, H.H, 2000, "Sediment Yield Study for Muddy Canyon and Los Trancos Canyon", prepared for the Irvine Community Development Company, Newport Beach, CA.

Chang, H. H., 2001, "Fluvial Study to Determine Failure of Bridge No. 504.1 of Burlington Northern and Santa Fe Railroads in Kingman, Arizona", prepared for Jardine, Baker, Hickman & Houston, 3300 North Central Street, Suite 600, Phoenix, AZ 85012.

Chang, H. H., 2002, "Calleguas Creek Watershed Sediment Study", prepared for Ventura County Flood Control District, Ventura, CA.

Chang, H. H., 2003, "Fluvial Modeling Study for Ventura River Responses to Matilija Dam Removal and Related Issues", prepared for Ventura County Flood Control District, Ventura, CA.

Chang, H. H., 2004, "Fluvial Modeling Study of Feather River Responses to Oroville Dam and Related Issues", prepared for California Department of Water Resources, Northern District.

Chang, H.H., 2007, "Hydraulic and Scour Studies for Willow Street Bridge Project", prepared for Simon Wong Engineering.

Chang, H.H., 2008, "Fluvial Study of Serrano Creek Channel Stabilization, Trabuco Road to Rancho Parkway (Facility No. F19)", prepared for Public Works/Flood Control Division, County of Orange.

Chang, H.H., 2008, "Hydraulic Requirements for SARI Pipeline Protection along Channel Bank and at River Crossing of the Santa Ana River below Prado Dam", prepared for County of Orange Resources and Development Management Department.

Chang, H.H., 2009, "Calexico West Land Port of Entry, Hydrology and Hydraulic Studies for New River in Calexico, California", prepared for U. S. General Services Administration, 450 Golden Gate Avenue, 3rd Floor, San Francisco, CA.

Chang, H.H., 2009, "Hassayampa River Study", prepared for Maricopa County Flood Control District, Arizona.

X. TECHNICAL TRAINING COURSES TAUGHT

Lecturer of the short course "Background and Applications of the HEC-2 Program for Water-Surface Profiles", offered to engineers of the County of San Diego and the City of San Diego, January 21-26, 1973.

Coordinator and principal lecturer of the short course, "Applied Sedimentation and River Engineering," attendance: 61, Shelter Island, San Diego, January 14-17, 1982.

Coordinator and principal lecturer of the short course, "Applied Sedimentation and River Engineering," attendance: 56, Shelter Island, San Diego, January 18-21, 1984.

Lecturer of the course "River Processes and Engineering", offered to engineers and researchers at the Central Water and Power Research Station, Poona, India, Dec. 27, 1985 to January 18, 1986. The course was financially supported by UNDP for which the instructor was a consultant.

Guest lecturer of the two-day short course "Hydrology of Flood Control", July 1986 and July 1987

Lecturer of the short course "Identifying and Managing Debris-Flow Hazard and Erodible Channels in the Western U. S.", for the Arizona Floodplain Management Association meeting, Wickenburg, Arizona, September 17-18, 1987.

Lecturer of the two-day short course "River Engineering", offered to the engineers of the City of Tucson, March 3-4, 1988.

Guest lecturer on "Alluvial Fan and River Channels", at the workshop on Analysis and Evaluation of Mud Flow and Alluvial Fan Flooding, West Consultants, 1988.

Lecturer of the three-day short course "River Processes and Sedimentation", offered to the faculty and graduate students of the Civil Engineering Department, Clarkson University, Potsdam, New York, May 30-June 2, 1988.

Lecturer of the three-day short course "Sedimentation Engineering", invited by and offered at Queensland University of Technology, Attendance: 28, Brisbane, Australia, July 12-14, 1989.

Lecturer of the three-day workshop "River Sedimentation Modeling Using the GFLUVIAL Program", sponsored by the U. S. Geological Survey, attended by 20 professionals from the U.S. Geological Survey and Federal Highway Administration, Denver, Colorado, April 10-12, 1990.

Lecturer of the short course "Background and Applications of the HEC-2 Program", offered by invitation at Ranpac Engineering Corporation, Temecula, CA. June, 1990.

Guest lecturer of the three-day short course "Water-Surface Profile Computation Using HEC-2", sponsored by Continuing Education Service, ASCE, New York, course offered at San Diego, July 26-28, 1990.

Lecturer and Rapporteur at the four-day seminar on Mathematical Modeling of Alluvial Rivers, UNDP/UNESCO Regional Training Program on Erosion and Sedimentation for Asia, Kathmandu, Nepal, April 14-17, 1992.

Lecturer at the Hydrology Training Program sponsored by the City of Carlsbad, Calif., on floodplain management, erosion control and desilting basins, May 5, 1992.

Lecturer at the workshop on Hydraulic Engineering, sponsored by the Chinese National Science Foundation and National Cheng Kung University, Tainan, Taiwan, July 6-10, 1992.

Lecturer at the training course on river engineering at Yangtze Scientific Institute, Wuhan, China,

May 1998.

Lecturer at the three-day workshop "Applications in Stormwater Management", sponsored by the American Society of Civil Engineers, San Diego, CA, November 10-12, 1999.

Invited Senior Visiting Scholar by the Chinese National Academy of Sciences to present a series of lectures on river modeling at the Nanjing Hydraulic Research Institute, December 16 to 23, 2000.

Invited Senior Visiting Scholar by the Institute of Mountain Hazard and Environment, Chinese National Academy of Sciences to present a series of lectures on river modeling in Kunming, China, June 4-10, 2001.

Invited lecturer for a two-day short course on river engineering at Ventura County Flood Control District, CA, February 20-21, 2002.

Invited lecturer for a week long short course on river hydraulics and river engineering at Administrative Bureau of River Valley, Kuerle, South Xinjiang, China, May 25 to June 3, 2005.

Invited lecturer for a week long short course on river hydraulics and river engineering at Lanzhou China, August 16-23, 2005.

Invited lecturer for technical training workshop on FLUVIAL-12 at Maricopa County Flood Control District, Phoenix, Arizona, April 20-21, 2009.

XI. INVITED LECTURES

Invited speaker at the Mission Valley Planning Commission, the San Diego City Planning Commission, and the San Diego City Council on the topic "First San Diego River Improvement Project", 1980.

Invited speaker on the FLUVIAL model: at the University of Alaska, 1984; the Pima County, Arizona, 1986; U.S. Geological Survey at Menlo Park, CA, 1986; U.S. Army Corps of Engineers at Cincinnati, 1987; the Second Seminar on Stream Sedimentation Models, Sedimentation Committee, Federal Interagency Advisory Committee on Water Data, Denver, CO, October 19-20, 1988.

Invited speaker at the International Symposium on River Sedimentation, 1980, 1984, and 1986.

Invited speaker on the topic "Erodible Channel Modeling," at the Seminar on Stream Channel Erosion Protection, sponsored by the Federal Emergency Management Agency, Colorado Springs, August 27-28, 1987.

Invited speaker on the topic "Modeling General Scour at Bridge Crossings", at the Second Bridge Engineering Conference, Transportation Research Board, Minneapolis, Minnesota, September 24-26, 1984.

Invited speaker on the topic "River Morphology and Responses to Alterations", at the Seminar on Stream Channel Erosion Protection by the Federal Emergency Management Agency, Colorado

Springs, August 27-28, 1987.

Invited speaker at the Geological Science Seminar, SDSU, Dec. 2, 1987.

Invited speaker on the topics of "Analytical River Morphology" and "Computer-Aided River and Sedimentation Engineering", at Yangtze River Research Institute, Wuhan; IWHR and Qinghua University, Beijing; Hohai University and Nanjing Hydraulic Research Institute, Nanjing, October 17-October 28, 1987.

Invited speaker on "River Engineering", Nolte and Associates, San Jose, California, November 16, 1987.

Invited dinner meeting speaker on the topic "Bridge Scour", the Hydraulic Engineer's Meeting, California Dept. of Transportation, Los Angeles, September 29-30, 1988.

Invited speaker on the topic "Sediment Transport Modeling", at the U. S. and China Bilateral Symposium on Flood Forecasting", sponsored by National Weather Service, NOAA, March 28-31, 1989, Portland, Oregon.

Invited speaker at the Bilateral Workshop on Understanding Sedimentation Processes and Model Evaluation, National Research Council, Washington, D. C., December 16-18, 1991.

Invited speaker on the topic "Design of Intakes for Sediment Exclusion", Royal Institute of Technology, Stockholm, Sweden, May 14, 1993.

Invited speaker at the Bilateral Workshop on Understanding Sedimentation Processes and Model Evaluation, National Research Council, Washington, D. C., July 23-24, 1993.

Invited panel expert on Flood Control and Sedimentation Issues on Three Gorges Dam Project in China, Sponsored by Chinese Institute of Engineers/USA, Chinese American Environmental Protection Association, International River Networks, San Francisco, July 28, 1993.

Invited panel expert at the Forum on China's Three-Gorges Project, Sponsored by Chinese Institute of Engineers/USA, San Francisco Bay Area Chapter, San Francisco, October 30, 1993.

Invited speaker on Flood Control and River Sedimentation at the Technical Workshop on San Dieguito Lagoon Restoration, Santa Barbara, CA, January 28, 1994.

Invited speaker on Reservoir Sedimentation at the International Coordinating Committee on Reservoir Sedimentation, May 20, 1994, St. Petersburg, Russia.

Invited keynote speaker at the International Symposium on River Waterfront Development on Computer-Aided Design for River Channel Stabilization, Nile Research Institute, Egypt, Sept. 16, 1994.

Invited speaker at the Aerospace and Mechanical Engineering Colloquium, San Diego State University, on Numerical Modeling of River Channel Dynamics, October 20, 1994.

Invited speaker at the California Coastal Commission in San Francisco, on Flushing and Recharge of Inlet channel for the San Dieguito River, March 17, 1995.

Invited speaker at the HEC-6/FLUVIAL-12 Workshop sponsored by the Floodplain Mangers Association Conference, on FLUVIAL-12 Modeling, March 30, 1995, Anaheim, California.

Invited speaker at the International Reservoir Sedimentation Workshop, on Modeling for Sediment-Pass-Through Operations of Reservoirs, San Francisco, August 2, 1995.

Invited speaker at the Floodplain Management Association Conference, on San Dieguito Lagoon Restoration, Anaheim, CA, March 28, 1996.

Invited speaker at the Joint Power Authority workshop for San Dieguito Lagoon, on River Channel Responses to Lagoon Restoration, San Diego, CA, January 16, 1997.

Invited speaker at the Science Advisory Board, County of San Diego, on Application of Computer Models in San Diego County, August 11, 1997.

Invited speaker at the Board of Supervisors, County of San Diego, on Evaluation of Flood Impacts for El Nino Year, October 4, 1997.

Invited speaker at luncheon honoring ARCS scholars and donors, on San Dieguito Lagoon Restoration, San Diego State University, November 11, 1997.

Invited speaker at Wuhan University on river modeling, Wuhan, China, May 1998.

Invited speaker at the ASCE Student Chapter meeting, on Sediment Issues in Lagoon Restoration, San Diego State University, February 9, 1999.

Invited speaker at the U. S. Fish and Wildlife Services, on Applications of Fluvial Geomorphology to Environmental Assessments, Carlsbad, California, February 11, 1999.

Invited speaker at the bi-monthly meeting of the U.S.-China Peoples= Friendship Association on Three Gorges Dam Project, San Diego, California, September 11, 1999.

Invited speaker at the SDSU student chapter of ASCE on Three Gorges Dam Project, San Diego, California, October 18, 1999.

Invited speaker on Special Studies and Issues Relating to Sediment Transport and Channel Scour in the Western U. S., at the seminar on Applications in Stormwater Management, sponsored by ASCE, San Diego, California, November 11, 1999.

Invited speaker on Stabilization of Serrano Creek, to the engineers of the Public Facilities and Resources Department, County of Orange, February 15, 2000.

Invited speaker on Floodplain Mapping Relating to Riverine Erosion, at the Annual Conference for the Association for State Floodplain Managers, San Diego, CA, February 29, 2000.

Invited speaker on Three Gorges Dam in China, at the Young Member Forum of ASCE, San Diego, March 21, 2000.

Invited speaker on Riverine Erosion and Lateral Migration, at the Southwest River Management Restoration Conference for the Arizona Floodplain Management Association, Phoenix, AZ, April 4, 2000.

Invited speaker on Environmental Impacts of Three Gorges Dam, at the College of Engineering seminar, University of California at San Diego, April 21, 2000.

Invited speaker on River Modeling, at the Tibetan Hydrologic Insinuate, Lahsa, Tibet, China, May 26, 2000.

Invited speaker on Mountain Stream Dynamics, at the Institute of Mountain Hazards and Environment, Chinese Academy of Sciences and Ministry of Water Resources, Chengdu, China, June 2, 2000.

Invited speaker on Legal Aspects of River and Sedimentation Engineering, Sichuan University, Chengdu, China, June 5, 2000.

Keynote speaker on Floodplain Mapping for an Erodible Channel, at the plenary session of the Association of State Floodplain Managers, September 14, 2000, Sacramento, CA.

Invited speaker on Serrano Creek Modeling at the workshop on Stream Bank Stabilization for the Millennium, sponsored by Serrano Creek Conservancy, Lake Forest, CA, October 3, 2000.

Invited speaker on San Dieguito Lagoon Restoration at the ASCE Student chapter seminar SDSU, April 10, 2001.

Invited speaker on Three Gorges Dam at the San Diego Chinese Scientists and Engineers Association seminar, April 28, 2001.

Invited key note speaker on Three Gorges Dam at the ASCE Arizona Chapter seminar, Phoenix, Arizona, September 28, 2001.

Invited speaker on Sediment Modeling of River Channels at the College of Engineering Seminar, San Diego State University, October 1, 2001.

Invited speaker on Modeling of Fluvial Morphological Processes at the seminar on Applications in Stormwater Management, sponsored by ASCE, San Diego, California, January 10, 2002.

Invited speaker on Modeling River Channel Changes at the Civil Engineering Seminar, Pennsylvania State University, University Park, PA, February 27, 2002.

Invited speaker on Map Modernization at the Semi-Annual Conference for the Association of State Floodplain Managers, San Diego, CA, April 9, 2002.

Invited speaker on Three Gorges Dam at the seminar of the Metropolitan Wastewater Department, City of San Diego, January 22, 2004.

Invited Speaker on River Modeling at Water Resources Research Institute and Tsinghua University in Beijing on March 24, 2004, and at Yangtze River Scientific Institute in Wuhan, China on March 28, 2004.

Invited Keynote Speaker on "River Morphology and River Channel Changes", at the Conference on River and Coastal Investigation and Planning, Taichung, Taiwan, September 8, 2005.

Invited speaker on "River Morphology and River Channel Changes" at the National Taiwan University in Taipei Taiwan on September 7, 2005 and at Cheng Kung University in Tainan Taiwan on September 9, 2005.

Invited speaker on "River Morphology and River Channel Changes", at the International Symposium on River Regulation and Development, Tianjin University, October 13, 2008.

XII. GRANTS AND CONTRACTS

Principal Investigator, "Rohr-SDSU Water Table Research Project," awarded by Rohr Corporation, Chula Vista, California, amount $22,000, Sept. 1968 - Sept. 1969.

Co-Investigator, "Study Program for Derivation of Techniques to Predict Performance of In-Flight Thrust Reversers", awarded by the Aeronautical System Division, U. S. Air Force, $150,000, November 1970 to September 1971.

Principal Investigator, "Development of Hydrological Methods for Watershed and Flood Plain Analyses", awarded by Public Works Agency, County of San Diego, amount $41,180, 1972-1975.

Principal Investigator, "The City of Poway Floodwater Detention Basin Study," awarded by the City of Poway, California, amount $23,000, March 1 to August 31, 1981.

Coordinator of short course, "Applied Sedimentation and River Engineering," total income $25,000, January 1982.

Principal Investigator, "Computer-Based Flood and Sediment Routing Models," awarded by the National Academy of Science, amount $10,000, August 1981 - January 1982.

Co-Principal Investigator, "Acquisition of Research Equipment to Improve Capabilities of Civil Engineering Faculty to Carry Out Research in Computational Methods and Computer Needs," awarded by the National Science Foundation, amount $17,490, May 1982.

Principal Investigator, "A Mathematical Model for Erodible Channels with Width Variation," awarded by the National Science Foundation (Grant No. CEE-8209029), amount $95,711, November 15, 1982 - November 14, 1985.

Coordinator of short course, "Applied Sedimentation and River Engineering," total income $20,000, January 1984.

Principal Investigator, "Computer-Aided Stream-Gaging of Fluvial Sediment," awarded by the U. S. Geological Survey, $3,000, June, 1986.

Principal Investigator, "Maintenance of Entrance Channels for Coastal Lagoons and River Mouths," awarded by the National Sea Grant College Program, estimated total amount $150,000, October 1, 1986 to September 30, 1989.

Principal Investigator, "Sea Grant Traineeship", awarded by the National Sea Grant College Program, $30,000, October 1, 1986 to September 30, 1989.

Principal Investigator, "Computer-Based Design for Bank Protection", awarded by the Waterway Experiment Station, U. S. Army Corps of Engineers, Vicksburg, MS, $ 38,760, 1987.

Principal Investigator, "An Investigation of the Causes of Accelerated Channel Erosion and Development of Countermeasures for Bridge Stabilization on Stony Creek", awarded by California Dept. of Transportation, April 1, 1990 to March 31, 1992, $ 300,000.

Principal Investigator, "Computerized Gravel Transport Model of Cottonwood Creek", awarded by the California Department of Water Resources, June, 1991, $ 5,500.

Principal Investigator, "Numerical Modeling Study of Rock Creek, Cresta, and Poe Reservoir System on the Feather River", awarded by the Pacific Gas and Electric Company, San Francisco, CA, 1993-94, $ 143,000.

Principal Investigator, "Environmental Impact Assessment for Gravel and Sand Mining on Sisquoc and Santa Maria Rivers", awarded by the County of Santa Barbara, CA, 1993-95, $ 98,000.

Principal Investigator, "Environmental Impact Assessment for San Dieguito Wetlands Restoration", awarded by the Southern California Edison Company, Los Angeles, CA, 1993-96, $ 358,000.

Principal Investigator, "Computer Visualization of Hydrodynamic Models", awarded by the U.S. Navy, 1994-97, $ 300,000.

Principal Investigator, "Environmental Study for Tailings Delivery along Silver Bow Creek and the Clark Fork River in Montana", awarded by the Atlantic Richfield Company, Los Angeles, CA, 1995-96, $ 185,000.

Principal Investigator, "Caltrans Erosion Control Pilot Study", awarded by the California Department of Transportation, February 1998- January 2001, $ 525,000.

Principal Investigator, "Santa Ana River/Mentone Fan Hydrological Study", awarded by the California Department of Fish and Game, April 1998 - March 1999, $ 37,300.

Principal Investigator, "Research and Cooperation Relating to Yangtze River Bed Evaluation Downstream of the Three Gorges Dam", awarded by the Bureau of Science/Technology, Changjiang

Water Resources Commission, China, May 1998.

Principal Investigator, "Caltrans Slope Stability Study", awarded by the California Department of Transportation, September 1999- November 1999, $ 65,000.

Principal Investigator, "Laboratory and Field Test Correlation for Temporary Soil Stabilization", awarded by the California Department of Transportation, May 2001- June 2002, $ 153,600.

XIII. CONSULTING EXPERIENCES

I have been involved in professional consulting since joining San Diego State University in 1967. Within the general areas of hydraulics, hydrology, and sedimentation, I have been active in the flood plain mapping, channel design, hydrological simulation, watershed analysis, and river channel erosion and sedimentation. I am the author of over 100 technical reports and several computer models for river morphology and fluvial river hydraulics. Among the professional activities, I have taught short courses on river and sedimentation engineering, hydrology for flood control, and the use of the HEC-2 and the FLUVIAL-12 programs. I have served as a consultant for consulting firms, local, state, and federal governmental agencies, National Research Council and the United Nations. An outline of technical activities is given below.

Channel Design - I have been responsible in many channel design projects, including the First San Diego River Improvement Project, the Rillito River Levee Design (18 miles), the Elfin Forest channel design, Santa Cruz River levee design (40 miles), San Vicente Creek channel design, high velocity channel and energy dissipator of Bullhead City, Arizona, and environmental channel of Carmel Valley. In addition, I have served as a consultant to assist other engineers on design projects.

Hydrological Simulation - I have made the Floodwater Detention Basin Study for the City of Poway, Rattlesnake Dam Breach Study, and numerous designs and investigations involving hydrological simulation. I am well familiar with such programs as TR-20 and HEC-1. I have also served as an expert witness involving flood damages.

River and Sediment Studies - I have developed the FLUVIAL-12 model for simulating river hydraulics, sediment transport, and river channel changes. This model has been applied to the rivers listed below. This model was adopted by Academia Sinica in 1998 as the model for the Yangtze River. Data collection and model calibration were made in several cases. I have also made studies of sediment yields from many natural and disturbed watershed, and sediment deliveries by river channels.

Sweetwater River upstream of Sweetwater Reservoir, Upper San Diego River near Old Mission Dam, Otay River near the Beyer Way bridge, San Dieguito River near Rancho Santa Fe, San Dieguito River mouth in Del Mar, San Luis Rey River in Oceanside, San Elijo Lagoon in Del Mar, San Luis Rey River near Pala, Upper San Diego River in Santee and Lakeside, Otay River near the I-805 bridge crossing, Los Chollas Creek in San Diego, South Chollas Creek in San Diego, Canada Del Oro Wash in Tucson, Rillito River in Tuscon, San Lorenzo River in Santa Cruz, California, Salt River in Phoenix, Santa Cruz River in Tucson, Pantano Wash in Tucson, Santa Margarita River at Camp Pendleton, San Mateo River at Camp Pendleton, Trabuco Creek

in Orange County, San Juan Creek in Orange County, Tanana River near Fairbanks in Alaska, Tanana River near Nenana in Alaska, Escondido Creek in Vista, Buena Vista Creek in Carlsbad and Vista, Yellow River and Yangtze River in China, Santa Clara River in Ventura, Fall River in Colorado, Missouri River in Iowa and Nebraska, Temecula Creek in Riverside.

This Page Intentionally Left Blank

ATTACHMEN B

Assessment of Detention Basins/Debris Basins and SunCatcher Impacts for Calico Solar Site

This Page Intentionally Left Blank

CHANG Consultants
Hydrology•Hydraulics•Sedimentation
P.O. Box 9492 (required for regular mail)
6001 Avenida Alteras
Rancho Santa Fe, CA 92067-4492
(858) 756-9050, (858) 692-0761, FAX: (858) 756-9460
E-mail: changh@cox.net Web Site: http://chang.sdsu.edu/

ASSESSMENT OF DETENTION BASINS/DEBRIS BASINS AND SUNCATCHER IMPACTS FOR CALICO SOLAR SITE

Prepared for Tessera Energy

Prepared by Howard H. Chang, Ph.D., P.E.
September 13, 2010

EXECUTIVE SUMMARY

Detention basins (or debris basins) are being considered for installation along the foothills on the northern edge of the Calico Solar project site. While the basins would reduce the storm discharge; they also trap most of the sand and other coarser sediments that form the topography of the alluvial fan.

Alluvial fans form the dominant land features at the project site. Such alluvial fans have formed over the long-term geologic time. The terrain of a fan has established an approximate equilibrium in response to the natural inflows of water and sediment. Washes on the northern alluvial fan are characterized by flat topography with shallow sheet flow. Such morphological features are maintained by mild deposition on the alluvial fan. Under this condition, the discharge in a wash is limited by the low bank height since any discharge greater than the bankfull flow would overflow the banks to spread out to large adjacent areas. As long as sediment deposition continues, the discharge and flow depth of the wash would be very limited. The shallow flow depth limits the flow velocity and sediment transport, beneficial for wash stream stability.

The detention basins would reduce the sediment supply to the alluvial fan in addition to discharge reduction. The effects on sediment or debris reduction far outweigh the effects of discharge reduction. Such changes to the flow and sediment alter the natural equilibrium that has formed over the geologic time. In response to sediment reduction, the hungry storm water would erode sediment from the alluvial fan to meet its sediment carrying capacity. With continued maintenance of the debris basins, the sediment deficit storm flow would cause the formation of deeper stream channels that should also grow in size with time. In the long run, the multiple small stream flows on the alluvial fan will gradually converge into a few large incised channels. The discharge of an incised stream will increase in time as the sheet flows from adjacent fan

areas converge into the single channel. The large channel with higher discharge, greater depth and flow velocity is much less stable than the small washes with shallow sheet flows. The formation of stream channels is detrimental to stream channel stability since concentrated stream flows have greater depths, higher flow velocities, and greater potential for stream channel changes.

The detention basins would change the existing equilibrium of the fluvial system at the project site. The current fluvial regime (or equilibrium) would be altered by such changes. Alteration of the existing regime will result in stream channel instability. In addition, such changes can be a safety hazard for SunCatchers. Because of the potential adverse impacts of the detention basins on the fluvial system, the installation of detention basins is not recommended for the Calico Solar project site.

SunCatchers will be placed at the Calico Solar project site. This report summarizes the hydrologic and sediment modeling studies that were made to assess the potential impacts of the solar units. Conditions and restrictions for solar unit installation are provided so that potential impacts are properly mitigated.

I. INTRODUCTION

Detention basins (or debris basins) are being considered for the Calico Solar site. Figure 1 shows the drainage layout by URS for the project site. These detention basins would be installed along the foothills on the northern edge of the project site. The purpose of the detention basins is to reduce the storm discharge reaching the SunCatcher field. A detention basin is shaped like a small pond; it captures the flow from the watershed. The basin provides storm water storage to reduce the outflow discharge toward downstream. The small pond, while attenuates the storm discharge, also captures the sediment flow from the watershed to result in a reduction of sediment flow toward downstream. A detention basin traps most of the sand and other coarser sediments that form the topography of the alluvial fan.

This report was prepared for Tessera Energy to provide an assessment of the detention/debris basins. Recommendations for the detention/debris basins are provided. In addition, hydrologic impacts of the SunCatchers on the project site are analyzed.

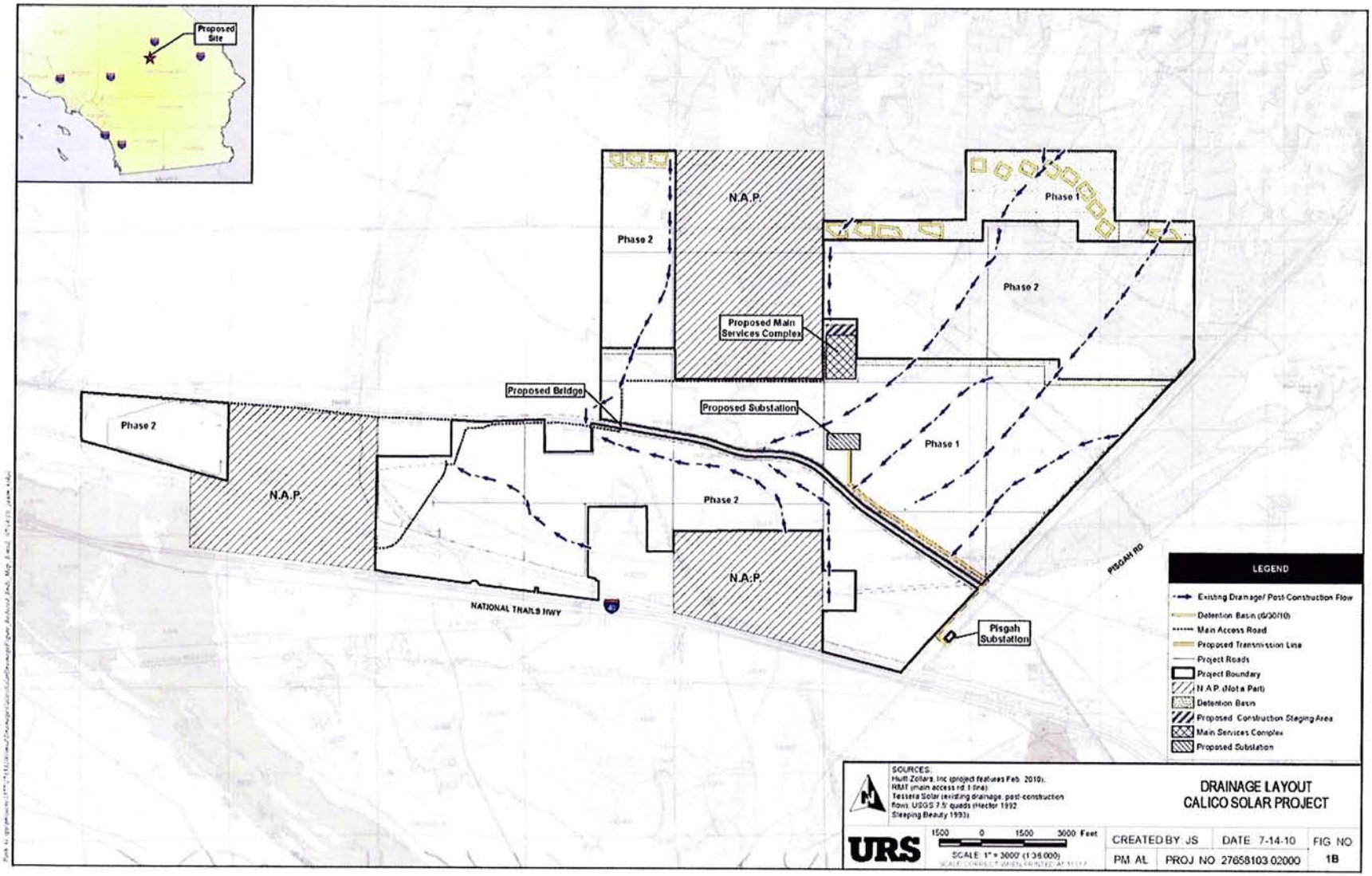


Figure 1. Drainage layout for the project site. Detention basins, if installed, are along the northern edge of the site.

II. FLUVIAL GEOMORPHOLOGY OF ALLUVIAL FAN AND WASHES UNDER EXISTING CONDITION

The Calico Solar project site has alluvial fans on both sides of the railroad. In fact, alluvial fans form the dominant land features at the project site. Such alluvial fans have formed over the long-term geologic time. The terrain of a fan has established an approximate equilibrium in response to the natural inflows of water and sediment. The flat topography of the alluvial fan reflects the dominant mode of continued sediment deposition. In fluvial geomorphology, stream flows tends to spread out to from wide flat areas during sediment deposition. On the other hand, a stream tends to slide back into its banks in the process of erosion (Leopold, Wolman, and Miller, 1964). A gulley forms in the case of continued erosion and flow concentration.

Alluvial fans are formed in the process of sediment deposition. Figure 2 illustrates the formation of an alluvial fan as the stream flow exits from a canyon. The stream flow spreads out like a fan as sediment settles out to build up the fan area. As the flow spreads out, its velocity slows down with the increasing surface area.

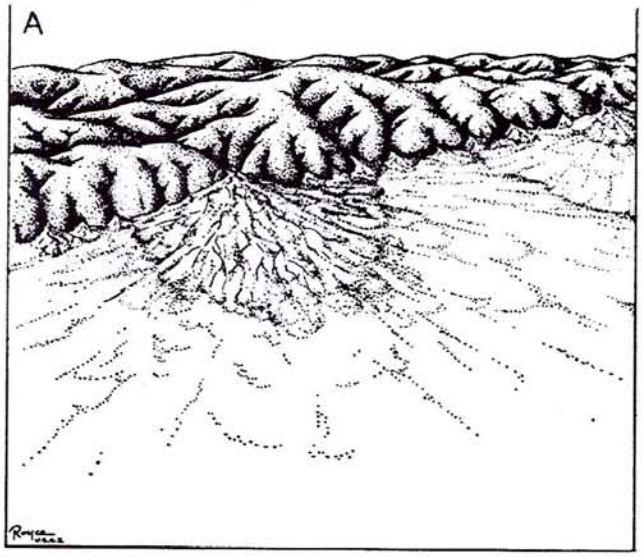


Figure 2. Alluvial fan formation at the exit of a canyon (after Bull, 1968)

The project site has washes on the alluvial fan north of the railroad. Such washes are very shallow in depth and flat in stream bed profile as illustrated in Figures 3 and 4. The bankfull depths for such washes are generally less than 1 foot. At lower flow rates, the flow is contained in the stream channel, but at higher flow rates, the flow spreads out to large adjacent areas to form sheet flow. The flow discharge and velocity in the wash are limited by the shallow flow depth.

Figure 3. A wash on alluvial fan viewed toward downstream (south)

Figure 4. A wash on alluvial fan viewed toward upstream (north)

On the generally flat terrain of alluvial fans, storm flows occur as sheet flows that are characterized by shallow depths and low velocities. The velocity of flow on the alluvial fan is directly related to the flow depth. Figure 5 is a graphical relation showing the flow velocity computed as a function of the flow depth for the alluvial fan north of the railroad. For existing washes on the alluvial fan, the bankfull depths seldom exceed one foot. For such shallow flow depths, the flow velocities are generally lower than 4 feet per second. At very large discharges, the flow simply spreads out to large adjacent areas without an appreciable increase of the flow depth or velocity.

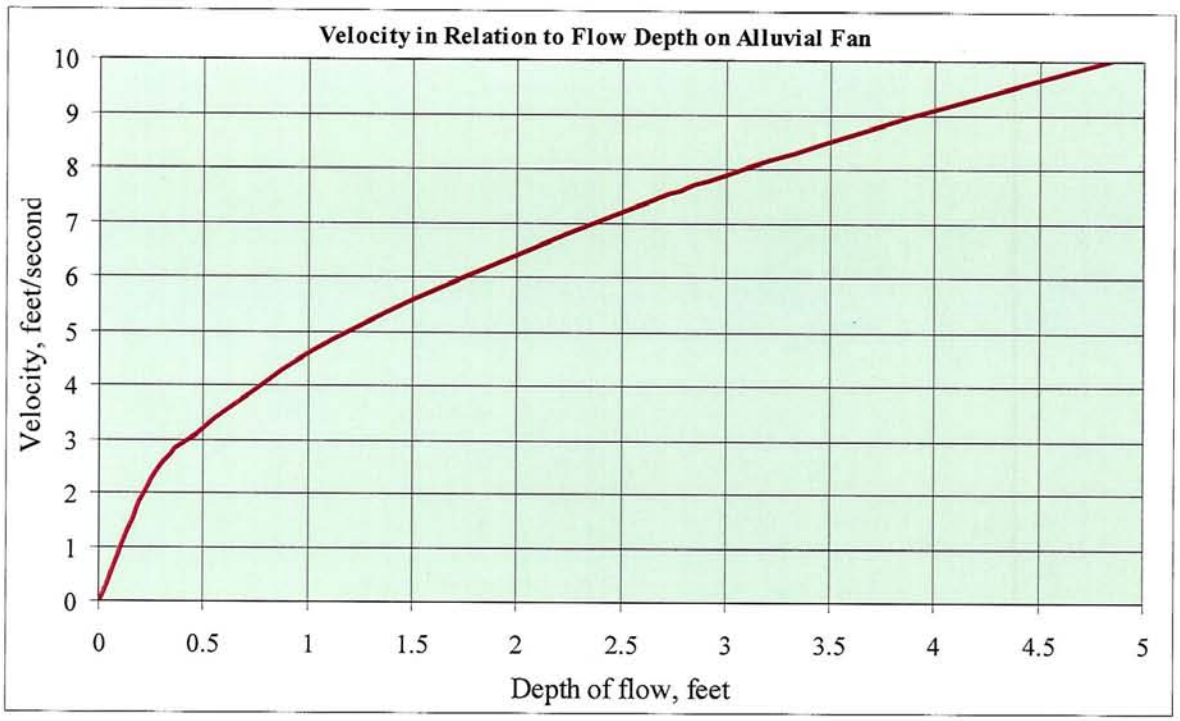


Figure 5. Flow velocity in relation of flow depth for washes on alluvial fan north of railroad

In the theory of sediment transport, the rate of sediment movement is very sensitive to the flow velocity. A small increase of the flow velocity is associated with more rapid increase of sediment load. Because of the shallow flow depth and low flow velocity, the existing washes are not subject to substantial changes during storms. In other words, they are relatively stable in morphology.

III. EFFECTS OF DETENTION BASINS ON SEDIMENT SUPPLY TO ALLUVIAL FAN

Detention basins (or debris basins) are being considered for the Calico Solar site. These basins would be installed along the foothills on the northern edge of the project site. The purpose of the detention basins is to reduce the storm discharge reaching the SunCatcher field. A detention basin is shaped like a small pond; it captures the flow from the watershed. The basin provides storm water storage to reduce the outflow discharge toward downstream. The small pond, while attenuates the storm discharge, also captures the sediment flow from the watershed to result in a reduction of sediment flow toward downstream. A detention basin traps most of the sand and other coarser sediments that form the topography of the alluvial fan.

IV. EFFECTS OF SEDIMENT DEFICIT ON STREAM MORPHOLOGY

Natural streams exist in a state of equilibrium. The stream morphology is formed by the water and sediment inflows from the watershed. In response to changes in water and sediment discharges, the steam channel adjusts in order to re-establish the dynamic equilibrium. The stream morphology changes in response to any alteration of the water discharge or sediment supply.

Human activities have often destabilized natural streams. Such examples are numerous. Figure 6 shows photographs of Las Vegas Wash of 1975 and 1984. The small desert wash shown in the 1975 photograph was shallow and wide. It was formed under the inflow of storm water carrying sediment from its watershed. Because of rapid urbanization, wastewater treatment plants were built along the wash. Effluent water from wastewater treatment plants carrying no sediment discharges into the wash. The clear water eroded sediment from the stream boundary to cause the formation of channel incision and widening. The dramatic changes in channel morphology occurred in a period of 9 years.

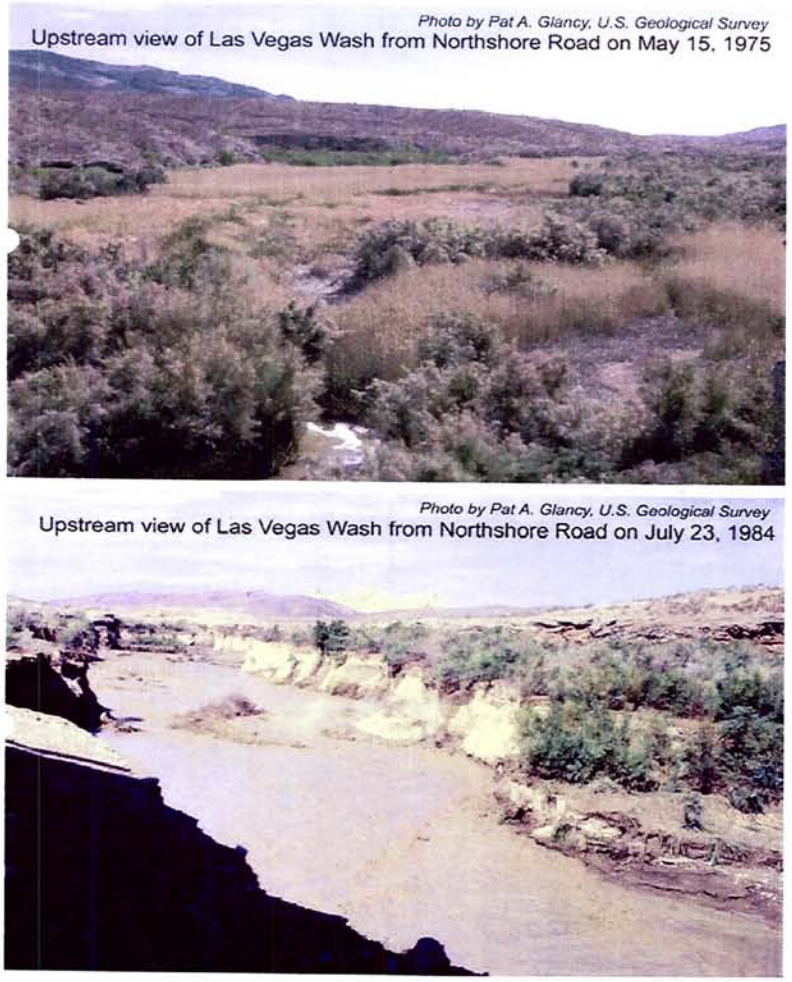


Figure 6. Photographs of Las Vegas Wash taken in 1975 and 1984.
The channel was greatly enlarged by clear water released from wastewater treatment plants.
The hungry water removed sediment from the channel boundary.

Figure 7 shows the topography of Serrano Creek in Orange County, California. The stream has a watershed area of about 5 square miles; it was a small and shallow natural stream. The watershed area was gradually urbanized. In that process, soil loss from the watershed was reduced by pavements, buildings, and ground covers. Because of reduced soil loss, storm water carried less sediment entering the creek to caused erosion. The highly incised channel was formed by the erosive hungry water. Such case histories illustrate that human activities can destabilize natural streams.

Figure 7. Topography of incised channel in Orange County, CA caused by sediment deficit

V. POTENTIAL CHANGES IN STREAM CHANNEL MORPHOLOGY DUE TO DETENTION BASINS ON ALLUVIAL FAN

Changes in Wash Discharge due to Flow Concentration — The washes on the alluvial fan are characterized by flat topography with shallow sheet flow. Such morphological features are maintained by mild deposition on the alluvial fan. Under current conditions, the discharge in a wash is limited by the low bank height since any discharge greater than the bankfull flow would overflow the banks to spread out to large adjacent areas. As long as sediment deposition continues, the discharge and flow depth of the wash would be very limited. Under this situation, the wash is relatively stable because its flow velocity and sediment transport are limited. On the other hand, a deeper and incised channel will form as a result of erosion induced by a deficit in sediment supply. As the erosion and incision process continues, the stream channel becomes deeper and its discharge capacity increases with the channel depth. It will then capture the

adjacent sheet flow into the single concentrated stream channel. As shown in Figure 5, the flow velocity increases with the depth.

Effects on Stream Channel Stability — The detention basins would reduce the sediment supply to the alluvial fan in addition to discharge reduction. The effects on sediment or debris reduction far outweigh the effects of discharge reduction. Such changes to the flow and sediment alter the natural equilibrium that has formed over the geologic time. In response to sediment reduction, the hungry storm water would erode sediment from the alluvial fan to meet its sediment carrying capacity. With continued maintenance of the debris basins, the sediment deficit storm flow would cause the formation of deeper stream channels. Such stream channels should also grow in size with time and storm flows would thus become more concentrated with time. In the long run, the multiple small stream flows will gradually converge into a few large incised channels on the alluvial fan. The discharge of an incised stream will increase in time as the sheet flows from adjacent fan areas converge into the single channel. The large channel with higher discharge, greater depth and flow velocity is much less stable than the small wash with shallow sheet flow. The formation of incised stream channels is detrimental to stream channel stability since concentrated stream flows have greater depths, higher flow velocities, and greater potential for stream channel changes. The current fluvial regime (or equilibrium) would be altered by such changes.

Effects of Detention Basins on Alluvial Fans near the Railroad — There are two major drainage systems at the Calico Solar project site; these are: (1) small washes on the north alluvial fan, and (2) washes along the railroad track and south of the railroad track. The effects of the detention basins change with distance. They have the most important effects on the upper reaches of the washes on the north alluvial fan. The effects decrease with distance toward downstream. For washes near the railroad, the effects are of long term nature.

No detention basins are being considered for certain washes south of the railroad. As long as no detention basins will be installed on a wash, there should also be no effects.

V. EFFECTS OF SUNCATCHERS ON ALLUVIAL FAN

SunCatchers and related facilities will be installed at the Calico Solar project site. Some of them will be located in the desert washes. For the sake of protecting the SunCatchers and other environmental considerations, the installation of SunCatchers is subject to certain restrictions. The restrictions related to the flow and sediment include: (1) Storm water flow depths around the SunCatcher cannot exceed 1.5 ft, (2) The maximum allowable scour depth around the SunCatcher pedestal is 4 ft, and (3) Sediment deposition within the SunCatcher field during a 100-year event cannot exceed 6 inches as Tessera Solar does not have earth moving equipment on site and an increase in the ground height above 6 inches will interfere with the dish movement and operation.

The analyze the hydraulics of flow, erosion and sedimentation, a study has been made to provide the dynamics of stream flow and potential stream channel changes including general scour and local scour for the Calico solar project site (Chang, 2010). General scour is due to the imbalance in sediment transport. Local scour is caused by local obstructions to flow, such as the pedestals supporting SunCatchers. The study provides the required information for SunCatcher installation.

Washes on Alluvial Fan North of Railroad – The alluvial fan north of the railroad track has an average slope of about 5%. Water and sediment on the alluvial fan are supplied from the northern hills. The general terrain is flat with only minor land features. Such a landform has formed by continued sediment deposition Storm flows on the generally flat terrain occur primarily as sheet flow, characterized by shallow depth and low velocity. Sheet flow area can be used for SunCatcher field. Well defined washes on the alluvial fan are few in number; they are small in size and shallow in depth. Modeling study of sediment processes for a small wash has been made using the FLUVIAL-12 model. The results show that the channel bed is subject to limited changes but sediment deposition can exceed 6 inches along channel reach with water depth exceeding one foot. SunCatchers will avoid washes on the alluvial fan if the height for both banks for such a wash exceeds 1 foot. This restriction for SunCatchers supersedes other restrictions.

The properties north of the railroad track, except for small areas near the bridge openings, have a generally flat terrain; on which storm flows occur as sheet flow. These areas can be used to develop SunCatcher fields.

Washes South of Railroad Track — The railroad track south of the alluvial fan is a flow barrier. As the flow from the alluvial fan reaches the railroad track, it splits into two parts: one part flows along the railroad track toward west; the other part passes through several bridge openings under the railroad track. Storm flow along the north side of the railroad track covers a large width in the form of sheet flow. As the storm water passes through the narrow bridge openings, it may form a well defined wash south of the railroad track. Such small wash channels are characterized by shallow depths; they gradually dissipate into sheet flow after some distance on the flat terrain.

The discharge of flood flows through the bridge openings to the south side is controlled by the size of the bridge openings. Such flows were not determined in the Hiitt-Zollars hydrology study. South of the railroad track, a part of flood flows stays in small channels and another part spreads out to the flat terrain as sheet flow. The effective discharge for a wash in this case is the bankfull discharge for the stream channel.

In order to assess the potential stream channel changes, modeling sediment processes was made for stream 100 as a sample case. The study is intended to determine if SunCatchers may be placed or excluded from such washes. The wash is predicted to undergo changes with both scour and deposition. For wash reaches with the height of both banks greater than 1.5 feet, the flow depths can be greater than 1.5 feet; the depths of sediment deposition can exceed 6 inches. Based on these findings, SunCatchers should be kept away from stream washes if the height of both banks exceeds 1.5 feet.

The southern properties have alluvial fans and more confined valleys. The alluvial fan areas with sheet flow can be developed into SunCatcher fields.

Streams in More Confined Valleys South of Railroad Track — Several streams south of the railroad track are in more confined valleys. They are capable of carrying the 100-yr flood without significant overflow to the overbank area. These valley streams gradually change into sheet flow toward downstream as they reach the broad and flat floodplain. Modeling of sediment transport and potential stream channel changes were made for stream 20B in confined valley as a

sample. Simulated channel changes based on the 100-yr flood are characterized by both scour and deposition in the channel. For channel areas with a flow depth greater than 1.5 feet, the depth of sediment deposition can exceed 6 inches. Thus, SunCatcher should be kept away from such areas.

Effects of SunCatchers on Alluvial Fan Surface Roughness and Water Budget — SunCatchers will be installed at the project site with a low density (one unit on 0.28 acre of land area). The structural support or pedestal for a SunCatchers is 2 feet in diameter. The structural supports of SunCatchers may affect the surface roughness of the alluvial fan. However, the area of a structural support is 3.14 square feet and it is on 0.28 acre of land area. The area ratio is 2.63×10^{-4}, or 0.00263%. The project site has scattered vegetation with a low density as shown in Figure 8. the structural supports scattered on the alluvial fan are similar to the vegetation density shown in the figure. The structural supports for the solar units do not cause significant changes to the existing surface roughness of the alluvial fan. In addition, the Sun Catchers do not change the surface water as they do not retain water or deplete water. For these reasons, the proposed solar units will have insignificant effects on the arid-land hydrology of the project site.

Figure 8. View of northern alluvial fan toward south.
The terrain is generally flat with only minor features

Local Scour around SunCatcher Pedestals — During a storm flow, local scour can be induces by the pedestals supporting the SunCatchers, much like the example shown in Figure 9. Local scour is first initiated by the pedestal's interference to flow and sediment transport. The erodible bed deforms until it reaches an equilibrium scour configuration for which the rate of sediment supplied to the scour area is balanced by the rate of transport out of the area. The sediment rate is an inverse function of the particle size. Because sediment rates flowing into and out of a scour area change with the size, at nearly the same proportion, the scour depth is not

significantly affected by the sediment size which is therefore missing in most formulas for local scour.

Figure 9. Local scour around bridge pier

The depth of local scour around a pedestal may be computed using the FHWA formula (Federal Highway Administration, "Hydraulic Engineering Record, No. 18", 2006).

$$Y_s/Y_1 = 2.0\ K_1\ K_2\ (b/Y_1)^{0.65}\ F^{0.43} \quad (1)$$

where Y = depth of local scour measured from the mean bed elevation, in feet;
K_1 = correction for pier/bent nose shape, equal to 1 for circular piers/bents and 1.1 for rectangular piers/bents;
K_2 = correction factor for angle of attack, equal to 1 for zero skew;
b = projected pier/bent width;
Y_1 = approach flow depth;
F = Froude number = $V//gY_1$; and
V = velocity of approach flow.

The basic information on the hydraulics of flow is required in order to compute the depth of local scour. Because of the steep slope for the terrain, the flow on the alluvial fan is nearly critical with the Froude number very close to 1. Substituting the value of 1 for the Froude number into Equation 1 yields:

$$Y_s/Y_1 = 2.0\ K_1\ K_2\ (b/Y_1)^{0.65}$$

In which, $K_1 = 1$ for circular piers/bents; $K_2 = 1$ for zero skew; $b = 2$ feet for projected pedestal diameter. The above equation can be reduced as follows:

$$Y_s = 3.14\ Y_1^{0.35}$$

This equation relates the local scour depth Y_s as a unique function of the flow depth Y_1. The computed local scour depths for several flow depths are listed below.

Flow depths Feet	Local scour depths Feet
1.00	3.14
2.00	4.00
3.00	4.61

Since SunCathers will not be installed in washes with a flow depth exceeding 1.5 feet, the maximum local scour is limited to about 3.5 feet in depth at the peak flow. The scour hole is partially refilled as the flow recedes.

VI. RECOMMENDATIONS FOR DETENTION BASINS

The detention basins would change the existing equilibrium of the fluvial system at the project site. The results include concentrated stream flows with greater depths, higher flow discharges, velocities, erosion, and stream channel changes. The current fluvial regime (or equilibrium) would be altered by such changes. Alteration of the existing regime will result in stream channel instability. In addition, such changes can be a safety hazard for SunCatchers. Because of the potential adverse impacts of the detention basins on the fluvial system, the installation of detention basins is not recommended for the Calico Solar project site.

REFERENCES

Bull, W.B., "Alluvuial Fans", *J. Geogl. Ed.*, Vol 16, pp. 101-106, 1968.

Chang, H. H., Sediment Study for Washes at Calico Solar Project Site in San Bernardino County", prepared for Tessera Energy, July 2010.

Federal Highway Administration, "Hydraulic Engineering Record, No. 18", 2006.

Leopold, L. B., Wolman, M. G., and Miller, J. P., *Fluvial Processes in Geomorphology*, W. H. Freeman, San Francisco, California, 1964, 522 pp.

EXHIBIT 118

Declaration of Robert Byall

This Page Intentionally Left Blank

DECLARATION OF ROBERT BYALL

I, Robert Byall, declare:

1. I am employed by Tessera Solar as a Senior Project Civil Engineer. I have participated in the analysis of facility design for the Calico Solar Project since 2008. I have previously testified in this proceeding in writing and at hearings, and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration, and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing the two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010, Order: a) Scenario 6, docketed on September 8, 2010; and b) Scenario 5.5, docketed on September 10, 2010. In evaluating the potential impact on hydrology and sedimentation associated with both scenarios it is important to note the following:

- No debris or detention basins are planned for the site. Retention basins will be installed at the Main Services Complex to comply with the San Bernardino County Drainage Ordinance.
- SunCatcher installation will be excluded from floodways that will produce a combined local and general scour depth greater than four feet during a 100-year event and/or a 100-year flow depth of more than 1.5 feet.
- With the revision of the northern boundary southward, excluding the detention basins area, there are no major revisions to the previously submitted plans, as the SunCatcher field general layout will not be altered.

3. The purpose of this Declaration is to describe what additional maintenance work is anticipated as a result of the elimination of detention basins under Scenario 5.5 and Scenario 6.

4. In the absence of detention basins, I anticipate additional maintenance work only after storm events large enough to result in stormwater flows onto the project site from the Cady Mountains.

5. I do not expect maintenance, removal, or restoration will be required for storms of lesser magnitude than the 5-year 24-hour storm. I anticipate such a storm will produce measurable runoff from the Cady Mountains onto the Project site, with some sediment movement likely at the at-grade crossings. After any such storm, the site will be inspected and any deposition or scour noted.

6. Roadway maintenance probably will be required for storm events larger than the 5-year 24-hour storm.

7. Larger storms, such as 25-year 24-hour events, may require maintenance of diversion channels, culverts, and the Main Services Complex retention basins to ensure these features are functioning properly. (The retention basins located at the Main Services Complex are required to comply with the San Bernardino County Drainage Ordinance.)

8. All drainage features are designed for a 100-year, 24-hour storm. Accordingly, major maintenance or reconstruction of drainage features is not expected for storm events at or under the 100-year 24-hour event.

9. I do not anticipate significant maintenance needs arising from sediment deposition on the project site. The overall site should not experience more than a couple of inches of sediment over the life of the project. The majority of sediment

movement will occur during large events. Sediment movement will be most noticeable along the railroad right-of-way, as is currently the case. The project would not significantly alter this existing condition.

10. Sediment deposition around the SunCatcher pedestals is not expected, as the pedestals do not restrict stormwater flows enough to cause deposition. Pedestals will be placed within drainageways only in those areas that do not create the potential for substantial scour around the pedestals. A 100-year 24-hour storm should be the only event that will create the need for pedestal maintenance for scour.

11. Vegetation on and uphill from the project site is sparse enough that I do not expect significant debris along the fence line after a storm event, even for the larger washes. The fence line will be electronically monitored and all storm damage will be repaired as quickly as possible.

12. Sediment maintenance activity most likely will be performed with a small motor grader and, if necessary, a water truck. Sediment within the at-grade road crossings will be pushed out of the floodway and spread out.

13. If maintenance occurs after the soils have dried out from storms, the motor grader will be required to have a water truck to control any dust that would be generated by moving the sediment. The water truck should be sufficient to prevent dust generation, thus avoiding any impacts to maintenance workers.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and that this Declaration was executed at Scottsdale, Arizona, on September 13, 2010.

Robert Byall

A/73499605.1

This Page Intentionally Left Blank

EXHIBIT 119

Declaration of Matt Moore

This Page Intentionally Left Blank

DECLARATION OF MATT MOORE

I, Matt Moore, declare:

1. I am employed by URS Corporation as a Water Resources Project Engineer. I have participated in URS's analysis of water resources and hydrology for the Calico Solar Project since 2008. I have previously testified in this proceeding in writing and at hearings and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing the two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe the erosion impacts associated with Scenarios 5.5 and 6 compared to the effects of the 6,215-acre, 850 MW project analyzed in the SSA (the "850 MW Project"), which included detention basins.

4. I performed the original modeling for the Calico Solar Project using standard soil erosion loss calculations and the RUSLE II model produced by the Natural Resources Conservation Service. The conclusion of the modeling analysis was that with proper installation and maintenance of standard best management practices during construction and operations, the Calico Solar Project would cause no significant impact on soil erosion rates. This conclusion is unchanged for the smaller Scenarios 5.5 and 6, which eliminate detention basins.

5. I have reviewed the September 8, 2010 and September 13, 2010 hydrology and sedimentation reports prepared by Howard H. Chang, Ph.D., P.E., and agree with Dr. Chang's

conclusions that removal of detention basins will preserve more natural flow conditions on the project site.

6. It is likely that additional maintenance will be required on the project site in the absence of the previously proposed detention basins. Such additional maintenance would not be required, however, following any storm smaller than the 5-year 24-hour storm event, because smaller storms would not cause stormwater to flow onto the project site from the Cady Mountains.

7. Similar to the 850 MW project, Scenarios 5.5 and 6 would create minimal impervious surfaces (less than 3% of the site). The project would not significantly alter hydrology and sediment transport at railroad facilities. Existing sedimentation and maintenance issues at railroad facilities represent an existing condition that would not be significantly altered by Scenario 5.5 or Scenario 6.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and that this Declaration was executed at San Diego, California on September 13, 2010.

Matt Moore

A/73498226.1

EXHIBIT 120

Declaration of Rachael Nixon

This Page Intentionally Left Blank

DECLARATION OF RACHAEL NIXON

I, Rachael Nixon, declare:

1. I am employed by URS Corporation as a Senior Archaeological Project Manager. I have participated in the analysis of cultural resources on behalf of Calico Solar, LLC for the Calico Solar Project since August 2008. I have previously testified in this proceeding in writing and at hearings, and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration, and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing the two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010, Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe how the two scenarios (Scenario 5.5 and Scenario 6) will affect cultural resources on the Project site, relative to the effects of the 850 MW Project.

4. The Supplemental Staff Assessment concludes that the 850 MW Project would have significant and unavoidable impacts on cultural resources. I disagree with this assessment, for reasons discussed previously. The Applicant has avoided significant cultural resources through project redesign (approximately 245 acres) and as a result there will be no impact to significant archaeological resources. In addition, measures have been set forth that will be included in the BLM Programmatic Agreement and the CEC Conditions of Approval that will avoid, minimize, or mitigate impacts to Route 66 (significant built resource) and inadvertent archaeological discoveries found to be significant

5. Regardless of whether any of the Project's effects on cultural resources are considered significant, Scenario 5.5 and Scenario 6 will have reduced or indistinguishable effects on cultural resources as compared to the 850 MW Project.

6. In the initial APE/Project Area, 119 archaeological sites and 206 archaeological isolates were identified.

7. The Project footprint subsequently was reduced to 6,215 acres (the 850 MW Project) to avoid culturally and biologically sensitive areas, resulting in the avoidance of 13 archaeological sites, 3 of which are significant archaeological sites and have been recommended eligible for the National Register of Historic Places (NRHP) as well as California Register of Historic Resources (CRHR) There are no archaeological sites within the current Project area that are recommended eligible or considered to be significant.

8. Scenario 5.5 excludes another 1,602 acres from the Project. Under Scenario 5.5, four archaeological sites and 25 archaeological isolates will be avoided relative to the coverage of the 850 MW Project. None of these archaeological resources are recommended eligible or considered significant.

9. When compared to the 850 MW Project, Scenario 6 excludes another approximately 1,971 acres from the Project. Under Scenario 6, four archaeological sites and 29 archaeological isolates will be avoided relative to the coverage of the 850 MW Project. None of these archaeological resources are recommended eligible or considered significant.

10. To the extent there is a broader prehistoric archaeological landscape on the Project site, Scenario 5.5 and Scenario 6 will have a lesser impact on this landscape due to the reduced footprints of these two scenarios relative to the 850 MW Project.

11. Scenario 5.5 and Scenario 6 will not change any cultural resource impacts on U.S. Route 66 from those caused by the 850 MW Project.

12. Scenario 5.5 and Scenario 6 will reduce cumulative impacts to cultural resources other than Route 66.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and that this Declaration was executed at San Diego, California on September 13, 2010.

Rachael Nixon

A/73500451.1

This Page Intentionally Left Blank

EXHIBIT 121

Declaration of Noel Casil

This Page Intentionally Left Blank

DECLARATION OF NOEL CASIL

I, Noel Casil, declare:

1. I am a Senior Transportation Engineer for URS Corporation. I have worked for URS on behalf of Calico Solar, LLC for the Calico Solar Project since January 2008. I have previously testified in this proceeding in writing and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe how the traffic and transportation impacts of Scenarios 5.5 and 6 compare to the less-than-significant impacts of the 6,215-acre, 850 MW project analyzed in the Supplemental Staff Assessment (the "850 MW Project").

4. Neither Scenario 5.5 nor Scenario 6 would result in greater impacts than the 850 MW project. For construction, the project would involve the same level of activity and number of employees under the new scenarios as under the 850 MW Project, but the duration of construction would be shorter – 41 months for Scenario 5.5 and 37 months for Scenario 6, as opposed to 52 months for the 850 MW Project. (See Declaration of Felicia Bellows.) This means that under Scenario 5.5 or Scenario 6, average daily and peak hour vehicle trips will occur at the same rate during construction, but the construction period will be shorter than under the 850 MW Project.

5. During project operations, Scenario 5.5 or Scenario 6 would require approximately the same number of employees as the 850 MW Project, so traffic impacts during operations would be similar to those of the 850 MW Project.

6. Access to the Calico Solar facility would not change compared to the 850 MW Project. The location of the perimeter road for Scenario 5.5 and Scenario 6 would change as shown in the maps attached to the Declaration of Felicia Bellows.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at Santa Ana, California on September 13, 2010.

Noel Casil

EXHIBIT 122

Declaration of Matt Dadswell

This Page Intentionally Left Blank

DECLARATION OF MATT DADSWELL

I, Matt Dadswell, declare:

1. I am employed by Tetra Tech EC, Inc. as a Senior Social Scientist/Economist. I have worked on the Calico Solar Project since 2008. I have previously testified in this proceeding in writing and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe how Scenarios 5.5 and 6 would affect project socioeconomics compared to the 6,215-acre, 850 MW project analyzed in the Supplemental Staff Assessment (the "850 MW Project").

4. Construction of Scenario 5.5 or Scenario 6 would result in the creation of the same number of construction jobs as the 850 MW Project (an estimated total of 637), but the period of employment would be shorter. The construction period for Scenario 5.5 is estimated to be 41 months. The construction period for Scenario 6 is estimated to be 37 months. *See* Declaration of Felicia Bellows.

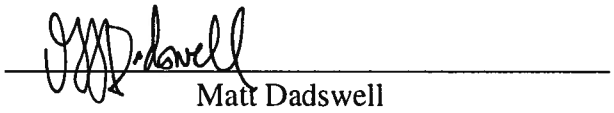
5. Scenario 5.5 and Scenario 6 would require less total construction effort and thus would create a smaller fiscal impact than the 850 MW Project, with the same or less need for housing, schools, parks and recreation, law enforcement, and emergency medical services. Scenario 5.5 and Scenario 6 would have the same effects as the 850 MW Project with regard to the following impacts: inducing substantial population growth, effects on the housing supply, displacing

existing housing or substantial numbers of people, and substantial physical impacts to government facilities.

6. Gross public benefits of Scenario 5.5 and Scenario 6 to the local economy may be reduced from the 850 MW Project as a result of reductions in capital costs, construction payroll, and sales tax from construction and operation spending. The applicant does not expect, however, to reduce operations personnel, estimated at 136 employees for the 850 MW Project as well as Scenarios 5.5 and 6. Therefore, this category of public benefit and public services demand would not be expected to change as a result of implementation of Scenario 5.5 or 6.

7. The CEQA Level of Significance for Scenario 5.5 and Scenario 6 would be unchanged from the less than significant project and cumulative impacts of the 850 MW Project.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at Bothell, Washington on September 13, 2010.



Matt Dadswell

A/73498780.1

EXHIBIT 123

Declaration of Michael Hatch

This Page Intentionally Left Blank

DECLARATION OF MICHAEL HATCH

I, Michael Hatch, declare:

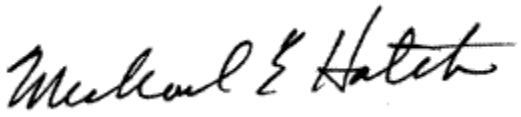
1. I am a Principal Geologist for URS Corporation. I have worked on the Calico Solar Project since 2007. I have previously testified in this proceeding in writing and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. With regard to geological hazards, the impacts of Scenario 5.5 and Scenario 6 would be the same as for the 6,215-acre 850 MW project, as the geological setting is identical to that of the 850 MW project, and the same types of facilities would be constructed under Scenario 5.5 and Scenario 6. There would be no relevant cumulative impacts.

4. The CEQA Level of Significance for Scenario 5.5 and Scenario 6 would be unchanged from the 850 MW project.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at San Diego, California on September 13, 2010.



Michael Hatch

This Page Intentionally Left Blank

EXHIBIT 124

Declaration of Tariq Hussain

This Page Intentionally Left Blank

DECLARATION OF S. TARIQ HUSSAIN

I, S. Tariq Hussain, declare:

1. I am employed by URS Corporation as a Program Manager. I have participated in URS's analysis of potential chemical hazards on behalf of Calico Solar, LLC for the Calico Solar Project since its inception. I have previously testified in this proceeding in writing and at hearings and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe how the hazardous materials impacts of Scenarios 5.5 and 6 compare to those of the 6,215-acre, 850 MW project analyzed in the Supplemental Staff Assessment (the "850 MW Project").

4. Under Scenario 5.5 and Scenario 6, as under the 850 MW Project, a worst case event at the facility with respect to a hydrogen release would not affect any sensitive receptors. As I explained in my testimony of July 28, 2010 (Exhibit 90), the operation of two independent centralized hydrogen systems, one north and one south of the BNSF rail line, would reduce the scale of the worst-case scenario compared to the operation of one larger centralized hydrogen system for the entire 850 MW Project, and a worst-case event at either the northern or the southern system would not affect any sensitive receptors.

5. Under both Scenario 5.5 and Scenario 6, the southern hydrogen system would be unchanged and the northern system would be reduced due to the scaling back of the project's

north side. This means that less hydrogen would be required in the northern system and the scale of a worst-case event on the north side would be reduced compared to a worst-case event on the north side of the 850 MW Project. Under Scenarios 5.5 and 6, the locations of the central hydrogen storage tanks for the northern and southern systems would not change compared to the 850 MW Project, but the amount of hydrogen stored in the northern tank would be somewhat reduced.

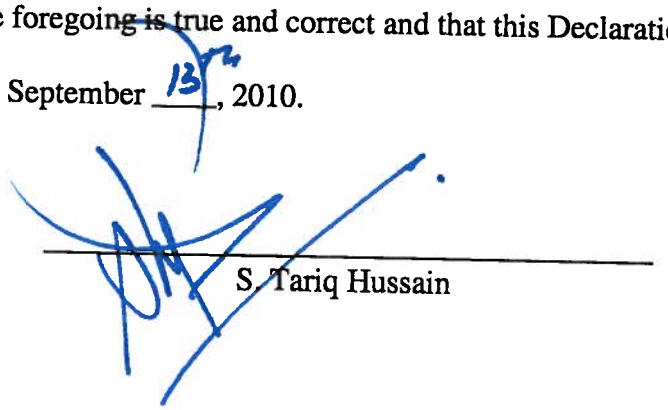
6. As I explained in my July 28 testimony, the Calico Solar Project's use of hydrogen would not cause a significant risk of fire at ground level. To the extent that any fire risk exists, that risk would be reduced under Scenarios 5.5 and 6, which substantially reduce both the project footprint and the volume of hydrogen needed, compared to the 850 MW Project.

7. While the types of hazardous materials impacts of Scenario 5.5 and Scenario 6 would be the same as those of the 850 MW Project, the magnitude of these impacts would be even less for Scenario 5.5 and Scenario 6 than for the 850 MW Project. This is due to the reduced use, handling, storage, and transport of hazardous materials and the smaller number of SunCatchers employed in Scenario 5.5 and Scenario 6 relative to the 850 MW Project. Construction and operational risk to workers due to the use of hydrogen also will be proportionately reduced because of the reduced number of SunCatchers. Scenario 5.5 and Scenario 6 would not result in any significant change in the potential for impacts associated with hazardous materials handling and storage.

8. Like the 850 MW Project, neither Scenario 5.5 nor Scenario 6 would pose a significant risk of a public or worker safety impact due to an accidental release of hazardous materials.

9. Like the 850 MW Project, neither Scenario 5.5 nor Scenario 6 would contribute to any significant cumulative impact with respect to hazardous materials or worker safety.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at Santa Ana, California on September 13, 2010.



S. Tariq Hussain

This Page Intentionally Left Blank

EXHIBIT 125

Declaration of Angela Leiba

This Page Intentionally Left Blank

DECLARATION OF ANGELA LEIBA

I, Angela Leiba, declare:

1. I am a Senior Project Manager / Environmental Group Leader for the URS Corporation. I have worked on the Calico Solar Project since 2006. I have previously testified in this proceeding in writing and in person, and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe how Scenarios 5.5 and 6 would compare to the 850 MW project analyzed in the Supplemental Staff Assessment (the "850 MW Project") with respect to land use and visual resources.

4. When compared to the 850 MW project, Scenario 5.5 and Scenario 6 would result in less land conversion to industrial utility uses. Scenario 5.5 and Scenario 6 would not result in greater impacts in terms of land use and visual resources than the 850 MW project. The impacts on recreational users of current wilderness areas and other established federal and state areas would be proportionally less than the impacts of the 850 MW project.

5. While the acreage for Scenario 5.5 and Scenario 6 would be lower, the southern boundary of the project would be the same. The scenarios would have the same impacts as the 850 MW project for motorists, and the visual resources impacts would likely remain the same. Specifically, in the SSA Staff found a significant impact from Key Observation Points 1 and 5. The views from these observation points would not change. It should be noted, however, that

Scenario 5.5 and Scenario 6 would have reduced impacts to Key Observation Point 2 in the Cady Mountains, as the Project boundary now is farther away from this observation point.

6. The contribution to cumulative land use and visual impacts would be less for Scenarios 5.5 and Scenario 6 than for the 850 MW Project.

7. In Scenario 5.5 and Scenario 6, as with the 850 MW project, there would be no impacts on agricultural lands, rangelands, horses, or burros. Similarly, like the 850 MW project, Scenario 5.5 and Scenario 6 would not physically divide or disrupt an established community.

8. Scenario 5.5 and Scenario 6, similar to the 850 MW project, would be consistent with all applicable federal land use policies, including the BLM's Interim Policy on Management of Donated Lands and Lands Acquired with Land and Water Conservation Funds (LWCF). Scenario 5.5 and Scenario 6 would use less donated and acquired lands than the 850 MW project. Specifically, Scenario 5.5 and Scenario 6 would use 96.2 acres of donated and acquired land, reducing this use by 663 acres from the 850 MW Project.

8. The CEQA Level of Significance for Scenario 5.5 and Scenario 6 would be unchanged from the 850 MW project.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at San Diego, California on September 13, 2010.

Angela Leiba

EXHIBIT 126

Declaration of Julie Mitchell

This Page Intentionally Left Blank

DECLARATION OF JULIE MITCHELL

I, Julie Mitchell, declare:

1. I am a senior air quality scientist for URS Corporation. I have worked on the Calico Solar Project since 2008. I have previously testified in this proceeding in writing and at hearings and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe how the air quality and public health impacts of Scenarios 5.5 and 6 compare to those of the 6,215-acre, 850 MW project analyzed in the Supplemental Staff Assessment (the "850 MW Project").

4. I provided testimony on the 850 MW Project filed with the Commission as Exhibit 83 on July 29, 2010. In that testimony, I noted revisions to estimates of maximum annual construction emissions in the SSA, Air Quality Table 7. My testimony was that the 850 MW Project would cause maximum annual NO_x emission of 79.45 tons and maximum annual PM_{10} emissions of 78.32 tons.

5. Scenarios 5.5 and 6 would produce approximately the same maximum annual construction emissions as the estimates I provided on July 29, 2010, for the following reasons. Scenario 5.5 would occupy approximately 74% of the acreage, and would provide approximately 78% of the SunCatchers and therefore 78% of the power generation, of the 850 MW Project. Scenario 6 would occupy approximately 68% of the acreage, and would provide approximately

71% of the SunCatchers and therefore 71% of the power generation, of the 850 MW Project. As explained in the Declaration of Felicia Bellows, construction of either of the smaller scenarios would proceed at the same pace, with the same numbers of construction workers and the same equipment usage, as the 850 MW Project, but would require fewer months for completion. Whereas the 850 MW Project was estimated to require 52 months of construction activity, Scenario 5.5 would require 41 months (78% of 52) and Scenario 6 would require 37 months (71% of 52). Thus although the total emissions for construction of Scenarios 5.5 and 6 would be less than those of the 850 MW Project, on a daily or annual basis, the maximum construction emissions would be approximately the same.

6. Scenarios 5.5 and Scenario 6 will result in lower operational emissions than would the 850 MW Project because the smaller project footprints would reduce on-site vehicle travel distances and because the reduced numbers of SunCatchers under these scenarios would result in less total maintenance activity.

7. Scenario 5.5 and Scenario 6 are likely to have slightly reduced public health and safety impacts compared to the 850 MW project. Scenario 5.5 and Scenario 6 would result in lower emissions than the 850 MW project, which would reduce the cancer risk and chronic and acute hazard indices predicted for the 850 MW project. Nevertheless, the cancer risk and chronic and acute hazard indices are so far below the level of significance at the point of maximum impact for the 850 MW project that there may not be any appreciable difference between the less-than-significant impacts for this project and for Scenario 5.5 and Scenario 6. The CEQA Level of Significance for Scenario 5.5 and Scenario 6 would be unchanged from the 850 MW project.

8. Contributions to local and regional cumulative impacts would be slightly less than for the 850 MW Project as well, and would not be cumulatively considerable.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at San Diego, California on September 13, 2010.

Julie Mitchell

This Page Intentionally Left Blank

EXHIBIT 127

Declaration of Joe Stewart

This Page Intentionally Left Blank

DECLARATION OF JOE STEWART

I, Joe Stewart, declare:

1. I am a Principal Paleontologist for URS Corporation. I have worked on the Calico Solar Project since 2008. I have previously testified in this proceeding in writing and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. Because Scenario 5.5 and Scenario 6, like the 850 MW project, are located in geological formations with low to possibly high paleontological sensitivity, it is possible that impacts to paleontological resources could occur. Since the Scenario 5.5 and Scenario 6 plants each would occupy less overall area than the 850 MW project, their potential to discover and positively or negatively impact significant fossils would be proportionately reduced. As with the 850 MW Project, the contribution to cumulative impacts from the Calico Solar Project should be either neutral (no fossils encountered) or positive (fossils encountered, preserved, and identified).

4. The CEQA Level of Significance for Scenario 5.5 and Scenario 6 would be unchanged from the 850 MW project.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at Pasadena, California on September 13, 2010.

Joe Stewart

EXHIBIT 128

Declaration of Mark Storm

This Page Intentionally Left Blank

DECLARATION OF MARK STORM

I, Mark Storm, declare:

1. I am employed as a Senior Project Engineer in URS Corporation's Acoustics and Noise Control Practice. I am a Board-Certified Member of the Institute of Noise Control Engineering (INCE). I have previously testified in this proceeding in writing and at hearings and my resume, previously entered into evidence, remains accurate. I have personal knowledge of the matters stated in this Declaration and if called as a witness I could and would competently testify thereto.

2. I have reviewed the text and maps describing two new project scenarios developed by Calico Solar pursuant to the Committee's September 3, 2010 Order: a) Scenario 5.5, docketed on September 10, 2010; and b) Scenario 6, docketed on September 8 and 10, 2010.

3. The purpose of this Declaration is to describe how Scenarios 5.5 and 6 would affect noise impacts compared to the 6,215-acre, 850 MW project analyzed in the Supplemental Staff Assessment (the "850 MW Project").

4. Given the distributive nature of the operational noise produced by the project's technology, Scenario 5.5 and Scenario 6 would, due to the relocation of noise generators generally southward by substantial distance, most likely correspond to lower construction and operational noise impacts at many locations north and northeast of the Project area. Operation and construction noise impacts at the noise receptor located east of the project, SR2, would be expected to be no greater than those noise impacts predicted for the 850 MW Project. Construction and operational noise impacts at the receptor south of the project would likely be the same as those of the 850 MW Project. Impacts related to transmission line construction would remain the same.

5. Scenario 5.5 and Scenario 6 would contribute even less to cumulative impacts than would the 850 MW Project, and cumulative noise impacts would remain less than significant.

6. At various points during this proceeding, it was asserted that the noise level at an individual SunCatcher during operation would reach 84 dBA at a distance of fifty feet (50'). By way of counter-example, it would appear the correct noise level at this approximate distance between two individual operating SunCatchers, based on measurement position #9 taken at the Maricopa Solar project near Peoria, Arizona, is 74 dBA L_{90}. Attached hereto as Attachment A is a true and correct copy of a report I prepared on March 22, 2010, documenting noise measured at various locations around the operating Maricopa facility. This information is also applicable to Scenarios 5.5 and 6.

I declare under penalty of perjury that the foregoing is true and correct and that this Declaration was executed at San Diego, California on September 13, 2010.

_____

Mark Storm

ATTACHMENT A

Maricopa Solar – Site Noise Measurement Survey& Data Analysis

This Page Intentionally Left Blank

URS

Memorandum

Date: March 22, 2010

To: Richard Knox and Felicia Bellows, Tessera Solar

From: Mark Storm, INCE Bd. Cert.
Senior Project Engineer, URS San Diego

Subject: **Maricopa Solar – Site Noise Measurement Survey & Data Analysis**

This technical memorandum describes the results of a sound measurement survey conducted March 17, 2010 within the site boundaries of the Maricopa Solar project near Peoria, Arizona. This memo also compares selected measurement data with the results of a noise prediction model representing the sum of sixty (60) operating SunCatchers at the Maricopa Solar project site, for the intended purpose of validating input parameters used in similar noise prediction models for other Tessera Solar projects (e.g., Imperial Valley Solar).

EXECUTIVE SUMMARY

A comparison of selected field noise measurement data with predictive operational noise model results for Maricopa Solar indicates that the input sound power levels for an individual SunCatcher unit as used in Table 5.12-7 of the Imperial Valley Solar AFC remain representative and valid. As shown in Table ES-1, differences between model results and measurement readings were less than 3 dBA, and in several cases less than 1 dBA. Differences of 1 dBA or less are considered indiscernible by the average human ear and are within the measurement tolerance of a normally functioning sound level meter.[1]

Table ES-1
Predicted vs. Measured Aggregate Operating SunCatcher Sound – Maricopa Solar

Project Site Location	Measurement Site ID	Predicted SPL (dBA)	Measured SPL (L90, dBA)	Difference (Predicted – Measured, dBA)
SW corner of site	6	66.5	68.2	-1.7
Near middle of West SunCatcher field	9	74.9	74.3	0.6
Southern site fenceline	11	68.3	68.8	-0.5
Southern site fenceline	12	67.3	67.2	0.1
Eastern site fenceline	13	71.3	71.8	-0.5
NE corner of site	14	64.5	65.1	-0.6
Approx. 75' North of East SunCatcher field	15	68.5	68.4	0.1
Approx. 50' North of SunCatcher "71"	18	69.3	66.6	2.7
Approx. 100' North of SunCatcher "71"	19	67.5	64.5	3.0
Northern site fenceline	20	66.4	64.3	2.1

Source: URS Corporation 2010

[1] Ebbing & Blazier, Application of Manufacturers' Sound Data, ASHRAE, 1998, p. 178, Table 14.1.

INTRODUCTION

In April 2008, URS conducted a sound measurement survey of a single nominally operating SunCatcher at the National Solar Thermal Test Facility (NSTTF) located on the site of Sandia National Laboratories near Albuquerque, NM. The octave band center frequency (OBCF) sound power levels (PWL) derived from the sound pressure level (SPL) measurements of this operating SunCatcher were then used as input parameters to complete a predictive operational noise impact analysis as part of satisfying the requirements of a California Energy Commission (CEC) Application for Certification (AFC) for Imperial Valley Solar (formally known as Stirling Energy Systems "Solar Two") near El Centro in Imperial County, CA.

In the two years since the measurement survey at NSTTF, URS understands that the SunCatcher design has developed into a system that is represented by the functioning samples at Maricopa Solar. Concerns arose that the new design, intended to represent what is proposed to be installed in quantity at Tessera Solar sites such as Imperial Valley Solar, may have different operating characteristics from the former generation sample at NSTTF that could include different sound levels. Thus, at Tessera Solar's request, URS performed a sound measurement survey at Maricopa Solar to collect data that should help determine whether the predictive operational model input parameters—based on the measurements of the SunCatcher sample at NSTTF—are still valid for purposes of predictive noise impact assessment, or if they need to be updated to better predict future noise levels.

PREDICTION MODEL

The Cadna/A Noise Prediction Model (Version 3.72.131) was used to estimate the aggregate SPL from all 60 operating SunCatchers at Maricopa Solar. Cadna/A is a Windows based software program that predicts and assesses noise levels emanating from user-defined noise sources based on International Standards Organization 9613-2 standards for noise propagation calculations. The model uses industry-accepted propagation algorithms and accepts sound power levels (in dB re: 1 picoWatt) provided by the equipment manufacturer and other sources. The calculations account for sound attenuation via classical sound wave divergence plus attenuation factors resulting from air absorption (as influenced by temperature and relative humidity), basic ground effects, and barrier/shielding.

Apart from the SunCatchers, the sum of which was modeled as an area source within the project site perimeter, no other sound-generating sources were included in the prediction model. For instance, while the Maricopa Solar project did have an operating hydrogen compression facility located near the field office parking lot adjacent to 75^{th} Avenue, this equipment did not appear to be a dominant noise generator during the field survey and was thus excluded from the prediction model. The contributing PWL from an individual SunCatcher appears in Table 1. The OBCF levels are identical to those used in the Imperial Valley Solar AFC (as determined from the 2008 NSTTF SunCatcher noise measurements). Other assumptions made for the prediction model include as follows:

- Flat terrain (i.e., no varying topography)
- Air temperature = 25^{o} C
- Humidity = 20 %
- Windspeed = 0 mph
- Project Site ground absorption coefficient = 0.25

Because the ground absorption coefficients can range from zero to unity, the usage of 0.25 is conservative and assumes a mix of some porous (e.g., loose dirt) and but mostly smooth, hard (i.e., acoustically reflective) ground surfaces.

Table 1
Noise Model Sound Level Parameters

Project Component	Type of Source	Unweighted Sound Power Level (PWL, dB) at Octave Band Center Frequency (Hz)									Overall Level (dB)	A-Weighted Level (dBA)	Acoustic Height (meters)
		31.5	63	125	250	500	1,000	2,000	4,000	8,000			
SunCatcher	Point	119	111	101	93	97	95	90	88	81	120	99	7

Source: URS Corporation, 2010.
Notes: SunCatcher assembly includes measured composite levels from the Stirling Engine, electric generator, cooling fan, and air compressor.

MEASUREMENT SURVEY

From approximately 11 a.m. through 3 p.m., sound measurements were conducted at various locations on the Maricopa Solar site with a Bruel & Kjaer Model 2250 Sound Level Meter (SLM), a Type 1 instrument per American National Standardization Institute (ANSI) S1.4 and S1.43 standards. Environmental conditions appeared to be seasonally typical for Peoria, Arizona: cloudless sky, temperature ranging from 75 to 90 degrees Fahrenheit as the day progressed, with relatively low humidity and low-to-moderate average wind speeds (5-10 mph). URS observed that the Maricopa Solar field office has limited meteorological measurement capability for its SunCatcher control needs, and learned that this data is available upon request—should detailed correlation with the sound measurement data be necessary.

Individual sound measurements were of 1-3 minutes duration, considered an adequate sampling time since the dominant sound sources (i.e., the operating SunCatchers) were generally considered continuous sources of noise based on perception and URS understanding that the SunCatcher's Stirling engine runs at a steady 1,800 revolutions per minute (rpm).

Measurement and predictive model locations that are referenced in Table ES-1 appear as numbered callouts in Figure 1, which depicts a simplified Maricopa Solar site plan and its major features. Representative photographs of these measurement locations appear in Appendix A, attached to this technical memo. Not shown are the following features and sources of non-project ambient noise that adjoin the site:

- 75th Avenue, which is located immediately to the West and exhibited intermittent flows of traffic, including a mixture of vehicle types (passenger cars, motorcycles, tractor-trailer trucks, etc.). Traffic noise was only audible at measurement positions #6, 11, and 12.
- The Agua Fria Generating Station Substation, located to the South. While the Generating Station and its turbines (southerly adjacent to the Substation) appeared to be offline, the transformers of the Substation sounded audible at the Maricopa Solar southern fenceline. Substation transformer noise was only audible at measurement positions #11, and 12.
- An open, grass-covered field to the East of the Maricopa Solar site.
- An unpaved road immediately to the North, beyond which is a light industry facility that did not appear to have any activity. The unpaved road exhibited some passenger car traffic. An elevated portion of Route 60 was visible from the site, and traffic noise was occasionally audible at measurement positions #14, 15, 18, 19 and 20.
- Power transmission lines, traversing roughly east-to-west over the northern project area, did not appear to exhibit audible noise.

During the survey, with few exceptions, all sixty SunCatchers appeared to be operating at what URS understood was full capacity, associated with 900 Direct Normal Insolation (DNI) or better. One or two individual SunCatchers were observed to move into an "offset" position and temporarily discontinue Stirling engine operation. Any sound associated with such witnessed SunCatcher dish re-positioning was perceptibly inaudible from the indicated measurement positions. On one occasion, a single SunCatcher exhibited a momentary hissing noise that was audible over the ambient sound of the other operating SunCatchers and was later explained by Maricopa Solar crews as a "blow-off" event not associated with normal system operation. The sound of this hissing noise is not contained in the presented results of Table ES-1.

Other sources of intermittent audible noise noted during the survey were occasional aircraft overflights and birdcalls (e.g., from birds visibly resting on the framing of a SunCatcher dish, or from the direction of the Agua Fria Substation).

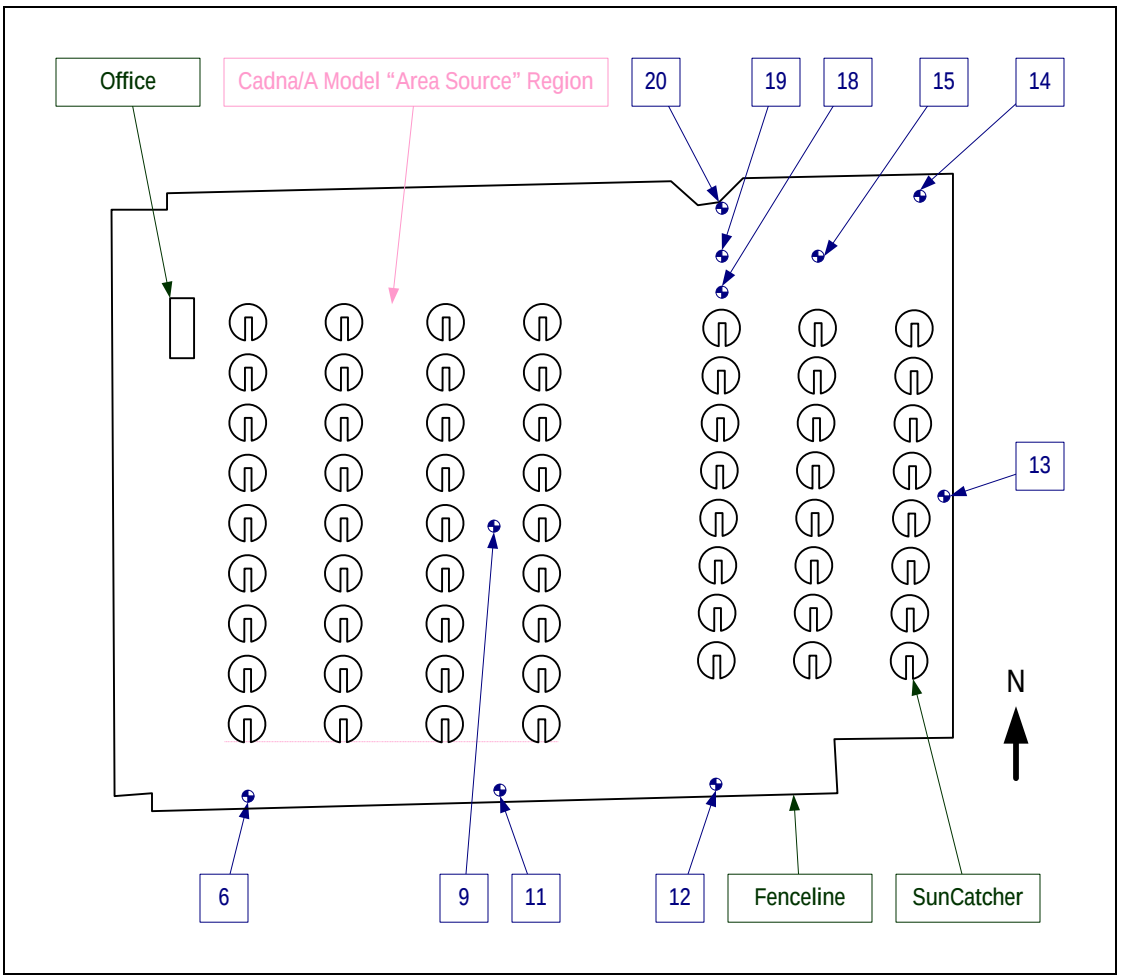


Figure 1. Measurement/model positions on Maricopa Solar siteplan (NTS)

ANALYSIS

Due to the observed presence of non-project ambient noise sources, and because the Cadna/A model of Maricopa Solar only considers the operating SunCatcher noise, the A-weighted L_{90} values from the measurements are compared to the model prediction results. Unlike L_{eq}, which is the equal-energy sound level value for all sound sources detected by the instrument microphone, the L_{90} is a statistical descriptor of the sound level value exceeded ninety percent (90%) of the measurement period. This means sound from an essentially continuous source of noise like the aggregate field of SunCatchers will be included, but the impulsive or intermittent sounds of passing road traffic or birdcalls will not. Since the difference in measured L_{eq} and L_{90} at the locations shown in Table ES-1 is not greater than 1.5 dBA, with the average difference for all ten locations equal to 1 dBA, usage of L_{90} as the comparison value seems appropriate.

Table ES-1 presents the differences between the predicted aggregate SunCatcher sound and the A-weighted L_{90} values from the measurements at ten positions within the site as shown in Figure 1. The differences are within a range of +/-3 dBA, with several within +/- 1 dBA, suggesting that the Cadna/A model is valid and, in turn, contains input PWL parameters that accurately characterize operating SunCatcher sound.

The presented positive and negative differences between the prediction and measurement data in Table ES-1 should not be interpreted as a reason to change the model input PWL parameters. These differences are expected for one or more reasons including as follows:

- Measurement tolerance of the sound level meter. Per International Organization of Standards (ISO) 3714, the standard deviation for acoustical measurements at OBCF ranging between 500 Hz and 4000 Hz is +/- 1.5 dB.
- Position of measurement location with respect to SunCatcher dish orientation. The northern measurement locations have L_{90} values that generally tend to be lower than predictions, suggesting that the SunCatcher dishes may be providing some degree of intervening barrier-type noise reduction (i.e., the dish for the nearest SunCatcher is between the Stirling engine and the sound measurement position). Correspondingly, and because one might say that the engines are more exposed, the southern measurement locations show L_{90} levels that are slightly higher than predictions. These effects, however, are estimated to be minor since the measurement positions are exposed to multiple engines by direct sound pathways that are not visibly or acoustically occluded.
- Differences between actual and modeled meteorological conditions.

A subsequent field survey could measure and collect data that might produce difference values either very similar to those shown in Table ES-1, or different but likely displaying the same variance range of +/- 3 dBA between prediction and L_{90} level.

LIMITATIONS

The opinions, findings and recommendations presented herein are based in part upon field measurements and observations of what are believed to be typical and representative conditions of current Maricopa Solar operations. The sound measurements and analyses were conducted using the professional standard of care as practiced in the industry and are representative of the activity being measured as influenced by environmental conditions existing during the measurement period. Because of the variability of factors not within the control of the investigators, no warranty can be made that the exact sound or activity levels would be obtained by subsequent field measurements. However, for similar climatic and seasonal conditions, intensity of surrounding community activity, and similar facility operations, the sound levels measured would be very similar to those reported herein.

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT
COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION

***For the CALICO SOLAR** (Formerly SES Solar One)*

Docket No. 08-AFC-13

PROOF OF SERVICE
(Revised 8/9/10)

APPLICANT
Felicia Bellows
Vice President of Development
& Project Manager
Tessera Solar
4800 North Scottsdale Road,
#5500
Scottsdale, AZ 85251
felicia.bellows@tesserasolar.com

CONSULTANT
Angela Leiba
AFC Project Manager
URS Corporation
1615 Murray Canyon Rd.,
#1000
San Diego, CA 92108
angela_leiba@URSCorp.com

APPLICANT'S COUNSEL
Allan J. Thompson
Attorney at Law
21 C Orinda Way #314
Orinda, CA 94563
allanori@comcast.net

Ella Foley Gannon, Partner
Bingham McCutchen, LLP
Three Embarcadero Center
San Francisco, CA 94111
ella.gannon@bingham.com

INTERESTED AGENCIES
California ISO
e-recipient@caiso.com

Jim Stobaugh
BLM – Nevada State Office
P.O. Box 12000
Reno, NV 89520
jim_stobaugh@blm.gov

Rich Rotte, Project Manager
Bureau of Land Management
Barstow Field Office
2601 Barstow Road
Barstow, CA 92311
richard_rotte@blm.gov

Becky Jones
California Department of
Fish & Game
36431 41st Street East
Palmdale, CA 93552
dfgpalm@adelphia.net

INTERVENORS
County of San Bernardino
Ruth E. Stringer,
County Counsel
Bart W. Brizzee,
Deputy County Counsel
385 N. Arrowhead Avenue,
4th Floor
San Bernardino, CA 92415-
bbrizzee@cc.sbcounty.gov

California Unions for Reliable
Energy (CURE)
c/o: Loulena A. Miles,
Marc D. Joseph
Adams Broadwell Joseph
& Cardozo
601 Gateway Boulevard, Ste. 1000
South San Francisco, CA 94080
lmiles@adamsbroadwell.com

Defenders of Wildlife
Joshua Basofin
1303 J Street, Suite 270
Sacramento, California 95814
e-mail service preferred
jbasofin@defenders.org

Society for the Conservation of
Bighorn Sheep
Bob Burke & Gary Thomas
P.O. Box 1407
Yermo, CA 92398
cameracoordinator@sheepsociety.com

Basin and Range Watch
Laura Cunningham &
Kevin Emmerich
P.O. Box 70
Beatty, NV 89003
atomictoadranch@netzero.net

*indicates change

INTERVENORS CONT.

Patrick C. Jackson
600 N. Darwood Avenue
San Dimas, CA 91773
e-mail service preferred
ochsjack@earthlink.net

Gloria D. Smith, Senior Attorney
*Travis Ritchie
Sierra Club
85 Second Street, Second floor
San Francisco, CA 94105
gloria.smith@sierraclub.org
travis.ritchie@sierraclub.org

Newberry Community
Service District
Wayne W. Weierbach
P.O. Box 206
Newberry Springs, CA 92365
newberryCSD@gmail.com

Cynthia Lea Burch
Steven A. Lamb
Anne Alexander
Katten Muchin Rosenman LLP
2029 Century Park East,
Ste. 2700
Los Angeles, CA 90067-3012
Cynthia.burch@kattenlaw.com
Steven.lamb@kattenlaw.com
Anne.alexander@kattenlaw.com

ENERGY COMMISSION

ANTHONY EGGERT
Commissioner and Presiding Member
aeggert@energy.state.ca.us

JEFFREY D. BYRON
Commissioner and Associate Member
jbyron@energy.state.ca.us

Paul Kramer
Hearing Officer
pkramer@energy.state.ca.us

Lorraine White, Adviser to
Commissioner Eggert
e-mail service preferred
lwhite@energy.state.ca.us

Kristy Chew, Adviser to
Commissioner Byron
e-mail service preferred
kchew@energy.state.ca.us

Caryn Holmes
Staff Counsel
cholmes@energy.state.ca.us

Steve Adams
Co-Staff Counsel
sadams@energy.state.ca.us

Christopher Meyer
Project Manager
cmeyer@energy.state.ca.us

Jennifer Jennings
Public Adviser
e-mail service preferred
publicadviser@energy.state.ca.us

*indicates change

DECLARATION OF SERVICE

I, Darin Neufeld, declare that on September 13, 2010, I served and filed copies of the attached Applicant's Submittal of Testimony with Applicant's Exhibits for Scenarios 5.5 and 6. The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at: [www.energy.ca.gov/sitingcases/solarone].

The documents have been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

(*Check all that Apply*)

FOR SERVICE TO ALL OTHER PARTIES:

__X__ sent electronically to all email addresses on the Proof of Service list;

____ by personal delivery;

__X__ by delivering on this date, for mailing with the United States Postal Service with first-class postage thereon fully prepaid, to the name and address of the person served, for mailing that same day in the ordinary course of business; that the envelope was sealed and placed for collection and mailing on that date to those addresses NOT marked "email preferred."

AND

FOR FILING WITH THE ENERGY COMMISSION:

__X__ sending an original paper copy and one electronic copy, mailed and emailed respectively, to the address below (***preferred method***);

OR

____ depositing in the mail an original and 12 paper copies, as follows:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 08-AFC-13
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512
docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct, that I am employed in the county where this mailing occurred, and that I am over the age of 18 years and not a party to the proceeding.

Original Signed By
Darin Neufeld

*indicates change