PROGRAMMATIC AGREEMENT
AMONG
THE BUREAU OF RECLAMATION, MID-PACIFIC REGION,
THE U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT,
AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING
COMPLIANCE WITH SECTION 106 OF
THE NATIONAL HISTORIC PRESERVATION ACT
PERTAINING TO THE IMPLEMENTATION OF
THE SAN JOAQUIN RIVER RESTORATION PROGRAM
MENDOTA POOL BYPASS AND REACH 2B IMPROVEMENTS PROJECT

WHEREAS, the Bureau of Reclamation (Reclamation) is required by the Stipulation of Settlement (Settlement) in Natural Resources Defense Council, et al. v. Kirk Rodgers, et al. (United States District Court, Eastern District of California, No. CIV. S-88-1658-LKK/GGH) and by Public Law (P.L.) 111-11, also known as the San Joaquin River Restoration Settlement Act (Act), to implement specific actions to meet Restoration and Water Management Goals as outlined in the Settlement; and

WHEREAS, the proposed Mendota Pool Bypass and Reach 2B Improvements Project (Project) would fulfill requirements of the Settlement and the Act through (1) creation of a bypass channel around Mendota Pool to ensure conveyance of at least 4,500 cubic feet per second (cfs) from a section of the San Joaquin River designated as Reach 2B downstream to a section of the San Joaquin River as designated Reach 3, which requires construction of a structure capable of directing flow down the bypass channel and also allowing the Secretary of the Interior, through Reclamation, to make deliveries of San Joaquin River water into Mendota Pool when necessary; and (2) modifications in San Joaquin River channel capacity (incorporating new floodplain and related riparian habitat) to ensure conveyance of at least 4,500 cfs in Reach 2B between the Chowchilla Bifurcation Structure and the new Mendota Pool bypass channel; and

WHEREAS, Reclamation has determined the Project, which will be designed and constructed by Reclamation, constitutes an Undertaking as defined in 36 CFR § 800.16(y) and involves the type of activity that has the potential to cause effects on historic properties eligible for inclusion in the National Register of Historic Places (NRHP), pursuant to 36 CFR § 800.3(a), requiring compliance with Title 54 U.S.C. § 306108, formerly and commonly referred to as Section 106 of the National Historic Preservation Act (NHPA), as amended (Section 106), and its implementing regulations at 36 CFR Part 800; and

WHEREAS, Reclamation's area of potential effects (APE) for this Undertaking broadly encompasses the entirety of Reach 2B of the San Joaquin River channel as defined by the San Joaquin River Settlement and Settlement Act, which extends from approximately 0.3 miles above the existing Chowchilla Bifurcation Structure to approximately 1.0 mile below the existing Mendota Dam, and neighboring lands adjacent to and in the vicinity of the river channel within which the Project will be constructed (see Appendix A: Figure 1); and

WHEREAS, the U. S. Army Corps of Engineers, Sacramento District (Corps) under the authority of Section 404 of the Clean Water Act (33 U.S.C. § 1344), Sections 10 and 14 of the Rivers and Harbor Act of 1899 (33 U.S.C. § 403 and 33 U.S.C. § 408) (Section 10 and Section 408, respectively) may issue permit(s) or permissions to Reclamation for the construction of the Project, and the issuance of such permit(s) or permissions by the Corps constitutes an Undertaking as defined by Title 54 U.S.C. § 300101, requiring Section 106 compliance; and

WHEREAS, because the Corps' APE is limited to Project areas that are subject to Section 404, Section 10, and/or Section 408 permit(s) or permissions, which areas are encompassed entirely within the APE for Reclamation's Undertaking, the Corps has designated Reclamation as the lead Federal agency to fulfill the agencies' collective responsibilities under Section 106, as provided for at 36 CFR § 800.2(a)(2); and

WHEREAS, because Reclamation's APE consists largely of privately-owned land where access is currently restricted, and Project construction will occur over many years as these lands are acquired through fee or easement and Project designs finalized, Reclamation, the Corps, and the SHPO agree to use a phased approach to conduct historic properties identification and evaluation efforts pursuant to 36 CFR § 800.4(b)(2), and a phased approach to assess effects pursuant to 36 CFR § 800.5(a)(3), as specifically provided for at 36 CFR § 800.14(b); and

WHEREAS, Reclamation, the Corps, and the SHPO agree to enter into this Programmatic Agreement (Agreement) to phase the Section 106 process and outline procedures for consulting with the SHPO and other parties as land access becomes available and construction activities are further defined, as provided for in the regulations at 36 CFR § 800.14(b)(1)(ii); and

WHEREAS, the State of California (State), under the jurisdiction of California State Lands Commission (CSLC), owns lands within the San Joaquin River channel and, as such, the CSLC may have responsibilities related to the custody and control of archaeological or historic resources, including human remains, resulting from the Undertaking, the CSLC may elect to participate as a Concurring Party to this Agreement; and

WHEREAS, pursuant to the special relationship between the Federal government and federally recognized Indian tribes (codified in Section 101(d)(6)(B) of the NHPA, 36 C.F.R. § 800.2(c)(2)(ii), the American Indian Religious Freedom Act (AIRFA), Executive Orders 13007 and 13175, and Section 3(c) and Section 12 of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. § 3001 – 3013)), Reclamation, as the lead Federal agency, is responsible for government-to-government consultation with federally recognized Indian tribes for the Undertaking; and

WHEREAS, Reclamation has formally notified and invited the Picayune Rancheria of Chukchansi Indians of California, the Santa Rosa Rancheria Tachi-Yokut Tribe, the Table Mountain Rancheria, and the Tule River Indian Tribe, which are federally recognized Indian tribes (Tribes) known to have an interest in cultural resources in the vicinity of the APE, and/or identified by the California Native American Heritage Commission (NAHC) as potentially having knowledge of cultural resources in the project, to participate in the Section 106 process for the Undertaking, pursuant to 36 CFR § 800.3(f)(2) and 36 CFR § 800.4(a)(4), and in the

development of this Agreement, and these Tribes may elect to be Concurring Parties to this Agreement; and

WHEREAS, Reclamation has formally notified and invited Mr. Lawrence Bill, Mr. Jerry Brown, Mr. Robert Ledger Sr., Ms. Lois Martin, Ms. Lorrie Planas, Ms. Katherine Erolinda Perez, and Mr. Kenneth Woodrow, who comprise the non-federally recognized Native American organizations and individuals (Native American Organizations and Individuals) identified by the NAHC as potentially having interests in the lands in the APE to consult regarding the Undertaking, pursuant to 36 CFR § 800.4(a)(3), and the development of this Agreement, and these Native American Organizations and Individuals may elect to be Concurring Parties to this Agreement; and

WHEREAS, the Advisory Council on Historic Preservation (ACHP) was afforded an opportunity to participate in the development of this Agreement in accordance with 36 CFR § 800.6(a)(1) and, through correspondence dated December 1, 2015, declined to participate; and

WHEREAS, the definitions set forth in 36 CFR § 800.16 are incorporated herein by reference and apply throughout this Agreement; and

WHEREAS, Reclamation will ensure the stipulations included herein applicable to the Undertaking are implemented; and

NOW, THEREFORE, Reclamation, the Corps, and the SHPO agree that the Undertaking will be implemented in accordance with the following stipulations in order to take into account the effects of the Undertaking on historic properties and to satisfy the requirements of Section 106 of the NHPA.

STIPULATIONS

I. ROLES AND RESPONSIBILITIES

A. As lead Federal agency, Reclamation will be responsible for ensuring the provisions of the Agreement are completed consistent with requirements of 36 CFR § 800.2(a). Generally, Reclamation will be responsible for:

1. Refining and documenting the APE, as Project design progresses, in consultation with the Corps and the SHPO, pursuant to Stipulation V of this Agreement. The APE may be modified to account for Project changes without requiring amendment to this Agreement proper. Reclamation will make any necessary changes to the APE in accordance with Stipulation V and notify all Signatory and Concurring Parties to this Agreement as required.

2. Completing historic property identification efforts and evaluations for NRHP eligibility of cultural resources identified within the APE (e.g., archaeological, built environment, historic districts, cultural landscapes, TCPs, ethnographic, and other types of cultural resources) and ensuring the timely completion of all related technical documents,

including cultural resources inventory reports, resource eligibility recommendations, and findings of effect on historic properties, as stipulated in this Agreement.

3. Making all determinations of eligibility for historic properties and findings of effect for the Undertaking, and participating in the resolution of adverse effects and any disputes arising pursuant to such determinations and findings.

4. Preparing a Programmatic Historic Properties Treatment Plan (PHPTP), and any subsequent resource-specific Historic Property Treatment Plans (HPTPs), to govern the treatment of adversely affected historic properties within the APE.

5. Conducting government-to-government consultation with federally-recognized Tribes, as required, pursuant to 36 CFR Part 800 and other applicable Federal laws and regulations.

6. Consulting with non-federally recognized Native American Organizations and Individuals and other appropriate consulting parties, as required by 36 CFR Part 800.

7. Providing the Corps with copies of pertinent reports, letters, emails, and other documentation required for their administrative record for Section 106 compliance.

8. Circulating draft documents, comments on documents, and final documents among the Agreement Signatories and Concurring Parties, as appropriate.

9. Maintaining documentation of Section 106 compliance for the Undertaking**.**

B. As a cooperating Federal agency, the Corps will be responsible for:

1. Reviewing and providing comments on all pertinent documents necessary to ensure Section 106 compliance for Section 404, Section 10, and/or Section 408 permit(s) or permissions.

2. Notifying Reclamation of any comments or concerns regarding the Undertaking expressed to the Corps by Tribes, Native America Organizations and Individuals, or other potential consulting parties.

3. Maintaining documentation of Section 106 compliance for their Undertaking.

C. Other Federal agencies.

1. If other Federal agencies are required to issue permits and otherwise provide assistance for the Undertaking(s) covered by this Agreement, Reclamation, as lead Federal agency, may request that such agencies fulfill their Section 106 responsibilities in coordination with Reclamation using the applicable provisions of this Agreement. Such Federal agencies may designate Reclamation as lead Federal agency pursuant to 36 CFR § 800.2(a)(2) to fulfill their responsibilities. Other Federal agencies participating in the Undertaking(s) that have not designated Reclamation as the lead Federal agency may use

studies and background documentation developed by Reclamation to support their own findings and determinations under 36 CFR Part 800.

II. TIME FRAMES AND REVIEW PROCEDURES

A. Unless stipulated otherwise, for all documents and deliverables produced in compliance with this Agreement, Reclamation shall provide a hard copy draft document for review via mail to the Corps, Concurring Parties to this Agreement, and any Tribes, Native American Organizations and Individuals, or other interested parties that have formally requested and been granted Section 106 consulting party status. Any written comments provided by the Corps, Concurring Parties, and other Section 106 consulting parties within thirty (30) calendar days from the date of receipt, shall be considered in the revision of the document or deliverable.

B. Reclamation shall document and report the substantive written comments received for the document or deliverable and how comments were addressed. Reclamation shall provide a final document or deliverable to the SHPO for review and concurrence. The SHPO shall have thirty (30) calendar days to respond. Should the SHPO determine that the final document or deliverable does not meet the standards set forth in 36 CFR § 800.11(a), the SHPO and Reclamation shall continue to consult on the document or deliverable.

C. Failure of the SHPO, Corps, Concurring Parties, and other Section 106 consulting parties to respond within thirty (30) calendar days of any submittal shall not preclude Reclamation from moving forward with the Undertaking or the next step in this Agreement.

D. Should Reclamation and the SHPO be unable to reach agreement on a final document or deliverable, Reclamation and SHPO shall consult for a period not to exceed fifteen (15) calendar days following the receipt of the SHPO's written objection in an effort to come to agreement on the issues to which the SHPO has objected. Should the SHPO and Reclamation be unable to agree on the issues to which the SHPO has objected, the SHPO and Reclamation shall proceed in accordance with Stipulation XV.B (Dispute Resolution), as outlined below. The timeframe to consult to resolve a disagreement or objection related to documents or deliverables may be extended by mutual consent of Reclamation and the SHPO.

E. Notwithstanding the requirements in this Stipulation (Time Frames and Review Procedures) or Stipulation XV.B (Dispute Resolution), any Signatory Party may, at any time, request to meet with the other Signatories to discuss implementation of this Agreement.

III. PROFESSIONAL QUALIFICATIONS STANDARDS

All actions prescribed by this Agreement that involve the identification, evaluation, analysis, recording, treatment, monitoring, or disposition for historic properties, or that involve reporting or 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 who meet at a minimum the U.S. Secretary of Interior's Professional Qualifications Standards (48 FR 44738-44739; Appendix A

to 36 CFR 61) in the appropriate discipline. Reclamation will ensure that the work outlined in this Agreement is conducted by individuals meeting these qualifications standards.

IV. PROGRAMMATIC HISTORIC PROPERTIES TREATMENT PLAN

A. Reclamation will prepare a Programmatic Historic Properties Treatment Plan (PHPTP) for the Undertaking that provides detailed procedures for implementing actions prescribed by the Agreement. The PHPTP is intended to guide all efforts related to the identification and evaluation of historic properties, findings of effect, and resolution of adverse effects, including cumulative effects and possibilities for standardized treatment of frequently occurring property types. Adverse effects to historic property types not covered under the PHPTP may require the development of separate and specific Historic Property Treatment Plans (HPTPs), as provided for in Stipulation VIII.A of this Agreement, when avoidance, minimization, or mitigation of such a historic property or properties in the APE is required. The PHPTP will include a well-developed environmental and cultural-historical context, which may be incorporated by reference into separate HPTP(s) as required. Reclamation will ensure that the PHPTP conforms to the principles of *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* and is consistent with this Agreement.

B. Reclamation will ensure that a draft PHPTP is prepared within 120 days of execution of this Agreement. The PHPTP will include an anticipated timeline for the completion of identification, evaluation, and treatment of historic properties for the Undertaking. Reclamation, in consultation with the SHPO, will determine whether it is appropriate to implement individual treatment measures before, during, or after construction of the Project.

C. Reclamation shall provide the draft PHPTP to Agreement Signatories and Concurring Parties for a forty-five (45) day review and comment period. Following this initial extended review and comment period, the review times and procedures outlined in Stipulation II (Time Frames and Review Procedures) will apply.

V. AREA OF POTENTIAL EFFECTS

Current planning, design, and engineering requirements necessitate two major phases of Project construction. The first phase (Phase I) will consist of the Mendota Pool Bypass Channel, associated infrastructure, and all staging and access areas. The second phase (Phase II) will consist of channel and floodplain modifications, including levee relocation and side channel excavation to accommodate increased river capacity and restore riparian habitat upstream of the new Bypass Channel, associated infrastructure, and all staging and access areas.

A. The APE, as established (Appendix A: Figure 1), encompasses the entirety of the Project. As Project designs are further developed and finalized, Reclamation will refine the APE specific to Phase I and Phase II of the Undertaking. Once established, Reclamation will submit the refined APE to the SHPO, the Corps, any Concurring Parties to this Agreement, and Tribes and Native American Organization and Individuals for review prior to completing cultural resources inventories for that phase of the Project. The SHPO and all parties consulted will

have thirty (30) calendar days to review and provide comments on the proposed APE. Reclamation will take into account any comments on the APE and finalize the APE based on comments received. Failure of any party to comment within thirty (30) days shall not preclude Reclamation from finalizing the APE for that phase of the Project. The final APE will be distributed to the Signatories and Concurring Parties to this Agreement and any other consulting parties for the Undertaking. Reclamation will follow the Dispute Resolution process outlined in Stipulation XV.B of this Agreement for disputes regarding delineation of the APE that cannot be resolved during the thirty (30) day review and comment period as set forth above.

B. As the Undertaking progresses, design changes to the Project may be necessary. If any such changes would necessitate modification of an APE that has already been agreed to, pursuant to Stipulation V.A, Reclamation will submit a modified APE to the SHPO and other Signatory and Concurring Parties to this Agreement and consulting parties for the Undertaking for review and comment as outlined above. The APE may be changed as described herein without requiring amendment to this Agreement proper.

VI. IDENTIFICATION OF HISTORIC PROPERTIES

Reclamation is responsible for identifying historic properties present within the Undertaking's APE prior to any ground-disturbing activities associated with the construction of any phase of the Project. Identification efforts may be coordinated with the construction phases proposed for the Project, in accordance with 36 CFR § 800.4(b)(2), and as land within the APE is made accessible for surveys as detailed below. Reclamation will identify historic properties in accordance with the *Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 CFR 44716-44742) and 36 CFR § 800.4.

A. Cultural Resources Inventory

1. Reclamation shall conduct an updated records and literature search covering the Project APE. These searches will be conducted at the appropriate Information Centers (IC) of the California Historical Resources Information System (CHRIS), archival repositories, and suitable research facilities. These inventory efforts will also involve additional outreach, coordination, and/or consultation with Tribes, Native American Organizations and Individuals, and other potentially interested parties, such as local historical societies, local landowners, and other stakeholders in the Project that may have information to provide regarding historic properties in the APE or other cultural resources of concern.

2. Prior to the initiation of construction or ground disturbing activities for any phase of Project construction, an intensive pedestrian survey to identify and record all cultural resources within the APE will be conducted. The inventory will be consistent with the PHPTP and conducted as phases of the Undertaking are further defined and access to parcels obtained.

3. Reclamation commissioned a geoarchaeological assessment of the APE (see Appendix A: Figure 1). The report of that assessment is included as Appendix B to this Agreement.

Prior to the initiation of construction or ground disturbing activities for any phase of Project construction, Reclamation will conduct focused geoarchaeological studies within the APE, based on recommendations regarding subsurface archaeological sensitivity in the report (Appendix B). The results of these studies will be used to inform subsequent identification efforts within the APE.

4. All archaeological and architectural resources identified during surface and/or subsurface surveys will be recorded on the appropriate California Department of Parks and Recreation 523 (DPR 523) forms. The results of such field investigations may be documented in stand-alone documents or in combined archaeological, architectural, and/or ethnographic technical reports. As inventory efforts may be non-concurrent, based on Project phase, access to land, and type of investigation, multiple technical inventory reports may be produced. If cultural resources can be evaluated for NRHP eligibility based on survey level identification efforts alone, the resulting inventory report(s) may also include the NRHP evaluation(s) of those resources.

5. Reclamation will ensure that the draft and final inventory report(s) produced under this Agreement are subject to the time frames and procedures for review and comment as outlined above in Stipulation II (Time Frames and Review Procedures).

B. Evaluation of Cultural Resources

Reclamation will evaluate recorded cultural resources within the APE for their eligibility for listing in the NRHP. Identified cultural resources within the APE may be evaluated in part or in whole depending on the anticipated level of disturbance from the Undertaking. If cultural resources can be avoided and/or protected, Reclamation may treat them as eligible for the purposes of the Undertaking. Recorded architectural resources, ethnographic resources, and/or traditional cultural properties (TCPs) within the APE will likewise be evaluated. A more thorough discussion about the protocols for evaluating resources will be developed in the PHPTP.

1. Reclamation will produce cultural resources evaluation report(s), which may be generated according to Project construction phase, for cultural resources not evaluated in the inventory report(s) prepared as outlined in subpart A of this Stipulation.

2. Reclamation will make determinations of eligibility in accordance with the NRHP criteria set forth in 36 CFR § 60.4 for all potential historic properties within the APE, consistent with the *Secretary of the Interior's Standards and Guidelines for Evaluation* (http://www.cr.nps.gov/local-law arch stnds 3.htm).

3. Reclamation will ensure that the draft and final evaluation documentation and report(s) produced under this Agreement are subject to the time frames and procedures for review and comment as outlined above in Stipulation II (Time Frames and Review Procedures).

4. If Reclamation and the SHPO disagree on the NRHP eligibility of a resource, Reclamation shall obtain a determination as outlined at 36 CFR § 800.4(c)(2). Any determination obtained in this way shall be final for the purposes of this Agreement.

VII. ASSESSMENT OF EFFECTS

A. Reclamation will assess the effects, including any cumulative effects, of each Project construction phase on all historic properties identified within the APE by applying the Criteria of Adverse Effect pursuant to 36 CFR § 800.5. This assessment will be provided in one or more draft Finding of Effect (FOE) reports, which may be incorporated into inventory and/or evaluation reports if enough information is available to make the assessment. The FOE will assess potential adverse effects resulting from the Project and identify mitigation measures that would eliminate or minimize such effects.

B. Reclamation will ensure that the draft and final FOE documentation and report(s) produced under this Agreement are subject to the time frames and procedures for review and comment as outlined above in Stipulation II (Time Frames and Review Procedures).

VIII. RESOLUTION OF ADVERSE EFFECTS

Pursuant to 36 CFR § 800.6(a), Reclamation shall continue consultation with the Signatories, Concurring Parties, and any other identified consulting parties for the Undertaking, to develop and evaluate alternatives or modifications to the Undertaking that could avoid, minimize, or mitigate adverse effects on historic properties in the APE, if possible. Reclamation may elect to invite other individuals or organizations with special interests in particular historic properties to become consulting parties for the resolution of adverse effects. Reclamation will also ensure that the views of the public are considered and included when addressing adverse effects to historic properties resulting from the Undertaking.

A. Historic Property Treatment Plans

When, through FOE consultation as described above, it is determined that historic properties within the APE will be adversely affected by Project activities, Reclamation will prepare and implement standard treatment measures as defined in the PHPTP or develop specific HPTPs to address and resolve such effects as required. All HPTPs will set forth detailed avoidance, protection, and/or treatment measures to reduce or mitigate the particular adverse effect(s) (e.g., data recovery, documentation, oral histories, public education, community outreach, etc.) for the specific historic property or property type. Information related to environmental and cultural setting, historic context, research design, etc., that was developed for and provided in the PHPTP may be incorporated by reference into individual HPTPs as appropriate.

HPTPs will conform to the principles of *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation*. At Reclamation's discretion, a single HPTP may be developed to resolve effects on an individual historic property or property type or for multiple historic properties and property types, depending on the property type or types, the nature of the effect(s), and the timing of Project construction. Mitigation measures outlined in

HPTPs may be conducted prior to construction, during construction, or after construction is completed, based on property type, mitigation requirements, and construction timetable.

1. HPTP Review. Reclamation will ensure that any draft and final HPTP(s) produced under this Agreement are subject to the time frames and procedures for review and comment as outlined above in Stipulation II (Time Frames and Review Procedures).

2. Reclamation will ensure that each HPTP is finalized prior to the commencement of the construction activity or activities posing the identified adverse effect. The HPTP will include a schedule for completion of the prescribed treatment(s), which, depending on historic property type and the nature of the treatment, may occur before, during, or after construction takes place.

B. Synthesis Reports

Reclamation, in consultation with the Agreement Signatories, will prepare preliminary and final reports that synthesize data and information regarding the cultural-historical use and significance of the San Joaquin River and associated landscape, with particular attention to the Reach 2B Project area. Information attained through the planning and implementation of the Project, other components of the San Joaquin River Restoration Program, and elsewhere, may be used for this synthesis. The final report(s) prepared under this stipulation will be written for a broad audience and intended for use in public outreach and education. Reclamation will determine the appropriate institutions, repositories, and/or media for the archival and/or dissemination of the final reports(s) in consultation with the Agreement Signatories, prior to final report production.

1. Preliminary Report

a. Within two (2) years following the execution of this Agreement, Reclamation will submit to the Corps and SHPO a preliminary synthesis report outlining the prehistory and history of the San Joaquin River, with specific emphasis on the current Project area. The report will include a compilation of the data collected as part of the environmental review for the current Undertaking, additional reviews associated with other components of the San Joaquin River Restoration Program, and other sources of available data, as appropriate. The report will explore interpretive themes that specifically relate to cultural use of the San Joaquin River and adjacent lands, the changes in such use through time, and the environmental and/or cultural drivers of these changes. Reclamation will submit the preliminary report to the Signatory and Concurring Parties to this Agreement for a ninety (90) day review and comment period. Reclamation will consider and incorporate comments received, as appropriate, and produce the document for public distribution.

2. Final Report

a. Within one (1) year after the completion of Project construction, Reclamation will prepare a final synthesis report for Reach 2B of the San Joaquin River that documents the results obtained through the inventory and evaluation efforts and work completed in fulfillment of the HPTPs for the Undertaking. The final synthesis report will utilize the themes established in the preliminary synthesis report, but develop them more thoroughly through the incorporation of the all findings related to the Project. The final synthesis may also take into account other work completed by Reclamation as part of the broader San Joaquin River Restoration Program in areas outside the APE for this Undertaking. Reclamation will submit the final report to the Signatory and Concurring Parties to this Agreement, and other consulting parties for the Undertaking, as appropriate, for a ninety (90) day review and comment period. Reclamation will consider and incorporate comments received into the final synthesis report.

b. Following revision, Reclamation will submit the revised final synthesis report to the SHPO, and other Signatory and Concurring Parties, for a final thirty (30) day review and comment period. Absent a specific request for continued consultation by the SHPO, or other Signatory or Concurring Parties to this Agreement, Reclamation will consider and incorporate comments received during the final thirty (30) day review period, as appropriate, and produce the final synthesis report for public distribution. If disputes remain regarding the content of the final synthesis report following the final thirty (30) day review, Reclamation may elect to continue consultation regarding the dispute with the Signatory or Concurring Parties, or other consulting party or parties, for an additional forty-five (45) day period or will follow the procedures for Dispute Resolution as outlined in Stipulation XV.B.

IX. DOCUMENTATION STANDARDS

A. Reclamation will ensure that all documentation that supports the findings and determinations made under this Agreement is consistent with 36 CFR § 800.11 and adheres to the framework provided in the PHPTP and any subsequent revisions or modifications to that document. All documentation will be prepared by qualified professionals, by or on behalf of Reclamation, as stated in Stipulation III.

B. All documentation prepared under this Agreement will be kept on file by Reclamation, and made available to the public, consistent with applicable confidentiality requirements referenced under Stipulation XV.E of this Agreement.

X. NATIVE AMERICAN CONSULTATION AND PARTICIPATION

Reclamation will invite Tribes and Native American Organizations and Individuals to review and provide input on the identification, evaluation, and proposed treatment of historic properties, including but not limited to archaeological sites and TCPs, as stipulated elsewhere in this

Agreement. Invitations for input may be extended through letters of notification, public meetings, and site visits facilitated by Reclamation. Reclamation will afford Tribes and Native American Organizations and Individuals thirty (30) calendar days from the receipt of a document for review to respond with comments, unless otherwise stipulated. Failure by any reviewers to comment within this time period shall not preclude Reclamation from allowing reports to be finalized, treatment protocols to proceed, or otherwise move forward with the Undertaking.

XI. PUBLIC AND CONSULTING PARTIES PARTICIPATION

A. Individuals, organizations, and local agencies with a demonstrated interest in the Undertaking may be invited to participate as Concurring Parties to this Agreement or be consulting parties for the Undertaking, and to provide input on the identification, evaluation, and proposed treatment of historic properties consistent with 36 CFR §§ 800.2(c)(5) and 800.2(d). Invitations for input may be extended by Reclamation or the Corps through letters of notification, public meetings, and site visits.

B. Information regarding the Undertaking that is released to the public will comply with Stipulation XV.E; 36 CFR § 800.2(d)(1-2) and 800.11(c)(1) and (3); Section 304 of the NHPA, as amended (54 U.S.C. § 307103); Section 9 of the Archaeological Resources Protection Act (10 U.S.C. § 470aa – 470mm); Executive Order on Sacred Sites 13007 FR 61-104 dated May 24, 1996; the Freedom of Information Act (FOIA) (5 U.S.C. § 552), and Section 6254.10 of the California Government Code, as applicable.

XII. POST REVIEW DISCOVERIES

The PHPTP will include a Post Review Discovery Plan that is consistent with 36 CFR § 800.13. The PHPTP will include measures to address the discovery of previously unknown cultural resources and unanticipated adverse effects or damage to historic properties. If a previously undiscovered archaeological, historical, or cultural property is encountered during construction, or previously known properties will be affected or have been affected in an unanticipated adverse manner, Reclamation will ensure that the procedures in the PHPTP are followed.

XIII. INADVERTENT DISCOVERY OR INTENTIONAL EXCAVATION OF HUMAN REMAINS

The PHPTP will include an Inadvertent Discovery Plan to address the treatment and disposition of human remains that are inadvertently discovered during Project planning, construction, or operation. The PHPTP also will include a Burial Plan to govern the intentional removal of human remains through controlled archaeological excavation, if required for the Undertaking.

A. For Native American human remains, associated funerary objects, unassociated funerary objects, sacred objects, and/or objects of cultural patrimony inadvertently discovered or intentionally excavated on Federal lands, Reclamation will follow the procedures outlined in NAGPRA, as specified in the implementing regulations at 43 CFR § 10.2(d)(1-2). Reclamation will ensure that all such NAGPRA cultural items encountered during any activity associated with the Undertaking on Federal lands are treated in accordance with the

requirements with Section 3(c-d) of NAGPRA and the implementing regulations at 43 CFR Part 10.

B. For Native American burials, skeletal remains, and associated grave goods discovered or intentionally excavated on non-Federal land during any activity associated with the Undertaking, Reclamation will ensure the treatment and disposition of the remains follows the requirements of Section 7050.5 of the California State Health and Human Safety Code and Section 5097.98 of the California Public Resources Code and work with the NAHC as required.

XIV. CURATION OF ARCHAEOLOGICAL COLLECTIONS

A. Collections from Reclamation Lands

Reclamation will ensure that any non-NAGPRA related cultural materials and associated records falling under Reclamation's Scope of Collections Statement that result from the identification, evaluation, and treatment of historic properties on Reclamation land conducted under this Agreement shall be properly maintained in accordance with 36 CFR Part 79 (see Stipulation XIII for treatment of NAGPRA related items). Reclamation will ensure that documentation of the curation of these materials is prepared and provided to parties named in the HPTP specific to the resolution of effects for that historic property within thirty (30) days of curation of the archaeological materials.

B. Collections from State Lands

Reclamation will ensure that in the event any non-burial related cultural materials and associated records resulting from the identification, evaluation, and treatment of historic properties on lands owned or under the jurisdiction of the State of California conducted under this Agreement are to be curated, they shall be properly maintained in accordance with 36 CFR Part 79 and the State of California's *Guidelines for the Curation of Archeological Collections* (State Historical Resources Commission, Department of Parks and Recreation 1993). The resource specific HPTPs will detail the materials, if any, proposed for curation as a part of this project. If items are curated, Reclamation will ensure that documentation of the curation of these materials is prepared and provided to parties named in the HPTP specific to the resolution of effects for that historic property within thirty (30) days of curation of the materials.

C. Collections from Private Lands

Reclamation will ensure that any archaeological materials excavated or otherwise recovered from private land during implementation of the Undertaking shall be handled and maintained in accordance with 36 CFR § 79 until all necessary analyses of such materials have been completed as outlined in the PHPTP or HPTP. Reclamation will encourage private landowners to consent to the curation of archaeological materials recovered from their lands upon the completion of all necessary analyses in a museum or repository that meets the requirements of 36 CFR § 79. If a private landowner does not consent to curation of the

archaeological materials as stipulated, Reclamation will return the materials to the landowner(s), document the return, and submit copies of this documentation to the Signatories to this Agreement within thirty (30) days of such return. Landowners who retain archaeological materials will be encouraged to rebury the returned items close to their original location, if possible, based on Project requirements.

XV. ADMINISTRATIVE STIPULATIONS

A. Notices

1. All notices, demands, requests, consents, approvals or communications from any party to a Signatory Party shall be personally delivered or sent by email to the Signatory Party or shall be so deemed given five (5) days after deposit in the United States mail, certified and postage prepaid, return receipt requested.

2. Provided a Concurring Party accepts an invitation to act as a Concurring Party to and sign this Agreement, the Concurring Party or Parties agree to send communications as outlined in Stipulation XV.A. If an invited Concurring Party elects not to sign this Agreement, Reclamation will continue to communicate with the party as a consulting party for the Undertaking in accordance with the stipulations in this Agreement.

3. All Signatory and Concurring Parties to this Agreement agree to accept copies of signed deliverables and agree to rely upon such copies as if they bore original signatures. Each party agrees to provide Reclamation with the original documents that bear the original signatures as soon as practicable following the transmission of such copy or copies.

B. Dispute Resolution

1. Should any Signatory or Concurring Party object in writing to Reclamation regarding the manner in which the terms of this Agreement are carried out, to any action carried out or proposed with respect to implementation of this Agreement, or to any document prepared in accordance with and subject to the terms of this Agreement, Reclamation will immediately notify the other Signatory and Concurring Parties of the objection, request their comments on the objection within thirty (30) days following receipt of Reclamation's notification, and proceed to consult with the objecting party for no more than thirty (30) days to resolve the objection. Reclamation will honor the request of the other parties to this Agreement to participate in the consultation and will take any comments provided by those parties into account.

2. If the objection is resolved through consultation, Reclamation may proceed in accordance with the terms of such resolution.

3. If after initiating such consultation, Reclamation determines that the objection cannot be resolved through consultation, Reclamation will forward all documentation relevant to the objection to the ACHP, Signatories, and Concurring Parties, including Reclamation's proposed response to the objection, with the expectation that the ACHP will, within

forty-five (45) days after receipt of all pertinent documentation, exercise one of the following options:

a. Advise Reclamation that the ACHP concurs with Reclamation's proposed response to the objection, whereupon Reclamation will respond to the objection accordingly; or,

b. Provide Reclamation with recommendations, which Reclamation shall take into account in reaching a final decision regarding its response to the objection; or,

c. Notify Reclamation that the objection will be referred for comment pursuant to 36 CFR § 800.7(c), and proceed to refer the objection and comment. Reclamation shall take the resulting comment into account in accordance with 36 CFR § 800.7(c)(4).

4. Should the ACHP not exercise one of the foregoing options within forty five (45) days after receipt of all pertinent documentation, Reclamation may proceed with implementation of that response.

5. Reclamation will take into account any ACHP recommendation or comment, and any comments from the other parties to this Agreement, in reaching a final decision regarding the objection. Reclamation's responsibility to carry out all actions under this Agreement that are not the subject of the objection shall remain unchanged.

6. Reclamation shall provide all other Signatory and Concurring Parties to this Agreement and the ACHP with a written copy of its final decision regarding an objection addressed pursuant to this Stipulation.

7. Reclamation may authorize any action subject to objection under items 1-6 of this Stipulation to proceed provided the objection has been resolved in accordance with the terms of aforesaid items 1-6, as determined by Reclamation.

8. At any time during implementation of the terms of this Agreement, should any member of the public raise an objection in writing pertaining to such implementation to any Signatory Party to this Agreement, that Signatory Party shall immediately notify Reclamation. Reclamation will notify the other Signatory Parties in writing within fifteen (15) days of receipt of their notification. Reclamation will consider the objection, and in reaching its decision, Reclamation will take all comments into account. Within fifteen (15) days following closure of the comment period, Reclamation will render a decision regarding the objection and respond to the objecting party. Reclamation will promptly notify the Signatory Parties of its decision in writing, including a copy of the response to the objecting party. Reclamation's decision regarding resolution of the objection will be final. Following issuance of its final decision, Reclamation may authorize the action subject to dispute hereunder to proceed in accordance with the terms of that decision.

C. Amendments

1. Any Signatory to this Agreement may request, in writing, to the other Signatories that it be amended, whereupon the Signatories will consult for a period of no more than thirty (30) days to consider such amendment. The effective date of the amendment is the date of written concurrence with the proposed amendment by all Signatory Parties to the Agreement. If the Signatory Parties cannot agree to the appropriate terms to amend the Agreement, the Agreement may be terminated, as outlined below in Stipulation XV.F, or remain in place unchanged.

2. The APE, PHPTP, and HPTPs may be amended to address necessary changes to the Project and/or the treatment of historic properties affected by the Undertaking without amendment to this Agreement.

D. Reporting and Review

1. Reclamation will submit a draft annual progress report to the Corps and SHPO by December 31 of every year, beginning December 31, 2017, until all treatments to historic properties associated with implementation of the Undertaking are completed. Reclamation will also send the annual report to any Concurring Parties to this agreement. Following a thirty (30) day period for Signatory and Concurring Party review and comment, Reclamation will produce a final annual progress report, incorporating any comments received, by March 31 of every calendar year. Report content shall include, but not be limited to, a summary of actions taken under this Agreement including all findings and determinations, public objections, inadvertent effects, Post Review Discoveries, APE modifications, emergency actions, status of implementation of treatments and resolution of effects, and upcoming activities planned for the next fiscal year.

2. The annual progress report will provide the opportunity for the Agreement Signatories and Concurring Parties to review the effectiveness of the Agreement. If any of the Signatories believes changes to the Agreement are required, they will consult regarding proposed changes as specified in Stipulation XV.C.

3. Upon completion of the final annual report, during each year this Agreement is in effect, Reclamation will coordinate an in-person meeting among the Agreement Signatories and Concurring Parties to discuss the Project and activities carried out pursuant to the Agreement during the preceding year and activities scheduled for the upcoming year. In any given year, the in-person meeting may be canceled through mutual agreement of the Signatory Parties if the meeting is deemed unnecessary.

E. Confidentiality

All Signatory and Concurring Parties to this Agreement will ensure that shared data, including data concerning the precise location and nature of archaeological historic properties and properties of religious and cultural significance, are protected from public disclosure to the

greatest extent permitted by law, including conformance to Section 304 of the NHPA, as amended (54 U.S.C. § 307103), and implementing regulations under 36 CFR § 800.6(a)(5) and 36 CFR § 800.11(c); Section 9 of the Archaeological Resources Protection Act (10 U.S.C. §§ 470aa – 470mm); FOIA; Executive Order on Sacred Sites 13007 FR 61-104 dated May 24, 1996; and California Government Code Section 6250-6270, as applicable.

F. Termination

Reclamation, the Corps, or the SHPO may terminate this Agreement by providing thirty (30) days written notice to the other Signatories. Upon such notice, the Signatories shall consult during the thirty (30) day period prior to termination to seek agreement on amendments or other actions that would avoid termination. Should such consultation result in an agreement on an alternative to termination, the Signatory Parties shall proceed in accordance with that alternative and the Signatory Parties will amend this Agreement as necessary in accordance with Stipulation XV.C. In the event of termination, if work remains to be completed under the Agreement, then Reclamation will consult in accordance with 36 CFR § 800.14(b) to develop a new Agreement. Beginning with the date of termination, Reclamation will ensure that until and unless a new Agreement is executed for the actions covered by this Agreement, Undertakings will be reviewed individually for Section 106 compliance in accordance with 36 CFR § 800.4 – 800.6.

G. Effective Date

This Agreement shall take effect on the date it has been fully executed by Reclamation, the Corps, and the SHPO. Amendments shall take effect on the dates they are fully executed by Reclamation, the Corps, and the SHPO.

H. Agreement Duration

The Agreement will be in effect for five (5) years following execution by all Signatories. If the Signatories agree to extend the Agreement term, the Agreement will be amended pursuant to Stipulation XV.C. The Signatories shall consult on extending the term of the Agreement on a date not less than six months prior to the fifth anniversary of Agreement execution. If the Signatories determine that the Agreement will not be extended through amendment, the Agreement shall expire as outlined above or be terminated pursuant to Stipulation XV.F.

EXECUTION of this Agreement by Reclamation, the Corps, and the SHPO, its transmittal to the ACHP, and subsequent implementation of its terms, evidence that Reclamation has afforded the ACHP an opportunity to comment on the Undertaking and its effects on historic properties, that Reclamation has taken into account the effects of the Undertaking on historic properties, and that Reclamation has satisfied its responsibilities under Section 106 and applicable implementing regulations for all aspects of the Undertaking.

SIGNATORY:

Bureau of Reclamation, Mid-Pacific Region

FOR

By _____ 8/30/16
David G. Murillo Date
Regional Director

SIGNATORY:

U.S. Army Corps of Engineers, Sacramento District

By _____ 22 Sep 2016
Michael S. Jewell Date
Chief, Regulatory Division

SIGNATORY:

California State Historic Preservation Officer

By _____ 27 Sept 2016
Julianne Polanco — Date
State Historic Preservation Officer

APPENDIX A:

Figure 1. Project Location & Area of Potential Effects

RECLAMATION
Managing Water in the West

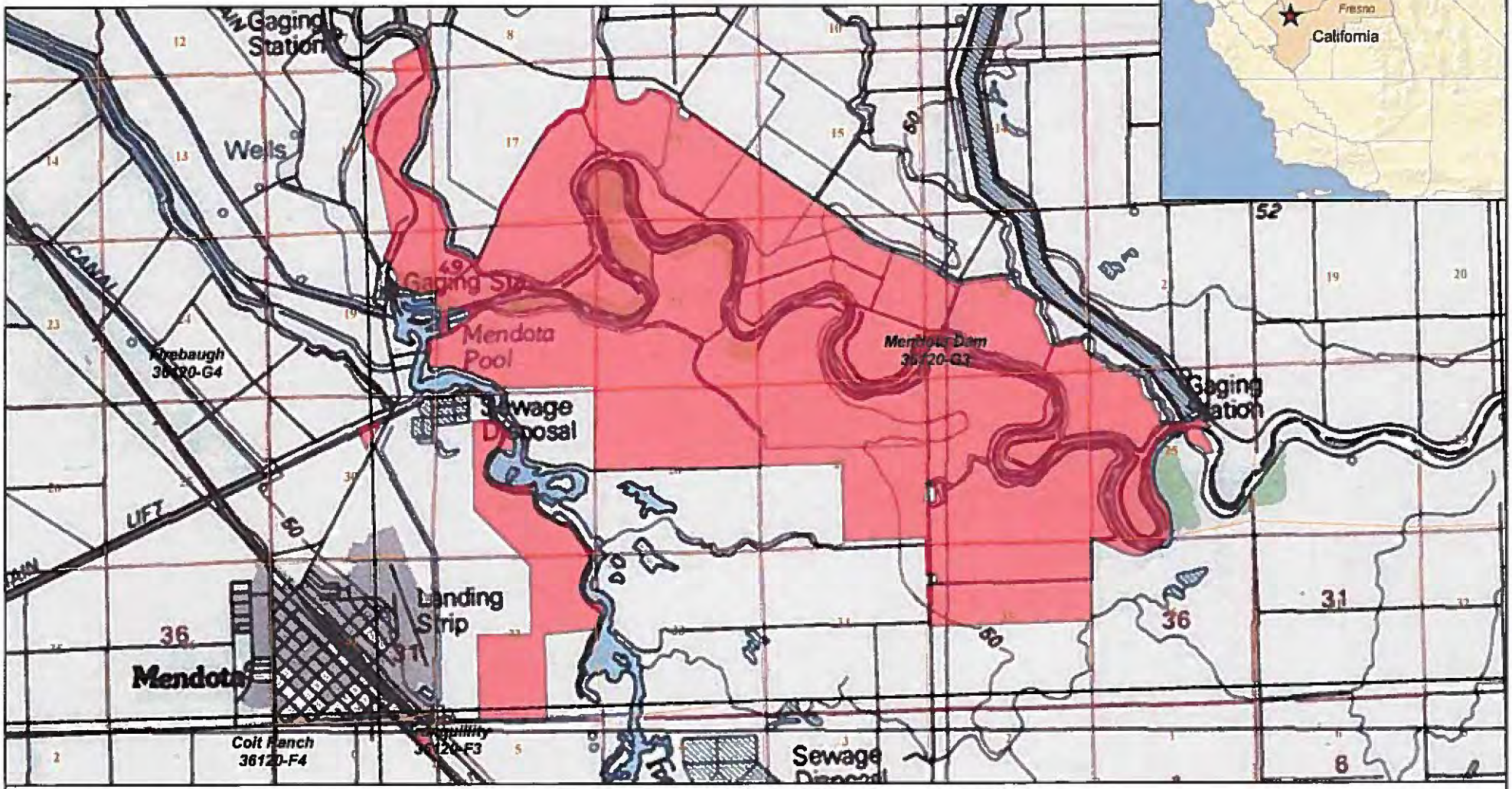

Figure 1. Project Location & Area of Potential Effects (APE)
Mendota Pool Bypass and Reach 2B Improvements Project
Project Tracking No.: 14-SCAO-274

Legend

Project Location/APE

USGS Quadrangle

0 0.5 1 2 3 Miles

7.5' Quads: Firebaugh, Medota Dam, & Tranquility, CA

Legal: Sections 7, 8, 15-30, 32-36, T. 13 S., R. 15 E. & Sections 5 & 6, T. 14 S., R. 15 E.;

Mount Diablo Base Meridian

N

APPENDIX B:

Murphy, L.R. and Meyer, J. (2016). *Geoarchaeological Assessment of Reach 2B for the San Joaquin River Restoration Project, Fresno and Madera Counties, California.*

Geoarchaeological Assessment of Reach 2B for the San Joaquin River Restoration Project, Fresno and Madera Counties, California

By:
Laura R. Murphy
Jack Meyer

April 2016 FINAL

On behalf of:
Adam Nickels
Joanne Goodsell
US Bureau of Reclamation
Mid-Pacific Region
2800 Cottage Way
Sacramento, CA 95825

FAR WESTERN ANTHROPOLOGICAL RESEARCH GROUP, INC.
2727 Del Rio Place, Suite A, Davis, California, 95618
http://www.farwestern.com 530-756-3941

Geoarchaeological Assessment of Reach 2B for the San Joaquin River Restoration Project, Fresno and Madera Counties, California

By:
Laura R. Murphy, Ph.D.
Jack Meyer, M.A.

April 2016 FINAL

On behalf of:
Adam Nickels
Joanne Goodsell
US Bureau of Reclamation
Mid-Pacific Region
2800 Cottage Way
Sacramento, CA 95825

MANAGEMENT SUMMARY

Far Western Anthropological Research Group, Inc., (Far Western) on behalf of the US Bureau of Reclamation (USBR), conducted a geoarchaeological assessment of Reach 2B, a segment of the San Joaquin River in Fresno and Madera Counties, California. The geoarchaeological assessment was completed as a subtask of the San Joaquin River Restoration Program (SJRRP), to assess the archaeological potential and presence or absence of cultural material and to evaluate buried soils within the Area of Potential Effects (APE) of the proposed "Mendota Pool Bypass and Reach 2B Improvements Project" (Project) of the SJRRP.

The geoarchaeological assessment of Reach 2B included examination of geotechnical cores, cutbank survey, radiocarbon-age dating, and development of a potential buried site sensitivity model. A total of 280 continuous cores from throughout the entire SJRRP Area were inventoried and documented in the USBR's Friant Dam core facility by Far Western personnel. A total of 66 cores within the Reach 2B APE were examined, photographed, and described in detail. The presence or absence of buried soils informed our understanding of the landscape's potential to contain buried archaeological sites and aided further delineation of areas and landforms deemed highly sensitive or not within the APE. Radiocarbon dating of buried soils and charcoal helped establish a landscape evolution chronology that also guided adjustments to the potential buried site sensitivity model.

This document includes the summary of core analysis results from Reach 2B, revises the buried site sensitivity model proposed by Byrd et al. (2009), and provides recommendations for undertaking future work to determine if buried archaeological sites are present or absent in High sensitivity areas at locations where deep and extensive earth disturbances will occur within the Project area.

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INTRODUCTION

In 1988, the National Resources Defense Council presented a lawsuit against the US Department of the Interior, the US Department of Commerce, and the Friant Water Users Authority in order to restore migratory fish populations in the San Joaquin River. The San Joaquin River Restoration Program (SJRRP) is a direct result of the Settlement decided in *Natural Resources Defense Council et al. v. Kirk Rodgers et al.* The Settling Parties agreed to the terms and conditions of the Settlement on September 13, 2006, which was subsequently approved by the US Eastern District Court of California on October 23, 2006. The "Implementing Agencies" responsible for managing the SJRRP are the US Department of the Interior, through the US Bureau of Reclamation and the Fish and Wildlife Service, the US Department of Commerce through the National Marine Fisheries Service, and the State of California through the California Department of Water Resources, the California Department of Fish and Game, and the California Environmental Protection Agency.

The Settlement has two primary goals:

- Restoration—To restore and maintain fish populations in "good condition" in the main stem San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.
- Water Management—To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement (e.g., ensure irrigation supplies).

To this end, the "Mendota Pool Bypass and Reach 2B Improvements Project" (Project) was devised to achieve the ultimate goal of reconnecting the San Joaquin River from Friant Dam to the Merced River and to restore pre-Friant Dam migratory fish populations. The Project aims to improve fish passage and water conveyance capacity through the construction of a compact bypass control structure at Mendota Pool, northeast of the town of Mendota, California, along with a series of levee realignments and improvements.

Due to the extent and volume of potential ground disturbances associated with the Project, a geoarchaeological assessment was completed as a subtask of the SJRRP, to assess the archaeological potential and presence or absence of cultural materials and buried soils within the Area of Potential Effects (APE) of the proposed Project. The primary goal of this study was to generate relevant and useful information for the management of cultural resources, future archaeological investigations, and for future planning and project design.

PROJECT AREA

The SJRRP Area includes approximately 118 linear miles along the San Joaquin River, starting in the lower foothills of the Sierra Nevada and extending across the San Joaquin Valley floor, crossing parts of Fresno, Madera, Merced, and Stanislaus counties (Figure 1). Potential impacts of restoration actions are expected to be concentrated close to the river. For this reason, the area within approximately 1,500 feet (457 meters) of the centerline of the main stem of the San Joaquin River from Friant Dam downstream to the confluence of the Merced River, including the Chowchilla, Eastside, and Mariposa bypasses, is referred to as the Restoration Area.

Byrd et al. (2009) conducted a cultural resources review and preliminary buried site assessment (sensitivity analysis) of the Restoration Area. USBR defined the cultural resources impact area to be a two-mile-wide corridor centered on the river, along with a one-mile-wide corridor centered on the Eastside Bypass and Mariposa Bypass canals (Table 1; Figure 2). The Restoration Area was subdivided into five main reaches (Reaches 1–5), and each Reach was further subdivided using A and B. Reach 2B is the focus of this geoarchaeological investigation.

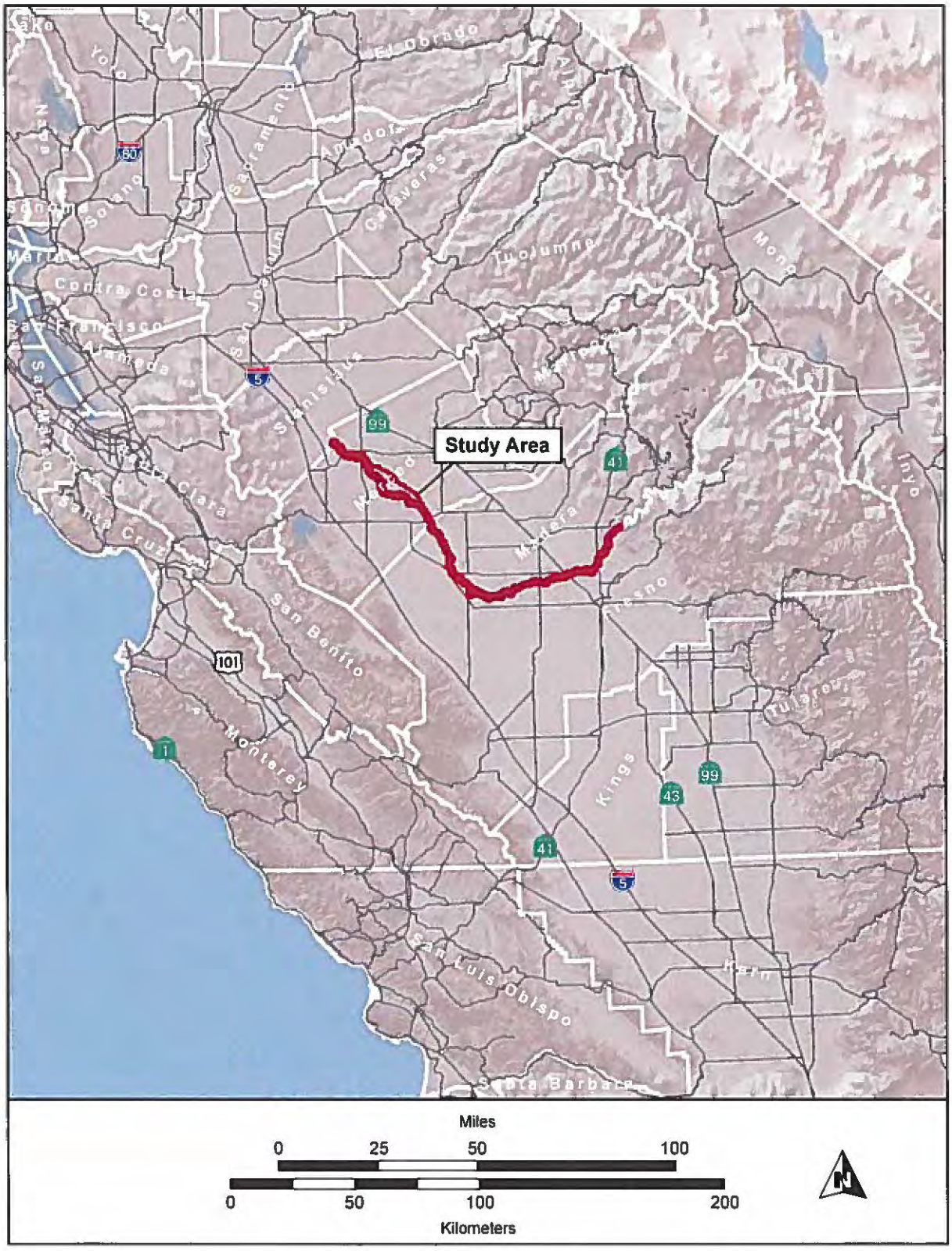

Figure 1. San Joaquin River Restoration Project Location.

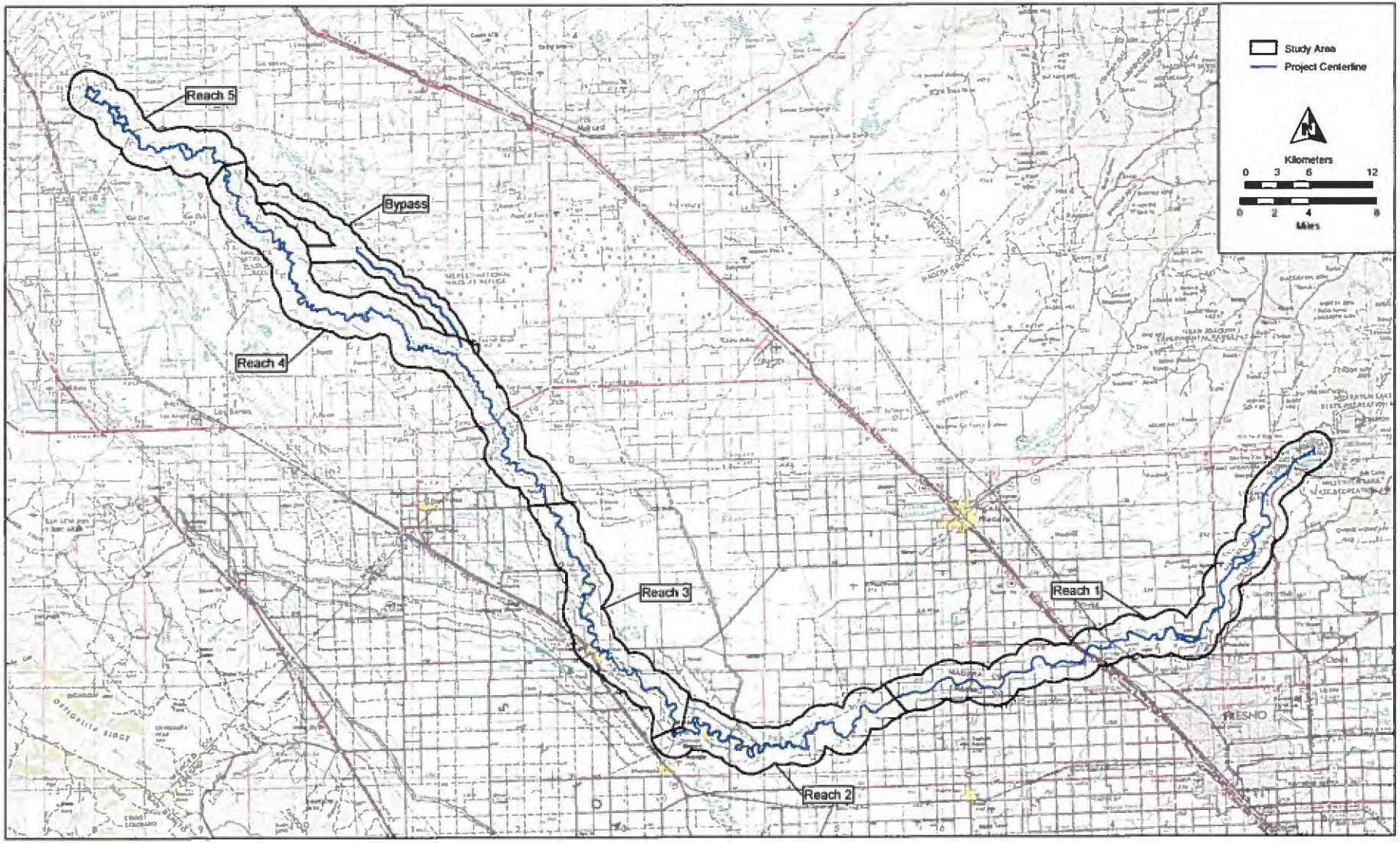

Figure 2. San Joaquin River Restoration Project Cultural Resources Study Area.

Table 1. Cultural Resources Study Area.

REACH	BEGIN	END	ACRES
1	1 mile above Friant Dam	Gravelly Ford	47,882.6
2	Gravelly Ford	Mendota Pool	23,667.3
3	Mendota Pool	Sack Dam	23,600.3
4	Sack Dam	Sand Slough Control Structure	46,820.9
5	Confluence of Eastside Bypass	1 mile downstream of Confluence of Merced and San Joaquin Rivers	17,677.7
Bypass [a]	Confluence of Ash Slough and Chowchilla Bypass	Confluence of San Joaquin River and head of Reach 5	12,750.1
Total	-	-	**172,383.9**

Note: [a] Eastside and Mariposa Bypass along this route.

The Reach 2 cultural resources study area covers approximately 23,667.3 acres from Gravelly Ford to Mendota Pool (Table 1). Reach 2B begins at River Mile 216 at the western side of the Chowchilla Canal and extends west to River Mile 204 north of the Mendota Pool. The APE for Reach 2B extends both north and south of the modern San Joaquin River channel that encompasses the modern floodplain, levees, and potential borrow area for the construction of the proposed Mendota Pool bypass and channel improvements within Reach 2B (Figure 3). The acreage calculated from Figure 3 for the Reach 2B APE is approximately 5,593 acres; most of this area occurs to the north and south of the San Joaquin River channel (5,180 acres), with a smaller area located to the south of the channel and west of Fresno Slough (413 acres). The APE shown in Figure 3 is approximate; it is likely to change slightly as the project continues to develop.

Prehistoric Archaeological Sites

Within or immediately adjacent to the APE are five recorded prehistoric archaeological sites (Table 2); seven total are within Reach 2. Two of the sites, CA-FRE-106 and -0398, were buried at 0.7 meters and 2.4 meters below surface, respectively. FRE-398 is a major residential site that contained a 50-x-35-x-2.4-meter-thick mound with numerous flood-deposited lenses, 31 burials, and a variety of grave goods (McAlexander and Upson 1969). The absence of Late Period artifacts and arrow points suggests a Middle-Late Transition or Middle Period occupation. The dearth of recorded surface scatters throughout Reach 2B, and the fact that two of the five sites were buried, indicates that additional sites could also be buried and have escaped surface survey detection. However, the assessment by Byrd et al. (2009), determined that only 5.9% of the total cultural resources area for Reach 2 has been surveyed. Given the lack of archaeological data for Reach 2B, we took a geoarchaeological approach using a combination of a buried archaeological site potential model, geotechnical cores, cutbank survey, and radiocarbon-age dating in order to make recommendations for cultural resources management planning in the Project area.

GEOARCHAEOLOGICAL OBJECTIVES

The geoarchaeological approach is based on the premise that geologic controls shape the archaeological record, creating predictable patterns and ages for buried soils (i.e., former stable land surfaces) that have the potential to contain archaeological deposits within alluvial fills (Mandel 2006; Murphy et al. 2014). Because buried soils represent periods of non-deposition, they have a higher probability of correlating with times of human occupation compared to land surfaces undergoing rapid sedimentation (Holliday 2004; Rapp and Hill 2006). Buried soils also serve as stratigraphic markers that can be traced and correlated over wide areas, and are important for reconstructing landscape evolution and paleoenvironments during episodes of climate stability. The patterns of erosion, deposition, and landscape stability that have shaped the archaeological record during the latest Pleistocene and throughout the Holocene are largely climate-driven (e.g., Allen et al. 1999; Meyer 1996; Meyer and Rosenthal 1997, 2008;

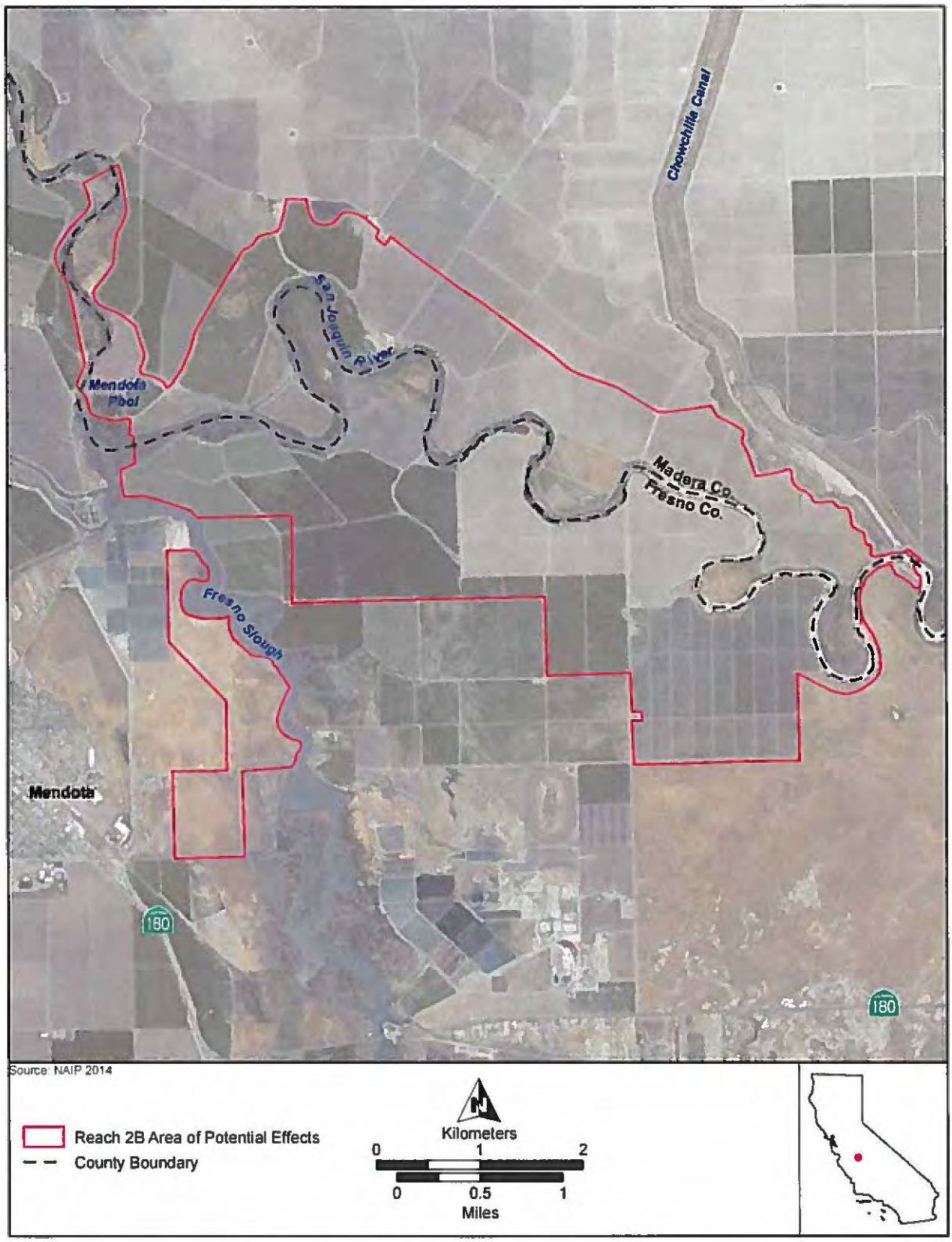

Figure 3. Area of Potential Effects for Reach 2B.

Table 2. Reach 2B Prehistoric Archaeological Sites.

Primary (P-)	Trinomial (CA-)	Site Description	Known Depth (meters)	Meters to Cutbank Edge	Soil Type	Last Site Update
10-000106	FRE-0106	Prehistoric midden with burials; pipeline ditch revealed 5 burials (2 that were removed), mortars and pestles	0.7	71	Chino loam	1952
10-000563	FRE-0563	Prehistoric artifact scatter consisting of 2 clam-shell disc beads, burned, possibly from cremation	-	-	Water	1975
10-000045	FRE-0045	Prehistoric midden that includes skeletal material, obsidian, manos, mortars, pestles, clay beads, a round abalone bead. Material from ditch backdirt. Partially leveled	-	548	Dello sandy loam	1939
10-000398	FRE-0398	Mound with burials; Pitcachi Yokuts Gewachiu site salvage excavation by McAlexander and Upson (1969) yielded midden with abundant vertebrate and invertebrate remains, ground stone, flaked stone, daub, ash, charcoal, cremations, and 31 burials. Grave goods included dart points, steatite, and *Olivella* beads	2.4	833	Chino loam	1968
20-000301	MAD-301	Two square mile area of prehistoric dispersed artifact scatter containing mortars, pestles, and lithics; exact site extent unknown. Several burials removed by County Coroner	-	1,055	Wunjey very fine sandy loam	1975

Note: Table modified from Byrd et al. 2009; Meters to cutbank edge are estimates based on general mapped site location to the edge of the nearest water source edge.

Rosenthal and Meyer 2004a, 2004b; White 2003). For example, a large segment of the archaeological record older than about 3,000 years is thought to have been buried by episodic deposition during the late Holocene (e.g., Rosenthal and Meyer 2004a, 2004b) at a time when extreme arid conditions destabilized the landscape.

For Reach 2B, Byrd et al. (2009) created a working model for the relative probability of encountering buried archaeological sites in the Restoration Area by integrating a surface site model with a landform age map. Because buried archaeological deposits will only be associated with landforms that developed during the span of human occupation in central California, the search for missing portions of the archaeological record can be narrowed to landform segments emplaced during the terminal Pleistocene and the Holocene (i.e., the last 15,000 years). Likewise, portions of the landscape that developed prior to human colonization of North America can be confidently excluded from consideration for buried resources. Once this distinction is made, age differences between younger depositional landforms, such as those found in the San Joaquin River valley, can then be used as a measure of the relative potential (i.e., probability) for buried sites.

The active alluvial environment of the San Joaquin River consists of younger depositional landforms that generally have a Very High to High potential to contain buried archaeological sites (Byrd et al. 2009). Because large segments of the study area include floodplain deposits laid-down beginning about 4,000 years ago and continuing into the Historic Period, even sites a few hundred years old have the potential to be buried. This is because the younger the age of the landform, the higher the likelihood that buried archaeological deposits will be discovered. This results from two main factors: (1) Holocene-age surface landforms commonly contain multiple Holocene-age buried soils; and (2) within young surface landforms, the aggregate of time represented by Holocene-age buried soils is greater than the aggregate of time represented by buried soils in older surface landforms. Due simply to the greater length of time represented by buried soils in Holocene-age landforms, there is a higher probability that an underlying landform was occupied. Also, it is assumed archaeological deposits from later time periods are more common overall due to higher population densities. Formerly stable land surfaces buried later in time, therefore, have a higher probability of containing archaeological material that those buried earlier in the Holocene.

Based on an initial buried site potential assessment, Byrd et al. (2009) concluded that standard archaeological survey would not be sufficient to account for a substantial portion of the archaeological record in the Restoration Area, and, that because of the recently deposited floodplain sediments, surface sites will be strongly biased toward the late Holocene (i.e., <4000 cal BP).

To supplement the model with field data, Far Western personnel examined a series of continuous subsurface cores, originally taken for the purposes of hydrologic and geologic studies as a separate subtask of the SJRRP. Cores were taken throughout the entire Restoration Area between 2009 and 2015. Approximately 66 cores were recovered from Reach 2B, and are currently stored in wax-lined boxes in a building located at the US Bureau of Reclamation Friant Dam facility near Friant, California.

Most of the cores were obtained from alluvial floodplain sediments that were deposited along and near the main channel of the San Joaquin River during the Holocene. Because these cores had the potential to contain buried archaeological deposits, the purpose of the geoarchaeological undertaking was to examine the cores for archaeological materials, and to establish the presence or absence of buried soils. The cores also serve to compare soils and sediments to those currently exposed in natural cutbanks and artificial cuts (e.g., canals, ditches, and roadcuts) that exist within Reach 2B.

The SJRRP Reach 2B cores were used (1) to confirm the presence or absence of archaeological deposits at each of the sampled locations; (2) to test the underlying assumptions of the buried site model so that any needed revisions or refinements can be made; (3) to determine the age, nature, and extent of the sampled deposits to reconstruct the history of landscape changes; and (4) to evaluate the influence of landscape evolution on early human settlement patterns and the archaeological record. Specific tasks included an inventory of the cores and their locations, the examination, documentation, and sampling of cores, supplemented by additional cutbank survey, and compilation and analysis of core descriptions, stratigraphic data, and radiocarbon results.

BACKGROUND

ENVIRONMENTAL CONTEXT

The study area lies within the central portion of the San Joaquin Valley, the southern extension of California's Great Central Valley (see Figure 1). The San Joaquin Valley is a large structural trough (syncline) that lies between the Sierra Nevada on the east and the Coast Ranges on the west. The northern part of the valley is drained by the San Joaquin River, which flows generally south to north from an elevation of about 200 feet (61 meters) above mean sea level (amsl) in Fresno County to sea level in San Joaquin County. The source of the San Joaquin River is along the crest of the high Sierra Nevada, between Yosemite and Kings Canyon national parks. The river descends through high glacial valleys and then steep canyons before it enters the Central Valley north of Fresno. The San Joaquin is the southernmost drainage that typically flows north to the Sacramento-San Joaquin Delta and San Francisco Bay; in high water years, the Kings River and even the Kern River overflowed Tulare and Buena Vista lakes, respectively, and flowed northward to join the San Joaquin. Elevations within the study area range from 760 feet (232 meters) amsl near Friant Dam, to 150 feet (46 meters) near Mendota Pool where the San Joaquin River turns and beings flowing northward, to 60 feet (18 meters) just past the confluence with the Merced River.

Climate

Climate varies across the large San Joaquin valley. Climate in much of the southern and western San Joaquin Valley is characterized as semi-arid Steppe, while areas to the north and east are more typical of the mild, humid, Mediterranean climate of the surrounding foothill and northern valley regions (Hornbeck 1983; Major 1977). Summer days in this region often exceed 100 °F (37.8 °C) with maximum average temperatures in June and July ranging between about 86 to 97 °F (30 to 36.1 °C). In the winter (December to January), maximum average temperatures range between 53 and 56 °F (11.6 and 13.3 °C). Approximately 90% of annual rainfall occurs between November and April; more than 50% occurs in December, January, and February. The summer months of June, July, and August are the driest of the year, with only about 1% of average annual rainfall originating from periodic thunderstorms.

Soils

Soil formation is a by-product of sustained or prolonged landscape stability, and soil development is directly related to the amount of time a landform has been subject to near-surface weathering processes. The surface soils vary across the entire San Joaquin valley due to climate, topography, and parent material changes. However, Reach 2B surface soils are fairly ubiquitous floodplain soils developed in granitic alluvium shed from the Sierra Nevada. A majority of the mapped surface soils are deep and very deep, somewhat poorly drained sandy loam to loam soils of the Grangeville-Chino association (USDA 1971). Grangeville soils formed in better drained, higher areas, such as secondary floodplains, whereas Chino soils tend have formed in more poorly drained areas. Similar floodplain soils such as the Dello, Tujunga, Wunjey, and Columbia Series are mapped to a lesser extent (Soil Survey Staff 2016), and are generally associated with localized floodplain features. Most of the soils have been used for farming alfalfa, cotton, and orchard crops in conjunction with extensive irrigation practices (USDA 1971).

Late Quaternary Landscape Evolution and Geoarchaeology

The San Joaquin Valley has witnessed dramatic changes over the last 22,000 years since the last glacial maximum, resulting in a landscape completely different from that encountered by the region's first human inhabitants around 12,000–13,000 years ago. Late Quaternary geoclimatic processes that have

shaped the landscape are inferred from stratigraphy, multiproxy paleoenvironmental data (i.e., pollen), as well as landform and soil mapping.

During the late Pleistocene (22,000–13,000 cal BP), a series of large coalescing alluvial fans developed along the east side of the valley as a result of glacial outwash and continued tilting of the Sierra. In Fresno County, a large fan formed on the lower Kings River around 15,000 years ago and blocked the San Joaquin River. This diverted the flow of the Kings River into Tulare Lake, which enclosed the drainage of the southern San Joaquin Valley (Atwater et al. 1986). Large alluvial fans were also deposited along the western side of the valley as a result of climatic changes, and not as a result of glacial outwash (Lettis 1982, 1985). Pollen and macrofossil evidence from the region indicate that the late Pleistocene experienced cold and dry conditions (Atwater et al. 1986; Cole 1983; Davis 1999). Lowered sea levels during the late Pleistocene promoted channel incision and extremely low sedimentation rates in the northern San Joaquin Valley, as indicated by radiocarbon dates from "pre-Delta" deposits (Brown and Pasternack 2004).

As a result of continued cycles of erosion and deposition during the middle and late Holocene, very few late Pleistocene and early Holocene archaeological sites have persisted or are visible if present. This is likely because in the San Joaquin Valley, early Holocene soils and sediments are deeply buried or have been removed by erosion and deposited downstream or have been deposited as alluvial fans. Late Pleistocene- to early Holocene-age (13,500–7000 cal BP) alluvial fan remnants are common in the lower reaches of the San Joaquin Valley, where they extend basin-ward from the Coast Ranges and foothills of the Sierra Nevada. On the east side of the valley, Holocene deposition was insufficient to overtake the higher gradient Pleistocene fans developed from multiple cycles of glacial outwash. Younger, Holocene-age fans are inset and often blanket only the medial to distal portions of older Riverbank and Modesto formations. As a result, large surficial exposures of these older landforms occur above and below younger alluvial cones. It is these old surfaces that have produced the most ancient archaeological materials thus far reported from the northern San Joaquin Valley.

Throughout much of central California, the middle Holocene (7000–4000 cal BP) began with a relatively brief interval of landscape instability (Meyer 1996; Meyer and Rosenthal 1997; Rosenthal and Meyer 2004). As early as 7000 cal BP, hill slopes were eroded and floodplains and fans began to aggrade, effectively capping portions of many late Pleistocene to early Holocene land surfaces and associated archaeological deposits. Evidence for archaeological deposits older than approximately 5000 cal BP is virtually lacking in the San Joaquin Valley, and the identification of buried soils of comparable age is just as rare.

The late Holocene (4000–Historic Period) in central California was a time of considerable geomorphic change. The Sacramento-San Joaquin Delta expanded and stabilized during this time interval, and fans and floodplains experienced multiple cycles of deposition and stability in concert with channels that avulsed sediments, built levees, and later incised. The archaeological record from this time period is extensive, with sites found throughout most environmental zones and in many geological settings; this is primarily a surface record, only marginally affected by geomorphic processes of erosion and deposition.

As noted above, however, widespread episodes of landscape evolution during the late Holocene are largely responsible for structuring the record of human occupation during the middle and early Holocene. In localized areas throughout central California, many late Holocene archaeological sites are also buried, particularly those dating older than 1,000 or 2,000 years (Meyer et al. 1999; Rosenthal and Meyer 2004). In the San Joaquin Valley, Holocene-age floodplains are set into the upper segments of older fans, creating low terraces along most major drainages entering the valley from the east and west. Toward the axis of the valley, these younger alluvial sediments spill over older floodplain surfaces and fill erosional cuts and basins formed during the early and middle Holocene. Archaeological sites associated with these younger floodplains rarely exceed 2,800 years old.

The late Holocene is marked by two climatic extremes recognized worldwide as the Medieval Climatic Anomaly (MCA). Also known as the Medieval Warm Period or Medieval Drought, this period consists of two extremely dry periods with increased temperatures and decreased effective precipitation that occurred between 1100 and 890 cal BP and 790 and 650 cal BP, which were separated by a "period of increased wetness" between about 840 and 740 cal BP (Stine 1994:549). By about 650 cal BP, warm, dry conditions gave way to the Little Ice Age, or Matthes glaciation, in the Sierra Nevada (Matthes 1939). The Matthes glaciation reached its maximum extent about 100 years ago (AD 1850) and retreated thereafter (Stine 1996). It is unclear how the MCA and Little Ice Age affected and erosion and deposition patterns in the San Joaquin River valley.

Historic-era Floodplain Changes

Historically, the San Joaquin River channel braided out into streams, channels, and sloughs as the slope of the land diminished from the Sierras, and flood waters seasonally inundated adjacent land. The first irrigation on the San Joaquin River above Mendota occurred in the 1870s, and the practice continued to expand through the establishment of irrigation companies. By 1887, public tax-supported and democratically controlled irrigation districts were established with the Wright Act. In 1917, construction of Mendota Dam occurred near the confluence of the San Joaquin River and Fresno Slough. By 1940, the Central Valley Project, a large-scale water control project proposing canals, dams and reservoirs for the valley, was underway. The USBR proposed an integrated dam and canal system with the construction of the Friant Dam, completed in 1942, and Madera Canal, completed in 1945 (USBR 1958).

The Friant dam diverts San Joaquin river water to both the Friant-Kern and Madera Canals, regulates water releases to water users, and provides flood control (USBR 1958). Both ground water pumping for irrigation and flood control practices from the Mendota and Friant dams have impacted groundwater hydrology and fluvial geomorphology of Reach 2B over time. An 1886 historic-era irrigation map depicts the Chowchilla Canal and Willow Slough north of Reach 2B, and differences in the morphology of the meander belt along the San Joaquin River within Reach 2B (Figure 4). Most notable are changes in the overall shape and width of the meander belt, which appears to be related to down cutting and lateral erosion. Such changes may signal a disruption in the equilibrium and competence of the river system that can lead to bank scouring until the river channel becomes "armored" and protected by sand, gravel, or cobbles (Mount 1995). Thus, some prehistoric sites that were once located along the banks of the river may have been partially or completed destroyed by bank erosion and lateral channel migration. At the same time, lateral channel movement could have helped to protect and preserve of some sites, especially if positioned on older point bars that lie in the opposite direction of the "active" meander belt.

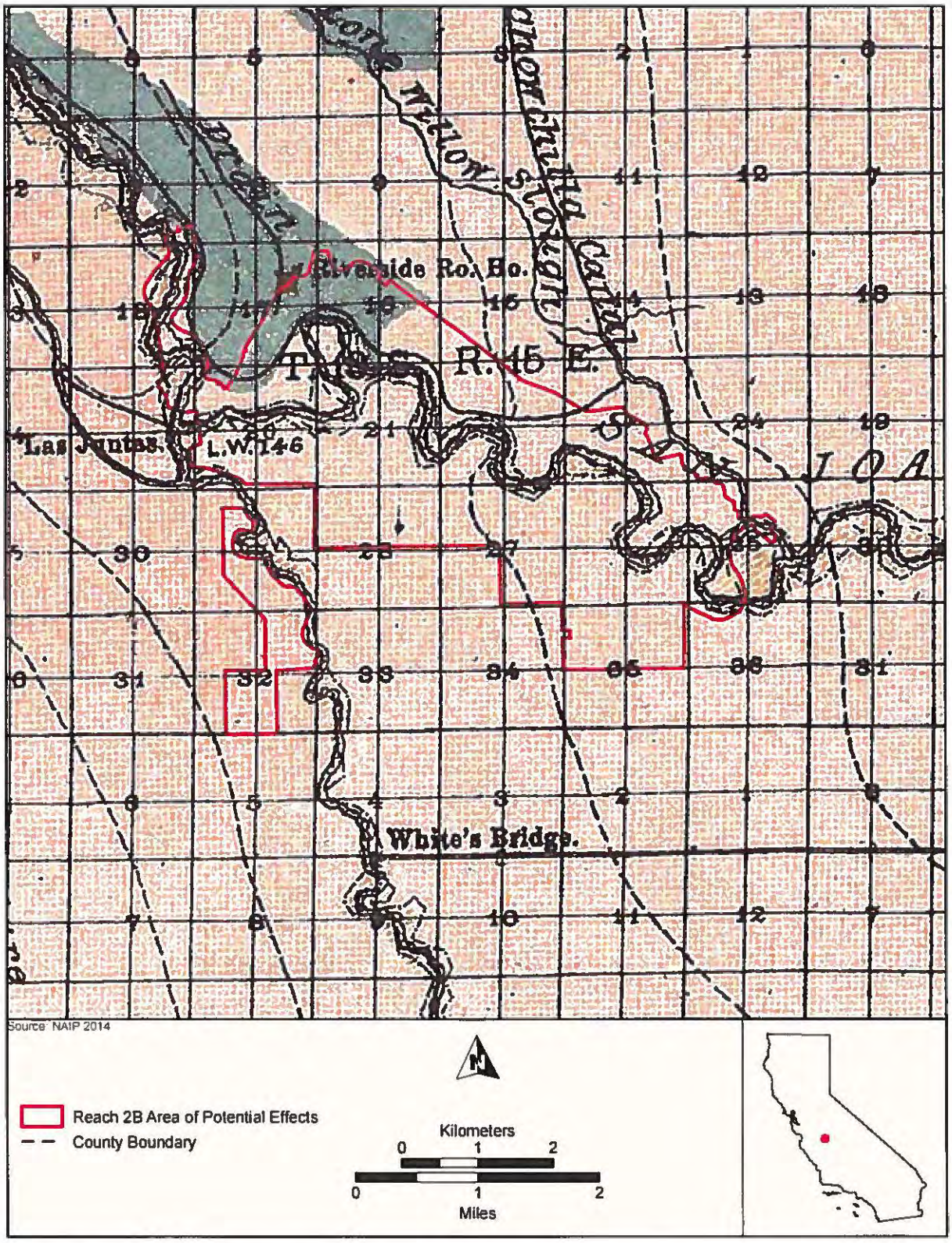

Figure 4. Known Historic Hydrography shown on 1886 San Joaquin Valley Irrigation Map.

STUDY METHODS

FIELD METHODS

A total of 280 continuous cores were inventoried and documented in the Friant Dam core facility by Far Western personnel under the direction of Geoarchaeologist Laura Murphy. These cores, extracted for geotechnical purposes, were recovered using either a Standard Penetration Test Hole (SPT) with a truck-mounted 18-inch diameter drill auger, or a Cone Penetrometer Test Hole (CPT) that uses a 1-inch diameter hydraulic press (Nickels 2010). Also, soils and sediments were recovered during the installation of Piezeometer Wells (PZ) and Ground Water Monitoring Wells (MW). Most monitoring wells were placed along road shoulders, highway medians, or active flood channels of the San Joaquin River, and did not occur in undisturbed deposits (Nickels 2010). The drill rig implemented a hollow stem flight auger and a wire-line split barrel sampler or mud rotary drilling method (Nickels 2010).

Sixty-six cores from Reach 2B stored at the Friant facility were examined, photographed, and described by Far Western personnel using standard USDA NRCS pedologic nomenclature after Schoeneberger et al. (2012). In the geotechnical cores, stratigraphic units (strata) were identified on the basis of physical composition, superposition, relative soil development, and/or textural transitions (i.e., upward-fining sequences) characteristic of discrete depositional cycles. Each stratum identified in the cores was assigned a Roman numeral, beginning with the oldest or lower-most stratum and ending with the youngest or uppermost stratum. Buried soils, representing formerly stable land surfaces, were identified on the basis of color, structure, horizon development, bioturbation, lateral continuity, and the nature of the upper boundary (contact) with the overlying deposit (Birkeland et al. 1991; Holliday 1990; Retallack 1988; Waters 1992).

Master horizons describe in-place weathering characteristics and are designated by upper-case letters. These are sometimes preceded by Arabic numerals when the horizon is associated with a different stratum (i.e., 2Cu); Number 1 is understood but not shown. The upper part of a complete soil profile is usually called the A horizon, with a B horizon being the zone of accumulation in the middle of a profile, and the C horizon representing the relatively unweathered parent material in the lower part of a profile. Lower-case letters are used to designate subordinate soil horizons (Schoeneberger et al. 2012). A lower-case "b" designates a buried soil; buried soils from top of the core to bottom were numbered consecutively following the "b" in soil horizon nomenclature (Holliday 2004). All stratum and soil designations were assigned in the field and are not formal designations.

A total of 55 samples from buried soils or organic-rich sediments were subsampled from the Reach 2B cores and returned to Far Western for potential radiocarbon dating, archaeological wet-screening through a 1/16-inch mesh, and/or additional paleoenvironmental analyses. Also, 18 charcoal samples were collected for potential radiocarbon dating to aid in the establishment of stratigraphic control of alluvial fills. At the Far Western laboratory, soil subsamples were split in half; half of the subsample was retained for potential paleoenvironmental analysis and the other half was wet-screened through a 1/16-inch mesh by archaeological technician Derek Morris.

All other geotechnical cores housed in the Friant facility taken from reaches outside of 2B were given a cursory examination for the presence or absence of buried soils and/or archaeological evidence, and photographed. Cores outside of Reach 2B that did exhibit well-preserved buried soils were sampled for potential future analysis. Two cores from Reach 4 with over thickened, organic-rich A-horizons were sampled and radiocarbon dated (Table 3).

Table 3. Radiocarbon Dating Results on Samples from Cores Reach 2B and Reach 4.

Core No.	Material	Soil Horizon/ Strat Unit	Depth (cm)	^{14}C Age BP	±	Lower Cal Range BP	Median Probability	Upper Cal Range BP	Lab No. (EZV-)
Reach 2B									
CWSPT-14-15	Charcoal	Unit II	752	15,450	30	18,609	18,718	18,808	00245
SPT-14-8	Organic soil	Akb1	81	1150	25	980	1058	1098	00239
SPT-14-8	Organic soil	Akb2	132	1430	20	1297	1325	1355	00240
CWSPT-14-45	Organic soil	Ab (top)	132	3600	30	3838	3907	3978	00236
CWSPT-14-45	Organic soil	Ab (bottom)	183	4480	30	5152	5173	5289	00237
CNSPT-13-57	Charcoal	Unit I	699	15,300	40	18,447	18,580	18,710	00244
CNSPT-14-23	Organic soil	4A1b	315	4630	30	5372	5412	5463	00241
CNSPT-14-23	Organic soil	4A2b	351	4740	20	5504	5532	5582	00242
CNSPT-13-27	Organic soil	ACb	122	2420	20	2356	2431	2491	00238
CNSPT-15-33	Organic soil	2Ab1	249	1030	25	919	946	976	00340
CNSPT-15-33	Organic soil	2Ab2 (top)	287	550	20	524	549	559	00341
CNSPT-15-33	Organic soil	2Ab2 (bottom)	318	1220	25	1064	1144	1186	00342
SPT-15-2	Organic soil	2Ab1	274	1070	25	931	971	1006	00338
SPT-15-2	Organic soil	2Ab2	338	1140	20	974	1027	1087	00339
Reach 4									
MW-09-86	Organic soil	2Ab1	211	650	25	558	596	602	00255
MW-09-86	Organic soil	2Ab2	277	815	35	680	725	786	00256
MW-09-86	Organic soil	2ABb2	338	4230	35	4800	4789	4860	00257
MW-11-146	Organic soil	Ab	86	1510	25	1337	1390	1418	00258
MW-11-146	Organic soil	ACb	135	1900	25	1780	1850	1898	00259
MW-11-146	Organic soil	ACb	213	4130	30	4566	4674	4729	00260

Note: cm – Centimeters.

RADIOCARBON SAMPLES AND DATING RESULTS

To provide an initial determination of landscape chronology, soil subsamples were carefully collected for radiocarbon (^{14}C) dating, with efforts to avoid potential contamination from bioturbation, the coring process, and subsequent mold growth that occurred during core storage. Despite potential contaminates from older and younger carbon, radiocarbon ages determined on soil organic matter provide a minimum age of landscape stability and concomitant soil formation (Holliday et al. 2008; Mandel 2008). Charcoal, when present within soils and sediments in the cores, was also collected.

Of the soils, sediments, and charcoal sampled for radiocarbon dating, 14 samples (12 organic soil and two charcoal) were sent to Eckert & Ziegler Vitalea ArcLab in Davis, California, to obtain ^{14}C Accelerated Mass Spectrometry (AMS) ages and establish initial chronological control and correlation of the alluvial fills in Reach 2B. An additional six soil samples from two cores in Reach 4 were also submitted to Eckert & Ziegler Vitalea ArcLab for AMS dating to determine the age of soils downstream of Reach 2B.

Radiocarbon results were returned in uncalibrated years BP, and calibrated to 2-sigma (95% probability) with Calib 7.1 software using the IntCal 13 atmospheric curve (Stuiver et al. 2005). Results are presented in both uncalibrated and calibrated years BP in Table 3; the median calibrated ages are hereafter used in text results and discussions that follow.

MODELING BURIED SITE POTENTIAL

For archaeologists to rigorously investigate prehistoric site distributions, to reconstruct how prehistoric populations adapted to a changing landscape, and to model the decision-making processes that underlay settlement and subsistence choices, it is necessary to reconstruct the paleogeography and paleoecology of an area. Such reconstructions then provide a solid basis for refining predictive models of where sites are most likely to be located (a key factor in buried-site potential modeling), and it also provides insights into diachronic changes in settlement patterns and subsistence strategies.

Information provided above, as well as numerous studies throughout northern and central California, demonstrate that repeated cycles of erosion, deposition, and landscape stability occurred across this broad region during the latest Pleistocene and Holocene (e.g., Allen et al. 1999; Meyer 1996; Meyer and Rosenthal 1997, 2008; Rosenthal and Meyer 2004a, 2004b). Due to the episodic nature and timing of these processes, the modern ground surface is often composed of a variety of different landforms that range from almost modern to tens of thousands of years in age. Because the existing geologic maps of the Study Area place these landforms into broad or poorly defined temporal groups, it was necessary to assess the age and refine the extent of the surface deposits so that landforms without the potential for buried archaeological deposits are clearly distinguished from those that possess the potential to contain them.

As the primary goal of the current study is to identify those portions of the landscape with a potential to contain buried archaeological sites—i.e., deposits that cannot be recognized through traditional pedestrian survey—it is necessary to identify segments of the landscape that developed during the span of human occupation in California over roughly the last 13,000 years. Segments of the surface landscape that developed prior to human colonization of North America obviously cannot contain buried archaeological deposits (Rosenthal and Meyer 2004a, 2004b). With this basic understanding, the potential for buried archaeological deposits in the Study Area can be narrowed to the recent landform segments, allowing older portions of the landscape to be confidently excluded from further consideration.

Because landscape changes of different types have occurred at different times, and at different scales (e.g., worldwide sea-level rise, regional climate change, local cutting or filling), it is especially important to recognize how the formation of the current landscape can reflect the complex interplay of different processes over time. By understanding the timing and extent of landscape evolution, it is possible to assess the "geologic potential" for buried prehistoric sites in given areas or regions as a whole. Overall, this provides a strong basis for understanding the relationship between climate change, landscape evolution, human occupation, artificial human modification, and the resulting structure of the archaeological record.

Landform-age mapping conducted by Byrd et al. (2009) for the Restoration Area was used to establish archaeological potential for buried sites. Methods for a revised and updated model for this report considered both the mapped distribution of different Quaternary-age landforms and distance to perennial water source (i.e., main channel of the San Joaquin). Distances from perennial water sources were mapped in 300 meter intervals with the highest sensitivity applied to the first 300 meters adjacent to perennial water sources, and the lowest buried site potential applied to distances greater than 1,200 meters from water. These buried site potential parameters (i.e., those areas modeled as having Lowest, Low, Moderate, High, or Highest sensitivity) were then modified based on field, aerial imagery, and geotechnical core observations. For example, areas near the modern channel that have been scoured out or modified by historic-era or modern channelization that have little to no potential to contain intact or buried archaeological materials were mapped with the lowest potential, rather than given the highest potential because of proximity to the water source.

RESULTS

GEOTECHNICAL CORE ANALYSIS

Of the 280 geotechnical cores extracted throughout the entire Restoration Area, none exhibited apparent archaeological material during visual examination and description. Of the 280 cores, 66 cores were from Reach 2B within the APE for the Mendota bypass project. Of these 66 cores, 29 contained at least one buried soil; only seven cores exhibited multiple buried soils (Figure 5). Core locations were plotted within the APE (Figure 6); cores with buried soils are depicted in red dots and cores without buried soils in yellow dots. The average depth to a buried soil in Reach 2B was 4.35 meters (14.27 feet) below surface; however, with a standard deviation of 2.19 meters (6.89 feet), the depth to buried soils varies across Reach 2B. One buried soil was as shallow as 0.20 meters (0.67 feet) where the surface soil had been truncated. Near the Chowchilla Canal, a buried soil is 2.5 meters (8.2 feet) deep where recent sediments have buried the former stable land. Thus, depth to natural buried soil surfaces depends largely on modern deposition or erosion associated with levee and canal building.

Wet-screening of 49 subsampled A horizons through a 1/16-inch mesh resulted in alluvial (detrital) charcoal flecks in three samples, and only one indeterminate fish bone fragment recovered from a 2Ab2 horizon outside of Reach 2B (Core MW-09-86 in Reach 4).

On October 22, 2015, a portion of the San Joaquin River was surveyed beginning at North San Mateo Road near River Mile 212, and east to River Mile 215. Laura Murphy, Joanne Goodsell (archaeologist, USBR), and Derek Morris, walked the center of the dry river channel to observe soils and sediments on the north and south sides of the channel. One buried soil was observed at GPS-1 (Figure 6) about one meter below surface, but it was not laterally continuous as it was inset next to a more recent cut-and-fill. A second location, GPS-2, marks a large cutbank that includes about 5.5 feet of fill containing modern trash. Additional touring by car of the APE via landowner access on November 19, 2015, in areas around Mendota Pool near River Miles 204–206 revealed no visible cutbank exposures; the current water levels were up to the toe of the levee slopes and all exposed surfaces near the banks were covered in heavy vegetation with 0% visibility.

RADIOCARBON CHRONOLOGY

Eighteen radiocarbon ages determined on bulk soil (A horizons), 12 from Reach 2B and six from Reach 4, and two ages determined from wood charcoal samples from Reach 2B are presented in Table 3. Based on their soil-stratigraphic context, all charcoal samples are detrital, that is, deposited in the alluvial sediments from which they were collected; no charcoal was the result of anthropogenic activity. Bulk soil ages range from 549 cal BP to 5532 cal BP, capturing three general periods of landscape stability beginning at the end of the middle Holocene around 5,500 years ago, one roughly between 2,400 and 1,000 years ago, and another, younger period of stability from about 500 to 800 years ago. These buried soils overlie thick packages of upward-fining clay, silt, and unconsolidated fine, medium, coarse, and very coarse granitic sand. The two charcoal ages from two different cores come from these underlying alluvial packages much deeper in the cores. One charcoal sample from clay (Core CWSPT-14-15) yielded a radiocarbon age of 18,718 cal BP, and one from sand (Core CNSPT-13-57) was 18,580 cal BP (Figure 7), and thus date to the final stage of the Last Glacial Maximum (LGM). All radiocarbon age results were plotted as a function of depth (Figure 8). Despite variability of late Holocene ages in relationship to depth, there is a general trend of increasing age with depth. Significantly, no dated buried soils or former stable land surfaces were identified beyond a depth of more than 4.35 meters (14.27 feet).

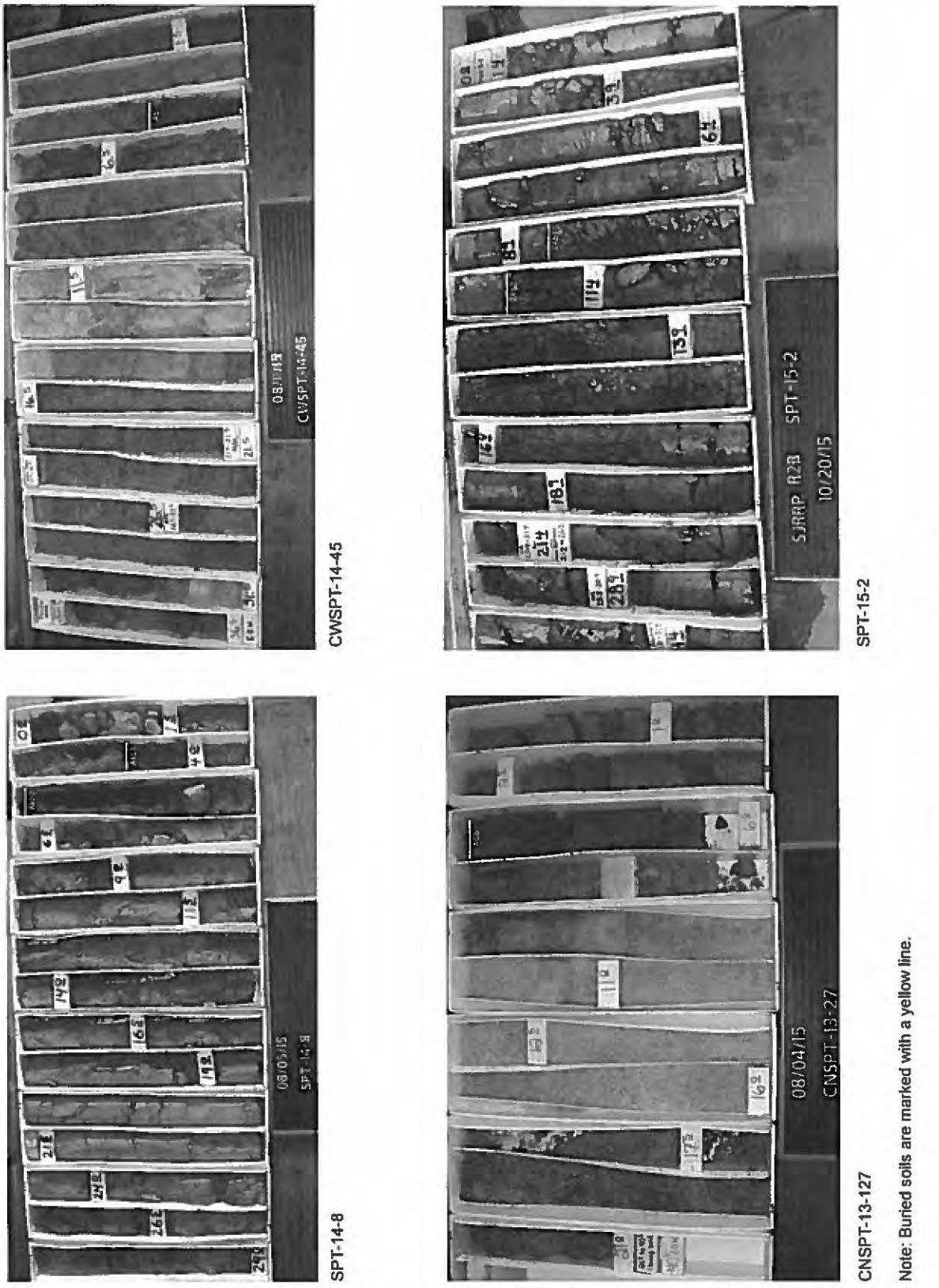

Figure 5. Compilation of Cores Featuring Buried Soils.

Note: Buried soils are marked with a yellow line.

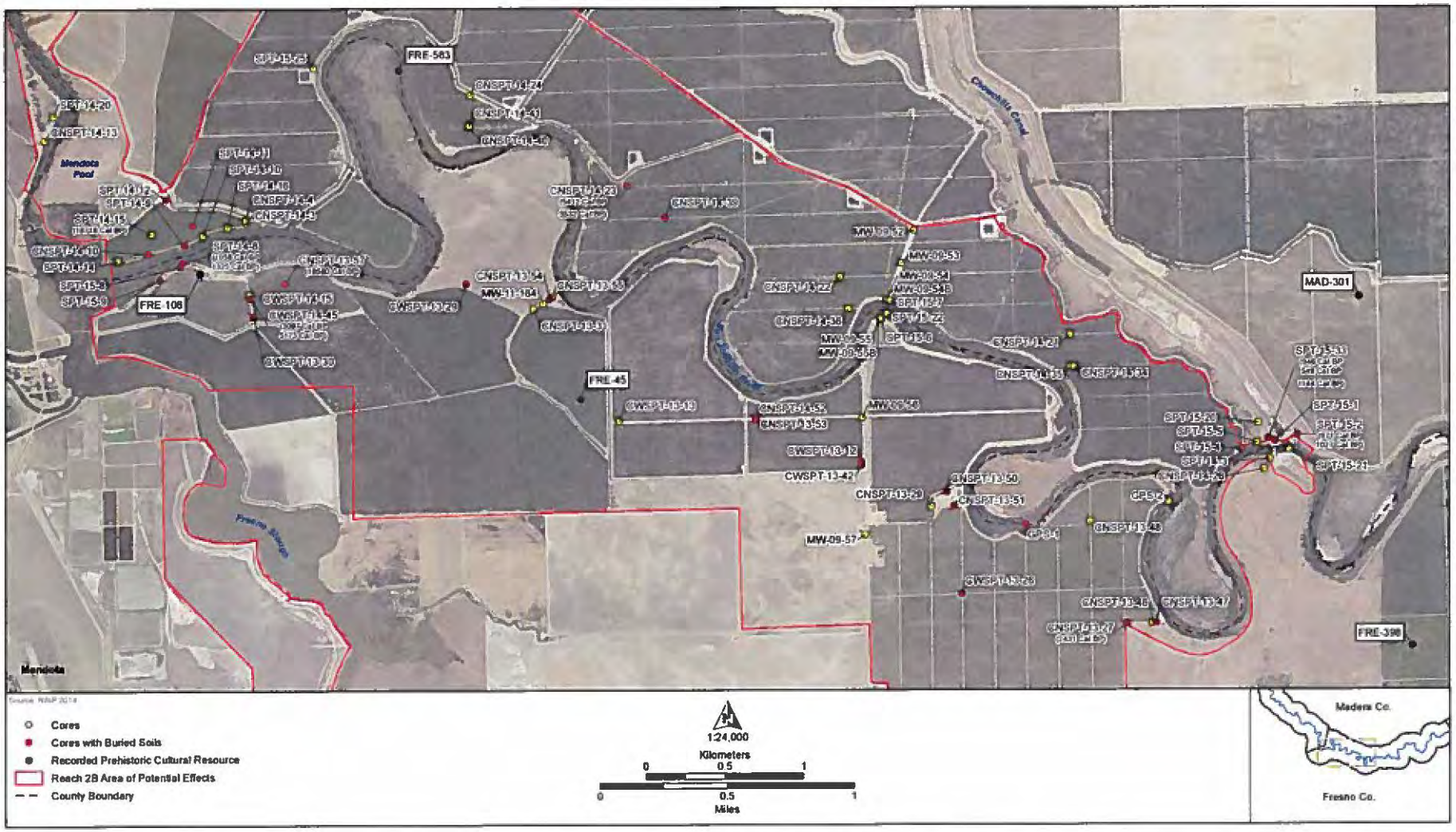

Figure 6. Reach 2B Core Locations in Relation to Known Archaeological Sites.

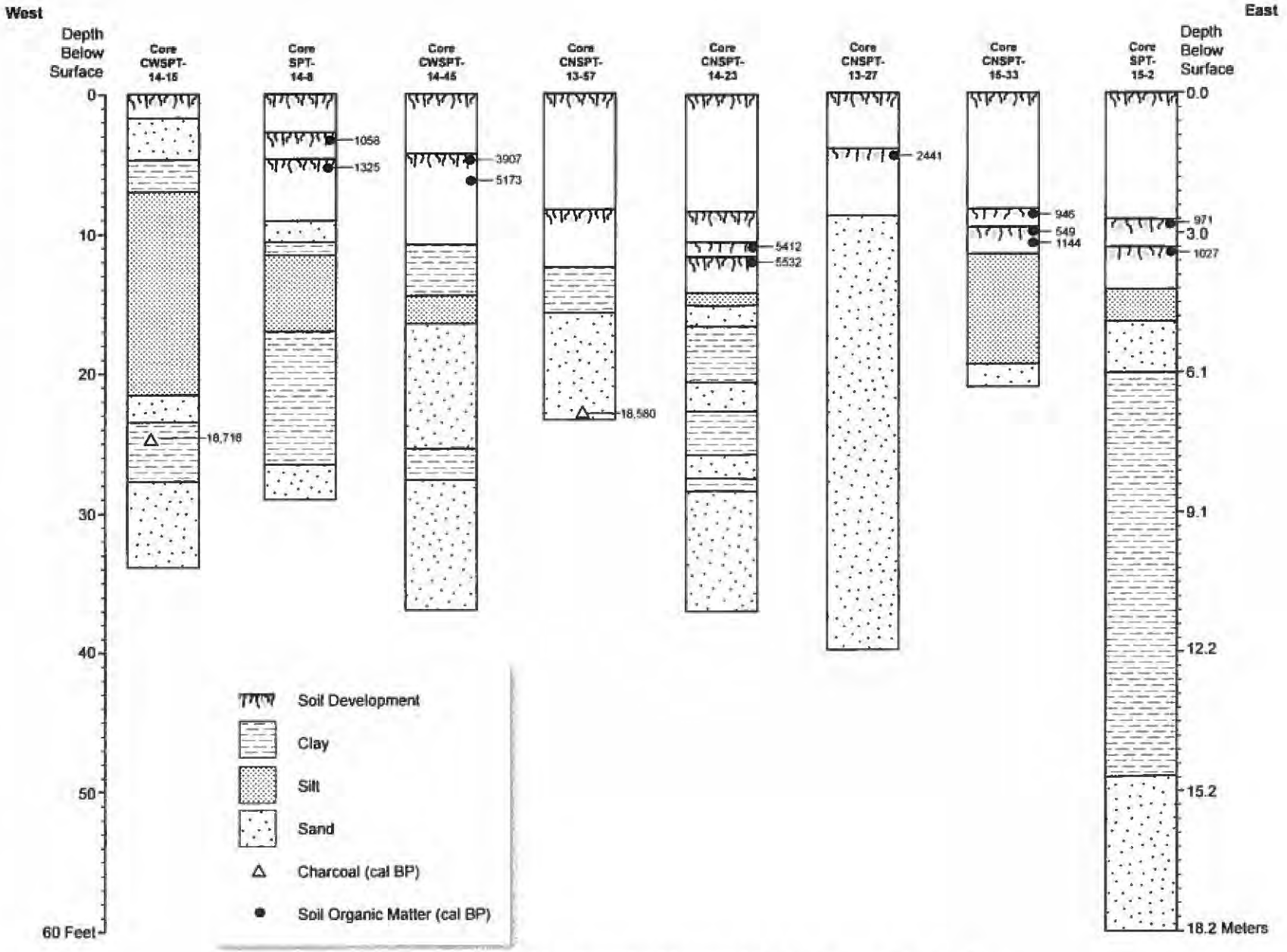

Figure 7. Simplified Soil Stratigraphic Diagram for Select Cores in Reach 2B.

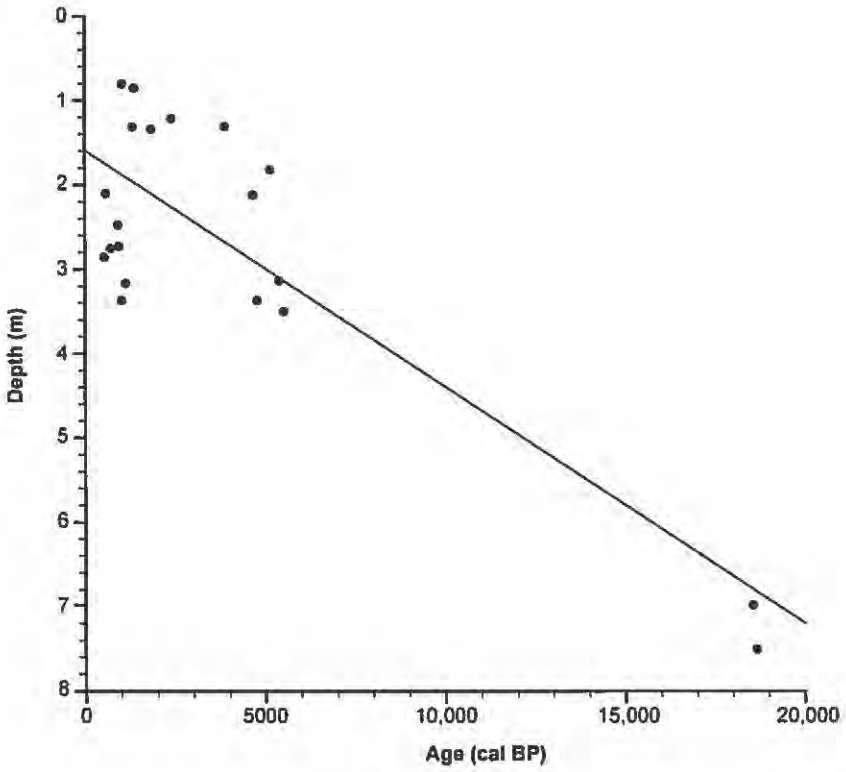

Figure 8. Radiocarbon Depth Function Diagram.

BURIED SITE POTENTIAL MODEL RESULTS

Based on results of the fieldwork (cutbank survey) and analysis of the cores in relation to known previously recorded buried archaeological sites and landform ages (Figure 9), the sensitivity analysis presented in Byrd et al. (2009) was modified to account for larger areas around meander belts that have been scoured out or modified by modern levee construction, which have little or no potential to contain buried or *in situ* archaeological deposits. Using the modeling and sensitivity parameters outlined in the Methods section, the potential for buried sites was mapped across the Reach 2B APE (Figures 10 and 11). Table 4 reflects the breakdown of acreage and percentage of area mapped for the APE (5,590 acres) for the five categories (Highest to Lowest). Based on surface landform ages and their proximity to water, the potential for buried sites is High or Highest in the majority (nearly 75%) of the Reach 2B APE as currently proposed. At the same time, the potential for buried sites is Lowest within the recent alluvial deposits located in and near the active meander belt of the modern San Joaquin River, which amounts to 21.1% of the APE.

Table 4. Buried Site Sensitivity by Acres and Percentage of Area Mapped.

Buried Sensitivity	Acres	% of Area Mapped
Highest	2,294	41.0
High	1,889	33.8
Moderate	206	3.7
Low	20	0.4
Lowest	1,180	21.1
Total APE Acres	**5,590**	**100.0**

Note: APE – Area of Potential Effects.

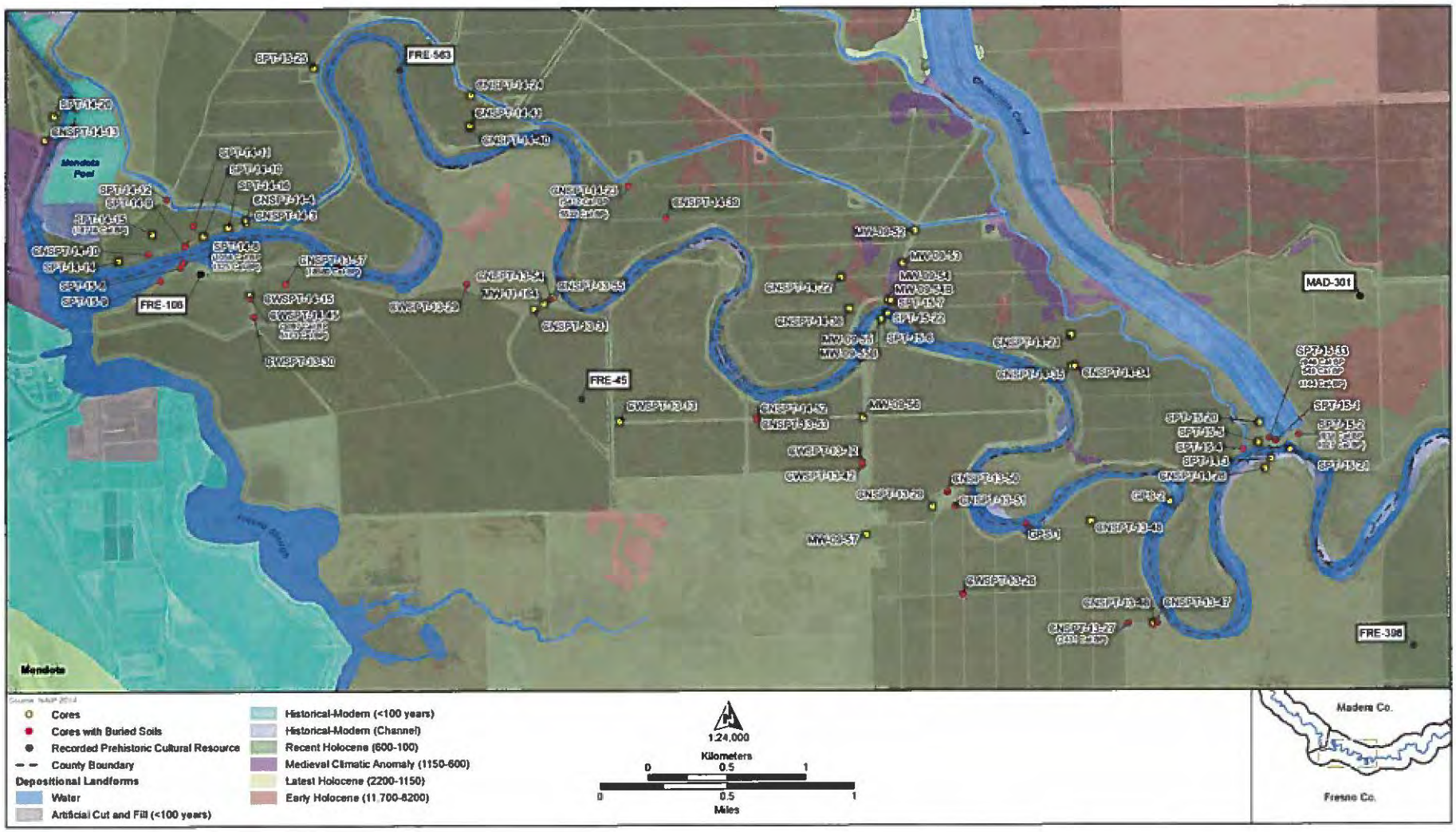

Figure 9. Reach 2B Core Locations Plotted on Landforms.

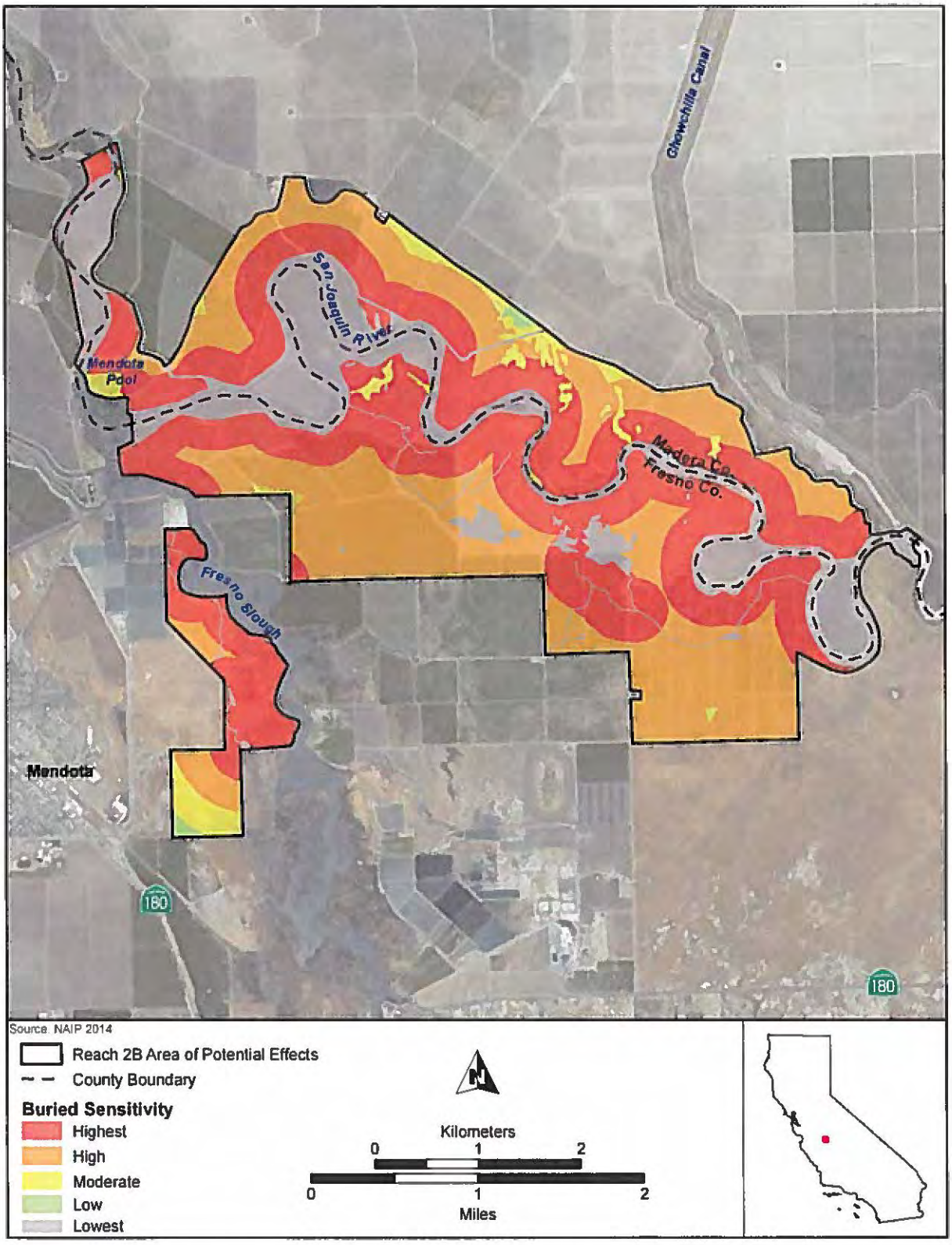

Figure 10. Reach 2B Buried Site Potential in Area of Potential Effects.

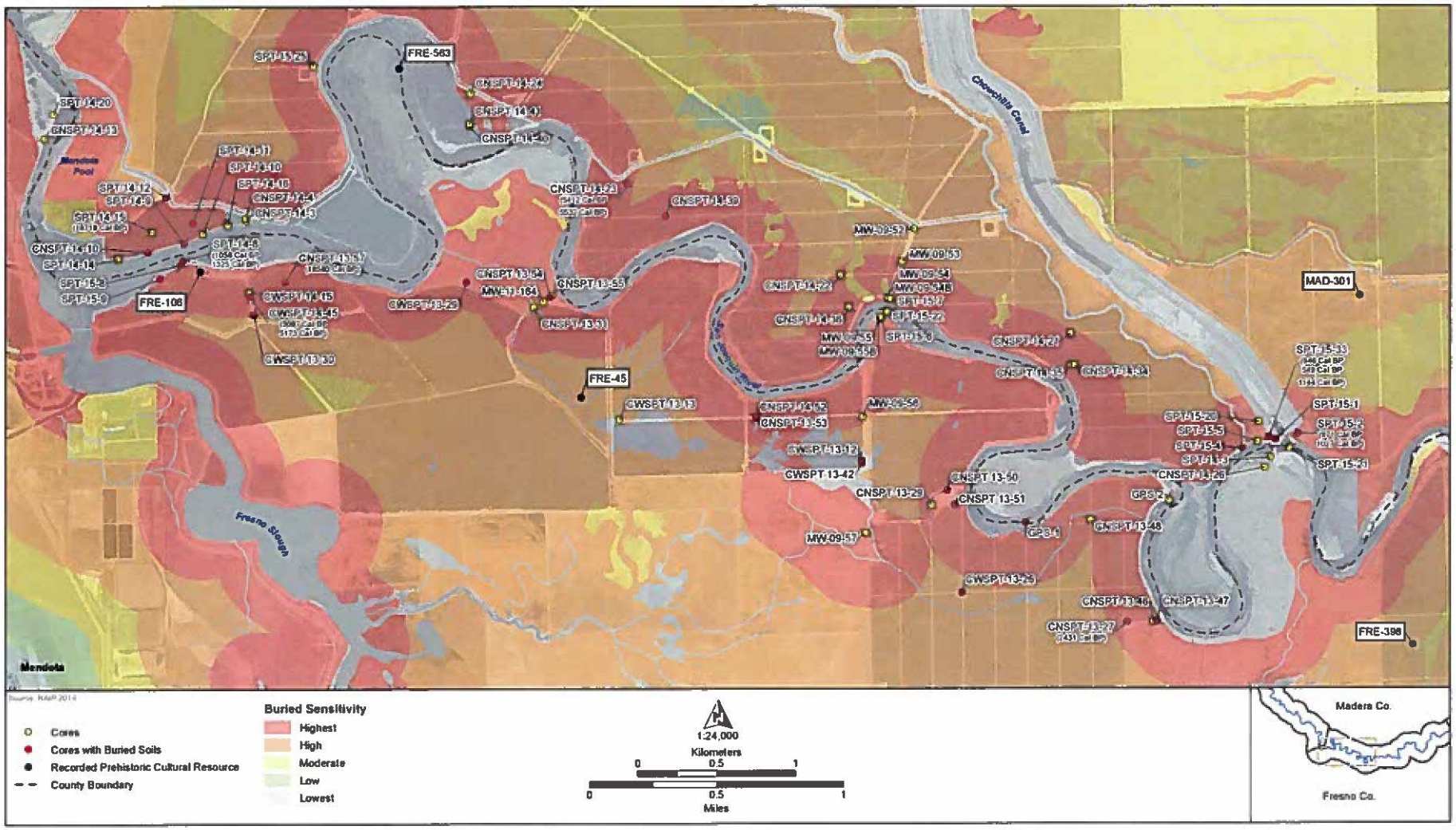

Figure 11. Reach 2B Core Locations Plotted on Buried Site Sensitivity.

DISCUSSION AND RECOMMENDATIONS

Based on the results of this study, one could conclude that the absence of archaeological material in 280 observed cores and the relatively low number of buried soils recorded in the Reach 2B cores equates to a low probability of encountering buried archaeological sites within the APE. However, the negative outcomes may reflect significant biases derived from the core locations. The geotechnical teams placed cores in both previously disturbed (i.e., unnatural) areas containing levee fill, or areas where sediments have aggraded or eroded in the active meander belts due to the effects of historic-era and modern levee construction. These core locations underrepresent other more stable, near-channel areas within the APE. In other words, the effects of historic-era and modern levee construction have created erosion and deposition patterns that do not accurately reflect the "natural" geological conditions that best inform us about the potential for buried prehistoric sites.

Taking these factors into account, buried site sensitivity was revised to exclude the areas within the active meander belt, which is characterized by extensive erosion and recent sediment deposition (i.e., sand, gravel, cobbles). The modeling results within the APE shows a bimodality that allows the areas near and within the river channel, modeled as "Lowest," to be ruled out for *in situ* archaeological materials, while ruling in the "Highest" areas that may require additional consideration or exploratory study.

The presence or absence of buried soils throughout Reach 2B lacks patterning based on the core observations alone. This again could be due to the geotechnical sampling strategy, or could reflect the complex evolution of the San Joaquin River floodplain during and after the middle Holocene. Despite the apparent lack of patterning and the highly variable age and depth relationships, several conclusions about floodplain evolution can be drawn.

First, the sequence of late Holocene buried soils reflect multiple periods of stability, perhaps during times of more effective moisture before and after the MCA and Little Ice Age. Second, the absence of soils and stable land surfaces between 5500 cal BP and the time of the first human occupation for the region corroborates the research showing that geomorphic filtering has biased the latest Pleistocene through middle Holocene archaeological record. In this case, it appears that soils and sediments of this age were either not deposited, or have been removed by erosion from Reach 2B, rather than being preserved or deeply buried.

Given the apparent complexity of this depositional sequence, subsurface exploratory studies will likely be needed to address the potential for buried sites in some areas where deep and/or extensive impact areas are planned, such as the Mendota bypass project, as well as other reaches of the San Joaquin Restoration Area. However, since the cores were taken to an average depth of about 10 meters (33 feet), and given the initial radiocarbon chronology from late Holocene buried soils and late Pleistocene alluvial sediments, we feel confident that the vertical archaeological impacts are likely to occur only in the upper five meters of any given land surface within the APE.

In other words, radiocarbon results and geotechnical core descriptions suggest the potential to encounter buried cultural material lies within the first four to five meters below the ground surface, but not beyond—suggesting that backhoe trenching, rather than coring, will likely be the most efficient and effective method for archaeological exploration. Because the earth disturbances for the proposed Mendota pool control structure (River Mile 205) will be approximately 3.6 meters (12 feet) deep and 328 meters (1,000 feet) in width, exploratory backhoe trenching is recommended in this area.

Given that two of five known prehistoric archaeological sites were discovered in a buried context, both of which included human remains, targeted geoarchaeological trenching in the proposed high impact area near Mendota pool is the best method for discovery of buried archaeological materials. In this area, six cores near the buried archaeological site of FRE-106 exhibited buried soils, two of which were dated 1058

and 1325 cal BP in Core SPT-14-8 within the upper 1.5 meters of the land surface (see Figures 5 and 6). Considering the level of disturbance planned for this segment of the APE, we propose targeted backhoe trenching be conducted in the areas where the cores were found to contain buried soils, both on the north and south side of the channel. If monitoring is required for the bypass project, monitoring may only be needed within the upper five meters of the floodplain deposits, because that appears to be the maximum depth at which middle to late Holocene soils and sediments occur.

In sum, thick late Pleistocene alluvial deposits too old to contain archaeological material underlie late Holocene alluvium throughout Reach 2B. Based on geotechnical core analysis and limited cutbank survey, buried soils, where present, are not laterally continuous in or near the active river channel. However, buried soils, representing several periods of stability within the last 5,500 years, do occur within the APE that have an elevated potential to contain buried archaeological materials within the upper four to five meters of the land surface.

This preliminary study demonstrates the need for a geoarchaeological investigation within the proposed Mendota pool area, as well as the continued development and refinement of a work plan to address the potential for buried sites in conjunction with systematic pedestrian survey and exploratory investigations in other reaches of the Restoration Area. In part, this is because the Reach 2B results suggest that the complex sequence of landscape development will be different both upstream and downstream, which may lead to changes in the estimated potential for buried sites, and have direct implications for determining the need, and appropriate level of effort, for future archaeological studies in different parts of the project area.

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