Imperial Solar Energy Center South

Appendix K

Memorandum of Agreement among the Bureau of Land Management-California, the United States Army Corps of Engineers, The Department of Energy, LightSource Renewables, LLT and the California State Historic Preservation Officer, Regarding the Imperial Solar Energy Center South Project

Prepared by Bureau of Land Management

DRAFT

MEMORANDUM OF AGREEMENT
AMONG THE
BUREAU OF LAND MANAGEMENT-CALIFORNIA,
THE UNITED STATES ARMY CORPS OF ENGINEERS,
THE DEPARTMENT OF ENERGY,
LIGHTSOURCE RENEWABLES, LLC,
AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
REGARDING
THE IMPERIAL SOLAR ENERGY CENTER SOUTH PROJECT
IMPERIAL COUNTY, CALIFORNIA

WHEREAS, CSOLAR Development, LLC (Applicant) has applied for a right-of-way (ROW) grant on public lands managed by the Bureau of Land Management (BLM) and has submitted a Plan of Development (POD) to construct, operate and maintain a solar energy electrical generating plant on non-Federal lands and a transmission line across Federal lands, including construction of photovoltaic solar energy panels, a 230 kilovolt (kV) transmission line, access and maintenance roads, laydown and staging areas, and support facilities and infrastructure (hereinafter, the "Project"); and

WHEREAS, the BLM has determined that the issuance of a ROW (proposed Federal Action) to the Applicant in accordance with the Federal Land Policy and Management Act (FLPMA) (Public Law 940-579; 43 U.S.C 1701), and authorization of the Project is an undertaking subject to Section 106 of the National Historic Preservation Act (NHPA), 16 USC 470(f), and its implementing regulations under 36 C.F.R. Part 800 (2004) (Section 106); and

WHEREAS the U.S. Department of Energy (DOE) may also have Section 106 responsibilities since it may issue a loan guarantee (proposed Federal action) for the undertaking under Title XVII of Energy Policy Act of 2005 as amended by Section 406 of the American Recovery and Reinvestment Act of 2009 and therefore has participated in this consultation and is a Signatory to this Memorandum of Agreement (Agreement); and

WHEREAS, the United States Army Corps of Engineers (COE) may also have Section 106 responsibilities since it may issue a Department of the Army (DA) permit pursuant to Section 404 of the Clean Water Act (proposed Federal action) for discharges of dredged or fill material into jurisdictional waters of the United States associated with the undertaking, and therefore has participated in this consultation and is a Signatory to this Agreement; and

WHEREAS, the BLM is the lead Federal agency for this undertaking for the purpose of complying with Section 106 on behalf of itself, the COE and the DOE, and the BLM shall be responsible for managing historic properties within the area of potential effects (APE) for the undertaking pursuant to the NHPA; and

WHEREAS, by Secretarial Order No. 3285 issued March 11, 2009, the Secretary stated as policy that encouraging the production, development, and delivery of renewable energy is one of

the Department of Interior's (DOI) highest priorities and that agencies and bureaus within the DOI will work collaboratively with each other, and with other federal agencies, departments, states, local communities, and private landowners to encourage the timely and responsible development of renewable energy and associated transmission while protecting and enhancing the Nation's water, wildlife, and other natural resources; and

WHEREAS, the BLM has authorized the Applicant to conduct specific identification efforts for this undertaking including a review of the existing literature and records, cultural resources surveys, ethnographic studies, and geo-morphological studies to identify historic properties that might be located within the APE; and

WHEREAS, the reports (*Final Class III Cultural Resources Survey for the Imperial Solar Energy Center South Project, Imperial County, California*, prepared by RECON Environmental, October 2010, and; *Draft Enhanced Inventory Investigation at IMP-3971 and near IMP-4485/4495 – Addendum 3 to Class III Cultural Resources Survey for the Imperial Solar Energy Center South Project*, prepared by RECON Environmental, February 2011, and; *Draft Inventory, Evaluation and Analysis of Effects on Historic Built Environment Properties within the Area of Potential Effect of the Imperial South Energy Center, South Imperial County, California*, prepared by ASM Affiliates, Carlsbad, CA, April 2011.) presents the results of identification efforts; and

WHEREAS, the BLM has identified 19 archaeological sites within the APE which are described in Appendix C to this Agreement, and the sites designated CA-IMP-3999, CA-IMP-4485/4495 and CA-IMP-4962 have been determined eligible for inclusion on the National Register of Historic Places (NRHP) in consultation with SHPO, site CA-IMP-7875 has been determined not eligible for inclusion on the NRHP in consultation with SHPO, and all other sites are unevaluated but will be treated as eligible for inclusion on the NRHP for project management purposes; and

WHEREAS, all eligible sites and sites treated as eligible for inclusion on the NRHP, with the exception of the archaeological site designated CA-IMP-3999, will be avoided through project design and the implementation of management or protection measures; and

WHEREAS, the BLM has determined that the undertaking will have an adverse effect on archaeological site designated CA-IMP-3999 which is eligible for inclusion on the National Register of Historic Places (NRHP) and has consulted with the California State Historic Preservation Officer (SHPO) pursuant to 36 C.F.R. Part 800.6 of the regulations implementing Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C. § 470f); and

WHEREAS, in accordance with the regulations at 36 C.F.R. 800.6(a)(1) BLM has notified the ACHP regarding the effects of the undertaking on Historic Properties and has invited them to participate in consultation to resolve the potential effects of the undertaking on Historic Properties, and as per their letter dated February 11, 2011, the ACHP has declined to participate (see 36 C.F.R. 800.6(b)(1), "Resolution without the Council); and

WHEREAS, the Applicant has participated in this consultation per 36 C.F.R. 800.2(c)(4) and, will be the entity to whom the BLM may grant a ROW and the COE and DOE may issue permits or loan guarantees for the undertaking, and has the responsibility for carrying out the specific terms of this Agreement under the oversight of the BLM, and therefore is an Invited Signatory to this Agreement; and

WHEREAS, Imperial County has participated in consultation on the undertaking and is invited to concur in this MOA; and

WHEREAS, pursuant 36 C.F.R. 800.2(c)(2)(ii) and Executive Order 13175, the BLM is responsible for government-to-government consultation with federally recognized Indian tribes and is the lead federal agency for all tribal consultation and coordination; and

WHEREAS, the BLM has formally notified and invited Federally recognized tribes including the Barona Band of Diegueno Indians, Campo Band of Mission Indians, Cocopah Indian Tribe, Fort Yuma Quechan Tribe, Ewiiaapaayp Band of Kumeyaay Indians, Jamul Indian Village, La Posta Band of Kumeyaay Indians, Manzanita Band of Kumeyaay Indians, Mesa Grande Band of Mission Indians, San Pasqual Band of Diegueno Indians, Santa Ysabel Band of Diegueno Indians (Tribes), Sycuan Band of Kumeyaay Nation, Torres-Martinez Desert Cahuilla Indians and Viejas Band of Kumeyaay Indians , and the non Federally recognized tribe of the Kwaaymii Laguna Band of Indians (Tribal Organization) to consult on this undertaking and participate in this Agreement as a Concurring Party; and

WHEREAS, the BLM shall continue to consult with the Tribes throughout the implementation of this Agreement regarding effects to historic properties to which they attach religious and cultural significance. BLM will carry out its responsibilities to consult with Tribes that request such consultation with the further understanding that, notwithstanding any decision by these Tribes to decline concurrence, BLM shall continue to consult with these Tribes throughout the implementation of this Agreement; and

NOW, THEREFORE, the BLM, COE, DOE, and SHPO, (hereinafter "Signatories) and the Applicant (hereinafter "Invited Signatory"), agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the adverse effect of the undertaking on historic properties, resolve such adverse effects through the process set forth in this Agreement, and provide the ACHP with a reasonable opportunity to comment in compliance with Section 106.

STIPULATIONS

The BLM shall ensure that the following measures are implemented:

I. DEFINITIONS

a) The definitions found at 36 C.F.R. 800.16 and in Appendix A shall apply throughout this Agreement.

II. AREA OF POTENTIAL EFFECTS

a) The area of potential effects (APE) for the undertaking is depicted in Appendix B to this Agreement. Appendix B as set forth hereunder may be modified through consultation among the parties to this Agreement without amending the Agreement. The APE, as currently defined, encompasses an area sufficient to accommodate all of the proposed and alternative project components under consideration as of the date of the execution of this Agreement. If it is determined in the future that the undertaking may directly or indirectly affect historic properties located outside the currently defined APE, then the BLM, in consultation with the parties to this Agreement, shall modify the APE using the following process:

i) Any party to this Agreement may propose that the APE established herein be modified. The BLM shall notify the parties of the proposal and consult for no more than 15 days to reach agreement on the proposal.

ii) If the BLM agrees to the proposal, then the BLM will prepare a description and a map of the modification to which the parties agree. The BLM will keep copies of the description and the map on file for its administrative record and distribute copies of each to the other parties to this Agreement within 30 days.

iii) Upon agreeing to a modification to the APE that adds a new geographic area, the BLM shall identify and evaluate historic properties in the new APE, assess the effects of the undertaking on any historic properties in the new APE, and provide for the resolution of any adverse effects to such properties in consultation with the parties to this Agreement, Indian tribes, or other parties that request consultation.

iv) If the parties to this Agreement cannot agree to a proposal for the modification of the APE, then they will resolve the dispute in accordance with Stipulation XI.

III. HISTORIC PROPERTIES TREATMENT PLAN

a) The BLM shall ensure that the adverse effect of the undertaking on archaeological site CA-IMP-3999 is resolved by implementing and completing the historic properties treatment plan (HPTP) referred to as *Research Design for Archaeological Data Recovery at Prehistoric Site CA-IMP-3999, Imperial County, California (Draft)*, prepared by ASM Affiliates, January 2011, which is Appendix C to this Agreement. Due to the property's scientific or information value as defined in Criterion D of 36 C.F.R. 63, the qualifying

criteria for inclusion on the NRHP, data recovery, scientific study and observation is the appropriate treatment for the archaeological values at CA-IMP-3999 as outlined in the HPTP. Amendment of the HPTP will not require amendment of this Agreement.

b) The HPTP may include provisions for public interpretation including, but not limited to, publications, professional papers, and museum exhibitions.

c) The HPTP may be augmented or amended to include additional provisions for alternative mitigation or treatment to which the parties to this Agreement may agree are appropriate and reasonable.

d) The HPTP may include procedures for managing discoveries and unanticipated effects consistent with Stipulation V and Appendix E.

e) If the HPTP has not been finalized by the date of execution of this Agreement, the BLM shall continue consultation on the HPTP and submit the HPTP to the consulting parties for a 30-day review period. A consulting party may provide its comments directly to the SHPO with a copy to the BLM within the 30-day comment period. BLM will consider timely comments when finalizing the HPTP. The BLM will forward to the SHPO all comments regarding the HPTP received during the comment period.

    i) The BLM will provide the consulting parties with written documentation indicating whether and how the draft HPTP will be modified in response to any timely comments received. If the HPTP is revised in response to comments received within the 30 day period, BLM shall submit the revised HPTP to all parties for a final, 15 day review period. BLM will consider any timely comments in finalizing the HPTP and provide the consulting parties with a copy.
    ii) Should the undertaking be approved by the BLM, the HPTP will be implemented after the ROW is granted and issuance of any DA permit by the COE, and prior to the issuance of a Notice to Proceed for construction in those portions of the undertaking addressed by the HPTP.

f) All remaining cultural resources will be avoided by implementing the management or protective measures as described in Table 1 in Appendix D.

    i) Archaeological sites that can be protected from direct impacts, but are within within 50 feet , including buffer areas, of proposed construction activities will be identified and labled as Environmentally Sensitive Areas (ESAs). This includes archaeological sites determined eligible for inclusion in the NRHP and sites that have not been formally evaluated, but are being treated as eligible and avoided for project management purposes.
    ii) The ESAs will be designated by marking the boundaries of sites with appropriate buffer zones (generally a buffer of 20 feet beyond the outer limits of the site extent, as demonstrated by surface and/or subsurface indications) using temporary fencing or other easily recognizable boundary defining materials.

(1) These areas will be shown on the engineering plans for the project as off-limits to construction activities.
(2) Once established, an ESA will define areas where construction can occur while preventing construction activities and damage to archaeological resources within the designated ESA.
(3) ESAs will be identified and established by a qualified archaeologist prior to initiation of ground disturbing activities and will be maintained for the duration of the work effort in the ESA vicinity

IV. MONITORING

a) Qualified archaeologist(s) and tribal monitoring consultant(s) will be on site during construction to observe grading, trenching or other excavation for any facilities, roads or other project components related to the undertaking near ESAs and in other areas determined appropriate for full-time monitoring, as detailed in the HPTP and Appendix D.

i) Archaeological monitors will be qualified archaeologists who are familiar with the types of historic and prehistoric resources that may occur in the APE and will be directly supervised by a principal archaeologist (PA). The principal archaeological monitor will be approved by the BLM prior to construction.
ii) Tribal monitoring consultants will be individuals certified and/or recognized by the Tribal parties to this Agreement as familiar with the types of Native American resources that could be present in the APE and will report to the PA.

(1) The Applicant will solicit from the Tribes a list of tribal monitoring consultants that the Tribes have approved to work on the Project.
(2) The Applicant and the Tribes will work to develop a tribal monitoring strategy and schedule. The strategy and schedule will be submitted to BLM prior to construction. The Applicant will keep the BLM informed of any modifications to the schedule.
(a) The Applicant will make a reasonable and good faith effort to allocate monitoring work among tribal monitoring consultants identified in IV(a)(ii)(1).
(3) In the event that a tribal monitoring consultant is not available, the Applicant will notify the BLM, and may proceed with construction.

b) Documentation of archaeological and tribal monitoring activities will be submitted weekly by the PA to the BLM by email. Documentation will include the location of archaeological monitoring activities for the reporting time period, as well as a description of any cultural resources identified and appropriate actions taken. The PA will prepare a monthly field monitoring verification report with the compiled monitoring observations, results, and actions taken for submission to the BLM.

i) Unless otherwise informed by a party to this Agreement, the BLM will not provide copies of weekly and monthly monitoring to the parties to this Agreement.

c) Upon completion of all monitoring tasks and requirements of the HPTP, the PA will submit a final monitoring report for the BLM describing the monitoring program and the findings and results, and presenting a detailed professional description, analysis, and evaluation of any cultural resources that were encountered and evaluated during construction.

   i) The BLM will provide a copy of the final monitoring report to the parties to this Agreement.

d) The Applicant, in consultation with the parties to this Agreement, shall establish a Long Term Management Plan (LTMP) for the post-construction monitoring and condition assessment of sites in the APE which could be subject to project operations and maintenance activities.

   i) The Applicant shall submit a draft LTMP to the BLM within six months from the date of the issuance of the Notice to Proceed for the undertaking.
   ii) The BLM will submit the LTMP to the consulting parties for review. The parties will be afforded 30 days following receipt of the LTMP to submit any written comments to BLM. BLM will provide the reviewing parties with written documentation indicating whether and how the draft LTMP will be modified in accordance with any reviewing party comments. Unless the reviewing parties object to this documentation in writing to the BLM within 30 days following receipt, BLM may modify the LTMP as BLM may deem appropriate. Thereafter, BLM may issue the LTMP in final form and distribute the LTMP to the consulting parties.

V. POST_REVIEW DISCOVERIES AND UNANTICIPATED EFFECTS

a) If the undertaking affects a previously unidentified cultural resource, including human remains and/or associated funerary objects or graves, or affect such properties in a way not previously anticipated, or have greater adverse effect than previously anticipated, all work in the vicinity of the discovery shall cease. The archaeological monitor and/or tribal monitoring consultant shall immediately notify the PA regarding any inadvertent effects or discoveries. The PA shall contact the BLM El Centro Project Manager or designated compliance manager and shall follow the procedures provided in the HPTP prepared pursuant to this agreement. If the HPTP does not provide procedures for discoveries or unanticipated effects, the PA shall follow the procedures outlined in Stipulation V and Appendix E.

   i) Amendment of the procedures for discoveries and unanticipated effects outlined in Appendix E will not require amendment of this Agreement.

b) If human remains and/or associated funerary objects compose all or part of the discovery, then the BLM shall follow the process described in Stipulation VI.

c) The BLM at its discretion may treat any discovered property to be eligible for inclusion

in the NRHP for project management purposes. The BLM's compliance with this stipulation shall satisfy the requirements of 36 C.F.R. 800.13(c).

VI. TREATMENT OF HUMAN REMAINS OF NATIVE AMERICAN ORIGIN

a) The BLM shall ensure that any Native American burials and related items discovered on BLM administered lands during implementation of the terms of the Agreement will be treated in accordance with the requirements of the NAGPRA. The BLM will consult with concerned Tribes, Tribal Organizations, or individuals in accordance with the requirements of Sections 3(c) and 3(d) of the NAGPRA and implementing regulations found at 43 C.F.R. Part 10 to address the treatment of Native American burials and related cultural items that may be discovered during implementation of the undertaking.

b) The BLM shall ensure that Native American burials and related cultural items on non-Federal lands are treated in accordance with the applicable requirements of the California Public Resources Code at Sections 5097.98 and 5097.991 , and of the California Health and Human Safety Code at Section 7050.5(c).

VII. REPORTING

a) Within twelve (12) months after BLM has determined that all fieldwork required by Stipulation III has been completed, BLM will ensure preparation, and concurrent distribution to the consulting parties, a written draft technical report that documents the results of implementing the requirements of the HPTP. The reviewing parties will be afforded 30 days following receipt of the draft technical report to submit any written comments to BLM. Failure of these parties to respond within this time frame shall not preclude BLM from authorizing revisions to the draft technical report as BLM may deem appropriate. BLM will provide the reviewing parties with written documentation indicating whether and how the draft technical report will be modified in accordance with any reviewing party comments. Unless the reviewing parties object to this documentation in writing to the BLM within 30 days following receipt, BLM may modify the draft technical report as BLM may deem appropriate. Thereafter, BLM may issue the technical report in final form and distribute this document in accordance with Paragraph "b" of this stipulation.

b) Copies of the final technical report documenting the results of implementing the requirements of the HPTP, will be distributed by BLM to the consulting parties and to the appropriate California Historical Resources Information Survey (CHRIS) Regional Information Center.

VIII. ADMINISTRATIVE STANDARDS

a) PROFESSIONAL QUALIFICATION STANDARDS. All actions prescribed by this Agreement that involve the identification, evaluation, analysis, recordation, treatment, monitoring, and disposition of historic properties and that involve the reporting and documentation of such actions in the form of reports, forms or other records, shall be

carried out by or under the direct supervision of a person or persons meeting, at a minimum, the Secretary of the Interior's Professional Qualifications Standards (PQS), as appropriate (48 Fed. Reg. 44739 dated September 29, 1983). However, nothing in this Stipulation may be interpreted to preclude any party qualified under the terms of this paragraph from using the services of persons who do not meet the PQS, so long as the work of such persons is supervised by someone who meets the PQS. Indian tribes have the sole authority to certify and approve tribal consultants who may perform monitoring activities in support of implementation of this Agreement.

b) DOCUMENTATION STANDARDS. Reporting on and documenting the actions cited in this Agreement shall conform to every reasonable extent with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 Fed Reg. 44716-40 dated September 29, 1983), as well as, the BLM 8100 Manual, the California Office of Historic Preservation's Preservation Planning Bulletin Number 4(a) December 1989, Archaeological Resource Management Reports (ARMR): Recommended Contents and Format (ARMR Guidelines) for the Preparation and Review of Archaeological Reports, and any specific and applicable county or local requirements or report formats.

c) CURATION STANDARDS. On BLM-administered land, all records and materials resulting from the actions required by this Agreement shall be curated in accordance with 36 C.F.R. Part 79, and the provisions of the NAGPRA, 43 C.F.R. Part 10, as applicable. To the extent permitted under Sections 5097.98 and 5097.991 of the California Public Resources Code, the materials and records resulting from the actions required by this Agreement for private lands shall be curated in accordance with 36 C.F.R. Part 79. The BLM will seek to have the materials retrieved from private lands donated through a written donation agreement. The BLM will attempt to have all collections curated at one local facility where possible unless otherwise agreed to by the consulting parties.

IX. IMPLEMENTATION OF THE UNDERTAKING

a) The BLM may authorize construction activities, including but not limited to those listed below, to proceed in specific geographic areas where there are no historic properties; where there will be no adverse effect to historic properties; where a monitoring and discovery process or plan is in place per Stipulation VI(b); or in areas where an HPTP(s) has been approved, initiated and field work completed. Such construction activities may include:

i) demarcation, set up, and use of staging areas for construction of the undertaking,
ii) conduct of geotechnical boring investigations or other geophysical and engineering activities, and
iii) grading, constructing buildings, and installing photovoltaic panels.
iv) construction of transmission towers

b) Initiation of any construction activities on Federal lands shall not occur until after the Signatory parties agree and BLM issues the ROD, ROW grant, and Notice(s) to Proceed.

Construction shall not occur in waters of the United States on or off federal lands until the COE issues the DA permit.

X. AMENDMENTS TO THE AGREEMENT

a) This Agreement may be amended only upon written agreement of the Signatories.

   i) Upon receipt of a request to amend this Agreement, the BLM will immediately notify the other consulting parties and initiate a 30 day period to consult on the proposed amendment, whereupon all parties shall consult to consider such amendments.

   ii) If agreement to the amendment cannot be reached within the 30 day period, resolution of the issue may proceed by following the dispute resolution process in Stipulation XII.

b) This Agreement may be amended when such an amendment is agreed to in writing by all Signatories.

c) Amendments to this Agreement shall take effect on the dates that they are fully executed by the Signatories.

d) Modifications, additions, or deletions to the appendices made as a result of continuing consultation among the consulting parties do not require the Agreement to be amended.

XI. DISPUTE RESOLUTION

a) Should any party to this Agreement object at any time to any actions proposed or the manner in which the terms of this Agreement are implemented, the BLM shall consult with such party to resolve the objection. If the BLM determines that such objection cannot be resolved, the BLM will:

   i) Forward all documentation relevant to the dispute, including the BLM's proposed resolution, to the ACHP. The ACHP shall provide the BLM with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the BLM shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. The BLM will then proceed according to its final decision.

   ii) If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, the BLM may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the BLM shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and concurring parties to the MOA, and provide them and the ACHP with a copy of such written response.

iii) The BLM's responsibility to implement all other actions subject to the terms of this MOA that are not the subject of the dispute remain unchanged.

XII. TERMINATION

a) If any Signatory or Invited Signatory to this Agreement determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties to attempt to develop an amendment per Stipulation XI above. If within sixty (60) days an amendment cannot be reached;

   i) a Signatory or Invited Signatory may terminate their participation in the Agreement upon written notification to the other Signatories and Invited Signatories.

b) If the Agreement is terminated, and prior to work continuing on the undertaking, the BLM shall continue to follow the process provided at 36 C.F.R. 800.6 until (a) a new Agreement is executed pursuant to 36 C.F.R. 800.6 or (b) the agencies request, take into account, and respond to the comments of the ACHP under 36 C.F.R. 800.7. The BLM shall notify all parties to this Agreement as to the course of action it will pursue.

XIII. PARTIES TO THE AGREEMENT

a) Should conditions of the undertaking change such that other federal agencies, state agencies, Indian tribes, tribal organizations or other organizations or individuals not already party to this Agreement request in writing to participate, the BLM will notify the other consulting parties and consider the request to participate in the Agreement. If the BLM determines that the party should be invited to participate in this Agreement, the BLM shall notify the requesting party in writing and the Agreement shall be amended following the procedures in Stipulation XI.

b) Should conditions of the undertaking change such that a Signatory or Invited Signatory to this Agreement determine that its participation in the undertaking is no longer required the party may withdraw from participation by informing the BLM. The BLM shall inform the other parties to this Agreement of the withdrawal. Withdrawal of a Signatory or Invited Signatory to the Agreement where its participation is no longer required for purposes of section 106 does not terminate the Agreement as described in Stipulation XIII.

c) Should a Concurring Party determine that its participation in the undertaking and this Agreement is no longer warranted, the party may withdraw from participation by informing the BLM. The BLM shall inform the other parties to this Agreement of the withdrawal. Withdrawal of a Concurring Party to the Agreement does not require an amendment of the Agreement.

XIV. DURATION OF THIS AGREEMENT

a) This Agreement will expire if the undertaking has not been initiated and the BLM ROW grant expires or is withdrawn, or the stipulations of this Agreement have not been

initiated, within five (5) years from the date of its execution. Prior to such time, the BLM may consult with the other signatories to reconsider the terms of the MOA and amend it in accordance with Stipulation VIII below. Prior to work continuing on the undertaking, the BLM shall continue to follow the process provided at 36 C.F.R. 800.6 until either (a) a new memorandum of agreement or programmatic agreement is executed pursuant to 36 C.F.R. 800.6, or (b) the BLM request, take into account, and respond to the comments of the ACHP under 36 C.F.R. 800.7. The BLM shall notify the parties to the Agreement as to the course of action they will pursue.

b) Unless the Agreement is terminated pursuant to Stipulation XIII, another agreement executed for the undertaking supersedes it, or the undertaking itself has been terminated, this Agreement will remain in full force and effect until BLM, in consultation with the other Signatories, determines that implementation of all aspects of the undertaking has been completed and that all terms of this have been fulfilled in a satisfactory manner. Upon a determination by BLM that implementation of all aspects of the undertaking have been completed and that all terms of this Agreement have been fulfilled in a satisfactory manner, BLM will notify the parties to this Agreement in writing of the agency's determination. This Agreement will terminate and have no further force or effect 30 days after BLM so notifies the Signatories to this Agreement, unless BLM retracts its determination before the end of that period.

XV. EFFECTIVE DATE

a) This Agreement and any amendments shall take effect on the date that it has been fully executed by the Signatories. The Agreement and any amendments thereto shall be executed in the following order: (1) BLM, (2) COE, (3) DOE, and (4) SHPO.

b) Execution and implementation of this Agreement is evidence that the BLM, COE and DOE have taken into account the effect of this undertaking on historic properties, afforded the ACHP a reasonable opportunity to comment, and that the BLM, COE and DOE have satisfied their responsibilities under Section 106. The BLM shall be responsible for managing historic properties within the APE for this undertaking pursuant to the NHPA. The Signatories and Invited Signatories to this Agreement represent that they have the authority to sign for and bind the entities on behalf of whom they sign.

The remainder of this page is blank.

SIGNATORY PARTIES

U.S. BUREAU OF LAND MANAGEMENT

BY: _____ DATE: _____

Margaret L. Goodro
Manager, El Centro Field Office

U.S. ARMY CORPS OF ENGINEERS, LOS ANGELES DISTRICT

BY: _____ DATE: _____

David J. Castanon
Chief, Regulatory Division

U.S. DEPARTMENT OF ENERGY, LOAN PROGRAMS OFFICE

BY: _____ DATE: _____

Matthew C. McMillen
Director, Environmental Compliance

CALIFORNIA STATE HISTORIC PRESERVATION OFFICER

BY: _____ DATE: _____

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

INVITED SIGNATORY PARTIES

CSOLAR Development, L.L.C.

Invited Signatory

CSOLAR Development, L.L.C.

BY: _____ DATE: _____

TITLE: _____

CONCURRING PARTIES

BARONA BAND OF DIEGUENO INDIANS
CAMPO BAND OF MISSION INDIANS
COCOPAH INDIAN TRIBE
FORT YUMA QUECHAN INDIAN TRIBE
EWIIAAPAAYP BAND OF KUMEYAAY INDIANS
JAMUL INDIAN VILLAGE
KWAAYMII LAGUNA BAND OF INDIANS
LA POSTA BAND OF KUMEYAAY INDIANS
MANZANITA BAND OF KUMEYAAY INDIANS
MESA GRANDE BAND OF MISSION INDIANS
SAN PASQUAL BAND OF DIEGUENO INDIANS
SANTA YSABEL BAND OF DIEGUENO INDIANS
SYCUAN BAND OF KUMEYAAY NATION
TORRES-MARTINEZ DESERT CAHUILLA INDIANS
VIEJAS BAND OF KUMEYAAY INDIANS
IMPERIAL COUNTY, CALIFORNIA

BARONA BAND OF DIEGUENO INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

CAMPO BAND OF MISSION INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

COCOPAH INDIAN TRIBE

BY: _____ DATE: _____

TITLE: _____

Concurring Party

FORT YUMA QUECHAN INDIAN TRIBE

BY: _____ DATE: _____

TITLE: _____

Concurring Party

EWIIAAPAAYP BAND OF KUMEYAAY INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

JAMUL INDIAN VILLAGE

BY: _____ DATE: _____

TITLE: _____

Concurring Party

KWAAYMII LAGUNA BAND OF INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

LA POSTA BAND OF KUMEYAAY INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

MANZANITA BAND OF KUMEYAAY INDIANS

BY: _____ DATE: _____

TITLE: _____

MESA GRANDE BAND OF MISSION INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

SAN PASQUAL BAND OF DIEGUENO INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

SANTA YSABEL BAND OF DIEGUENO INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

SYCUAN BAND OF KUMEYAAY NATION

BY: _____ DATE: _____

TITLE: _____

Concurring Party

TORRES-MARTINEZ DESERT CAHUILLA INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

VIEJAS BAND OF KUMEYAAY INDIANS

BY: _____ DATE: _____

TITLE: _____

Concurring Party

IMPERIAL COUNTY, CALIFORNIA

BY: _____ DATE: _____

TITLE: _____

APPENDIX A - DEFINITIONS

a) ***Area of Potential Effect.*** The APE is defined as the total geographic area or areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties per 36 C.F.R. 800.16(d). The APE is influenced by the scale and nature of an undertaking and includes those areas which could be affected by an undertaking prior to, during and after construction.

b) ***Concurring Parties.*** Collectively refers to consulting parties with a demonstrated interest in the undertaking, who agree, through their signature, with the terms of this Agreement. Concurring Parties may propose amendments to this Agreement.

c) ***Cultural Resource.*** A cultural resource is an object or definite location of human activity, occupation, use, or significance identifiable through field inventory, historical documentation, or oral evidence. Cultural resources are prehistoric, historic, archaeological, or architectural sites, structures, buildings, places, or objects and locations of traditional cultural or religious importance to specified social and/or culture groups. Cultural resources include the entire spectrum of objects and places, from artifacts to cultural landscapes, without regard to eligibility for inclusion on the National Register of Historic Places (NRHP) or California Register of Historical Resources (CRHR).

d) ***Consulting Parties.*** Collectively refers to the Signatories, Invited Signatories and Concurring Parties who have signed this Agreement.

e) ***Historic Properties.*** Properties (cultural resources) that are included in, or eligible for inclusion in, the NRHP maintained by the Secretary of the Interior and per the NRHP eligibility criteria at 36 C.F.R.60.4 and may include any prehistoric or historic district, site, building, structure, traditional cultural property or object. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meet the NRHP criteria. The term "eligible for inclusion on the NRHP" refers both to properties formally determined as such in accordance with regulations of the Secretary of the Interior and all other properties that meet the NRHP criteria.

f) ***Historical Resources.*** Historical resources are cultural resources that meet the criteria for listing on the CRHR as provided at California Code of Regulations Title 14, Chapter 11.5, Section 4850 and may include, but are not limited to, any object, building, structure, site, area, place, record, or manuscript which is historically or archaeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California.

g) ***Invited Signatories.*** Invited Signatories are parties that have specific responsibilities as defined in this Agreement. Those Invited Signatories who actually sign this Agreement have the same rights with regard to seeking amendment or termination of this Agreement as the Signatory Parties, but whose signatures are not required for execution of the Agreement. The Invited Signatory to this Agreement is the Applicant.

h) ***Lands Administered by the U.S. Department of Interior, Bureau of Land Management*** (BLM) means any federal lands under the administrative authority of the BLM.

i) ***Lands Regulated by the U.S. Army Corps of Engineers*** (COE) means any lands subject to regulation by the COE pursuant to Section 404 of the Clean Water Act (33 USC Part 1344) or other law, and for which the COE has issued a Department of the Army permit.

j) ***Literature Review.*** A literature review is one component of a BLM class I inventory, as defined in BLM Manual Guidance 8100.21(A)(1), and is a professionally prepared study that includes a compilation and analysis of all reasonably available cultural resource data and literature, and a management-focused, interpretive, narrative overview, and synthesis of the data. The overview may also define regional research questions and treatment options.

k) ***Records Search.*** A records search is one component of a BLM class I inventory and an important element of a literature review. A records search is the process of obtaining existing cultural resource data from published and unpublished documents, BLM cultural resource inventory records, institutional site files, State and national registers, interviews, and other information sources.

l) ***Signatories.*** Signatories are parties that have the sole authority to execute, amend or terminate this Agreement. Signatories to this Agreement are the BLM, COE, DOE, and SHPO.

m) ***Traditional Cultural Property.*** A traditional cultural property is defined generally as a property that is important to a living group or community because of its association with cultural practices or beliefs that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. It is a place, such as a traditional gathering area, prayer site, or sacred/ceremonial location, that may figure in important community traditions. These places may or may not contain features, artifacts, or physical evidence, and are usually identified through consultation. A traditional cultural property may be eligible for inclusion in the NRHP and the CRHR.

n) ***Tribes.*** The federally recognized Indian tribes that the BLM is consulting with on this undertaking.

o) ***Tribal Organization.*** A non-Federally recognized Indian tribe or Native American organization that the BLM is consulting with on this undertaking.

p) ***Windshield Survey.*** A windshield survey is the driving or walking of surveyors along streets and roads of a community in order to observe and record the buildings, structures, and landscape characteristics seen from those vantage points. A windshield survey is a method commonly utilized in reconnaissance surveys to identify built-environment resources, such as buildings, objects, and structures.

APPENDIX B – AREA OF POTENTIAL EFFECT

a) The BLM has defined the APE for the CSOLAR Imperial Solar Energy Center South Project based on consideration of both direct and indirect impacts. Below is a discussion about the APE and the methodology used to so define, and the survey methodology utilized within each APE.

   i) The area within which historic properties could sustain direct effects as a result of the undertaking is defined to include:

      (1) The block area of installation of the proposed solar energy generating facility, which includes approximately 928 acres of private and formally developed agricultural lands, and generally includes; the west half of Section 21, Township 17 South and Range 12 East north of the international border, and; all of Section 20, Township 17 South, Range 12 East north of the international border, and; the southeast quarter of Section 17, Township 17 South, Range 12 East (all San Bernardino Base Meridian).

      (2) All linear elements of the undertaking including:

         (a) A ROW for the IVS-3 230 kV transmission line is approximately 125-feet wide and 1 mile long and extends from the solar electric generating plant to the intersection of the IVS-1 transmission line. The survey corridor for cultural resources for this linear element was established as a 250-foot wide buffer on either side of the center line (500-foot wide corridor) to allow for changes in the ROW to avoid cultural resources.

         (b) A ROW for access and use of the existing 230 kV transmission line corridor and construction of the IVS-1 230 kV transmission line. The ROW is approximately 125-feet wide and 5 miles long and extends from the intersection of the IVS-3 transmission line to the Imperial Valley Substation. The survey corridor for cultural resources for this linear element was established as a 150-foot wide buffer on either side of the center line (300-foot wide corridor) to allow for changes in the ROW to avoid cultural resources.

   ii) The area within which historic properties could sustain indirect effects, including visual, auditory, atmospheric, and contextual, as a result of the undertaking includes:

      (1) Historic properties within a 1-mile radius of the direct effects APE that are identified through a review of existing literature and records search, information or records on file with the BLM or at the South Coastal Information Center, interviews or discussions with local professional or historical societies and local experts in history or archaeology.

(a) Historic properties identified through archaeological or other field investigations for this undertaking that, as a result of project redesign to avoid direct effects to cultural resources, are no longer within the APE.

(2) Historic properties included in the Native American Heritage Commission Sacred Lands Files, identified through a literature review or records search, or identified by a Tribe or Tribal Organization, through consultation as having religious or cultural significance that may be affected by the undertaking.

(3) Historic properties that have been identified by a consulting party, organization, governmental entity, or individual through consultation or the public commenting processes as having significance or being a resource of concern that may be affected by the undertaking.

(4) Built-environment resources located within one-half mile of the project footprint whose historic settings could be adversely affected.

(a) On private property, historic properties within one-half mile of the direct effects APE that are identified through surveys, where access was granted, and windshield surveys, where access was not granted.

APPENDIX C: HISTORIC PROPERTIES TREATMENT PLAN

Confidential information about the location, character, or ownership of historic resources discussed in this document have been removed or redacted to reduce the potential of threat or harm to the historic resource (Section 304 of the National Historic Preservation Act; Section 9 of the Archaeological Resources Protection Act).

RESEARCH DESIGN FOR ARCHAEOLOGICAL DATA RECOVERY AT PREHISTORIC SITE CA-IMP-3999, IMPERIAL COUNTY, CALIFORNIA

DRAFT

Prepared for:

LightSource Renewables, LLC
9151 Rehco Road
San Diego, California 92121

and

USDI Bureau of Land Management
El Centro Field Office

Prepared by:

ASM Affiliates, Inc.
2034 Corte Del Nogal
Carlsbad, California 92011

Don Laylander and Jerry Schaefer

January 2011
PN 17450

USGS 7.5' Quadrangle: Mount Signal
Acreage: 15

Keywords: Data Recovery Plan; IMP-3999; Prehistoric Site; Salton Basin, Imperial Valley, Yuha Desert, West Mesa, Lake Cahuilla; Ceramics, Lithics, Fire-Affected Rock; Surface Collection, Magnetometry, Excavation, Trenching, Geomorphology, Radiocarbon, Thermoluminescence, Obsidian Hydration, X-ray Fluorescence, Protein Residue Analysis

TABLE OF CONTENTS

Chapter **Page**

TABLE OF CONTENTS

(Continued)

Chapter **Page**

LIST OF FIGURES

Page

LIST OF TABLES

Page

NATIONAL ARCHAEOLOGICAL DATA BASE INFORMATION

Authors: Don Laylander and Jerry Schaefer

Consulting Firm: ASM Affiliates
2034 Corte del Nogal
Carlsbad, California 92011

Report Date: January 14, 2010

Report Title: Research Design for Archaeological Data Recovery at Prehistoric Site CA-IMP-3999, Imperial County, California

Submitted to: Carrie Simmons

Prepared for: Bureau of Land Management,
El Centro Field Office
1661 S. 4th Street
El Centro, CA 92243

Project Number: 17450

USGS Quadrangle: 7.5 -minute Mount Signal quad (photorevised 1976)

Keywords: Data Recovery Plan; IMP-3999; Prehistoric Site; Salton Basin, Imperial Valley, Yuha Desert, West Mesa, Lake Cahuilla; Ceramics, Lithics, Fire-Affected Rock; Surface Collection, Magnetometry, Excavation, Trenching, Geomorphology, Radiocarbon, Thermoluminescence, Obsidian Hydration, X-ray Fluorescence, Protein Residue Analysis

1. INTRODUCTION

The purpose of this document is to provide a design for additional archaeological research to be conducted at prehistoric site CA-IMP-3999 (Figures 1-3). This research will be done to mitigate adverse effects to the site's scientific and heritage values from the proposed LSR Imperial Valley Photovoltaic Solar Farm Project in Imperial County, California. The research design will be incorporated in the Historic Properties Management Plan that is being prepared for the solar project.

Information on the solar farm project indicates that direct impacts will occur at four locations that are partially or completely within the previously mapped limits of site IMP-3999. For purposes of this document, those locations will be referred to as, from northwest to southeast, locations A, B, C, and D. At each of the four locations, a temporary tower site will be used, within which a smaller permanent tower will be erected. At location A, the temporary tower site will be 140 x 140 ft.; at the other three locations, the temporary tower sites will be 80 x 60 ft. At location A, where the orientation of transmission line shifts from northwest to north-northwest, two pull sites, each 150 x 75 ft. in area, will be adjacent to the temporary tower site. The northern pull site will lie outside of the mapped archaeological site area, but the southern pull site will be within the archaeological site. At locations B, C, and D, short access roads will extend to the southwest beyond the temporary tower sites for approximately 100 ft., 150 ft., and 275 ft. respectively. The access roads for locations B and C will lie within the archaeological site's boundary, while the access road for location C will be outside of that boundary.

Following this introductory section, the next section of the data recovery plan will briefly review the information concerning site IMP-3999 that is presently available as a result of previous archaeological investigations. This will be followed by a discussion of the regional context of the site, including relevant aspects of its modern geography, information on paleoenvironmental conditions during the prehistoric period, the history of previous archaeological investigations in the region, a general overview of the region's prehistoric culture history, and a summary of ethnographic information on the native groups that were living in the region during the early historic period. The next section will identify research issues that are potentially applicable to the site and the types of data needed to address those issues. A final section will lay out the field and laboratory methods that are proposed for the data recovery program and a tentative schedule for their completion.

CONFIDENTIAL MAP LOCATION INFORMATION NOT INCLUDED

Figure 1. Project location map.

CONFIDENTIAL MAP LOCATION INFORMATION NOT INCLUDED

Figure 2. Project vicinity map.

CONFIDENTIAL MAP LOCATION INFORMATION NOT INCLUDED

Figure 3. Site map.

2. PREVIOUS INVESTIGATIONS AT SITE CA-IMP-3999

Information concerning site IMP-3999 is taken from a draft Class III cultural resources survey report prepared for the Imperial Solar Energy Center South Project in 2010 and a site record for IMP-3999 that was updated for that report (Zepeda-Herman et al. 2010).

The site was initially recorded by Greenwood and Associates in 1981 (Foster and Greenwood 1983). It was classified as a temporary camp. An updated site record was prepared in 1983, Some disturbance to the site was noted as having occurred as a result of off-road vehicle activity and sheet wash. The site was assessed as potentially eligible for the National Register of Historic Places (NRHP).

A 1996 site record update noted the presence of The latter presumably correspond to the FAR noted in the original site record.

Studies for a transmission line in 2001 resulted in an expansion of the site area and some additional documentation of site contents, (Berryman and Cheever 2001a). Observed impacts to the site included off-road vehicle activity, erosion, grading, and the construction of a culvert and drainage ditches. Within the portions of the site that were to be impacted by the transmission line project, a 100-percent surface collection was made, 10 surface scrapes were excavated, and 19 shovel test pits (STPs) were excavated (Berryman and Cheever 2001b). Due to the limited research potential indicated by this testing, no further work in those portions of the site was recommended. The tested portions were recommended as not eligible for the NRHP (i.e., as not contributing to any potential eligibility for the site as a whole), but it was suggested that the portions of the site that had not been tested should be considered as potentially eligible.

The 2010 archaeological survey for the Imperial Solar Energy Center South Project provided additional information concerning site IMP-3999 (Zepeda-Herman et al. 2010). The boundary of the site was extended to the southeast, and it was noted that "the site probably continues in a southeasterly direction outside the survey area for the proposed project" (Zepeda-Herman et al. 2010:31).

In the report for the 2010 survey, several sites, including IMP-3999, were recommended as eligible for the NRHP under Criterion d and for the California Register of Historical Resources under Criterion 4, for their "potential to answer questions about settlement/mobility patterns, site function, and chronology" (Zepeda-Herman et al. 2010:45).

Brief field spot checks by ASM Affiliates in September 2010 found the site to be substantially as previously described (Schaefer 2010). The current mapped dimensions of the site are [redacted]

3. REGIONAL CONTEXT

MODERN GEOGRAPHY

Geomorphology and Geology

The project area lies on the western margin of the Colorado Desert and of the Salton Trough. The Salton Trough is a distinct geomorphologic feature that consists of a massive graben formed at the interface of the North American and Pacific tectonic plates. The trough was formed by the ongoing movement of faults and has been filled by immense quantities of sediments that, in places, are up to 6,000 m deep (Morton 1977). Much of this sediment is derived from the continuous uplift and erosion of the high Peninsular Range located just to the west of site IMP-3999.

IMP-3999 lies in a generally very flat area, at an elevation of about 10-12 m above mean sea level. About 1 km to the east of the site, the developed agricultural fields of Imperial Valley begin. The site is underlain, at least in part, by Quaternary lake deposits left by prehistoric Lake Cahuilla (Morton 1977; Strand 1962). Immediately to the west, in the Yuha Desert above the maximum lake shoreline, lie other sediments, including Quaternary alluvium, Quaternary non-marine terrace deposits, Pliocene non-marine deposits of the Palm Spring Formation, and, at a greater distance, earlier Pliocene deposits of the Imperial Formation. Some of these deposits may have provided sources of cobbles used in the manufacturing of flaked and ground stone tools by the prehistoric occupants of IMP-3999. About 20-25 km west of the site, the steep escarpment of the Peninsular Range begins, with a variety of plutonic, metamorphic, and volcanic rocks that offered potential tool stone sources.

Contemporary Climate and Hydrology

IMP-3999 is situated within the Colorado Desert, a subarea of the Sonoran Desert. Few areas of North America are hotter or drier, due to Colorado Desert's very low elevation and its position in the rain shadow of the Peninsular Range. Current climatic conditions include mild winters and dry, hot summers. The weather records for El Centro, less than 20 km to the northeast, indicate mean winter lows of 5° C and mean summer highs of 42° C, with a record high of 50° C (Wikipedia 2011). Precipitation in the region is insignificant, with only 7.5 cm of rain falling annually in sporadic winter rains and in a few, often violent summer thunderstorms. The nearest drainage, Yuha Wash, provides only intermittent runoff from the Peninsular Range. However, water may also be available seasonally in natural tanks located in the mountains, and it is possible to dig shallow wells in major sandy washes.

Contemporary Flora and Fauna

Typical natural vegetation in the vicinity of the site includes creosote (*Larrea tridentata*) and bursage (*Ambrosia dumosa*), established on broad stretches of alluvial sand and gravel. Larger washes host plants of the woodland wash community intermixed with creosote-bursage, along with such species as burrobrush (*Hymenoclea salsola*) and ocotillo (*Fouquieria splendens*).

Desert species adapted to higher elevations would have been accessible on the flank of the Peninsular Range, a short distance to the west (Cleland and Apple 2003).

Fauna common to creosote-bursage environments in the project area include typical desert mammals such as the coyote (*Canis latrans*), black-tailed jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus audubonii*), and various rodents (e.g., *Peromyscus* spp.). Among larger mammals, the Sonoran pronghorn (*Antilocapra americana sonorensis*) once occupied open plains and desert areas but has now been extirpated in the Colorado Desert. Mule deer (*Odocoileus hemionus*) are occasionally found in areas away from the desert floor. Reptiles such as the desert tortoise (*Gopherus agassizi*), western diamondback (*Crotalus atrox*), rosy boa (*Lichanura trivirgata*), and various lizards are quite common in creosote-dominated habitats. On the margin of the Peninsular Range, bighorn sheep (*Ovis canadensis*) are present (Jaeger1965).

PALEOENVIRONMENTS

Modern conditions in the region around site IMP-3999 only imperfectly echo conditions during periods of prehistoric occupation between the terminal Pleistocene and the advent of Euro-Americans. The region's paleoenvironments are only very imperfectly known as yet, but important clues are available, both concerning changes in climate and vegetation and concerning the unique phenomenon of Lake Cahuilla.

Climate and Biotic Communities

Evidence concerning Late Pleistocene/Holocene environmental conditions in the Colorado Desert is still very limited. Pollen-bearing stratified deposits from caves or lake beds are not as common in the Colorado Desert as in the Great Basin, where most of the desert climatic reconstructions have been based. The best information has come from investigations of plant microflora in fossil packrat (*Neotoma* sp.) middens along the Colorado and Gila rivers and extending across the Sonoran Desert to the east (King and Van Devender 1977; Van Devender 1990; Van Devender and Spaulding 1979, 1983). Of greatest relevance to the low elevations of the Colorado Desert are the stratified fossil packrat middens in the Wellton Hills (160-180 m above mean sea level [amsl]), Hornaday Mountains (240 m amsl), Butler Mountains (240-255 m amsl), Picacho Peak (300 m amsl), Tinajas Altas Mountains (330-580 m amsl), and Whipple Mountains (320-525 m amsl). Van Devender (1990) provided an authoritative review and reconstruction of climate and vegetation over the last 14,000 years from these investigations that is summarized in Table 1. The focus here is on data that are specific to the lower Sonoran Desert.

Table 1. Colorado Desert Paleoenvironmental History (based on Van Devender 1990)

Period	Climate	Vegetation in Packrat Middens
Late Holocene (2000 B.C. - Present)	Modern climatic regime with high summer temperatures, mild winters, and low precipitation in the lowlands. Periodic wetter and drier intervals evident in the uplands.	Lowlands (<300 m amsl): Modern creosote scrub. Uplands (300-600 m amsl): Modern Sonoran Desert habitat distributions.
Middle Holocene (7000 - 2000 B.C.)	Winter dominant rainfall pattern replaced by modern bimodal pattern. Rainfall 20 percent greater than present. Summer monsoon rains greater than present in uplands and west of the lower Colorado River valley but probably same as present in the lowlands. A dry altithermal may apply only to winter dominant rainfall areas.	Lowlands: Modern desert scrub with creosote bush, Mormon tea, white bursage, pygmy cedar, ironweed, and catclaw acacia by beginning of period. Uplands: Juniper disappears from the Sonoran Desert at 6900 B.C. when modern transition boundary between the Mojave and Sonoran deserts is established. Desert riparian species found on hot, dry, south-facing slopes unlike modern conditions.
Early Holocene (8000 – 7000 B.C.)	Transitional to present climate with still cooler summers. Rainfall 20-40 percent greater annually and 70 percent greater in winter than present.	Lowlands: Desert scrub already established. Mojavean scrub persists at sites closest to Colorado River. California Juniper disappears from the Butler Mountains midden profile. Uplands: Mesic woodland plants and singleleaf pinyon ascend to above 1,315 m amsl after 9000 B.C. Xeric juniper-scrub live oak woodland or chaparral continues, although California juniper disappears from the Whipple and Tinajas Altas mountains midden profiles.
Late Wisconsin (16,000 - 8000 B.C.)	Summers cooler, winters not much cooler than present but with more freezes. Rainfall 40-60 percent greater than present with winter dominant pattern.	Lowlands: Mojavean scrub with creosote bush, black bush, Joshua tree, and Whipple yucca. Uplands: Woodland-scrub ecotone at 240-300 m amsl. Xeric juniper woodland with California juniper, shrub live oak, Joshua tree, Whipple yucca, and Bigelow beargrass from 300-600 m amsl. Singleleaf pinyon starts above 460 m amsl.

The data from below 300 m amsl indicate that the lower Colorado River Valley, and presumably the Salton Trough as well, may have been a refugium for Lower Sonoran Creosote Scrub habitat during the Pleistocene, but also containing the frost-resistant Mojavean species (Cole 1986). The region would have resembled Joshua Tree National Park until 8000-7000 B.C., when the Sonoran-Mojave desert boundary moved north to its present location and modern vegetation associations were established. Mojavean species persisted at some locations into the early Holocene and indicate a transitional period from colder and wetter to warmer and drier conditions. Some investigators have interpreted the paleoenvironmental record to suggest that El Niño effects were more intense and stronger at this time, but with little effect from summer monsoons in the Salton Trough.

The extent to which very hot and dry altithermal extremes affected the lowlands remains problematical, and such effects may have been mitigated to some extent by possible infillings of Lake Cahuilla. The same may be true of late Holocene climatic fluctuations such as the Medieval

Climatic Anomaly, an episode of warmer and drier conditions that lasted from around A.D. 800 through the great drought of A.D. 1209-1350 (Jones et al. 1999). Drought impacts in some mountain and coastal areas are now well established from tree-ring analyses, and there may have been direct and indirect ramifications for desert dwellers on the western side of the Salton Trough. Episodes of cooler and wetter conditions are also documented through a number of paleoenvironmental indices and in historical accounts. The most recent episode was the Little Ice Age, whose effects were felt between about A.D. 1450 and 1850 (Jones et al. 1999; West et al. 2007). Throughout the Quaternary, the Salton Trough, when it was not filled by Lake Cahuilla, probably contained much the same alkali sink habitat that it now does, although no paleoenvironmental data are available to confirm this directly.

At higher elevations, between 300 and 600 m amsl, midden analyses indicate that a juniper woodland habitat was present in the Late Pleistocene, between 20,000 and 9000 B.C. These xeric woodlands continued through the early Holocene, finally ascending to higher elevations during the middle Holocene. They were replaced with the current creosote scrub and desert riparian habitat at that time (Van Devender 1990).

Lake Cahuilla

The Salton Basin represents a northern extension of the Gulf of California, shaped by the same tectonic processes that gave rise to the gulf. Throughout the period of potential human occupation, the basin has been isolated from the gulf. However, the basin also constitutes a northern branch of the Colorado River's delta. Periodically, the river shifted its course away from the southern delta and into the northern basin. Once diverted, the river found a steeper descent into the basin than it had followed when flowing directly into the southern delta, at least when the oceans stood at approximately their present level. The river would have entrenched itself into the soft sediments of the Imperial Valley, as it was doing in 1905-1907 when it had accidentally been diverted northward by human agency. Once entrenched, the river would have been unable to divert itself to the south again until the filling of the basin was complete (Redlands Institute 2002).

Under modern conditions of climate and the natural volume of the Colorado River, it would have taken approximate 18 years for the lake to rise to the 12-13 m amsl level. At that point, about half of the Colorado River's volume would have been lost to evaporation from the lake's surface, but the other half would have spilled over into the southern delta and the Gulf of California, probably following the line of the modern Río Hardy in northeastern Baja California. Once the lake was full, its inlet channel would have gradually become clogged with sediment, and the river would have become ready to shift its course again, back to the south. Under modern conditions, if the river's waters were completely diverted away from the basin, it would have taken approximately 56 years for the lake to completely evaporate (Laylander 1997a; Waters 1983a; D. Weide 1976a; Wilke 1978).

It has sometimes been suggested that Lake Cahuilla, when full, might have experienced significant regular seasonal fluctuations in its level, perhaps even on the order of 20 m (von Werlhof 2008). Hydrologic modelling does not bear out this suggestion. Under modern natural conditions of average river volume and evaporation rate, the level of the lake would have dropped only about 5 cm during the months of September and October, overflowing during the

remainder of the year. To produce a drop of 20 m would have required the complete isolation of the lake from any input of river water for a period of more than three years (Laylander 1997a).

At least six Late Pleistocene infillings of Lake Cahuilla have left relic maximum shorelines at elevations between 52 and 31 m amsl. The latest and lowest of the shorelines is tentatively radiocarbon dated at about 24,000 B.C., but none of the Pleistocene stands are known to have cultural associations (Waters 1980, 1983b). To account for these stands, it is necessary to posit either that the lip of the Salton Basin has been lowered approximately 19 m during the last 26,000 years or that the areas where the Pleistocene shorelines were observed have been raised by that amount, or some combination of those two factors. This suggests an average rate of vertical movement of about 0.7 m per millennium.

The hydrological status of the Salton Basin during the early and middle Holocene remains largely unknown. It is possible that Lake Cahuilla was present throughout much of this period; if so, however, the scarcity of diagnostic artifacts and archaeological or geological radiocarbon dates from this period in association with lake shorelines is difficult to explain. On the other hand, it is possible that the lake was absent during much of this period; however, that would make it difficult to account for the apparent absence of obsidian from the Obsidian Butte source (which was inaccessible when the lake was present) in regional deposits, assuming that the eruption of Obsidian Butte had occurred prior to this period (Friedman and Obradovich 1981).

Firm evidence for the presence of Lake Cahuilla dates from the first millennium A.D. and is relatively abundant within the second millennium A.D. (Laylander 1997a; Love and Dahdul 2002; Waters 1983a; D. Weide 1976b; Wilke 1978). An initial archaeological assessment by Rogers (1945) was that there had been a single stand of the lake, between about A.D. 1000 and 1500. The subsequent availability of radiocarbon dates from sites both located on the maximum shoreline and on the exposed lake bed, as well as studies of stratigraphic exposures of lacustrine and non-lacustrine deposits, has clearly established that multiple episodes of lake filling and recession occurred. According to one analysis, the available radiocarbon and stratigraphic evidence requires a minimum of three separate lake stands, each followed by a recession, during the last millennium: a first stand around the thirteenth and fourteen century A.D., a second during the fifteenth century A.D., and a final stand during the seventeenth century A.D. (Laylander 1997a). The lake's final stand had originally be posited as ending prior to the arrival of Spanish explorers on the lower Colorado River in 1540, and this early termination is still often cited (e.g., Sutton 2011), but evidence for a seventeenth-century lake stand seems to be firm. Indeed, it has been suggested that newer radiocarbon evidence indicates a full stand that extended into the early eighteenth century (Tom Rockwell, personal communication 2010).

When Lake Cahuilla was present, it would have offered a range of potential resources to the aboriginal inhabitants of the region, in addition to fresh water. At least five species of Colorado River fish were present, including bonytail (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), machete (*Elops affinis*), striped mullet (*Mugil cephalus*), and Colorado pikeminnow (*Ptychocheilus lucius*). One species of freshwater mollusk, *Anodonta dejecta*, was available. At least 22 species of aquatic birds were present seasonally or throughout the year; among these, American coots (*Fulica americana*), ducks (e.g., *Aythya* spp., *Oxyura jamaicensis*), and grebes (*Aechmophorus* sp.) are conspicuous in the archaeological record, along with geese, swans, and

pelicans. Freshwater marsh plants along the shoreline included bulrush (*Scirpus* spp.), cattail (*Typha* sp.), and spikerush (*Juncus* sp.). Non-lacustrine flora located back from the lake shore may have been more abundant during lacustrine periods because of the higher water table. Game animals may have frequented the shoreline to exploit its fresh water and other resources (Laylander 1997a; Sutton and Wilke 1988; Wilke 1978).

HISTORY OF ARCHAEOLOGICAL INVESTIGATIONS

The earliest archaeological observations in the Colorado Desert were primarily descriptive in character. They attempted to fit the region's archaeological remains into essentially synchronic patterns recognized from the region's ethnographic record (e.g., Heye 1919).

Malcolm J. Rogers introduced a more scientific, diachronic, and interpretive perspective into the field, beginning in the 1920s. He documented apparent chronological patterns in the pre-ceramic artifact types and site distributions that are now dated to the early and middle Holocene periods, both within the Colorado Desert and in adjacent regions (Rogers 1939, 1966). For the late prehistoric period, his contributions were even more concrete and included the proposal of a detailed culture history (Rogers 1945). Rogers' studies of aboriginal ceramics, both ethnographic and archaeological (Rogers 1936, 1945), along with the collections he deposited at the San Diego Museum of Man, have provided the foundations for later studies of Colorado Desert ceramics by Albert Schroeder (1958), Ronald V. May (1978, 2001), Gena R. Van Camp (1979), and Michael R. Waters (1982a, 1982b, 1982c), among others. Although many of Rogers' views have not gone unchallenged, they remain an important starting point for the discussion of Colorado Desert prehistory.

Other archaeologists carried Rogers' investigations forward during the 1940s, 1950s, and 1960s. Adan E. Treganza was another pioneer in local archaeological studies during the early 1940s. He documented site distributions and artifact types, primarily relating to the late prehistoric period, on both sides of the international border in the vicinity of the Yuha Desert and site IMP-3999 (Treganza 1942). William J. Wallace conducted investigations in the Anza-Borrego desert, including Indian Hill Rockshelter (Wallace 1962a; Wallace and Taylor 1958, 1960a, 1960b; Wallace et al. 1962).

Most of the archaeological research in this region during the last four decades has been performed as part of compliance with state and federal environmental laws. It has often taken the form of small projects that have not been published beyond the discipline's grey literature, although contributions have appeared in the *Pacific Coast Archaeological Society Quarterly*, the *Journal of California Archaeology*, the *Journal of California and Great Basin Anthropology*, and the *Proceedings of the Society for California Archaeology*. Independent research has also been conducted for academic dissertations and by local institutions such as the Imperial Valley College and the University of California, Riverside.

Of particular interest are several overviews, management plans, and sample surveys addressing various portions of the California desert, including the Colorado Desert, prepared for the U.S. Department of the Interior's Bureau of Land Management (USDI BLM). Philip J. Wilke edited

one of the earliest syntheses concerning the Yuha Desert, with contributions by David L. Weide, James P. Barker, Harry W. Lawton, and Margaret L. Weide (Wilke 1976). Elizabeth von Till Warren, Robert H. Crabtree, Claude N. Warren, Martha Knack, and Richard McCarthy prepared a cultural synthesis for the Colorado Desert Planning Units as a whole (Warren et al. 1981). Dennis R. Gallegos (1980) conducted a sample survey inventory that included the West Mesa area.

Two doctoral dissertation projects have particular relevance to the present studies. Although Philip J. Wilke's (1978) dissertation work was done on the northern shore of Lake Cahuilla in Riverside County, it did much to advance studies of the prehistoric lake in general beyond the initial work of Rogers. Meg McDonald (1992; Wilke et al. 1986) studied Indian Hill Rockshelter, a unique site containing middle and late Holocene deposits and features, located about 40 km to the west of IMP-3999.

Several publications have offered synthetic discussions of the region's prehistory, each successive summary based on more solid data as archaeological studies have progressed. These syntheses have included essays by Wallace (1962b), Albert H. Schroeder (1979), Claude N. Warren (1984), Jerry Schaefer (1994a), and Jerry Schaefer and Don Laylander (2007).

CULTURE HISTORY

The following discussion presents a summary view of the regional prehistoric archaeology that may be relevant to site IMP-3999. Because this site does not contain any known Euro-American component, the historic period is discussed only in so far as it contributes to the understanding of possible environmental changes and early historic Native American identities in this region.

Regional prehistory has been categorized in a number of different ways, and a brief explanation of the approach used here may be appropriate. When Rogers undertook his pioneering work in the region during the 1920s and 1930s, prior to the availability of radiocarbon dating, he was able to propose sequences in relative cultural chronology that were not firmly anchored within an absolute chronology but that were narrower than any sequences distinguishable in absolute chronology. Like other archaeologists and anthropologists of his day, Rogers also tended to view cultures as normative entitiess, with a single culture producing largely identical units of behavior and consequently also producing largely identical archaeological sites and assemblages. Under these circumstances, it was natural that he used named periods and named cultures as the key elements of his culture history.

Periods and cultures continue to be commonly used units of classification and interpretation in California archaeology, along with a variety of other categories, including phases, horizons, stages, traditions, co-traditions, complexes, patterns, aspects, roots, stems, branches, industries, facies, and peoples (Society for California Archaeology 2011). Adding to the confusion of a proliferation of unit types, units of different types have often been given identical labels, and many writers do not specify clearly which type of unit is meant. For instance, "San Dieguito" has variously been used to designate an archaeological complex, a pattern, a culture, an industry, a tradition, a period, or a people.

Here it is proposed to discuss the prehistoric archaeological record in terms of just two main types of units: absolute time periods, and cultural patterns. Arguably, the availability of absolute dating techniques and regional chronological frameworks has rendered the use of named cultural periods obsolete and counterproductive. Relative chronological units, such as Rogers' Malpais, San Dieguito I/II/III, Pinto/Gypsum, Amargosa I/II, and Yuman I/II/III periods, are no longer needed or useful. If a component can be dated to the thirteenth century A.D., for instance, classifying it as "Patayan II" merely results in a loss of chronological precision. Other degrees of precision can be expressed in terms of millennia, date ranges (e.g., "ca. A.D. 500-1000"), or non-cultural geologic periods ("Pleistocene," "early Holocene," etc.).

Cultural patterns are used to highlight observed similarities or differences in artifact and assemblage traits. Such patterns may variously be indicative of particular time periods, cultural traditions, or functions. The essentially normative view that a pattern is necessarily diagnostic of a period or an ethnic identity, and that remains produced by a single group during a particular period can be expected to be largely uniform, is not accepted.

The archaeological record for the Colorado Desert can be discussed in terms of four successive periods, although it should be recognized that major discontinuities did not necessarily separate these periods. The periods may conveniently be defined as extending prior to ca. 10,000 B.C., between ca. 10,000 and 5000 B.C., between ca. 5000 B.C. and A.D. 500, and after ca. A.D. 500.

Prior to 10,000 B.C.

Archaeological remains that are said to extend well back into the Pleistocene have long been a focus of interest and controversy in the California deserts. A Malpais pattern has been proposed as being represented by archaeological materials that supposedly dating between ca. 50,000 and 10,000 B.C. (Begole 1973, 1976; Davis et al. 1980; Hayden 1976). The term was originally used by Rogers (1939, 1966) for ancient-looking cleared circles, tools, and rock alignments that he subsequently classified as San Dieguito I. The designation of Malpais continued to be applied to heavily varnished choppers and scrapers lacking any associated projectile points, found on desert pavements of the Colorado, Mojave, and Sonoran deserts. Although few would question that most of the Malpais specimens are genuine artifacts, methods for dating them remain extremely uncertain and have been challenged on several grounds (McGuire and Schiffer 1982:160-164).

In the 1970s, arguments for very early settlement of the Colorado Desert focused on the Yuha Desert, immediately to the west of IMP-3999 (Childers 1977; Minshall 1976). The radiocarbon dating of a cairn burial, "Yuha Man," to over 18,000 B.C., on the basis of caliche deposits on the cairn was vigorously debated (Bischoff et al. 1976, 1978, 1979; Childers 1974; Payen et al. 1978, 1979; Rogers 1977). More reliable dates based on the accelerator mass spectrometry (AMS) radiocarbon method applied to human bone fragments now place the burial well within the Holocene, at about 3000 B.C. (Taylor et al. 1985). An age in excess of 50,000 years was also claimed for reported flaked stone tools exposed by erosion in Yuha Pinto Wash, but the age of the materials and their status as artifacts have been questioned (Childers and Minshall 1980; Moratto 1984).

The earliest archaeological pattern in southern California that is fully recognized by researchers is the Clovis pattern, dated to around 11,500 B.C. Distinguished primarily by large, unstemmed projectile points with basal fluting, the Clovis pattern is widely represented throughout North America. Fluted points have reportedly been found in the Yuha Desert, as well as Cuyamaca Rancho State Park, Ocotillo Wells, and Lost Valley to the west and north (Davis et al. 1980; Kline and Kline 2007; Rondeau et al. 2007).

10,000 to 5000 B.C.

In the Colorado Desert, most of the rock features, cleared circles, and lithic assemblages lacking associated ceramics have been routinely assigned by many investigators to the San Dieguito pattern, which is now generally dated to the early Holocene. Rogers first distinguished the San Dieguito pattern in western San Diego County, based initially on surface surveys and subsequently through excavations at the C. W. Harris Site. His extensive surveys also identified the complex in the southern California deserts, including southwestern Imperial County, southeastern San Diego County, and northern Baja California (Rogers 1929, 1939, 1966).

San Dieguito lithic technology was based on primary and secondary percussion flaking of cores and flakes. Projectile points included forms with long, wide stems and weak shoulders ("Great Basin Stemmed" or "Lake Mojave" and "Silver Lake" types). Flaked crescents have sometimes been considered particularly diagnostic of the early Holocene period. A variety of edge tool forms have been distinguished, although it is open to question whether or not this variability was intentionally patterned. Milling implements seem to be absent or conspicuously rare. Faunal remains and burials are not documented. One interpretation has been that the San Dieguito pattern reflects a hunter-gatherer adaptation consisting of small, mobile bands exploiting both small and large game and collecting seasonally available wild plants but perhaps excluding hard seeds and nuts (Rogers 1966).

Rogers proposed to distinguish three successive San Dieguito phases, each characterized by the addition of new, more sophisticated tool types to the preexisting tool kit. San Dieguito I and II tools included bifacially and unifacially reduced choppers and chopping tools, concave-edged scrapers (spokeshaves), bilaterally notched pebbles, and scraper planes. Appearing in the San Dieguito II phase were finely made blades, smaller bifacial points, and a larger variety of scraper and chopper types. The San Dieguito III tool kit was appreciably more diverse, with the introduction of fine pressure flaking; tools included pressure-flaked blades, leaf-shaped projectile points, scraper planes, plano-convex scrapers, crescents, and elongated bifacial knives (Rogers 1939, 1966; Warren 1967; Warren and True 1961). Various attempts have also been made to seriate cleared circles into these phases, but without convincing results (Pendleton 1986). Because of the purely surface character of most desert sites and the scarcity of good chronological evidence, it has been difficult to test the validity of Rogers' San Dieguito I, II, and III phases. Some of the variations may have been present contemporaneously, in response to particular functional, ecological, or aesthetic requirements.

5000 B.C. to A.D. 500

The Pinto, Gypsum, and Amargosa patterns (designated in various ways) characterize the middle Holocene and the early portion of the late Holocene in the California deserts. These have been

interpreted as regional specializations within the general hunting and gathering adaptations that characterized the long period between ca. 5000 B.C. and A.D. 500. The patterns occur more frequently in the Great Basin, the Mojave Desert, and parts of the Sonoran Desert east of the Colorado River. Few of the large projectile points ("Pinto," "Gypsum," "Elko," and other types) have been identified on the desert pavements in the Colorado Desert, although that situation is beginning to change as the number of archaeological investigations increases. Some sites assigned to late portion of this period are known, indicating that occupations occurred along the boundary between the low desert and the Peninsular Range, and in other favored habitats (McDonald 1992; Schaefer and Laylander 2007).

It has been suggested that the environment of the California deserts was unstable and inhospitable during this period, particularly during the so-called Altithermal period between about 5000 and 2000 B.C., and that this condition forced mobile hunter-gatherers to move into more hospitable regions (Crabtree 1981; Schaefer 1994a; Wilke 1976). The paleoenvironmental data discussed above do not have the resolution to detect drastic short-term conditions. Lake Cahuilla may have mitigated any Altithermal effects on human occupation in the Colorado Desert.

Several Colorado Desert sites belonging to this period have been excavated in recent years. The most substantial is Indian Hill Rockshelter in Anza-Borrego Desert State Park. At that site, 1.5 m of cultural deposits were excavated below a Late Prehistoric component (McDonald 1992). Particularly significant were 11 rock-lined cache pits and numerous hearths, indicative of either a residential base or a temporary camp where food storage was integral to the settlement and subsistence strategies. Also recovered were numerous expanding-stem, concave-base ("Elko Eared") dart points, flaked lithic tools, and milling tools, as well as three inhumations, one of which was radiocarbon dated to 4070 ±100 B.P. Two rock-lined pits similar to those at Indian Hill Rockshelter, along with an accompanying assemblage assignable to this period, were excavated at a small rockshelter in Tahquitz Canyon near Palm Springs (Bean et al. 1995). The small number of artifacts at the site suggested strategically stored food processing equipment that was used by a small, mobile group. Several important sites have recently been documented from the northern Coachella Valley (Love and Dahdul 2002). Deeply buried midden deposits with clay-lined features and living surfaces, cremations, hearths, and a rockshelter deposit have been found at various sites in association with radiocarbon dates ranging from before 1000 B.C. to A.D. 700. Radiocarbon dates of almost 1000 B.C. and associated bird and fish bone confirm an early Lake Cahuilla occupational horizon, as well as early non-lacustrine phases. Larger habitation sites remained elusive in the Colorado Desert until 2006, when a series of deeply buried midden deposits and some house features were discovered under alluvial fan and dune formations at the very northern end of the Coachella Valley at Seven Palms near Desert Hot Springs (Mariam Dahdul, personal communication 2006). These findings bring Colorado Desert cultural history more in line with comparable late patterns in the Mojave Desert and the southwestern Great Basin during this period.

Early projectile points in Imperial County have generally been reported only as isolates on desert pavements, but a recent inventory at the Salton Sea Test Base produced a cluster of early projectile points, including "Lake Mojave," "Pinto/Gatecliff," and "Elko" forms, and even two eccentric crescents, scattered among protohistoric sites on the bed of Lake Cahuilla at elevations

about 30 m below sea level (Apple et al. 1997; Wahoff 1999). If these points were in situ, as the investigators suggested, then presumably they had escaped burial by lake sediments or were subsequently re-exposed. An alternative explanation may be that the points were collected elsewhere and reused by protohistoric occupants. Several large points have also been reported within the Truckhaven area. Direct evidence of an early occupation comes from the Truckhaven flexed burial (IMP-109), found under a cairn and dated to 5790 ±250 B.P. (Taylor et al. 1985; Warren 1984).

The emerging picture of occupation in the Colorado Desert during the later portion of this period is of mobile hunter-gatherer bands with atlatls for hunting and milling stones for seed and nut processing, operating out of a limited number of base camps in optimal areas on the boundaries of the Salton Basin and on the shoreline of Lake Cahuilla. This pattern may be viewed as a cultural precursor of the late prehistoric period, although linguistic data and tribal origin stories suggest that demographic displacements had also occurred within the late prehistoric past (Laylander 2011; Schaefer and Laylander 2007; Sutton 2009).

After A.D. 500

Sites dating after ca. A.D. 500 are more numerous than those known from any other prehistoric period in the Colorado Desert. The major innovations during these centuries were the introduction of the bow and arrow, probably shortly after A.D. 500; the beginning of substantial pottery production using the paddle-and-anvil technique, perhaps around A.D. 800; and the introduction of floodplain agriculture along the Colorado River and in its delta, which has been largely invisible archaeologically but may possibly date from around the same time. Cultural patterns within this period have been variously labeled as Patayan I/II/III (Colton 1945; Hargrave 1938; McGuire and Schiffer 1982; Waters 1982b), Yuman I/II/III (Rogers 1945), and Hakataya (Schroeder 1979).

Ceramics and agriculture probably reached the region from the east or south, either through the Hohokam communities in the middle Gila River valley or directly from Sonora in northwestern Mexico (McGuire and Schiffer 1982; Rogers 1945; Schroeder 1975, 1979). Bow-and-arrow technology may have diffused south from the Mojave Desert (Yohe 1992, 1998).

Ceramic analysis has provided the basis for attempts to distinguish finer chronological subdivisions within this period. Both Rogers (1945) and Michael R. Waters (1982a) proposed sequences of pottery types and traits as diagnostic of three distinct phases: prior to ca. A.D. 1000 (Yuman/Patayan I), between ca. A.D. 1000 and 1500 (Yuman/Patayan II), and after ca. A.D. 1500 (Yuman/Patayan III). The scheme was founded, in part, on a belief that Lake Cahuilla had been present between ca. A.D. 1000 and 1500 but was absent before and after those limits. However, more recent research has demonstrated that the lake was not present throughout the period A.D. 1000-1500 and that other lake stands had occurred both prior to A.D. 1000 and subsequent to A.D. 1500. The replicability and chronological significance of some of the ceramic types and traits have also been questioned (Laylander 1997a; Schaefer 1994a; Schaefer and Laylander 2007). These findings in turn cast some doubt on the viability of the Yuman/Patayan I/II/III phase distinctions.

The diversity of sites and assemblages associated with Lake Cahuilla indicates considerable variability in late prehistoric social and ecological adaptations to the lake (Wilke 1978). The number of house pits at fish camps ranges from one to more than a dozen, perhaps indicating the number of households in residence at any one time. Fish traps range from single examples to long lines that are suggestive of cooperative fishing ventures. Archaeological excavations of house pits indicate that some have well-developed middens and diverse artifact types, suggestive of season-long occupations, while others have only sparse artifact in association, suggestive of use during short-term fishing expeditions. Faunal assemblages vary from those largely limited to fish bone or the remains of migratory water birds, to others that contain more diverse resources, including rabbit and large mammal bone. This variability in site types and assemblage contents has yet to be correlated in a systematic manner with other variables, such as the recessional stages of Lake Cahuilla (reflected in site elevations), localized geography and paleoenvironments, ethnicity, or other factors (Schaefer 2000a; Schaefer and Laylander 2007).

Mobility was an important element in this pattern, probably involving frequent travel between Lake Cahuilla and areas outside of the Salton Basin when the lake was present. The numerous trail systems throughout the Colorado Desert attest to long-range travel to special resource collecting zones and ceremonial locales, trading expeditions, and possibly warfare. Pot drops, trailside shrines, and other evidence of transitory activities are sometimes associated with these trails (McCarthy 1993). Trade and travel is also seen in the distribution of localized resources such as obsidian from Obsidian Butte, wonderstone from the south end of the Santa Rosa Mountains and from Cerro Colorado just south of the international border, soapstone presumably from the mountains to the west, marine shell from both the Gulf of California and the Pacific coast, and ceramic types that were not locally manufactured. The Elmore site (IMP-6427) near Kane Springs contained evidence of Olivella shell bead manufacturing and other shell processing, trade, craft specialization, and possibly cultural connections with delta Yumans who may have been displaced during Lake Cahuilla's infillings (Laylander 1997a, 2006; Rosen 1995; Schaefer 2000b). Evidence of metate manufacture is also documented at several sites in the Superstition Mountain area where outcrops of Imperial Formation sandstone afforded a ready local material for milling equipment (Schaefer 1988).

Euro-American observers did not reach the vicinity of site IMP-3999 until the A.D. 1770s, when Anza's expedition from Sonora to coastal California passed through the area (Bolton 1930). However, earlier Spanish explorations on the Colorado River and its delta have some relevance here for the light they may shed on the hydrology of the Salton Basin and the distribution of native groups between 1539 and the early 1770s.

Francisco de Ulloa was the first European to reach the head of the Gulf of California in September 1539, although he did not enter the delta. He noted that the gulf's water had become "white, like river water" (Wagner 1929:20) and then subsequently muddy and reddish in color. It is clear that the Colorado River was flowing directly south into the gulf rather than into the Salton Basin during this period. If Lake Cahuilla had been present, most of the river's silt and clay would have settled through its relatively still waters; the low volume of the river in September would also likely have left little or no water to reach the gulf after losses through evaporation from the lake's surface had been subtracted. It has been suggested that Ulloa's reference to an *ancón* or tidal channel might hint at some awareness of the presence of a lake

farther north, but this seems unpersuasive (Carter 1964; Laylander 1997a; Polk 1991; Wagner 1925).

In 1540, Hernando de Alarcón sailed to the head of the gulf, entered the delta, and followed the Colorado River's course apparently as far north as its junction with the Gila River. Alarcòn's testimony seems to be conclusive that the Colorado River was flowing directly to the gulf at that time. His account also seems to locate several different native groups within the delta, although the interpretation is problematic. Two named groups are the Quicama (probably the later Halyikwamai) and the Coana (Kahwan), both speakers of delta Yuman languages (Forbes 1965; Hammond and Rey 1940; Kelly 1977; Laylander 1997b). Later that same year, Melchior Díaz reached the lower Colorado River overland from Sonora, but he died during his return trip, and no contemporary account of his exploration has survived.

The next visitors arrived overland from New Mexico under Juan de Oñate in 1604-1605, travelling down the Colorado River from its junction with the Bill Williams River to the head of the gulf. Testimony from this expedition establishes that the river was still (or possibly again) entering the gulf directly. Native groups encountered by Oñate between the Gila River and the gulf included, from north to south, the Osera (probably Piman speakers), Alebdoma (Halchidhoma), Coguana (Kahwan), Agalle and Agalecquamaya (Halyikwamai), and Cocapa (Cocopa) (Hammond and Rey 1953; Laylander 2004a).

Between Oñate's visit and the next Spanish entry into the delta area, a little less than a century elapsed. This was long enough for Lake Cahuilla to have completed a cycle of filling and recession, which is what seems to have happened. Eusebio Francisco Kino undertook several overland expeditions between Sonora and the vicinity of the delta from 1699 to 1706. His testimony establishes that the river was once again flowing south toward the gulf during this period. Whether a partial or nearly full stand of Lake Cahuilla might also have been present at this time is a matter of dispute; several lines of evidence suggest that it is improbable. Native groups in the delta, as reported by Kino, included the Yumas and Cutganes (Quechan), Coanopas (Kahwan), Hoabonomas, Quiquimas (Halyikwamai), and Bagiopas (possibly Cocopa). The Halchidhoma were now reported as living to the north of the Gila junction (Forbes 1965; Kelly 1977; Laylander 1997b, 2008).

ETHNOGRAPHY

Properly speaking, ethnography refers to cultural patterns that were observed during the historic period, in this case primarily during the first half of the twentieth century, or to descriptions of traditional culture that were remembered during that period. However, used with appropriate caution, it provides an invaluable source of analogies and inferences concerning earlier, prehistoric cultural patterns.

Site IMP-3999 lies close to the recorded ethnographic boundary between two groups, the Kumeyaay to the north and the Cocopa to the south (Heizer 1978). The location may also have been prehistorically visited by and is now of interest to a third group, the Quechan. Linguistic evidence concerning the origins of these groups and their potential time depths in this region are

initially discussed below, followed by descriptions of their traditional cultures, with particular emphasis on aspects of those cultures that are potentially reflected in the archaeological record.

Linguistic Identities and Prehistory

All three groups discussed in this section speak languages belonging to the Yuman family, which includes about 10 aboriginal languages in southern California, western Arizona, and northern Baja California. The Yuman family is linked with a sister family, Cochimí, in central Baja California. On a larger geographical scale, but much more dubiously, Yuman may have belonged to a Hokan phylum, containing languages and language families scattered around the margins of California and in western Mexico, and even to an Amerindian group encompassing most of the native languages of the New World (Golla 2007; Laylander 1997b, 2011).

Within the Yuman family, the three languages belong to Core Yuman, consisting of the entire family except for Kiliwa in northern Baja California. Core Yuman in turn contains three branches: Delta-California Yuman, River Yuman, and Pai. Diegueño (i.e., Kumeyaay) and Cocopa are both Delta-California Yuman languages, while Quechan is a River Yuman language. Pai is not represented in the Colorado Desert, but it consists of two languages: Upland Yuman (Yavapai, Walapai, and Havasupai) in western Arizona, and Paipai in northern Baja California. Because these Pai languages geographically straddle the Salton Basin and the Colorado River delta, there is good reason to believe that Pai speakers played a role in the region's prehistory (Laylander 2007, 2011).

Linguistic analyses can offer at least tentative clues concerning when and where linguistic divisions arose. Hokan, if it is a valid grouping, must have split apart well back in the middle Holocene, if not earlier. There is no specific reason to associate ancestral Hokan with the Colorado Desert. Yuman-Cochimí may have split apart around 2000 B.C.; based on center-of-gravity arguments, the most likely homeland for Yuman-Cochimí would have been in northern Baja California. Kiliwa may have split from Core Yuman around 1 A.D., and again northern Baja California is a likely location. The next split, between the three branches of Core Yuman, may have occurred around A.D. 500, and it is the first that almost certainly had implications for Colorado Desert prehistory. The linguistic ancestors of the Cocopa and Kumeyaay may have separated by around A.D. 1000, but whether their homeland was most likely to have been in the Colorado Desert or near the Pacific Coast is unresolved. Divisions within Diegueño have most commonly been treated as constituting at least three distinct languages: Ipai in the north; Kumeyaay in the center and east, presumably including the area of site IMP-3999; Tipai in the south, primarily in Baja California; and perhaps also Kwatl in the far south, at Santa Catarina. Others have interpreted these differences within the Diegueño group as being only at the level of dialects rather than languages; in any case, the separations that they represent probably began within the second millennium A.D. and most likely in the western portion of Yuman territory (Laylander 2011).

The Kumeyaay

The principal ethnographic source that specifically discussed the desert-adapted Kumeyaay of Imperial Valley (also known, at least in part, as the Kamia) was written by Edward W. Gifford (1918, 1931). A major study by Edward F. Castetter and William H. Bell (1951) addressed

ethnobotany, agriculture, and land-use patterns among the Yumans on the Lower Colorado River, including the Kamia. For the Kumeyaay and Tipai of the Peninsular Range, the principal references are by Constance Goddard DuBois (Laylander 2004b), Thomas T. Waterman (1910), Leslie Spier (1923), Philip Drucker (1937, 1941), William D. Hohenthal, Jr. (2001) , and Florence C. Shipek (1982, 1989, 1991, 1993). Overviews and interpretations of Kumeyaay ethnography include those prepared by Frederic N. Hicks (1963), James P. Barker (1976), Katherine Luomala (1978), and Martha Knack (1981).

The Kamia occupied areas along the New and Alamo rivers, as well as springs and walk-in wells in Imperial Valley. During the ethnohistoric period, the Kamia were politically and militarily allied with the Quechan and Mohave, in opposition to the Cocopa, Halchidhoma, and Maricopa. The Kamia were permitted a farming rancheria at the large Quechan settlement of *Xuksil*, located a few miles south of the modern Mexican town of Algodones (Gifford 1931).

The Kamia were organized into 10 or 11 non-localized, exogamous patrilineages. Many Kumeyaay living to the west were also members of these same lineages, leading Gifford (1918, 1931:301) to conclude that the Kamia were, in essence, desert Kumeyaay who had assimilated many aspects of River Yuman culture. Lineage identification with specific locations was probably related to the settlement preferences of individual families who moved as lineage segments, rather than lineage territoriality. Gifford (1931:14) did suggest that a greater degree of lineage localization may have existed in the past but that it was inhibited by the mobility requirements for exploiting the shifting arable lands. As most of the lineages' totemic associations were with either the wildcat or the coyote, which were the totems of Cahuilla, Cupeño, and Serrano moieties, the Kamia may have had elements of a moiety system, although the Kamia were exogamous by lineage and not by totemic association. The economic unit was the extended family household consisting of a man and his wife or wives, their parents, and their children. Probably as a result of close contacts with the River Yumans, the Kamia maintained a greater degree of "tribal" identification than their Kumeyaay kinsmen to the west, recognizing a tribal "chief" over all of the lineages, an achieved rather than ascribed status and a role focusing on the organization of economic activities, warfare, and diplomacy.

The Kamia lived in rectangular, semi-subterranean structures of post-and-beam construction with thatch and earthen roofs. They also built ramadas, lean-tos, and conical sweathouses. They constructed their dwellings some distance apart, on or adjacent to arable alluvial terraces and as close as possible to running water, hand-dug walk-in wells, or sloughs. They had no permanent villages, and their moves were dependant on the availability of floodwater farming areas and the ripening stands of wild plants. They would move to higher terraces if flooding occurred. Some years, seasonal overflow from the Colorado River into the New and Alamo river sloughs failed to occur and the Kamia had to move to other locations, including the Colorado River valley (Gifford 1931).

The Kamia practiced a mixed economy of horticulture and hunting and gathering. Mesquite (*Prosopis pubescens*) was the most important wild staple crop. Acorns were either obtained directly in the Peninsular Range or through trade with the western Kumeyaay in exchange for cultigens, especially watermelons. The Kamia also procured baked and dried agave cakes from the western Kumeyaay but did not participate in the early spring agave harvest. Tule pollen and

roots were gathered from sloughs, one favorite spot being Seven Wells on the east-west portion of the Alamo River south of the U.S.-Mexico border. Gifford (1931:24) reported on another marsh plant called *wāró*. The seed capsules were pulled off by hand over a ceramic pot and the capsules were rubbed until the seeds were freed. The pods were then winnowed away with a ceramic dish. The seeds were ground on a metate and eaten dry. Either wooden mortars or stone metates were used on many wild seeds, followed by cooking. Among them were saltbush (*Atriplex* sp.), yerba mansa (*Anemopsis californica*), and sedge (*Cyperus erythrorrhizos*). Gifford's (1931:27) informants apparently had no knowledge of the widespread practice of parching seeds prior to grinding. As with the River Yumans, fish was a principal protein source, supplemented by hunting of rabbits and large mammals.

The Cocopa and the Delta Yumans

Important ethnographic reports describing the Cocopa include studies by Fred B. Kniffen (1931), Gifford (1933), Drucker (1941), Castetter and Bell (1951), and William H. Kelly (1977). Ethnographic and historical syntheses were prepared by Hicks (1963) and Anita Álvarez de Williams (1974, 1975, 1983).

The Delta Yumans were the first Yumans to be contacted by the Spanish, beginning with Hernando de Alarcón in 1540. Subsequent encounters occurred in 1604-1605 and in several visits around the start of the eighteenth century, and continued intermittently beginning in the 1770s. A variety of ethnic designations were attached to the peoples of the delta by the Spanish explorers, who generally recognized the presence of several politically distinct entities, among whom the Cocopa, Halyikwamai, and Kahwan were most frequently recognized. During the period when the lower Colorado River was still essentially independent of European control, conflicts among the Yuman groups resulted in substantial displacements of populations. The Halchidhoma apparently moved from the delta below the Gila River junction to an area higher up the river, around Blythe, in the course of the seventeenth century. The Halyikwamai, Kahwan, and Halchedhoma had all moved to the middle Gila River, resettling among the Maricopa, by the early nineteenth century. Of the Delta Yumans, only the Cocopa have remained in their traditional homeland (Kelly 1977:4-10; Laylander 2008; Spier 1933).

Castetter and Bell (1951) estimated that the Cocopa derived about 30 percent of their diet from agricultural crops, including maize, beans, squash, melons, and various semi-wild grasses. The delta seemingly offered a prime field for floodplain agriculture, but Cocopa reliance on domesticated crops appears to have been less intensive than that of the River Yumans upstream from them. In part, this may reflect the readier access that the Cocopa enjoyed to a range of other resources, including many wild plants in the delta, marine resources in the upper Gulf of California, and montane resources available seasonally in the Sierra Juárez to the west (Kelly 1977; Castetter and Bell 1951).

The Cocopa were heavily involved in the system of alliances and warfare among the peoples of the lower Colorado River, being allied with the Maricopa and hostile to the Quechan and Mohave. However, the degree of nation-level political unification among the Cocopa seems to have been lower than among the Quechan, or perhaps even than that among the Kamia. Several essentially independent bands were remembered as existing within the delta, with inherited

patrilineal leaders, but no leaders or institutions at the national level were recognized (Kelly 1977:78-82).

The apparent emphasis on warfare among the cultures centered on the lower Colorado River has led to considerable discussion of its cause. Gifford (1931:161), Clifton B. Kroeber (1980), and Kroeber and Bernard L. Fontana (1986) stressed the deeply ingrained ideological and cultural values that were attached to personal battle within Yuman culture. They argued that fighting was seen by participants as a necessary means to enhance the spiritual power of the entire tribe, without regard to any material benefits. Chris White (1974) stressed the ecological reasons for warfare related to environmental circumscription, high population densities, and periodic environmental perturbations. In fact, both aspects probably operated to shape the Yuman warrior tradition over time, with economic circumstances motivating the development of a distinctive ideology. In the end, ecological and ideological factors would have been intertwined in a complex and dynamic system, much as Roy A. Rappaport (1968) demonstrated for the role of warfare among New Guinea tribal people.

The Quechan and the River Yumans

A number of important ethnographic and ethnohistoric sources are available on the Yuman peoples of the Lower Colorado River and its delta (Stewart 1983). Specifically for the Quechan, several ethnographic and historical studies have been prepared by John P. Harrington (1908), Alfred W. Kroeber (1920, 1925), Drucker (1937), C. Daryll Forde (1931), Casteller and Bell (1951), Jack D. Forbes (1965), and Robert L. Bee (1981, 1983, 1989).

The River Yumans were generally successful in maintaining their independence against Spanish colonial and missionary pressures and their relative spatial and cultural isolation from Euro-Americans. Because of this, the River Yumans continued their traditional languages, religions, and cultural practices to a greater degree than most coastal California groups. Early ethnographers in the period between 1900 and 1950 were able to record a rich oral literature and reconstruct pre-contact lifeways to a considerable degree (Drucker 1937; Forde 1931; Kroeber 1925). However, many aspects of traditional technology, such as ceramics and the production of flaked and ground stone tools, had been lost due to the rapid adoption of western material culture in the twentieth century. Yuman emphasis on spiritual concerns over material things and a preoccupation with warfare meant that a rich oral tradition of myths, epic stories, and battle narratives was still extant at the beginning of the century and has continued to the present (Harrington 1908; Kroeber 1948, 1951).

Under aboriginal conditions, the focus on riverine subsistence resources encouraged a mixed foraging way of life for the River Yumans. Small-scale agriculture supplemented foods procured during seasonal rounds of hunting, fishing, and gathering. Castetter and Bell (1951) estimated that about half of the Mohave diet and about 30 percent of the Cocopa diet derived from farming; the Quechan diet was put somewhere between those two groups.

It appears that agricultural strategies were designed to optimize the use of floodwaters to bring the necessary moisture to the fields, which tended to be quite small in size (2-3 acres). Seeds were planted in newly deposited sediments after the floodwaters had receded. The river Yumans also used more than 75 wild plant foods as food sources, the most important being mesquite and

screwbean. Their primary source of dietary protein came from fish caught in the Colorado River. Among the more important species were the razorback sucker (*Xyrauchen texanus*) and Colorado pikeminnow (*Ptychocheilus lucius*). This emphasis on fishing the same species that entered Lake Cahuilla when the lake was present may have endowed the Colorado River groups with a relatively strong pre-adaptation to Lake Cahuilla's resources, as compared with other groups such as the Kumeyaay and Cahuilla. Ethnographic sources indicate the use of drag nets, bow and arrow, basketry scoops, scoop nets, and fish weirs of woven vegetal material that were built against the river bank or across sloughs (Forde 1931:119).

Regularly hunted game included small mammals such as rabbits, squirrels, and packrats. Larger game that figured in the diet included deer and bighorn sheep, but these were probably hunted less frequently and were less abundant than small game. However, the meat from large game was highly regarded by the River Yumans, particularly in winter, when reliable sources of dietary fat were in especially short supply (Castetter and Bell 1951:214-217; Forde 1931:118; Stewart 1947).

Jeanne Swarthout and Christopher E. Drover (1981) proposed a model to characterize Quechan and Halchidhoma settlement and subsistence strategy on the Colorado River below Topoc. Residential bases were centered on the Colorado River but conformed to a bimodal pattern. Spring and summer houses were located near each agricultural field but on the mesas, safe from floods (Kelly n.d.:55), while open-air ramadas were constructed on the floodplains adjacent to the fields. Small parties sought out wild vegetal resources along the floodplain and adjacent washes. Mesquite and screwbean were relied upon as stored staples during the winter months, especially if domestic crop harvests were inadequate. The winter season was a time to relocate to residential bases on higher Colorado River terraces, lower bajadas, and lower mountain slopes. Winter homes were more substantial earth-covered lodges (Kelly n.d.:55). The population subsisted on stored domestic and wild foods, in addition to what wild game could be had. Additional temporary camps would be established in outlying areas for extracting specific animal, vegetal, or lithic resources. The population would then resume their lower terrace residences as soon as the spring floods had subsided.

River Yuman groups were organized into nonlocalized, patrilineal, exogamous, totemic clans or sibs. Each clan or *šimul* was named after a plant, animal, or natural object, but this name was borne only by female members (Gifford 1918). There were no clan leaders, and the clans did not have special ceremonial or sociopolitical functions. Clan members were not localized at specific rancherias, which instead contained members of several different clans.

Each localized rancheria or band recognized a leader (*pi'pa taxa'n*) who was called upon to settle disputes, to be responsible for the social and economic welfare of his people, to decide on seasonal moves, and to determine when to relocate the entire rancheria. His power was quite restricted, and he had limited influence. His position was achieved through dreaming, force of character, and demonstrated ability. Each tribal group also recognized a paramount chief (*kwoxot*) who might rise from the ranks of the rancheria leaders. This position may have become more important in post-contact times under the influence of Euro-American political and military institutions. Prowess in warfare was not required of the chief; indeed, the *kwoxot* was expected to

remain in the village and refrain from participating in battles. Special war leaders (*kwanami*) were recognized for that role (Bee 1983; Forde 1931).

Unlike other southern California groups, in which the primary political allegiance and identity was with the residential band (a localized clan or lineage in the case of the Cahuilla, but possibly a mix of lineages among the western Kumeyaay), members of each major ethnolinguistic group on the Colorado River thought of themselves as belonging to a consolidated people who lived as a true nation within their nation's territorial limits. Julian H. Steward (1955:159-161) postulated that Yuman clans had evolved from localized patrilineages (like those of the Cahuilla and perhaps the Kumeyaay), which had subsequently become dislocated and clustered into larger settlements. This had resulted from the higher population densities afforded by the introduction of horticulture. Growing population size in other areas of southern California brought about increased localization of bands, but instead of an increase in band size there was multiplication of bands and shrinkage of band territories. This did not happen on the lower Colorado River, where people moved freely from one settlement to another. Entire settlements also shifted within the confines of the river's floodplain, depending on the location of arable land after each flood season. Steward identified warfare as a factor inhibiting the localization of clans and promoting increases in band size. This afforded greater protection against raids and ensured a unified military response to enemy attacks. Members of tribal groups such as the Quechan therefore possessed a national identity unlike most California groups, where rancheria or lineage membership was the highest basis for group solidarity.

Hicks (1963, 1974) expanded on this model of cultural change to hypothesize that all Yuman clans at one time were patrilocal and had ascribed band territories. Like the western Kumeyaay, groups expanded or contracted their band territories in the face of shifting food abundance or population size. They also had the ability to fuse into larger, multi-band settlement groups or to fission into dispersed residence units when environmental conditions demanded, but still within a system of clan-specific territories. Exogamous marriage rules also permitted friendly accommodation of guest-residents if one clan experienced localized environmental stresses. It was a response to basic ecological adaptations to horticulture on the shifting arable alluvium of the Colorado River's floodplain that led to the de-localization of River Yuman clans, because limited farm land that shifted in size and configuration after each flood cycle demanded more residential mobility and the need to move as circumstances dictated within the larger tribal territory.

It is difficult to portray the complexity and the esoteric nature of traditional River Yuman spiritual beliefs, because they formed a dynamic belief system in which dreaming, adherence to traditional learning, personal experiences, and varying patterns of acculturation affected their expression. This worldview stressed the interconnection of daily life with religion, unlike contemporary Western society where the sacred and secular are more sharply segregated. The secular world was believed to exist concurrently with the spiritual and mythological world, and the latter could be experienced through dreams, vision quests, song cycles, the telling of the creation narrative, and many other oral traditions (Hinton and Watahomigie 1984; Kroeber 1925, 1948).

4. RESEARCH ISSUES

This section briefly identifies themes to be addressed by the data recovery program at site IMP-3999. Preliminary matters concern the chronological placement of the site and its contents, and an assessment of its depositional integrity. Potential contributions to regional archaeological research include defining the chronology of Lake Cahuilla, advancing the debate concerning settlement patterns associated with the lake, defining patterns of resource utilization, assessing evidence of intercommunity exchange and travel, and attempting to identify the cultural affiliation of the occupants of Lake Cahuilla's southern shores.

PRELIMINARY ISSUE – CHRONOLOGICAL PLACEMENT

The chronological placement of site IMP-3999 is a question that does not, in itself, constitute a regional archaeological research issue but that is a prerequisite to effectively addressing most such issues. It is known that the site dates, at least in part, from the late prehistoric period, based on the presence of aboriginal pottery. It is also likely that it dates, at least in part, from a period when Lake Cahuilla was at or near its maximal level, based on its location at the maximum shoreline and within an otherwise-uninviting region. However, if their chronological placement can be more sharply defined, the value of the data recovered from the site will be substantially enhanced.

Euro-American artifacts or ecofacts that are datable to the A.D. 1600s would confirm an association between the site and the final stand of Lake Cahuilla that occurred during that century. However, such materials are very unlikely to be encountered. Other sites at the lake that contain seventeenth-century deposits have not yielded any such materials (e.g., Laylander 1997a; Schaefer 2000b).

Radiocarbon dates, when they could be obtained, have traditionally provided the most reliable and precise method for dating archaeological sites in this region. Organic materials such as charcoal, bone, or shell are not mentioned in the records that have been consulted concerning site IMP-3999, but the data recovery excavations may be able to recover such materials. A possible drawback to radiocarbon dating in this instance is that, because of the large amounts of fossil carbon that has poured into the atmosphere since the beginning of the Industrial Revolution, radiocarbon dates subsequent to about A.D. 1650 become substantially more difficult to delimit precisely.

Thermoluminescence dating offers a relatively new but promising chronometric tool. Artificially fired materials, such as the ceramics and fire-affected rock that have been reported at IMP-3999, can be tested to determine the amount of time that has elapsed since their firing.

Obsidian artifacts may offer another potential chronometric tool. If obsidian is present, measurement of hydration rinds to arrive at rough relative or absolute dates may be possible. However, obsidian hydration dating must still be considered an experimental method within this region, with the calibration rate not firmly established (Chace 1980; Dominici 1984; Koerper et

al. 1986; Laylander 1997a; McFarland 2000). Obsidian has not previously been reported at IMP-3999. If obsidian is found to be absent from a substantial assemblage of lithic artifacts, this would be strong confirmation that the occupation of the site occurred during a period when Lake Cahuilla barred access to the Obsidian Butte source, given the desirability of the material for tool making and the source's reasonably close proximity (55 km) to the site. If obsidian is present, this would suggest either that the site was occupied at a time when the lake was not present in the vicinity or that scavenging of obsidian from older archaeological sites was occurring; the latter hypothesis could be addressed by looking for the presence or absence of multiple hydration rinds on the specimens.

Type and trait analyses of Lower Colorado Buff Ware ceramics offers the most promising artifact-based approach to determining the chronology of the site. However, this method is not without very serious drawbacks. Waters (1982b) offered the most comprehensive and widely acknowledged scheme for such an analyses, but questions have been raised concerning both some of the chronological ranges that were proposed by Waters and the replicability of sherd classifications that are based upon his scheme (e.g., Apple et al. 1997; Hildebrand 2003; Laylander 1997a; Schaefer 1994a, 1994b, 2000a; Schaefer and Laylander 2007).

PRELIMINARY ISSUE – INTEGRITY

Another preliminary question concerns whether the archaeological remains at IMP-3999 are substantially in situ, in the locations where they were deposited prehistorically, or whether they have subsequently been redeposited from the eroding lake berm. In the latter case, their value for addressing regional research issues may be substantially diminished.

Site IMP-3999 is recorded as located at [redacted]
Additional surface and subsurface observations of artifact distributions and possible features may shed further light on this issue.

RESEARCH ISSUE – LAKE CAHUILLA CHRONOLOGY

Important advances in defining the chronology of Lake Cahuilla's stands have been made during the last few decades, but many issues remain unresolved or poorly defined. Investigations at site IMP-3999, [redacted] may be able to advance our understanding of some of those issues.

It is likely that the archaeological deposits at IMP-3999 date from one (or more) of the lake stands during the last 1,000 years, as suggested by the presence of pottery. When, precisely, was the lake present at its maximum level? Did an early lake stand begin as early as the twelfth century A.D. and continue as late as the fourteenth century? Did another stand span the middle to

late fifteenth century? Had the final full stand already ended before the middle of the seventeenth century (Laylander 1997a), or did it continue through the end of that century or even beyond (Thomas Rockwell, 2010 personal communication)? How many distinct full stands and more-than-seasonal recessions are recognizable in the lake's stratigraphy near the maximum shoreline?

Radiocarbon dates, based on organic material in both cultural deposits and natural strata, may be obtainable at the site in order to address these questions. Thermoluminescence dating of ceramic sherds and fire-affected rock is also likely to be possible at this site and may be pertinent in particular to the seventeenth and eighteenth centuries. It is possible that obsidian hydration dating may also be able to make a contribution to the discussion.

RESEARCH ISSUE – SETTLEMENT PATTERNS

An ongoing issue has concerned the importance and permanence of settlement at Lake Cahuilla. Was the shoreline a magnet that drew large groups of migrants into the Salton Basin from surrounding regions for seasonal or year-round settlement when the lake was present? Or were lacustrine resources used primarily or exclusively on a more incidental and temporary basis, by groups that were more permanently based elsewhere, for instance in the Peninsular Range or on the Colorado River?

Homer Aschmann (1959), James F. O'Connell (1971), and Wilke (1978) suggested that major population relocations to and from Lake Cahuilla occurred in response to its cycles. This "Wilke model" was based at least in part on archaeological evidence for substantial perennial settlement near the lake's northern end, in the Coachella Valley. Jackson Underwood (2011) recently suggested that archaeological evidence of "temporary camps" (a classification that has been applied to IMP-3999) along the southern sections of the Lake Cahuilla shoreline may be misleading, because the Yuman groups on the Colorado River and its delta were accustomed to live in dispersed rancherias rather than within strongly nucleated villages. According to Underwood's hypothesis, groups from the Colorado River's delta relocated to the lake shore when the river shifted away from the delta to fill the lake, and returned to the delta when the lake desiccated.

A contrary view was proposed by Margaret L. Weide (1976) and generally supported by Schaefer (1994a). According to the "Weide model," the lake's instability or impermanence discouraged too great a reliance on its resources, and their use was sporadic and incidental within the larger regional settlement system, particularly in the case of the eastern shoreline.

Investigations at IMP-3999 may be able to shed light on the question of whether this site was used as a temporary camp, or whether it was occupied for a more extended period as a residential base by a small (family-sized) group. The functional range of artifacts present at the site may provide one clue: a residential base would be expected to contain evidence of more diverse activities than a temporary camp. Another line of evidence may be the amount and character of non-local items that are present in the assemblage. While some artifacts of exotic origin might well be carried along during a group's move to a temporary camp, the camp's occupants would not be expected to have made extended treks to bring in distant resources in a logistical manner.

Another indicator might be the relative importance of resource processing and resource consumption; a temporary camp might see a substantial amount of processing of resources that were to be subsequently consumed elsewhere, whereas processing and consumption would probably be more evenly balanced at a residential base.

RESEARCH ISSUE – RESOURCE UTILIZATION

Evidence concerning the range and the ratios of different resources that were processed or consumed at site IMP-3999 may help to shed light on wider patterns of lacustrine and non-lacustrine resource use in the Colorado Desert during periods when Lake Cahuilla was present. Some general inferences may be drawn from the types of artifacts and features that are present at the site. However, more specific evidence would come from faunal remains and protein residues, if those are present and preserved.

An issue of particular importance concerns the role, if any, of domesticated crops in this region. The dating of the advent of agriculture in the lower Colorado River valley is still very imperfectly known, and the timing of its introduction in the Imperial Valley is still more uncertain. If residues from agricultural crops are detectable and datable, they would potentially shed significant light on evolving regional adaptations.

RESEARCH ISSUE – EXCHANGE AND MOBILITY

How how strong were the prehistoric trade and travel links between the southwestern Salton Basin the surrounding regions, and how widely did they extend? This issue may be addressable at IMP-3999 through analysis of lithic materials, ceramics, and perhaps faunal remains.

Previously reported lithic materials at the site include [redacted] More geographically disgnostic materials that may possibly be encountered at the site include obsidian and "wonderstone." Obsidian would potentially have been available from the Obsidian Butte source, about 35 km to the north of IMP-3999, but only when the lake stood lower than 40 m below sea level. The nearest alternative obsidian source was located near San Felipe in northeastern Baja California, about 200 km to the south of IMP-3999 (McFarland 2000). Wonderstone, a fine-grained, silica-rich material, has been reported at two Colorado Desert sources: Cerro Colorado, in northern Baja California, about 15 km southwest of the site; and Rainbow Rock, in northwestern Imperial County, about 150 km northwest of the site (Pigniolo 1995). If these materials are present at the site, x-ray fluorescence studies may be able to match them with their sources.

Pottery may also be geographically diagnostic, although with difficulty. Tumco Buff (or type BT), characterized in particular by the scarcity of its mineral inclusions, was previously argued as having been produced in the lower Colorado River valley, but recent observations at sites to the west of Lake Cahuilla suggest that it was also made locally produced; the essential chemical

identity of the clays deposited in the two areas and the scarcity of inclusions would make distinguishing such sherds' origins difficult (Waters 1983a; Schaefer, personal communication 2011). Brown ware, as distinct from buff ware, has often been treated as a marker for pottery produced in the Peninsular Range rather than locally in the Colorado Desert. However, a Salton Brown type manufactured within the Salton Basin has been increasingly recognized, although it is difficult to distinguish macroscopically from the Tizon Brown type produced in the Peninsular Range (Gallucci 2001, 2004; Hildebrand et al. 2002). X-ray fluorescence analysis may be useful in distinguishing a mountain or desert origin for the brownware sherds at IMP-3999.

RESEARCH ISSUE – CULTURAL AFFILIATION

Discriminating the ethnic identity of the occupants of Lake Cahuilla sites is an important issue for understanding the character of regional settlement systems as well as the degree of cultural instability within the wider region (Laylander 2006; Underwood 2011). Potential candidates, at least for sites dating from the second millennium A.D., include the Kumeyaay and Cahuilla on the west, the delta Yumans (including the Cocopa and others) on the south, and River Yumans (e.g., Quechan, Halchidhoma, and Mohave) on the east.

Unfortunately, the definition of archaeological signatures to distinguish these groups is somewhat problematic. Exotic materials indicative of long-range exchange and mobility, as discussed above, would provide one potential form of evidence at IMP-3999. Specific resources, such as marine resources from the Pacific or Gulf of California coasts, or agricultural products, would provide another. If decorated or stylistically formed ceramic items are present at the site, these items might be helpful, but such items appear unlikely to be encountered.

5. PROPOSED METHODS AND SCHEDULE

This section discusses the various data recovery methods to be applied at site IMP-3999. These include field techniques, standard laboratory methods, special studies, reporting and dissemination of the results, and curation of the collection.

FIELD METHODS

Field methods to be applied during the data recovery program include mapping, surface recording, surface collection, magnetometry, shovel test excavations, standard unit excavations, and backhoe trenching. Arrangements will be made for a Native American monitor to be present during all ground-disturbing fieldwork.

Mapping and Surface Recording

A GPS mapping system will be used to plot all surface observations and landscape features in relationship to a reference grid and to create working field maps and final report-quality maps. Mapping will be oriented from a temporary site datum point georeferenced on the UTM coordinate system with an accuracy to 50 cm using Differential Global Positioning Systems equipment. This datum point and the grid will be established to plot the location of all points or grids for surface-collected artifacts, magnetometry grid points, shovel test excavations, standard unit excavations, and trenches. Photographs will be taken to record the condition of the site, the investigations in progress, and the location of any site features.

Surface Collection

A complete collection of prehistoric materials, excluding fire-affected rock, from the surface of the site will be undertaken, either by using a point-provenience method (grouping all artifacts within a 1-m radius) if artifacts are sparse enough to make that approach practicable, or by using a grid of 10-x-10-m collection squares. This will be done in order to recover a substantial sample of artifacts for analysis and to mitigate both direct impacts and indirect impacts to portions of the site that do not lie within the direct-impact areas.

Pottery sherds will be collected and bagged together with samples of the underlying sediment, in order to provide materials for thermoluminescence dating.

Samples of fire-affected sandstone rock will be collected to serve two objectives: for thermoluminescence dating of the site, and for use in archaeological experiments to attempt to distinguish possible natural reddening of the rocks from culturally produced reddening in hearths or earth ovens.

Remote Sensing – Magnetometry

Magnetometry will be used to attempt to locate subsurface cultural features such as hearths or earth ovens which may then be exposed by excavation. The method will be applied in the four portions of the site where towers, pull sites, and access roads are to be constructed.

This method is able to provide compositional information about subsurface deposits by measuring local magnetic fields and the global magnetic field. Cultural features that may generate anomalies in magnetometer data include hearths, fire-affected rocks, ceramics and bricks, ditches, and pits or burials. These features tend to have different physical properties than their surrounding soils.

The magnetometry survey will be conducted in grids so that data from multiple days can be easily appended to other grids. Corners of the grids will be referenced to an arbitrary datum and/or recorded utilizing a GPS unit. The survey grids will be laid out with nonmagnetic metric tapes and stakes. Any vehicles or other large field equipment that may interfere with the area's magnetic field will be noted or moved farther away if possible; any metallic ground debris or materials in the immediate vicinity will be removed. Metallic objects and electronic equipment in possession of the person performing the survey will also be removed. A rope will be placed between the tapes along the direction of the survey and will be marked at every 1 to 5 m in the absence of a GPS unit attached to the magnetometer. The marks on the rope will provide a guide for when to mark location information on the data recorder. This provides a measure of distance for the recorded data. The orientation of the sensors will remain the same throughout the survey. The survey will therefore be unidirectional when using the mag-harness. Transects in increments of 0.5 to 1 m will be surveyed, usually beginning in the southwest corner of each grid. The bottom sensor will be kept approximately 10 cm above the ground surface at all times so as to not generate erroneous changes in the measured magnetic fields. Analyzed magnetometry results will be processed and available on the day following their collection.

Shovel Test Excavations

Shovel test pits (STPs) will be used to probe for the possible presence of substantial subsurface cultural deposits in the areas of direct project impacts. Locations for the STPs will be judgmentally selected to avoid highly disturbed areas. A maximum of four STPs will be excavated at the temporary tower site and two additional STPs at the southern pull site at location A. At locations B and C, a maximum of four STPs will be excavated at each of the temporary tower sites and one STP in each of the access road alignments. At location D, a maximum of two STPs will be excavated in the portion of the temporary tower site within the site boundary. Thus, a maximum of 18 STPs will be excavated at the site. If a given area is found to contain a substantial subsurface archaeological deposit or features, further STPs will not be excavated in that area, but further investigations will be made using standard unit excavations.

Each STP will be 50 cm x 40 cm in area, excavated in 20-cm surface-parallel levels, continuing as deep as practicable. All excavated deposits will be sorted through 3-mm (1/8-in.) mesh screens. All cultural materials (except fire-affected rocks) will collected, bagged by provenience, and transported to the laboratory for cataloging, analysis, and curation, as appropriate. Sediment samples associated with ceramic sherds will be collected to assist in thermoluminescence dating.

Samples of fire-affected rocks, along with associated sediment samples, may be collected for thermoluminesce dating; otherwise, fire-affected rocks will be noted and counted in the field but not collected. STP forms will be completed, summarizing the dimensions of the excavations, their results, and stratigraphic observations. All STPs will be backfilled after their completion.

Standard Unit Excavations

Standard units will be excavated in order to recover more substantial samples of subsurface cultural materials, to expose subsurface features, and to assess stratigraphic contexts and integrity. Standard units will be judgmentally placed in areas that appeared to be most likely to contain significant, intact subsurface deposits, based on the evidence from the surface observations, STPs, and magnetometry. If no such areas are identified, no standard units will be excavated. A maximum of 20 units will be excavated, unless exceptional circumstances are encountered and additional excavation is approved.

Standard units will be 1 x 1 m in area and will be generally excavated in 10-cm surface-parallel levels. Adjacent 1-x-1-m units may be excavated to expose larger areas, particularly if subsurface features are encountered. Efforts will be made to excavate deposits within a feature separately from deposits located outside of the feature within the same levels. Exposed features will be photographed and sketched. Procedures for screening and collecting at the units will be the same as for the STPs. After the excavation of a unit has completed, it will be photographed, a stratigraphic profile of one sidewall will be drawn, and the unit will be backfilled.

Trenching

A backhoe trench will be excavated at each of the four temporary tower sites. These trenches will serve two objectives. The first will be to test for the presence of any deeply buried cultural deposits or features. It is considered unlikely that such deposits or features will be encountered, but if they are, they will be documented, samples of any cultural materials will be recovered, and a plan concerning appropriate further investigations of the buried deposits will be developed in consultation with the USDI BLM archaeologists. The second objective of trenching will be to expose stratigraphic sections in order to shed further light on the sequence of natural sedimentary events at Lake Cahuilla. A geomorphologist will examine the exposures, document them in writing and by photographs and sketches, and, as appropriate, collect samples for radiocarbon dating.

Each trench will be excavated to a maximum depth of 150 cm. The lengths and widths of the trenches will be the minimums necessary to accomplish the task safely. Excavated sediment will be casually inspected for possible cultural material but will not be systematically sorted. The trenches will be backfilled when the investigations at them are completed.

NAGPRA compliance

Any human remains, grave goods, items of cultural patrimony, or sacred objects encountered at site IMP-3999 during the data recovery program will be treated according to the provisions of the Native American Graves Protection and Repatriation Act (NAGPRA), its implementing regulations (43 CFR 10), and California Health and Safety Code 7050.5 and Public Resources Code 5097.98.

If human remains are discovered under any circumstances, all undertaking-related activities will halt immediately within 30 m of the location of the discovery. The human remains will be carefully covered and secured to protect them from degradation by weather or the actions of unauthorized individuals. The Imperial County Coroner will be asked to determine whether the remains are of an unrecorded dead body as defined by California statutes (California Health and Safety Code 7050.5 and Public Resources Code 5097.98) and whether the remains are part of a crime scene. If the remains are part of a crime scene, local law enforcement will assume jurisdiction and responsibility. If the remains are not part of a crime scene and are identified as Native American, the Coroner will notify the California Native American Heritage Commission. USDI BLM will develop a plan for further treatment of the remains and the site, in consultation with appropriate Native American groups and individuals.

LABORATORY METHODS

Laboratory work will include standard processing and cataloging of the materials recovered in the field, and special studies to address the program's research issues.

Standard Processing and Cataloging

Materials recovered from the field will be initially sorted and cleaned, as appropriate. Cleaning may be omitted for some materials that are to be the subjects of special studies, such as protein residue analysis.

A general digital catalog and any appropriate subcatalogs will be prepared. Analysts will individually examine and catalog all cultural materials according to class, type, and material; count them; and weigh them on a digital scale.

Special Studies

Special studies to address the research objectives of the data recovery program may include radiocarbon dating, thermoluminescence dating, obsidian hydration dating, x-ray fluorescence analyses, protein residue analysis, and fire-affected rock experiments.

Radiocarbon Dating

If organic samples are recovered that are appropriate for dating either human activity at the site or natural Holocene depositional events at Lake Cahuilla, they will be submitted to an appropriate laboratory for radiocarbon measurement. A maximum of four samples may be submitted.

Thermoluminescence Dating

Samples of prehistoric ceramic sherds and/or apparent fire-affected rocks, together with samples of the associated sediments, will be submitted to an appropriate laboratory for thermoluminescence dating. A maximum of 10 samples may be submitted.

Obsidian Hydration Analysis

If suitable obsidian artifacts are recovered, samples will be submitted to an appropriate laboratory for hydration measurement. A maximum of five samples may be submitted.

X-ray Fluorescence Analyses

A sample of brownware ceramic sherds will be submitted for x-ray fluorescence analysis to attempt to distinguish sherds produced in the Colorado Desert from sherds produced in the Peninsular Range. If obsidian or wonderstone artifacts are recovered, samples may be submitted to x-ray fluorescence analysis to identify ratios of trace elements and to match these ratios to those for materials from the potential geologic sources. A maximum of 20 samples will be submitted.

Protein Residue Analysis

If flaked or ground stone tools that are suitable for protein residue analysis are recovered, samples will be submitted to an appropriate laboratory. A maximum of 10 samples will be submitted.

Fire-Affected Rock Experiments

Limited experimentation to evaluate the temperatures that are necessary to produce reddening of the local sedimentary rocks may be performed on samples of non-reddened specimens from the site.

REPORT PREPARATION AND DISSEMINATION

A full descriptive and interpretive report of the results of the data recovery program will be prepared. This report will discuss the methods employed, describe in detail the archaeological field observations and the recovered materials, present and interpret the results of the geomorphic study and of the special studies, and discuss the results of the program in relation to the objectives that are identified in the present document and any additional research values that are encountered.

The draft report will be submitted to the USDI BLM El Centro Field Office for archaeological peer review. The final report will be deposited with the USDI BLM and at the South Coastal Information Center of the California Historical Resources Information System at San Diego State University.

If appropriate, significant results of the data recovery program will also be disseminated to other interested professional and non-professional groups. This dissemination may take the form of published articles or monographs, webpages, or oral presentations. However, confidential information concerning precise site locations will not be disclosed.

CURATION

The cultural materials that are collected during the data recovery program, excluding fire-affected rock and modern materials, will be prepared for permanent curation at a facility to be designated by the USDI BLM. Upon finalization of the report on the program, the collection will be delivered to the facility.

SCHEDULE

The timing for the completion of the data recovery program's various phases will depend, in part, on factors that cannot be confidently known in advance. These may include the issuance of permits and authorizations for fieldwork, exceptional conditions encountered in the field, the character and extent of the cultural remains encountered, and possible NAGPRA issues. Table 2 presents a realistic scenario. Completion of the phases of work may be substantially accelerated if the materials that are encountered and recovered are minimal. Additional time might be required if unforeseen circumstances are encountered.

Table 2. Schedule for the Data Recovery Program at IMP-3999

Benchmark	Cumulative Elapsed Time (in Weeks)
Receive all necessary work authorizations and permits	0
Commence fieldwork	1
Complete fieldwork	5
Commence laboratory work	6
Complete basic laboratory work	10
Complete special studies	28
Complete draft report	32
Receive review comments	35
Submit revised report	38
Submit collection for curation	40

REFERENCES

Álvarez de Williams, Anita
1974 *The Cocopah People*. Indian Tribal Series, Phoenix, Arizona.
1975 *Travelers among the Cucapá*. Dawson's Book Shop, Los Angeles.
1983 Cocopa. In *Southwest*, edited by Alfonso Ortiz, pp. 99-112. Handbook of North American Indians, Vol. 10, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Apple, Rebecca McCorkle, Andrew York, Andrew Pigniolo, James H. Cleland, and Stephen Van Wormer
1997 *Archaeological Survey and Evaluation Program for the Salton Sea Test Base, Imperial County, California*. KEA Environmental, San Diego.

Aschmann, Homer
1959 The Evolution of a Wild Landscape and its Persistence in Southern California. *Annals of the Association of American Geographers* 49(3):34-57.

Barker, James P.
1976 Ethnographic Sketch of the Yuha Desert Region. In *Background to Prehistory of the Yuha Desert Region*, edited by Philip J. Wilke, pp. 21-41. Ballena Press Anthropological Papers No. 5. Ramona, California.

Bean, Lowell John, Jerry Schaefer, and Sylvia Brakke Vane
1995 *Archaeological, Ethnographic, and Ethnohistoric Investigations at Tahquitz Canyon, Palm Springs, California.* Cultural Systems Research, Menlo Park, California.

Bee, Robert L.
1981 *Crosscurrents Along the Colorado*. University of Arizona, Tucson.
1983 Quechan. In *Southwest*, edited by Alfonso Ortiz, pp. 86-98. Handbook of North American Indians, Vol. 10, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.
1989 *The Yuma*. Chelsea House, New York.

Begole, Robert S.
1973 An Archaeological Survey in the Anza-Borrego Desert State Park: 1972. Preliminary Report. *Pacific Coast Archaeological Society Quarterly* 9(2):27-55.
1976 A Continuing Archaeological Survey in the Anza-Borrego Desert State Park: 1975-1976 Report. *Pacific Coast Archaeological Society Quarterly* 12(2):1-24.

Berryman, Judy, and Dayle Cheever
2001a *Cultural Resource Survey of a 230-kV Transmission Corridor from the Imperial Valley Substation to the International Border with Mexico*. RECON Environmental, San Diego.

2001b *Significance Evaluation of Cultural Resource Sites 4-IMP-7875, -3999, -4962, and -4485/4495 in Support of the Construction of Two 230-kV Transmission Lines from the Imperial Valley Substation to the International Border with Mexico*. RECON Environmental, San Diego.

Bischoff, James L., W. Morlin Childers, Reiner Protsch, and Roy M. Shlemon
1979 Reply to Payen et al., II. *American Antiquity* 44:599.

Bischoff, James L., W. Morlin Childers, and Roy M. Schlemon
1978 Comments on the Pleistocene Age Assignment and Associations of a Human Burial from the Yuha Desert, California: A Rebuttal. *American Antiquity* 43:747-749.

Bischoff, James L., Richard Merriam, W. Morlin Childers, and Reiner Protsch
1976 Antiquity of Man in America Indicated by Radiometric Dates on the Yuha Burial Site. *Nature* 261:128-129.

Bolton, Herbert Eugene
1930 *Anza's California Expeditions.* 4 vols. University of California Press, Berkeley.

Carter, George F.
1964 California as an Island. *The Masterkey* 38:74-78.

Castetter, Edward F., and William H. Bell
1951 *Yuman Indian Agriculture*. University of New Mexico Press, Albuquerque.

Chace, Paul G.
1980 Dating the Obsidian Trade in San Diego: Evidence from the Nelson Site. *San Diego County Archaeological Society Newsletter* 8(5):8-11.

Childers, W. Morlin
1974 Preliminary Report on the Yuha Burial, California. *Anthropological Journal of Canada* 12(1):2-9.
1977 Ridge-Back Tools of the Colorado Desert. *American Antiquity* 42:242-248.

Childers, W. Morlin, and Herbert L. Minshall
1980 Evidence of Early Man Exposed at Yuha Pinto Wash. *American Antiquity* 45:297-308.

Cleland, James H., and Rebecca McCorkle Apple
2003 *A View across the Cultural Landscape of the Lower Colorado Desert: Cultural Resource Investigations for the North Baja Pipeline Project.* EDAW, San Diego.

Cole, Kenneth L.
1986 The Lower Colorado River Valley: A Pleistocene Desert. *Quaternary Research* 25:392-400.

Colton, Harold S.
1945 The Patayan Problem in the Colorado River Valley. *Southwestern Journal of Anthropology* 1:114-121.

Crabtree, Robert H.
1981 Archaeology. In *A Cultural Resources Overview of the Colorado Desert Planning Units* by Elizabeth von Till Warren, Robert H. Crabtree, Claude N. Warren, Martha Knack, and Richard McCarty, pp. 25-54. USDI Bureau of Land Management, California Desert District, Riverside.

Davis, Emma Lou, Kathryn H. Brown, and Jacqueline Nichols
1980 *Evaluation of Early Human Activities and Remains in the Colorado Desert*. Great Basin Foundation, San Diego.

Dominici, Debra Ann
1984 Calibration of the Obsidian Butte Hydration Rate and Its Implication Regarding Late Prehistoric Exchange. Unpublished Master's thesis, Department of Anthropology, San Diego State University.

Drucker, Philip
1937 Culture Element Distributions: V, Southern California. *Anthropological Records* 1:1-52. University of California, Berkeley.
1941 Culture Element Distributions: XVII, Yuman-Piman. *Anthropological Records* 6:91-230. University of California, Berkeley.

Forbes, Jack D.
1965 *Warriors of the Colorado: The Yumas of the Quechan Nation and Their Neighbors*. University of Oklahoma Press, Norman, Oklahoma.

Forde, C. Daryll
1931 Ethnography of the Yuma Indians. *University of California Publications in American Archaeology and Ethnology* 28:83-278. Berkeley.

Foster, John, and Roberta Greenwood
1983 *Cultural Resource Inventory of the La Rosita to Imperial Valley Interconnection Project 230 kV Transmission Line, Imperial Valley, California.* Greenwood and Associates, Pacific Palisades, California.

Friedman, Irving, and John Obradovich
1981 Obsidian Hydration Dating of Volcanic Events. *Quaternary Research* 16:37-47.

Gallegos, Dennis R.
1980 *Class II Cultural Resource Inventory of the East Mesa and West Mesa Regions, Imperial Valley, California*. WESTEC Services, San Diego.

Gallucci, Karen L.
2001 From the Desert to the Mountains: Salton Brownware Pottery in the Mountains of San Diego. Unpublished Master's thesis, Department of Anthropology, San Diego State University.
2004 Ceramic Analysis at Wikalokal, San Diego County (CA-SDI-4787). *Proceedings of the Society for California Archaeology* 14:119-123.

Gifford, Edward W.
1918 Clans and Moieties in Southern California. *University of California Publications in American Archaeology and Ethnology* 14:155-219. Berkeley.
1931 *The Kamia of Imperial Valley*. Bureau of American Ethnology Bulletin No. 97. Washington, D.C.
1933 The Cocopa. *University of California Publications in American Archaeology and Ethnology* 31:257-334. Berkeley.

Golla, Victor
2007 California Archaeology and Prehistory after Moratto: Linguistic Prehistory. In *California Prehistory: Colonization, Culture, and Complexity,* edited by Terry L. Jones and Kathryn A. Klar, pp. 71-82. Altamira Press, Lanham, Maryland.

Hammond, George P., and Agapito Rey
1940 *Narratives of the Coronado Expedition 1540-1542*. University of New Mexico Press, Albuquerque.
1953 *Don Juan de Oñate, Colonizer of New Mexico, 1595-1628*. University of New Mexico Press, Albuquerque.

Hargrave, Lyndon L.
1938 Results of a Study of the Cohonino Branch of the Patayan Culture in 1938. *Museum of Northern Arizona Museum Notes* 11(6):43-50.

Harrington, John P.
1908 A Yuma Account of Origins. *Journal of American Folklore* 21:324-348.

Hayden, Julian D.
1976 Pre-Altithermal Archaeology in the Sierra Pinacate, Sonora, Mexico. *American Antiquity* 41:274-289.

Heizer, Robert F. (editor)
1978 *California*. Handbook of North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Heye, George G.
1919 Certain Aboriginal Pottery from Southern California. *Indian Notes and Monographs* 7:1-46. Museum of the American Indian, Heye Foundation, New York.

Hicks, Frederic Noble
1963 Ecological Aspects of Aboriginal Culture in the Western Yuman Area. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.
1974 The Influence of Agriculture on Aboriginal Socio-Political Organization in the Lower Colorado River Valley. *Journal of California Anthropology* 1:133-144.

Hildebrand, John G.
2003 Ceramics Excavated from the Lower Colorado River Region by the North Baja Pipeline Project. In *A View across the Cultural Landscape of the Colorado Desert: Cultural Resource Investigations for the North Baja Pipeline Project*, edited by James H. Cleland and Rebecca M. Apple, pp. 245-259. EDAW, San Diego.

Hildebrand, John A., G. Timothy Gross, Jerry Schaefer, and Hector Neff
2002 Patayan Ceramic Variability: Using Trace Elements and Petrographic Analysis to Study Brown and Buff Wares in Southern California. In *Ceramic Production and Circulation in the Greater Southwest: Source Determination by INAA and Complementary Mineralogical Investigations*, edited by Donna M. Glowacki and Hector Neff, pp. 121-139. Monograph No. 44, Cotsen Institute of Archaeology, University of California, Los Angeles.

Hinton, Leanne, and Lucille J. Watahomigie
1984 *Spirit Mountain: An Anthology of Yuman Story and Song*. University of Arizona Press, Tucson.

Hohenthal, William D., Jr.
2001 *Tipai Ethnographic Notes: A Baja California Indian Community at Mid-Century*. Ballena Press, Novato, California.

Jaeger, Edmund C.
1965 *The California Deser*ts. 4th ed. Stanford University Press, Palo Alto, California.

Jones, Terry L., Gary M. Brown, L. Mark Raab, Janet L. McVickar, W. Geoffrey Spaulding, Douglas J. Kennett, Andrew York, and Phillip L. Walker
1999 Demographic Crises in Western North American during the Medieval Climatic Anomaly. *Current Anthropology* 40:137-170.

Kelly, Isabel T.
n.d. Chemehuevi Field Notes: General Ethnological Information [1932-1933]. Unpublished manuscript (Book 17) on file at Bancroft Library, University of California, Berkeley.

Kelly, William H.
1977 *Cocopa Ethnography*. Anthropological Papers of the University of Arizona No. 29. Tucson.

King, James E., and Thomas R. Van Devender
1977 Pollen Analysis of Fossil Packrat Middens from the Sonoran Desert. *Quaternary Research* 8:191-204.

Kline, George E., and Victoria L. Kline
2007 Fluted Point Recovered from San Diego County Excavation. *Proceedings of the Society for California Archaeology* 20:55-59.

Knack, Martha
1981 Ethnography. In *A Cultural Resources Overview of the Colorado Desert Planning Units*, by Elizabeth von Till Warren, Robert H. Crabtree, Claude N. Warren, Martha Knack, and Richard McCarty, pp. 55-82. Cultural Resources Publications, Anthropology-History, USDI Bureau of Land Management, California Desert District, Riverside.

Kniffen, Fred B.
1931 The Primitive Cultural Landscape of the Colorado Delta. *University of California Publications in Geography* 5:43-66. Berkeley.

Koerper, Henry C., Jonathan E. Ericson, Christopher E. Drover, and Paul E. Langenwalter II
1986 Obsidian Exchange in Prehistoric Orange County. *Pacific Coast Archaeological Society Quarterly* 22(1):33-69.

Kroeber, Alfred L.
1920 Yuman Tribes of the Lower Colorado. *University of California Publications in American Archaeology and Ethnology* 16:475-485. Berkeley.
1925 *Handbook of the Indians of California.* Bureau of American Ethnology Bulletin No. 78. Washington, D.C.
1948 Seven Mohave Myths. *Anthropological Records* 11:1-70. University of California Press, Berkeley.
1951 A Mohave Historical Epic. *Anthropological Records* 11:71-178. University of California Press, Berkeley.

Kroeber, Clifton B.
1980 Lower Colorado River Peoples: Hostilities and Hunger, 1850-1857. *Journal of California and Great Basin Anthropology* 2:187-190.

Kroeber, Clifton B., and Bernard L. Fontana
1986 *Massacre on the Gila. An Account of the Last Major Battle between American Indians, with Reflections on the Origin of War.* University of Arizona Press, Tucson.

Laylander, Don
1997a The Last Days of Lake Cahuilla: The Elmore Site. *Pacific Coast Archaeological Society Quarterly* 33(1&2):1-138.

1997b The Linguistic Prehistory of Baja California. In *Contributions to the Linguistic Prehistory of Central and Baja California*, edited by Gary S. Breschini and Trudy Haversat, pp. 1-94. Coyote Press Archives of California Prehistory No. 44, Salinas.

2004a Geographies of Fact and Fantasy: Oñate on the Lower Colorado River, 1604-1605. *Southern California Quarterly* 86(4):309-324.

2004b *Listening to the Raven: The Southern California Ethnography of Constance Goddard DuBois*. Coyote Press Archives of California Prehistory No. 51. Salinas, California.

2006 The Regional Consequences of Lake Cahuilla. In *San Diego State University Occasional Archaeological Papers* 1:59-77. San Diego.

2007 Three Hypotheses to Explain Pai Origins. Paper presented at the VIII Encuentro Binacional: Balances y Perspectivas de la Antropología e Historia de Baja California, Mexicali.

2008 The Colorado Delta during the Century before Garcés and Anza. Paper presented at the IX Encuentro Binacional: Balances y Perspectivas de la Antropología e Historia de Baja California, Tecate.

2011 Linguistic Prehistory and the Archaic-Late Transition in the Colorado Desert. *Journal of California and Great Basin Anthropology*, in press.

Love, Bruce, and Mariam Dahdul

2002 Desert Chronologies and the Archaic Period in the Coachella Valley. *Pacific Coast Archaeological Society Quarterly* 38(2-3):65-86.

Luomala, Katherine

1978 Tipai and Ipai. In *California*, edited by Robert F. Heizer, pp. 592-609. Handbook of the North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

May, Ronald V.

1978 A Southern California Indigenous Ceramic Typology: A Contribution to Malcolm J. Rogers Research. *Journal of the Archaeological Survey Association of Southern California* 2(2).

2001 Ceramic Rims from the Rim of Lake Cahuilla. *San Bernardino County Museum Association Quarterly* 48(3):45-72.

McCarthy, Daniel F.

1993 Prehistoric Land-Use at McCoy Spring: An Arid-Land Oasis in Eastern Riverside County, California. Unpublished Master's thesis, Department of Anthropology, University of California, Riverside.

McDonald, Alison Meg

1992 Indian Hill Rockshelter and Aboriginal Cultural Adaptation in Anza-Borrego Desert State Park, Southeastern California. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.

McFarland, Sharon L.
2000 Changes in Obsidian Exchange in Southern California. Unpublished Master's thesis, Department of Anthropology, San Diego State University.

McGuire, Randall H., and Michael B. Schiffer
1982 Problems in Culture History. In *Hohokam and Patayan*, edited by Randall H. McGuire and Michael B. Schiffer, pp. 153-222. Academic Press, New York.

Minshall, Herbert L.
1976 *The Broken Stones: The Case for Early Man in California*. Copley Press, La Jolla, California.

Moratto, Michael J.
1984 *California Archaeology*. Academic Press, Orlando, Florida.

Morton, Paul K.
1977 *Geology and Mineral Resources of Imperial County, California.* California Division of Mines and Geology, Sacramento.

O'Connell, James F.
1971 Recent Prehistoric Environments in Interior Southern California. *University of California, Los Angeles, Archaeological Survey Annual Report* 13:173-184.

Payen, Louis A., Carol H. Rector, Eric Ritter, R. E. Taylor, and J. E. Ericson
1978 Comments on the Pleistocene Age Assignment and Associations of a Human Burial from the Yuha Desert, California. *American Antiquity* 43:448-453.

Payen, Louis A., Carol H. Rector, Eric W. Ritter, and R. E. Taylor
1979 Reply to Bischoff, Childers, and Shlemon. *American Antiquity* 44:596-599.

Pendleton, Lorann
1986 *The Archaeology of the Picacho Basin, Southeast California*. Wirth Environmental Services, San Diego.

Pigniolo, Andrew R.
1995 The Rainbow Rock Wonderstone Source and its Place in Regional Material Distribution Studies. *Proceedings of the Society for California Archaeology* 8:123-131.

Polk, Dora Beale
1991 *The Island of California: A History of the Myth*. Arthur H. Clark, Spokane, Washington.

Rappaport, Roy A.
1968 *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. Yale University Press, New Haven.

Redlands Institute
2002 *Salton Sea Atlas*. ESRI Press, Redlands, California.

Rogers, Malcolm J.
1929 The Stone Art of the San Dieguito Plateau. *American Anthropologist* 31:454-467.
1936 *Yuman Pottery Making*. San Diego Museum Papers No. 2.
1939 *Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas*. San Diego Museum Papers No. 3.
1945 An Outline of Yuman Prehistory. *Southwestern Journal of Anthropology* 1:167-198.
1966 *Ancient Hunters of the Far West*. Union-Tribune, San Diego.

Rogers, Spencer L.
1977 *An Early Human Fossil from the Yuha Desert of Southern California: Physical Characteristics*. San Diego Museum Papers No. 12.

Rondeau, Michael F., Jim Cassidy, and Terry L. Jones
2007 Colonization Technologies: Fluted Projectile Points and the San Clemente Island Woodworking/Microblade Complex. In *California Prehistory: Colonization, Culture, and Complexity*, edited by Terry L. Jones and Kathryn A. Klar, pp. 63-70. Altamira Press, Lanham, Maryland.

Rosen, Martin D.
1995 IMP-6427, A Lake Cahuilla Shell Bead Manufacturing Site. *Proceedings of the Society for California Archaeology* 8:87-104.

Schaefer, Jerry
1988 *Lowland Patayan Adaptations to Ephemeral Alkali Pans at Superstition Mountain, West Mesa, Imperial County, California.* Brian F. Mooney Associates, San Diego.
1994a The Challenge of Archaeological Research in the Colorado Desert: Recent Approaches and Discoveries. *Journal of California and Great Basin Anthropology* 16:60-80.
1994b The Stuff of Creation: Recent Approaches to Ceramic Analysis in the Colorado Desert. In *Recent Research Along the Colorado River*, edited by Joseph A. Ezzo, pp. 81-100. Statistical Research Technical Series No. 51. Tucson, Arizona.
2000a *Archaeological Investigations at a Protohistoric Fish Camp on the Receding Shoreline of Ancient Lake Cahuilla, Imperial County, California*. ASM Affiliates, Encinitas, California.
2000b Now Dead I Begin to Sing: A Protohistoric Clothes-Burning Ceremonial Feature in the Colorado Desert. *Journal of California and Great Basin Anthropology* 22:186-211.
2010 Imperial Solar Energy Center South Third-Party Review. Letter report, October 7, 2010, to Jenny Haggar Blanchard, BLM El Centro Field Office. ASM Affiliates, Carlsbad, California.

Schaefer, Jerry, and Don Laylander
2007 The Colorado Desert: Ancient Adaptations to Wetlands and Wastelands. In *California Prehistory: Colonization, Culture, and Complexity*, edited by Terry L. Jones and Kathryn A. Klar, pp. 247-258. Altamira Press, Walnut Creek, California.

Schroeder, Albert H.
1958 Lower Colorado River Buffware. In *Pottery Types of the Southwest*, edited by Harold S. Colton. Museum of Northern Arizona Ceramic Series 3D. Flagstaff.
1975 *The Hohokam, Sinagua and the Hakataya*. Imperial Valley College Occasional Papers No. 3. El Centro, California.
1979 Prehistory: Hakataya. In *Southwest*, edited by Alfonso Ortiz, pp. 100-107. Handbook of North American Indians, Vol. 9, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Shipek, Florence C.
1982 Kumeyaay Socio-Political Structure. *Journal of California and Great Basin Anthropology* 4:296-303.
1989 An Example of Intensive Plant Husbandry: The Kumeyaay of Southern California. In *Foraging and Farming: The Evolution of Plant Exploitation*, edited by David R. Harris and Gordon C. Hillman, pp. 99-110. Unwin Hyman, London.
1991 *Delfina Cuero: Her Autobiography.* Ballena Press, Menlo Park, California.
1993 Kumeyaay Plant Husbandry: Fire, Water, and Erosion Management Systems. In *Before the Wilderness: Native American Environmental Management,* edited by Thomas C. Blackburn and Kat Anderson, pp. 378-388. Ballena Press, Menlo Park, California.

Society for California Archaeology
2011 A Glossary of Proper Names in California Prehistory: Chronological and Cultural Units. Electronic document, http://www.scahome.org/ about_ca_ archaeology/chrono.html, accessed January 8, 2010.

Spier, Leslie
1923 Southern Diegueño Customs. *University of California Publications in American Archaeology and Ethnology* 20:295-358. Berkeley.
1933 *Yuman Tribes of the Gila River*. University of Chicago Press.

Steward, Julian H.
1955 *Theory of Culture Change: The Methodology of Multilinear Evolution*. University of Illinois Press, Urbana.

Stewart, Kenneth M.
1947 Mohave Hunting. *The Masterkey* 21(3):80-84.
1983 Yumans: Introduction. In *Southwest*, edited by Alfonso Ortiz, pp. 1-3. Handbook of North American Indians, Vol. 10, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Strand, Rudolph G.
1962 *San Diego-El Centro Sheet*. Geologic Map of California. California Division of Mines and Geology, Sacramento.

Sutton, Mark Q.
2009 People and Language: Defining the Takic Expansion into Southern California. *Pacific Coast Archaeological Society Quarterly* 41(2 & 3):33-93.
2011 *A Prehistory of North America*. Prentice Hall, Boston.

Sutton, Mark Q., and Philip J. Wilke (editors)
1988 *Archaeological Investigations at CA-RIV-1179, CA-RIV-2823, and CA-RIV-2827, La Quinta, Riverside County, California*. Coyote Press Archives of California Prehistory No. 20. Salinas, California.

Swarthout, Jeanne, and Christopher E. Drover
1981 *Final Report for an Archaeological Overview for the Lower Colorado River Valley, Arizona, Nevada and California Reach 3, Davis Dam to the International Border.* Museum of Northern Arizona, Flagstaff.

Taylor, R. E., L. A. Payen, C. A. Prior, P. J. Slota, Jr., R. Gillespie, J. A. J. Gowlett, R. E. M. Hedges, A. J. T. Jull, T. H. Zabel, D. J. Donahue, and R. Berger
1985 Major Revisions in the Pleistocene Age Assignments for North American Human Skeletons by C-14 Accelerator Mass Spectrometry: None Older than 11,000 C-14 Years B.P. *American Antiquity* 50:136-140.

Treganza, Adan E.
1942 Archaeological Reconnaissance of Southeastern California and Northeastern Baja California. *American Antiquity* 8:152-163.

Underwood, Jackson
2011 Major Migration Cycles and Lake Cahuilla. Unpublished manuscript in the author's possession.

Van Camp, Gena R.
1979 *Kumeyaay Pottery: Paddle and Anvil Techniques of Southern California*. Ballena Press Anthropological Papers No. 15. Socorro, New Mexico.

Van Devender, Thomas R.
1990 Late Quaternary Vegetation and Climate of the Sonoran Desert, United States and Mexico. In *Packrat Middens: The Last 40,000 Years of Biotic Change*, edited by J. L. Betancourt, Thomas R. Van Devender, and Paul S. Martin, pp. 134-165. University of Arizona Press, Tucson.

Van Devender, Thomas R., and W. Geoffrey Spaulding
1979 Development of Vegetation and Climate in the Southwestern United States. *Science* 204:701-710.

1983 Development of Vegetation and Climate in the Southwestern United States. In *Origin and Evolution of Deserts*, edited by Stephen G. Wells and Donald R. Haragan, pp. 131-156. University of New Mexico Press, Albuquerque.

von Werlhof, Jay
2008 A Desert Cahuilla Equinox Site. *Proceedings of the Society for California Archaeology* 19:185-188.

Wagner, Henry R.
1925 *California Voyages, 1529-1541*. John Howell, San Francisco.
1929 *Spanish Voyages to the Northwest Coast of America in the Sixteenth Century*. California Historical Society, San Francisco.

Wahoff, Tanya L.
1999 Flaked Lithic Tools from Recent Investigations on the Salton Sea Test Base. *Proceedings of the Society for California Archaeology* 12:20-27.

Wallace, William J.
1962a Archaeological Explorations in the Southern Section of Anza-Borrego Desert State Park, California. ArchaeologicalReport No. 5 California Department of Parks and Recreation, Sacramento.
1962b Prehistoric Cultural Development in the Southern California Deserts. *American Antiquity* 28:172-180.

Wallace, William J., and Edith S. Taylor
1958 An Archaeological Reconnaissance in Bow Willow Canyon, Anza-Borrego Desert State Park. *The Masterkey* 32(5):155-166.
1960a The Surface Archaeology of Indian Hill, Anza-Borrego State Park. *The Masterkey* 34(1):4-18.
1960b The Indian Hill Rockshelter: Preliminary Investigations. *The Masterkey* 34(2):66-82.

Wallace, William J., Edith S. Taylor, and G. Kritzman
1962 Additional Excavations at the Indian Hill Rockshelter, Anza-Borrego Desert State Park, California. In *Archaeological Explorations in the Southern Section of the Anza-Borrego Desert State Park*, edited by William J. Wallace. California Department of Parks and Recreation Archaeological Report No. 5(4). Sacramento.

Warren, Claude N.
1967 The San Dieguito Complex: A Review and Hypothesis. *American Antiquity* 32:168-185.
1984 The Desert Region. In *California Archaeology*, by Michael J. Moratto, pp. 339-430. Academic Press, Orlando, Florida.

Warren, Claude N., and Delbert L. True
1961 The San Dieguito Complex and Its Place in California Prehistory. *University of California Archaeological Survey Annual Report 1960-1961*:246-338. Los Angeles.

Warren, Elizabeth von Till, Robert H. Crabtree, Claude N. Warren, Martha Knack, and Richard McCarthy
1981 *A Cultural Resources Overview of the Colorado Desert Planning Units*. USDI Bureau of Land Management, California Desert District, Riverside.

Waterman, Thomas T.
1910 The Religious Practices of the Diegueño Indians. *University of California Publications in American Archaeology and Ethnology* 8:271-358. Berkeley.

Waters, Michael R.
1980 Lake Cahuilla: Late Quaternary Lacustrine History of the Salton Trough. Unpublished Master's thesis, Department of Geosciences, University of Arizona.
1982a The Lowland Patayan Ceramic Typology. In *Hohokam and Patayan: Prehistory of Southwestern Arizona*, edited by Randall H. McGuire and Michael B. Schiffer, pp. 537-580. Academic Press, New York.
1982b The Lowland Patayan Ceramic Tradition. In *Hohokam and Patayan: Prehistory of Southwestern Arizona*, edited by Randall H. McGuire and Michael B. Schiffer, pp. 275-297. Academic Press, New York.
1982c Ceramic Data From Lowland Patayan Sites. In *Hohokam and Patayan*, edited by Randall H. McGuire and Michael B. Schiffer, pp. 571-580. Academic Press, New York.
1983a Late Holocene Lacustrine Chronology and Archaeology of Ancient Lake Cahuilla, California. *Quaternary Research* 19:373-387.
1983b Man and Pleistocene Lake Cahuilla, California. *Journal of New World Archaeology* 5(3):1-3.

Weide, David L.
1976a Regional Environmental History of the Yuha Desert. In *Background to Prehistory of the Yuha Desert Region*, edited by Philip J. Wilke, pp. 9-20. Ballena Press Anthropological Papers No. 5. Ramona, California.
1976b Appendix: Summary of Radiometric Dates for the Salton Sink Region. In *Background to Prehistory of the Yuha Desert Region*, edited by Philip J. Wilke, pp. 95-97. Ballena Press Anthropological Papers No. 5. Ramona, California.

Weide, Margaret L.
1976 A Cultural Sequence for the Yuha Desert. In *Background to Prehistory of the Yuha Desert Region*, edited by Philip J. Wilke, pp. 81-94. Ballena Press Anthropological Papers No. 5. Ramona, California.

West, G. James, Wallace Woolfenden, James A. Wanket, and R. Scott Anderson
2007 Late Pleistocene and Holocene Environments. In *California Prehistory: Colonization, Culture, and Complexity*, edited by Terry L. Jones and Kathryn A. Klar, pp. 11-34. AltaMira Press, Lanham, Maryland.

White, Chris
1974 *Lower Colorado River Area. Aboriginal Warfare and Alliance Dynamics in Antrap, California Indian Political and Economic Organization*. Ballena Press Anthropological Papers No. 2, edited by Lowell J. Bean and Thomas F. King, pp. 111-136. Ballena Press, Ramona, California.

Wikipedia
2011 El Centro, California. Electronic document, http://en.wikipedia.org/wiki/El_Centro,_California, accessed January 7, 2011.

Wilke, Philip J.
1976 *Background to Prehistory of the Yuha Desert.* Ballena Press Anthropological Papers No. 5. Ramona, California.
1978 *Late Prehistoric Human Ecology at Lake Cahuilla, Coachella Valley, California*. Contributions of the University of California Archaeological Research Facility No. 38. Berkeley.

Wilke, Philip J., A. Meg McDonald, and L. A. Payen
1986 *Excavations at Indian Hill Rockshelter, Anza-Borrego Desert State Park, California, 1984-1985*. Archaeological Research Unit, University of California, Riverside.

Yohe, Robert M., II
1992 A Reevaluation of Western Great Basin Cultural Chronology and Evidence for the Timing of the Introduction of the Bow and Arrow to Eastern California Based on New Excavations at the Rose Spring Site (CA-INY-372). Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.
1998 The Introduction of the Bow and Arrow and Lithic Resource Use at Rose Spring. *Journal of California and Great Basin Anthropology* 20:26-52.

Zepeda-Herman, Carmen, Harry Price, and Richard Schultz
2010 *Draft Class III Cultural Resources Survey for the Imperial Solar Energy Center South Project, Imperial County, California*. RECON Environmental, San Diego.

APPENDIX D: CULTURAL RESOURCES WITHIN THE APE AND PROPOSED TREATMENT/MANAGEMENT STRATEGY

Table 1: Cultural Resources within the APE and Proposed Treatment/Management Strategy

Temporary # or Trinomial	Distance from Site Boundary to Nearest Disturbance		Brief Description	Effects	Management Strategy
	Feet	Meters			
IMP-3999	0	0	Temporary camp	Adversely affected	Adversely affected, implement treatment plan, research design, Monitoring
IMP-4485/4495	44	13	Temporary camp	Not affected, towers moved	ESA[1], Monitoring and Protective Measures
IMP-4959	96	29	Ceramic and lithic scatter	Not affected, road moved	Avoided[2]
IMP-4961	70	21	Ceramic and lithic scatter	Not affected	ESA, Monitoring and Protective Measures
IMP-4962	98	30	Temporary camp	Not affected	Avoided
IMP-4963	39	12	Ceramic and lithic scatter	Not affected	ESA, Monitoring and Protective Measures
IMP-5593	62	19	Lithic scatter	Not affected	ESA, Monitoring and Protective Measures
IMP-7874	309	94	Ceramic and lithic scatter	Not affected	Avoided
IMP-7875	33	10	Lithic scatter	Not affected, access road moved	ESA, Monitoring and Protective Measures
IMP-115-S-2	301	92	Ceramic and lithic scatter	Not affected	Avoided
IMP-115-S-3	407	124	Lithic scatter	Not affected	Avoided
IMP-115-S-4	254	78	Lithic scatter	Not affected	Avoided
IMP-115-S-5	173	53	Lithic scatter	Not affected	Avoided
IMP-115-S-6	72	22	Lithic scatter	Not affected	Avoided
IMP-115-S-7	64	19	Lithic scatter	Not affected, tower moved	ESA, Monitoring and Protective Measures
IMP-115-S-8	33	10	Ceramic and lithic scatter	Not affected, access road and tower moved	ESA, Monitoring and Protective Measures
S-1	331	101	Ceramic and lithic scatter	Not affected	Avoided
S-38	41	13	Ceramic and lithic scatter	Not affected	ESA, Monitoring and Protective Measures
S-5	34	10	Ceramic and lithic scatter	Not affected	ESA, Monitoring and Protective Measures
Signal Mountain	1 mile		Traditional cultural significance	Not affected	Avoided

[1] Environmentally Sensitive Areas are determined by buffering the known site boundaries by 20 feet, and if the boundary falls within 50 feet of proposed disturbance, monitoring and protective measures would be required.

[2] Site will not be affected and will be avoided. Monitoring or protection measures (temporary fencing, water runoff diversion) would be imposed by the Monitors, the Principle Archaeologist, or the BLM, should project conditions warrant.

APPENDIX E: PROCEDURES FOR DISCOVERIES ON INADVERTENT EFFECTS

As provided in Stipulation V to this Agreement, if the undertaking affects a previously unidentified cultural resource or affect such properties in a way not previously anticipated, or have greater adverse effect than previously anticipated, all work in the vicinity of the discovery shall cease.

a) The archaeological monitor will carefully inspect the ground surface around the discovery and the displaced dirt in order to determine whether the discovery is an isolated find (fewer than three items) or a site (three or more items, or a feature). If the find is determined to be an isolated find (with the exception of human remains), the discovery will be documented, reported and described in the monitoring report described above; all consulting parties will be apprised of such discoveries in the weekly monitoring summaries. Isolated finds will only be collected if they are diagnostic artifacts.

b) If the discovery is determined to be a site, after securing the work area from additional disturbance, in concert with the Construction Foreman or Field Supervisor, the archaeological monitor will notify the PA, who will notify the BLM archaeologist by telephone of the nature and extent of the discovery. In consultation with the PA, the BLM archaeologist will determine what additional fieldwork is necessary, such as limited test excavation, to determine the site's potential eligibility for the NRHP. It may be determined that a site visit by the BLM archaeologist or PA, is necessary to make that determination.

c) No further action will be taken until the BLM has determined the nature of the discovery and the affect. An area will be delineated not to exceed 50 meters from the approximate center point of the discovery (or a smaller or larger area if warranted by specific circumstances) in which no further work is to take place until management of the discovery is resolved. At such point BLM will notify all parties to the Agreement of the nature and general location of the discovery. The BLM will implement protection measures, including stabilization or covering, to protect any discovery from further disturbance until management of the discovery is resolved. Ongoing work outside the 50 meter buffer (or a smaller area if determined appropriate by parties in the field) of the discovery may continue.

d) If test excavation is required to evaluate a discovery, the BLM archaeologist and the PA will formulate a testing program, and it will be implemented. In general any evaluation effort will be focused on the area of discovery within the area of direct impact including a reasonable buffer (not more than 10 meters from the maximum extent of the find). The focus will be to determine the nature of the archaeological resource and to assess the quantity, quality, and variety of preserved archaeological items that are or may be present. Evaluation will include shovel test pits of a sufficient number to characterize the extent of subsurface archaeological deposits and a minimum of one sample unit to evaluate the condition of the discovery and acquire a controlled sample of the preserved cultural materials.

i) A tribal monitoring consultant will be present during evaluation field work, as well as during any subsequent ground-disturbing work at the discovery location.

e) After the site evaluation, the PA will have five business days in which to prepare a summary letter report assessing the site's eligibility and recommending appropriate treatment measures, such as the need for archaeological data recovery, if the site is recommended eligible. The letter report will be submitted to the BLM archaeologist, and the consulting parties to the PA as appropriate, who will have ten business days to review the report and evaluate the proposed treatment measures, if deemed necessary.

f) Determinations concerning NRHP eligibility and the implementation of proposed treatment measures will be made by the BLM and submitted to the SHPO for concurrence for a ten day review period. If the determination is that the discovered resource does not qualify for nomination to the NRHP, the BLM may issue a written notice-to-proceed.

i) If a discovered site is determined to be eligible for the NRHP, further treatment measures will be required. In consultation with the BLM and other consulting parties, the PA will prepare a data recovery plan for BLM review and approval. After review and concurrence, the BLM archaeologist will notify the PA that the proposed data recovery can proceed. Data recovery efforts will be focused only on that portion of the site within the APE with a reasonable buffer. To the degree possible the construction and engineering teams will be included in discussions to avoid or minimize potential damage to the discovered resource.

(1) The level of effort will be dictated by the nature and extent of the discovery and on the results of the initial evaluation effort. The focus will be on recovering a sufficiently large sample to characterize the discovery and to address regional research questions, as appropriate. Upon completion of any required fieldwork the PA will prepare a brief interim letter report summarizing the results. The BLM archaeologist or other signatories to the PA will have five business days to review the report and determine whether or not construction work at the discovery can resume or if additional sampling is required. The BLM archaeologist in consultation with the other signatories to the PA will notify the Applicant when work can resume. A final data recovery report will be prepared after laboratory studies and analyses.