PROGRAMMATIC AGREEMENT
AMONG THE
U.S. ARMY CORPS OF ENGINEERS,
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER, THE CENTRAL VALLEY FLOOD PROTECTION BOARD, and WEST SACRAMENTO FLOOD CONTROL AGENCY
REGARDING THE
WEST SACRAMENTO GENERAL REEVALUATION REPORT,
YOLO COUNTY and SOLANO COUNTIES, CALIFORNIA

WHEREAS, the United States Army Corps of Engineers, Sacramento District (The Corps) is proceeding to implement aspects of the recommended plan in the West Sacramento General Reevaluation Report. The West Sacramento Project (Undertaking) was authorized in the Water Resources Development Act 1992, Pub. L. No. 102-580, § 101(4), and the Energy and Water Development Appropriations Act of 1999, Pub. L. No. 105-245, 112 Stat. 1840 (1999) (project, as described in Attachment A: *Description of the West Sacramento GRR and Projects*); and

WHEREAS, this Undertaking requires authorization from the Corps to modify federal levees (See Attachment B) under Section 14 of the River and Harbors Act (33 U.S.C § 408) and a permit to discharge fill to waters of the United States under Section 404 of the Clean Water Act (33 U.S.C § 1344), and these actions constitute undertakings requiring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) (16 US Code Section 470f); and

WHEREAS, the Corps has determined that the Project activities constitute an Undertaking, as defined at 36 C.F.R. § 800.16(y), and has the potential to affect properties listed in or eligible for the National Register of Historic Places (NRHP) (historic properties)and therefore is subject to Section 106 of the National Historic Preservation Act of 1966 (NHPA); and

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

WHEREAS, because the final design of the Undertaking has not been determined the Corps has decided to defer final identification and evaluation of historic properties as permitted by 36 C.F.R. § 800.4[b][2]); and

WHEREAS, the Corps has chosen to prepare this programmatic agreement (Agreement) to ensure that historic properties that may be affected by the Undertaking are identified, such resources are evaluated for eligibility in the National Register of Historic Places (NRHP), and any adverse effects caused by this Undertaking are resolved prior to construction of project features; and

WHEREAS, in accordance with 36 CFR § 800.2(C)(2)(ii)(A), 800.3(f)(2), and 800.14(b)(2)(i), the Corps has contacted the Wilton Rancheria and the Yocha Dehe Wintun Nation, and interested Native American Tribal governments individuals to invite them to consult on the Undertaking and this

Agreement and they (and others who may be identified in the future as appropriate concurring parties) will be invited to concur with this Agreement; and

WHEREAS, in accordance with 36 C.F.R. § 800.2(b), the Advisory Council on Historic Preservation (ACHP) has been invited to participate in consultation, and the ACHP has accepted/declined in a letter [**Corps provide date when available**]; and

WHEREAS, the Corps has consulted with the State Historic Preservation Officer (SHPO) in accordance with 36 C.F.R. Part 800; and

WHEREAS, the Corps has invited the Central Valley Flood Protection Board (CVFPB), the West Sacramento Area Flood Control Agency (WSAFCA), and interested American Indian Tribal governments to concur in this agreement because the CVFPB authorizes modifications to affected levees (California Water Code Section 8710); and

WHEREAS, in accordance with 36 C.F.R. § 800.6(a)(4) and 36 C.F.R. § 800.14(b)(2)(ii), the Corps has notified the public of the Undertaking and provided an opportunity for members of the public to express their views on the Undertaking and the Section 106 process as outlined in this Agreement; and

WHEREAS, the Corps has prepared, and will revise as necessary, a research design and historic property management plan (Attachment C, *Historic Properties Management Plan* [HPMP]) that will be used to guide inventory and management of potential historic properties;

NOW THEREFORE, the Corps and the SHPO, agree that upon the Corps' decision to proceed with the Undertaking, the following stipulations will be implemented for all portions of the undertaking dependent on these Projects, in accordance with this Agreement and the attached HPMP in order to take into account the effects of the Undertaking on historic properties; and further agree that these stipulations shall govern the Undertaking and all activities occurring under these Projects that may affect historic properties, until this Agreement expires or is terminated.

STIPULATIONS

I. PROJECT DESCRIPTION

The Project is being developed to provide flood risk management to the City of West of Sacramento. The non-Federal sponsor for the Project is the CVFPB. The WSAFCA has a Local Cooperation Agreement with the CVFPB. The Area of Potential Effects (APE) for the Project is shown in **Attachment B, APE and Alternatives**. The authorized Undertaking is a flood risk management project that includes the features as described in **Attachment A, Project Description.**

II. EXISTING CONDITIONS

A records and literature search has been completed for the entire APE. Limited archaeological inventory and survey has been completed for all areas of the APE. A systematic survey of the APE has not been conducted.

A number of prehistoric sites are known to be present along the banks of the Sacramento River. However, archaeological survey of the area is of limited value because the alluvial depositional environment may obscure and bury sites, leaving no surface manifestation of those archaeological resources. For most of the length of the Project, levees have been built on the riverbanks or along the areas where the river has traditionally meandered. These levees are one focus of the Project's activity, and occupy a substantial portion of the Project's APE. Furthermore, it has not been established whether certain known sites in proximity to the Project's development activities extend under the existing levees. The existing levees both obscure ground surfaces and prevent subsurface archaeological testing within their footprints.

Because of these conditions, a full assessment of archaeological sites that may be present in the APE cannot be made in advance of construction. There is no definitive information, even for sites known to be in proximity to the Project, of site boundaries relative to the APE, or of the significance or integrity of any portions of such sites that may be within the APE. For these reasons, even though archaeological deposits may extend into the APE, and even though some of these deposits may qualify as Historic Properties, it is impossible to develop meaningful site-specific Historic Properties Treatment Plans (HPTPs) prior to construction, or to carry out all necessary mitigation in advance of the Corps' approvals, permitting and construction.

The levees of the Sacramento River are the one known historic properties within the APE that will be affected by the Project. The Sacramento River levees include those along the west bank of the Sacramento River that abut the City of West Sacramento.

III. Definition of the Area of Potential Effects for Each Phase or Activity

The APE for Project activities shall include the direct footprint of the activity, a buffer, and indirect effects, determined by consultation between SHPO and the Corps, according to the nature of the activity, land ownership interest or easement, and the probability that ground-disturbing work may extend beyond the footprint of planned improvements and activities. **Attachment B, Figures 1-4** includes an overall APE for the Project. As construction phases are planned and designed the APE shall be defined or revised as needed.

A. Revisions to the APE: For purposes of this Agreement, a revised APE for specific phases shall be defined to meet, at a minimum, the following criteria:

The APE for any segment of the West Sacramento levees that are being improved as part of the Project shall include the levee segment and a corridor extending not less than 75 feet from the landside toe of the levee segment. The APE also shall include:

- The extent of all Project construction and excavation activity required to construct flood control facilities and to modify irrigation and drainage infrastructure,

- The additional right-of-way/easements obtained by the Corps as part of the undertaking ,

- All areas used for excavation of borrow material and habitat creation, and

- All construction staging areas, access routes, spoil areas, and stockpiling areas.

B. Project Phasing, Potential Revisions to the APE, and Potential Cultural Resources within the Revised APE: The overall general APE shall be determined and documented in accordance with 36 CFR § 800.4(1). Because the Project will occur in phases, it will be necessary to further define the APE for each phase. The APE for each phase shall be submitted with the cultural resources inventory reports, and shall be consulted upon as part of that document, pursuant to **Stipulation IV (Identification)**, below.

After the initial consultation, changes to the APE may be necessary as the Corps refines its phased Project plans. In particular, the ability of the Corps to obtain access permission from private landowners, determination of borrow sites and ongoing negotiations with resource agencies regarding species mitigation requirements may affect the final Project's design, and may expand the current APE in some areas. Modifications to the APE may be made by the Corps without amending this Agreement. Any changes to the APE shall be made in accordance with subsections A and B of this **Stipulation III (Area of Potential Effects)**. The final APE shall account for all Project development activities for the as-built Project. The Corps shall consult with the SHPO and Concurring Parties of any change in the APE and the Corps shall determine the potential for Project development activities within the revised APE to affect historic properties, through cultural resources inventory and evaluation

(1) If there is the potential that historic properties exist in the revised APE, the Corps shall submit to the SHPO:

    (a) A map of the revised APE; and

    (b) A description of Project development activities to take place in the revised APE; and

    (c) A description of the inventory, nature, location, and known or potential historic properties in the revised APE; and

    (d) A description of any archaeologically sensitive areas in the revised APE that require monitoring by an archaeologist, as appropriate; and

(e) A plan for managing cultural resources in a manner that either avoids Project-related effects to cultural resources, or which mitigates any adverse effects, and which provides for the management of unforeseen cultural resources discoveries.

(2) If no cultural resources are identified within a revised APE, the Corps shall document such a determination, provide documentation to the SHPO and the Concurring Parties and keep such documentation on file at its principal offices.

After the Corps revises the APE and if such a change has the potential to have an effect on Historic Properties, the Corps shall submit the documentation to the SHPO for their review. The SHPO shall have thirty (30) calendar days from the date of receipt of the notice of a revision to the APE to review any proposed historic preservation activities. Should the SHPO not respond in writing within 30 calendar days, the Corps shall proceed with the revised APE, in accordance with 36 C.F.R. § 800.3(c)(3), and the proposed historic preservation activities, if any.

Should the SHPO object to the definition of the revised APE or proposed historic preservation activities, the Corps and the SHPO shall consult for a period not to exceed fifteen (15) calendar days following the date of the receipt of the SHPO's written objection in an effort to come to agreement on the issues to which the SHPO has objected.

IV. IDENTIFICATION

An inventory of Historic Properties within the APE consistent with the *Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716–44740) will be initiated for the Undertaking or for individual phases of the Undertaking as construction details become available. The Corps shall submit a completed inventory and evaluation for each phase of Project work to the SHPO for review and comment prior to initiating work. Such inventory shall be deemed complete by the Corps when the SHPO concurs with the NRHP eligibility recommendation for all cultural resources within the APE for that phase.

V. GEOTECHNICAL INVESTIGATIONS

For the purposes of gathering engineering data and for Project planning, it may be necessary for the Corps to conduct limited geotechnical investigations for areas within the APE. The Corps may conduct geotechnical investigations (borings, potholing, trenches) for planning and exploratory efforts provided the following requirements have been met:

A. A records and literature search has been conducted and it has been determined there are no known existing cultural resources sites located within 50 feet of the areas identified for geotechnical investigations; and

B. An archeological field survey of the areas identified for geotechnical investigations has been conducted and it has been determined there are no known cultural resources present; and

C. In the event that a cultural resource is identified during the records and literature search or the field survey as within an area where geotechnical investigation will occur, the geotechnical investigation in that area shall be relocated; and

D. Provisions for an archeological monitor meeting the qualifications described in **Stipulation IX.C.** are included in the contract specifications for the geotechnical investigations. As appropriate or when geotechnical activities may occur in sensitive areas, an archeological monitor will be present for all ground disturbing activities; and

E. If potentially NRHP eligible resources are discovered during geotechnical investigations, ground disturbing activities will cease until the provisions of 36 C.F.R. § 800.13(a), *Planning for subsequent discoveries* are met. Discoveries will be evaluated in accordance with **Stipulation VI** (**Evaluation**) and if a discovery is determined to be a Historic Property, **Stipulation XI (Discovery Procedures for Resources Encountered During Construction)** shall be followed; and

F. A Memorandum for Record will be written by the Corps documenting the results of the records and literature search, the archeological field survey, any decisions to relocate geotechnical investigation areas, and decisions to include an archeological monitor for ground disturbing activities. A synopsis of these Memoranda for Record will be included in the yearly report to the SHPO for undertaking activities.

VI. EVALUATION

A. Recordation of Historic Properties: Survey recordation shall include sites, features, isolates, and re-recordation of previously recorded historic and prehistoric archaeological sites and structures as necessary. The survey shall ensure that historical structures and buildings, and historical engineering features are recorded in addition to archaeological sites. Recordation of prehistoric and historic archaeological sites, historic structures and buildings shall be prepared using the California Department of Parks and Recreation (DPR) 523 Site Record forms.

B. Evaluation of Historic Properties: Cultural resources shall be evaluated for their eligibility for listing in the NRHP consistent with the *Secretary of Interior's Standards for Evaluation and* National Register Bulletin 15*; How to Apply the National Register Criteria for Evaluation*. Such evaluation shall be deemed complete by the Corps when the SHPO concurs with the NRHP eligibility recommendation.

C. Historic Context, Recordation, and Treatment of Levees: The Sacramento River levees are a known cultural resource within the APE that may be affected by the Project. Sections of the levees have been recorded and evaluated for their individual eligibility for listing in the NRHP but

no overall historic context or evaluation of the levee system has been developed. Because the specific Project design that may alter the levees will not be developed until after the Project has been approved for design, a determination of effect and HPTP cannot be developed until after approval and execution of this Agreement. In order to document the levees for evaluation, the Corps will develop a historic context and HPTP for recordation of the Sacramento River levees within the APE in order to evaluate the effects of the Project on the levees. The HPTP shall consider the levees in the context of the entire Sacramento River levee systems. Additionally, the HPTP shall require the development of clear and specific criteria for determining (1) recordation guidelines for the levees within the APE, (2) contributing and non-contributing elements of the levee system, (3) thresholds of adverse effect, (4) treatment of adverse effects. The SHPO shall have 30 calendar days from the date of receipt of the historic context and HPTP to review and to provide in writing comments to the documents. All comments will be considered for the final historic context and HPTP. If the Corps does not receive comments within 30 days of submittal of a determination of effect to the SHPO, they may assume that the SHPO has no objections to the Corps determination for treatment of the levees for this Project.

VII. DETERMINATION OF EFFECTS

Avoidance of adverse effects to Historic Properties shall be considered the preferred treatment approach. The Corps will consider redesign of the Project in order to avoid Historic Properties and Project effects that may be adverse. However, it may not be possible to redesign the Project in order to avoid adverse effects to all Historic Properties.

The Corps will apply the criteria of adverse effect pursuant to 36 CFR § 800.5(a)(1) to all Historic Properties within the APE that will be affected by the Project. Determinations of effect will be made in consultation with the SHPO. The SHPO shall have 30 days from receipt to comment in writing on the determination of effects. If the SHPO does not respond within 30 days of receipt of a request for review of a determination of effects document, the Corps may either proceed to the next step in the process based on their determination of effects or consult with the Council in lieu of the SHPO.

If the Corps determines that no Historic Properties are affected or determines there is no adverse effect to Historic Properties in accordance with 36 C.F.R. §§ 800.4(d)(1) or 800.5(b), and there are no written objections from the SHPO, the Corps will document the determination and their obligations under the NHPA for this phase of the Project will be complete.

If affects to Historic Properties are determined to be adverse, **Stipulation VIII (Historic Properties Management Plan)**, below, will be followed.

VIII. HISTORIC PROPERTIES MANAGEMENT PLAN

The Corps, in consultation with the SHPO, shall develop a Historic Property Management Plan (HPMP), which provides the framework by which remaining identification, evaluation of eligibility,

determinations of effect, and resolution of adverse effect to Historic Properties shall occur. The HPMP shall be appended to this Agreement and will form the basis of subsequent Historic Property Treatment Plans (HPTPs) that may be required for one or more phases of the Project.

The preferred treatment approach is to avoid Historic Properties; when avoidance is not feasible, the Corps, in consultation with the SHPO, shall ensure that appropriate measures are developed in the HPTP that are designed to minimize and/or mitigate Project-related effects to Historic Properties. An HPTP will be developed to resolve adverse effects to Historic Properties and will be based upon the structure outlined in the HPMP. For properties eligible under criteria specified in 36 C.F.R. § 60.4 (a) through (d), mitigation other than data recovery may be considered in the treatment plan (e.g., HABS/HAER, oral history, historic markers, exhibits, interpretive brochures or publications, or other means as deemed appropriate by the Signatories). The HPMP and HPTPs shall then become the means for the Corps to comply with 36 C.F.R. § 800.6 for the overall Project and individual phases.

A. **Review:** The Corps shall submit the Draft HPMP to the SHPO for review and comment. The SHPO shall have thirty (30) calendar days after receipt of the HPMP to provide written comments to the Corps. The Corps shall ensure that any written comments received during this time period are considered for the Final HPMP. Failure of the SHPO to comment within thirty (30) calendar days of receipt shall not preclude the Corps from allowing the HPMP to be finalized and implemented in accordance with the terms of this Stipulation.

B. **Historic Property Treatment Plans:** The Corps shall consult the SHPO, pursuant to 36 C.F.R. § 800.5, when the Corps has determined that an action covered by this Agreement will adversely affect a Historic Property, and a HPTP specific to the phase of the Project or the Historic Property will be prepared and appended to the HPMP following consultation with the signatories. An HPTP may address individual or multiple Historic Properties. An HPTP shall stipulate those actions the Corps shall take to resolve the adverse effects of the Project on Historic Properties affected by a certain phase of the Project. The Corps shall ensure that all provisions of an HPTP are carried out as stipulated in the HPTP. All Signatory Parties shall have thirty (30) calendar days to review and comment on any HPTP for this Project. Circulation of the HPTP shall not include a recirculation of the HPMP. The SHPO shall indicate in their review comments whether or not the HPTP is acceptable. The Corps shall ensure that any written comments received during this time period are considered for the Final HPTP. Comments from the SHPO that are not acceptable to the Corps shall be resolved by consultation between the Corps and SHPO for a period of not more than fifteen (15) calendar days. Should the Corps and SHPO be unable to resolve any dispute regarding the SHPO comments, the consulting parties shall proceed in accordance with **Stipulation XVII (Dispute Resolution)** of this Agreement. Failure of the Signatory Parties to comment within thirty (30) calendar days of receipt shall not preclude the Corps from allowing the HPTP to be finalized and implemented in accordance with the terms of this Stipulation. Final copies of the HPTPs shall be provided to the Signatory Parties to this Agreement.

C. **Unanticipated Discoveries and Treatment:** In accordance with the HPMP, for those Historic Properties found during construction, an HPTP applicable to the Historic Property or Historic Properties that may sustain adverse effects by the Project shall be prepared and amended to the HPMP. For HPTPs developed due to an unanticipated discovery during construction, all Signatory Parties shall have fifteen (15) calendar days from the date of receipt to review and comment on the HPTP. The SHPO shall indicate in their review comments whether or not the HPTP is acceptable. The Corps shall ensure that any written comments received during this time period are taken into account and incorporated into the Final HPTP. Comments from the SHPO that are not acceptable to the Corps shall be resolved by consultation between the Corps and SHPO for a period of not more than five (5) calendar days. Should the Corps and SHPO be unable to resolve any dispute regarding the SHPO's comments, the consulting parties shall proceed in accordance with **Stipulation XVII (Dispute Resolution)** of this Agreement. Failure of the Signatory Parties to comment within 15 calendar days of receipt shall not preclude the Corps from allowing the HPTP to be finalized and implemented in accordance with the terms of this Stipulation.

D. **Reporting:** Reports and other data pertaining to the inventory of, and treatment of effects on, Historic Properties may be distributed to the Signatories and Concurring Parties to this Agreement and to interested Native American Tribal governments, and other members of the public consistent with **Stipulation XVI (Confidentiality)** of this Agreement. Individual HPTPs may be submitted simultaneously with the cultural resources inventory report for specific Project phases (See Attachment B). If HPTPs are submitted simultaneously with an inventory and evaluation report for a Project phase or with an addendum to such report for an expanded APE or Project description, the Corps and SHPO review period for such HPTPs shall run concurrently with the review period for the inventory report (not to exceed thirty (30) days).

E. **Amendments/Addendums/Revisions:** The Corps shall submit to the SHPO and other signatories for review and comment any amendment, addendum, revision, or other change to the HPTP. The Corps shall proceed to make changes to the HPTP as per the procedure and schedule for the review and approval of the original HPMP. If a Historic Property is discovered within an expanded APE subsequent to an initial inventory effort for a phase, and the Corps and SHPO agree that the Project may adversely affect the property, the Corps shall submit an addendum to the HPTP or a new HPTP. The review schedule for this submittal follows the provisions of **Historic Properties Treatment Plans**, subpart of **Stipulation VIII.B**.

F. **Data Recovery:** When data recovery is proposed, the Corps, in consultation with the SHPO, shall ensure that HPTPs are developed consistent with the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* and the ACHP's "Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites" (ACHP, May 18, 1999).

G. **Final Report Documenting Implementation of the Historic Properties Treatment Plan(s):** Within one year after the completion of all work performed as part of the Project or a phase of the

Project the Corps shall submit to the Signatory Parties a Final Report documenting the results of all work prepared under the HPTPs and the information learned from each of the Historic Properties. This report shall be submitted to the Signatory Parties for review and comment. All Signatory Parties shall have 30 calendar days to review and comment on the Final Report for the Project or phase of the Project. The SHPO shall indicate in their review comments whether or not the Final Report is acceptable. The Corps shall ensure that any written comments received during this time period are taken into account and incorporated into the Final Report. Failure of the Signatory Parties to comment within 30 calendar days of receipt shall not preclude the Corps from allowing the Final Report to be finalized and implemented in accordance with the terms of this Stipulation, which the Corps shall incorporate.

IX. QUALIFICATIONS

A. Professional Qualifications. All technical work required for historic preservation activities implemented pursuant to this Agreement shall be carried out by or under the direct supervision of a person or persons meeting at a minimum the *Secretary of Interior's Professional Qualifications Standards* for prehistoric archaeology, historic archaeology, architectural history, or history, as appropriate (48 FR 44739). "Technical work" here means all efforts to inventory, evaluate, and perform subsequent treatment such as data recovery excavation or recordation that is required under this Agreement. This stipulation shall not be construed to limit peer review, guidance, or editing of documents by SHPO and associated Project consultants.

B. Historic Preservation Standards. Historic preservation activities carried out pursuant to this Agreement shall meet the *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740) and the *Secretary of Interior's Standards for Treatment of Historic Properties* as well as standards and guidelines for historic preservation activities established by the SHPO. The Corps shall ensure that all reports prepared pursuant to this Agreement will be provided to the signatories and shall ensure that all such reports are produced in accordance with the published standards of the California Office of Historic Preservation, specifically, *Preservation Planning Bulletin* Number 4(a), "Archaeological Resources Management Reports (ARMR): Recommended Contents and Format" (December 1989).

C. Archaeological Monitor Standards. Archaeological monitoring activities required for exploratory, construction, or construction related activities implemented pursuant to this Agreement shall be carried out by a person meeting at a minimum the *Secretary of Interior's Professional Qualifications Standards* for archaeology or history (48 FR 44739). "Archaeological monitoring" here includes those ground disturbing activities that have been determined by the Corps to be occurring in areas potentially sensitive for Historic Properties or buried resources.

X. NOTICES TO PROCEED WITH CONSTRUCTION

Notices to Proceed (NTP) may be issued by the Corps for individual construction segments, defined by the Corps in its construction specifications, after a Historic Properties inventory has been completed [per **Stipulations VIII (Historic Properties Management Plan)**, above], and prior to treatment of adverse effects on Historic Properties within the APE provided that:

A. A plan to respond to inadvertent archaeological discoveries is prepared by the Corps and approved by SHPO prior to the commencement of Project activities anywhere in the APE for that phase of the Project; and

B. Project development activities do not encroach within 30 meters (100 feet) of the known boundaries of any Historic Property as determined from archaeological site record forms, other documentation, or as otherwise defined in consultation with the SHPO; and

C. An archaeological monitor meeting the professional qualifications as described in **Stipulation IX (Qualifications)**, above, is present during any Project activities that are anticipated to extend either vertically or horizontally into any areas designated to be archaeologically sensitive by the Corps in consultation with SHPO.

XI. DISCOVERY PROCEEDURES FOR RESOURCES ENCOUNTERED DURING CONSTRUCTION

If cultural resources are discovered during construction, all construction shall immediately stop within 100ft (30m) of the discovery, the location of the discovery will be marked for avoidance, and efforts will be made to prevent inadvertent destruction of the find. The contractor must notify the Corps (if no Corps representatives are on location). The Corps shall determine whether the discovery is a potential NRHP-eligible resource per the criteria in 36 CFR Section 60.4. If the Corps determines that the discovery is not a potentially NRHP-eligible resource, the discovery will be documented and construction may proceed at the direction of the Corps.

If the Corps determines that human remains have not been encountered, that the discovery is not an isolated find, and that the discovery may be eligible for the NRHP, the Corps will notify the SHPO and other relevant parties within 48 hours of the discovery. Notification should include a description of the discovery, the circumstances leading to its identification, and recommendations for further action. Where feasible, the notification will also include a tentative NRHP-eligibility discussion per 36 CFR Section 60.4 and a finding of effect per 36 CFR Section 800.5(a)(1). If the resource cannot be evaluated based upon available evidence (for example, where test excavation is required), the Corps shall include a plan of action for further technical work necessary to determine the eligibility of the resource and make a finding of effect per 36 CFR Section 800.5(a)(1). Treatment shall be implemented where necessary to resolve adverse effects on inadvertently discovered historic properties. If treatment is necessary to resolve adverse effects, The Corps shall consult with Native American individuals and organizations that attach cultural significance to the relevant historic properties and with the SHPO prior to implementing treatment. The SHPO shall have 15 calendar days to review findings of effect and treatment plans submitted under this stipulation, when treatment is selected from the attached historic property treatment plan. When new treatment methods are developed, review shall follow Stipulation VIII(C) above.

If human remains are present, treatment shall conform to the requirements of state law under California Health and Safety Code Section 7050.5 and Public Resources Code Section 5097.98, unless the discovery occurs on federal land. Discoveries on federal land shall conform to the requirements of the Native American Graves Protection and Repatriation Act (NAGPRA, 25 US Code Section 3001 et seq.), after complying with the requirements of California Health and Safety Code Section 7050.5, which requires notice to the County Coroner so the coroner may determine if an investigation into the cause of death is required. These legal requirements, as well as appropriate monitoring, will be described in the plan, as indicated in Attachment 2.

XII. CURATION

The Corps shall ensure that all cultural materials and associated records resulting from identification, evaluation, and treatment efforts constructed under this Agreement are curated in accordance with 36 C.F.R. § 79, except where state law and regulations, including, but not limited to, California Public Resources Code Sections 5097.98 and 5097.991 for Native American human remains and associated grave goods discovered on non-federal land, require different treatment.. Archaeological items and materials from privately owned lands to be returned to their owners shall be maintained in accordance with 36 CFR § 79 until any specified analyses are complete. The Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 et seq.) does not apply to this Project as there is no federally owned or administered property within the APE.

The disposition of any abandoned shipwrecks and archaeological sites and historic resources on state lands under the jurisdiction of the California State Lands Commission (CSLC) shall be determined by CSLC as provided by California Public Resources Code Section 6313. The Corps will ensure that, to the extent permitted by applicable laws and regulations, the views of the appropriate Native American descendant group(s) are taken into consideration when decisions are made about the disposition of Native American archaeological materials and records.

XIII. TRIBAL INVOLVEMENT

A. In consultation with the appropriate Native American Tribal governments, the Corps will identify Historic Properties of traditional religious and cultural importance.

B. In accordance with the provided in National Register Bulletin 38, the Corps will seek comments from all potentially interested Native American Tribal governments in light of the guidance provided in National Register Bulletin 38 in making determinations of eligibility for any Traditional Cultural Properties, as defined in Bulletin 38. The Corps will allow Native America Tribal governments thirty (30) calendar days after receipt to provide comments to the Corps. The Corps will ensure that any comments received during this time period are taken into account and, if appropriate, incorporated into the final reports. Disputes shall be resolved by the Corps in accordance with **Stipulation XVI**.

XIV. TRIBAL CONSULTATION AND TREATMENT OF HUMAN REMAINS

There is no federally owned property within the designated APE. In the event that the Corps is handling the treatment of any Native American human remains or associated funerary items, the Most Likely Descendant (MLD), as identified by the Native American Heritage Commission, shall be invited to assist the Corps in the treatment of any Native American human remains and items associated with Native American burials discovered during the Project in accordance with California Public Resources Code Section 5097.98 and California Health and Safety Code Section 7050.5(b) and 7050.5(c)

XV. PUBLIC CONSULTATION AND PUBLIC NOTICE

Pursuant to 36 CFR § 800.6(c)(2)-(3) of the ACHP's regulations, the Corps will consider requests by interested parties to become Concurring Parties to this Agreement. Within 30 calendar days of the effective date of this Agreement, the Corps shall consult with the SHPO to compile a list of members of the interested public who shall be provided notice of this Agreement. The opinions of members of the public shall be taken into account by the Signatory Parties for historic preservation actions undertaken in accordance with this Agreement.

XVI. CONFIDENTIALITY

Confidentiality regarding the nature and location of the archaeological sites and any other cultural resources discussed in this Agreement shall be maintained in accordance with Section 304 of the NHPA, 16 U.S.C § 470w-3.

XVII. DISPUTE RESOLUTION

A. Should any Signatory Party to this Agreement object to any action proposed or carried out pursuant to this Agreement, the Corps shall consult with the objecting party for a period of time not to exceed 30 calendar days to resolve the objection. If the Corps determines that the objection cannot be resolved, the Corps shall forward all documentation relevant to the dispute to the ACHP. Within 30 calendar days after receipt of all pertinent documentation, the ACHP shall either:

(1) Provide the Corps with recommendations, which the Corps shall take into account in reaching a final decision regarding the objection; or

(2) Notify the Corps that the ACHP will comment in accordance with the requirements of Section 106 of the NHPA, and proceed to comment. Any ACHP comment provided in response shall be taken into account by the Corps, pursuant to the requirements of Section 106 of the NHPA.

B. Should the ACHP not exercise one of the above options within 30 days after receipt of all pertinent documentation, the Corps may assume the ACHP's concurrence in its proposed response to the objection.

C. The Corps shall take into account any ACHP recommendation or comment provided in accordance with this stipulation with reference only to the subject of the objection; the Corps' responsibility to carry out all actions under this Agreement that are not the subjects of the objection shall remain unchanged.

D. At any time during implementation of the measures stipulated in this Agreement should an objection pertaining to the Agreement be raised by a member of the public, the Corps shall notify all signatories of this document and take the objection into account, consulting with the objector and, should the objector so request, with any of the Signatories to this Agreement to address the objection.

XVIII. TIME FRAMES

Unless previously noted with different time frames, the Corps shall submit the results of all identification and evaluation efforts, including unanticipated discoveries, data recovery, testing plans and treatment plans to the SHPO and identified interested persons, as appropriate, for a 30 calendar day review and comment period.

If the SHPO or identified interested persons do not respond to the Corps within 30 calendar days of receipt of a submittal, the Corps may move forward in the process with their findings and recommendations as detailed in the submittal.

XIX. AMENDMENTS AND TERMINATION

A. **Amendments.** Any Signatory Party to this Agreement may propose that the Agreement be amended, whereupon the Corps shall consult with the Signatory Parties to this Agreement to consider such amendment. Any amendment shall be executed by the Signatory Parties in the same manner as the original Agreement.

All attachments to this Agreement, and other instruments prepared pursuant to this agreement such as, but not limited to, the Project's description, initial cultural resource inventory report and maps of the APE, the HPMP, HPTPs, and monitoring and discovery plans may be amended without requiring amendment of this Agreement. The Concurring Parties will receive amendments to the Project's description, initial cultural resource inventory report and maps of the APE, the HPMP, HPTPs, and monitoring and discovery plans when agreement on the amendment(s) is/are reached by the Signatory Parties.

B. **Termination**. Only signatory parties to this Agreement may terminate this Agreement. If this Agreement is not amended as provided for in Stipulation XIX A. or if any signatory proposes termination of this Agreement, the party proposing termination shall notify the other signatory

parties in writing, explain the reasons for proposing termination, and consult with the other parties for no more than 30 calendar days to seek alternatives to termination.

Should such consultation result in an agreement on an alternative to termination, the signatories shall proceed in accordance with that agreement and if necessary, shall amend this document in accordance with Stipulation XIX A.

Should such consultation fail to result in an agreed-upon resolution by the signatory parties, the signatory party proposing termination may terminate this Agreement by promptly notifying the other signatories in writing.

If this Agreement is terminated hereunder, and if the Corps determines that the undertaking will nonetheless proceed, then the Corps shall comply with the requirements of 36 CFR Section 800.3-800.6, or request the comments of the ACHP, pursuant to 36 CFR Part 800.

XX. DURATION OF AGREEMENT

Unless it is terminated pursuant to Stipulation XIX B. of this Agreement or superseded by another agreement executed for the covered undertakings, this Agreement shall remain in effect until the Corps, in consultation with the other signatory parties to this Agreement, determines that construction, monitoring, and maintenance of all aspects of the undertakings have been completed and all terms of this Agreement have been fulfilled in a satisfactory manner, or until10 years have passed from the date of execution of this Agreement, whichever comes first. Upon a determination by the Corps that construction, monitoring, and maintenance of all aspects of the covered undertakings have been completed and that all terms of this Agreement have been fulfilled in a satisfactory manner, or upon reaching the 10 year limit, the Corps shall notify the other signatory and concurring parties of this determination in writing, whereupon this Agreement shall be null and void.

XXI. REPORTING

At the ends of every calendar year during which management activities are performed under this Agreement, the Corps shall prepare and deliver to the SHPO a memorandum summarizing management activities and findings for that calendar year.

XXII. EFFECTIVE DATE

This Agreement shall take effect on the date that it has been fully executed by the Corps, the SHPO, and the ACHP.

EXECUTION and implementation of this Agreement is evidence that the Corps has afforded ACHP a reasonable opportunity to comment on this Agreement and the associated undertakings; that the Corps has taken into account the effects of the undertakings on historic properties; and that the Corps has

complied with Section 106 of the NHPA and 36 CFR Part 800 sufficiently to satisfy Section 106 for those undertakings dependent upon Section 106 compliance.

ATTACHMENTS

A. Description of the Project and Undertakings

B. APE and Alternatives

C . Historic Properties Management Plan

SIGNATORY PARTIES:

U.S. Army Corps of Engineers

By _____ Date _____
Michael J. Farrell
Colonel, U.S. Army
District Commander

California State Office of Historic Preservation

By _____ Date _____
Carol Roland-Nawi, Ph.D.
State Historic Preservation Officer

West Sacramento Area Flood Control Agency

By _____ Date _____
Flood Protection Manager

Central Valley Flood Protection Board

By _____ Date _____
Jay Punia
Executive Officer

CONCURRING PARTIES:

Yoche Dehe Wintun Nation

By _____ Date _____
Marshall McKay

Chairman

Wilton Rancheria of

By _____ Date _____
Andrew Franklin

Chairman

ATTACHMENT A

DESCRIPTION OF PROJECT AND ALTERNATIVES

Attachment A

West Sacramento General Reevaluation Report – Project and Alternatives

1.0 INTRODUCTION

The primary objective of the West Sacramento Project General Reevaluation Report (GRR) is to determine the extent of Federal interest in reducing the flood risk within the study area. The purpose of the GRR is to bring the 50 miles of perimeter levees surrounding West Sacramento into compliance with applicable Federal and State standards for levees protecting urban areas. Proposed levee improvements would address adequate levee height, levee seepage, erosion, and stability conditions along the West Sacramento levee system.

1.1 Scope of Environmental Analysis

The West Sacramento Project GRR is being prepared by the United States Army Corps of Engineers (Corps) and will include the evaluation of the Federal interest in addressing seepage, slope stability, erosion, and height problems on the levees surrounding West Sacramento. Four alternatives: Alternative 1, Alternative 3, and Alternative 5, are discussed in this document.

1.2 Project Location and Study Area

The West Sacramento Project GRR study area refers to the area that would be protected by the proposed levee improvements, including the city of West Sacramento itself, and the lands within WSAFCA's boundaries, which encompass portions of the Sacramento River, the Yolo Bypass, the Sacramento Bypass, and the Sacramento Deep Water Ship Channel (DWSC). The flood protection system associated with these waterways consists of over 50 miles of levees in Reclamation District (RD) 900, RD 537, DWR's Maintenance Area 4, and the DWSC, that completely surround the city. The city of West Sacramento is located in eastern Yolo County at the confluence of the American and Sacramento Rivers. The city lies within the natural floodplain of the Sacramento River, which bounds the city along the north and east. It is made up of a small amount of high ground north of Highway 50 along the Sacramento River, and reclaimed land protected from floods by levees and the Yolo and Sacramento Bypass systems. These bypasses divert floodflows around the city to the west. In addition to the area within the city limits (in Yolo County), the study area partially extends into Solano County on the extreme southwestern edge along the DWSC.

The DWSC provides a navigable passageway for commercial shipping to reach the Port of West Sacramento (formerly Port of Sacramento) from the Pacific Ocean via the San Francisco Bay, Delta, and connecting waterways. The DWSC water surface elevation is directly influenced by changes in water levels in the Delta at the south end of the Yolo Bypass, and is relatively insensitive to stage in the Sacramento River.

The DWSC and barge canal bisect the city into two subbasins, separating the developing Southport area from the more established neighborhoods of Broderick and Bryte to the north (City of West Sacramento 2000). The two subbasins are broken up into nine levee reaches based on location and fixes. The North Basin, which encompasses 6,100 acres, contains:

- Sacramento River north levee – 5.5 miles from the Sacramento Bypass south to the Stone Locks on the barge canal.
- Port north levee – 4.9 miles from the Stone Locks west to the Yolo Bypass levee.
- Yolo Bypass levee – 3.7 miles from the Port north levee north to the Sacramento Bypass.

- Sacramento Bypass levee – 1.1 miles from the Yolo Bypass levee to the Sacramento River.
- Sacramento Bypass training levee – 0.5 miles west into the Yolo Bypass from the Sacramento Bypass levee.

The South Basin, which encompasses 6,900 acres, contains:

- Sacramento River south levee – 5.9 miles south along the Sacramento River from the Stone Locks to the South Cross levee (just north of the waste water treatment plant).
- South Cross levee – 1.2 miles across the South Basin from the Sacramento River to the DWSC.
- DWSC east levee – 2.8 miles from the South Cross levee north to the point where it bends east.
- Port south levee – 4.0 miles east from the bend in the DWSC east levee to the Stone Locks.
- DWSC west levee – 21.4 miles from the intersection of the Port north levee and the Yolo Bypass levee south to Miners Slough.

1.3 Study Authority

The study authority for the West Sacramento area was provided through Section 209 of the Flood Control Act of 1962, PL 87-874. The West Sacramento Project was authorized in WRDA 1992, PL 102-580 Sec. 101 (4), as amended by the Energy and Water Development of 1999, PL 105-245.

1.4 Project Purpose and Need for Action

The Corps identified under seepage as an area of concern following the 1997 storms, prompting construction of the West Sacramento Project between 1998 and 2002. Only recently, however, has the Corps issued revised Federal levee design criteria to provide a consistent approach for addressing potential levee under seepage. Recent engineering analysis has resulted in the identification of levees that don't meet Corps standards and the necessary improvements to provide an urban level of flood protection to West Sacramento. Changes in engineering standards that account for under seepage affected the level of performance for the completed West Sacramento Project. While Federal standards were changing, the State of California also began developing new standards and criteria for protecting urban areas to reduce flood risk. Bringing the West Sacramento project levees up to these standards would reduce risk of uncontrolled flooding in the study area that could result in significant damages.

1.4.1 Seepage and Under seepage

Seepage beneath and through segments of the levee systems around Sacramento have been identified as a significant risk to the stability and reliability of the system. Through-seepage is seepage through a levee embankment that can occur during periods of high river stages. Excessive under seepage makes the affected levee segment susceptible to failure during periods of high river stage. Under these conditions, seepage travels horizontally under the levee and then is forced vertically upward through the low-permeability foundation layer, often referred to as the "blanket."

1.4.2 Levee Erosion

The levees continue to confine the flow into a relatively narrow channel, eroding and degrading the river channel. The Sacramento River is confined by levees and is sediment hungry. Channel erosion and degradation could have detrimental effects on the levees by undercutting the foundation materials beneath the levees, particularly if the riverbank consists of easily erodible materials. The erosion of the riverbank adjacent to levee embankments may increase the under seepage through the foundation soils. It can also reduce the stability of the

levee slopes by undermining the levee embankment and eroding the levees themselves. Significant erosion can lead to the failure of the levee.

1.3 Slope Stability

Slope stability problems were observed during high water events mentioned above in Section 1.3 on both on the landside and waterside slopes. Landside slope failures have been observed during high river stages in areas where impervious soils cover the sandy and gravelly layers in the levee foundation. These slope failures have also been observed in areas where water was seeping through the levee embankment above the toe of the levee.

1.4 Levee Overtopping

It is possible that a large enough flood event could occur that would overtop the levees. In past flooding, levees upstream have failed, relieving some of the pressure on the West Sacramento area. But as repairs to these levees are made, it increases the flood risk to West Sacramento as project levees could face the full brunt of the flood event. Because these levees were not built to modern engineering standards and levee failures upstream are assumed not to occur, levee overtopping would potentially lead to failure of the levee and cause devastating flooding.

2.0 Measures Proposed for Alternatives

Levees in the project area require improvements to address seepage, slope stability, overtopping, and erosion concerns. The measures proposed to improve the levees are described below and consist of: (1) seepage cutoff walls, (2) seepage berms, (3) stability berms, (4) levee raises, (5) flood walls, (6) relief wells, (7) sheet pile walls, (8) jet grouting, and (9) bank protection. The above measures would be implemented by fixing levees in place, constructing adjacent levees, or constructing a setback levee. It is possible that sheet pile walls, jet grouting, and relief wells would be used at various locations so they are also described below. Plate 2-1 identifies the reaches where each measure would be required. Once a levee is modified, regardless of the measure implemented for the alternative, the levee would be brought into compliance with Corps levee design criteria. This would include slope flattening and/or crown widening, where required. The levee crown would be widened to 20 feet, and 3:1 landside and waterside slopes would be established where possible. If necessary, the existing levee centerline would be shifted landward, where necessary, in order to meet the Corps' standard levee footprint requirements.

<u>Seepage and Slope Stability Measures</u>

Cutoff Walls

To address seepage concerns, a cutoff wall would be constructed through the levee crown. The cutoff wall would be installed by one of two methods: (1) conventional open trench cutoff walls, or (2) deep soil mixing (DSM) cutoff walls. The method of cutoff wall selected for each reach would depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of approximately 85 feet. For cutoff walls of greater depth, the DSM method would be utilized.

Prior to construction of either method of cutoff wall, the construction site and any staging areas would be cleared, grubbed, and stripped. The levee crown would be degraded to approximately half the levee height to create a large enough working platform (approximately 30 feet) and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids (Figure 2-1). Excavated and borrow material (from nearby borrow sites) would be stockpiled at staging areas. Once the cutoff wall is complete, haul trucks, front end loaders, and scrapers would bring borrow materials to the site, which would then be spread evenly and compacted according to levee design plans. The levee would be hydroseeded once construction was completed.

Conventional Open Trench Cutoff Wall

A trench approximately 3 feet wide would be excavated at the top of levee centerline and into the subsurface materials up to 85 feet deep with a long boom excavator. As the trench is excavated, it would be filled with low density temporary bentonite water slurry to prevent cave in. The soil from the excavated trench would be mixed nearby with hydrated bentonite, and in some applications cement. The soil bentonite mixture would be backfilled into the trench, displacing the temporary slurry. Once the slurry has hardened, it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

Deep Soil Mixing Cutoff Wall

The DSM method would require large quantities of cement bentonite grout. This would necessitate the use of a contractor-provided, on-site batch plant and deliveries of concrete aggregate, concrete sand, bentonite, and cement. The batch plant would be powered by generators or electricity from overhead power lines and would be located within the project area or in an adjacent staging area. The batch plant area would consist of an aggregate storage system, aggregate rescreen system (if needed), rewashing facility (if needed), the batching system, cement storage, ice manufacturing, and the grout mixing and loading system. All aggregate used within the batch plant operations would be obtained from existing local commercial off-site sources and delivered to the site.

From the batch plant, the grout mixture would be transported through high-pressure hoses (8,000 pounds per square inch [psi]) to the location of construction. At the construction site, a crane supported set of two to four mixing augers would used to drill through the levee crown and subsurface to a maximum depth of approximately 140 feet. As the augers are inserted and withdrawn, the cement bentonite grout would be injected through the augers and mixed with the native soils. An overlapping series of mixed columns would be drilled to create a continuous seepage cutoff barrier. Once the slurry has hardened it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

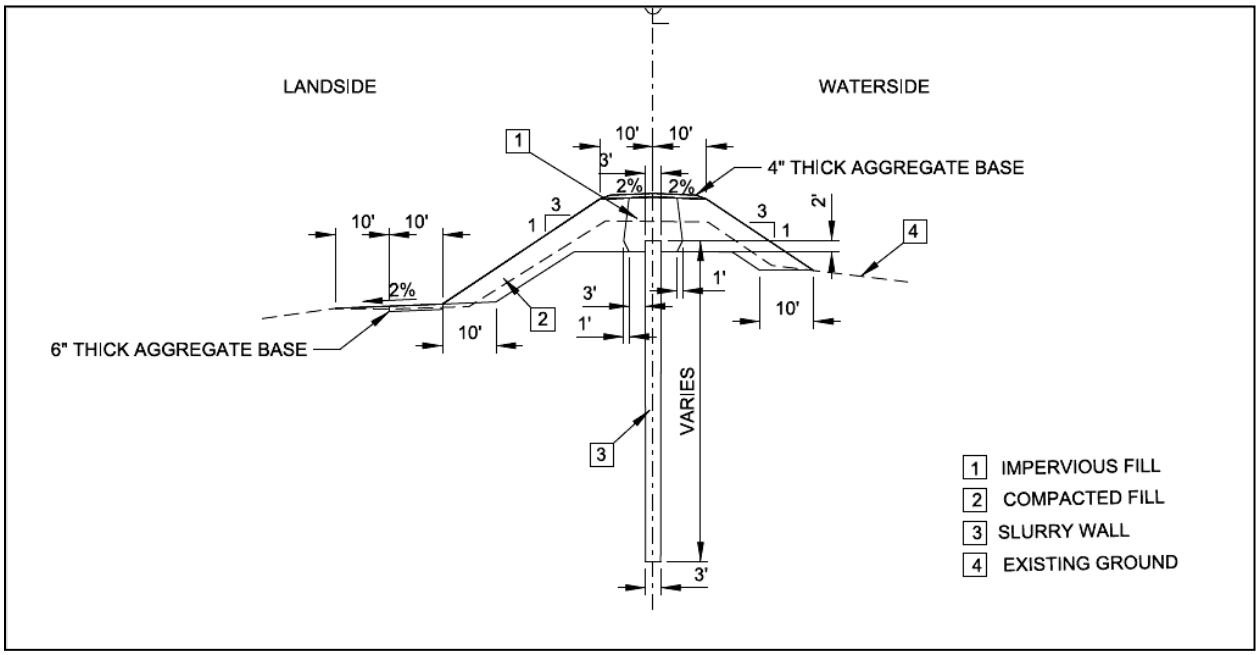


Figure 2-1. Levee Improvement with Slurry Wall.

Seepage Berm

Seepage berms are wide embankment structures made up of low-permeable to semi-pervious materials that resist accumulated water pressure and safely release seeping water. A seepage berm would be constructed in areas where it has been determined by geotechnical investigations that a seepage berm is more appropriate to address seepage than a cutoff wall. The seepage berm would extend out from the landside levee toe and would vary in width from 70 to 100 feet, tapering down from a five foot thickness, at the levee toe, to a three foot thickness, at the berm toe (Figure 2-2). The length of the seepage berm would depend on the seepage conditions along the levee reach.

Construction would consist of clearing, grubbing, and stripping the ground surface. Depending on the action alternative, soil used to construct a berm would be stockpiled from levee degradation, excavated from nearby borrow pits, or trucked on site from off-site locations (if on-site material is not adequately available). During the degrading, soil would be stockpiled at the proposed berm site. If constructing the alternative does not require levee degradation, all soil material used to construct a berm would come from nearby borrow sites. At the borrow sites, bulldozers would excavate and stockpile borrow material. Front-end loaders would load haul trucks, and the haul trucks would transport the borrow material to the site. The haul trucks would then dump the material, and motor graders would spread it evenly, placing approximately 3 to 5 feet of embankment fill material. Material used for berm construction would have greater permeability than the native blanket material. However, depending on material availability, a lower permeability material may be used. Adjustments to berm width would be made in such cases, as appropriate. During the embankment placement, material would be placed in a maximum of 1- to 2-foot loose lifts, thereby allowing the compactors to achieve the specified compaction requirements. Sheepsfoot rollers would compact the material, and water trucks would distribute water over the material to ensure proper moisture for compaction and reduction of fugitive dust emissions. The new seepage berm would be hydroseeded following construction.

Seepage berms may have an optional feature of a drainage relief trench under the toe of the berm. Drained seepage berms would include the installation of a drainage layer (gravel or clean sand) beneath the seepage berm backfill and above the native material at the levee landside toe. A drained seepage berm would likely decrease the overall footprint of the berm.

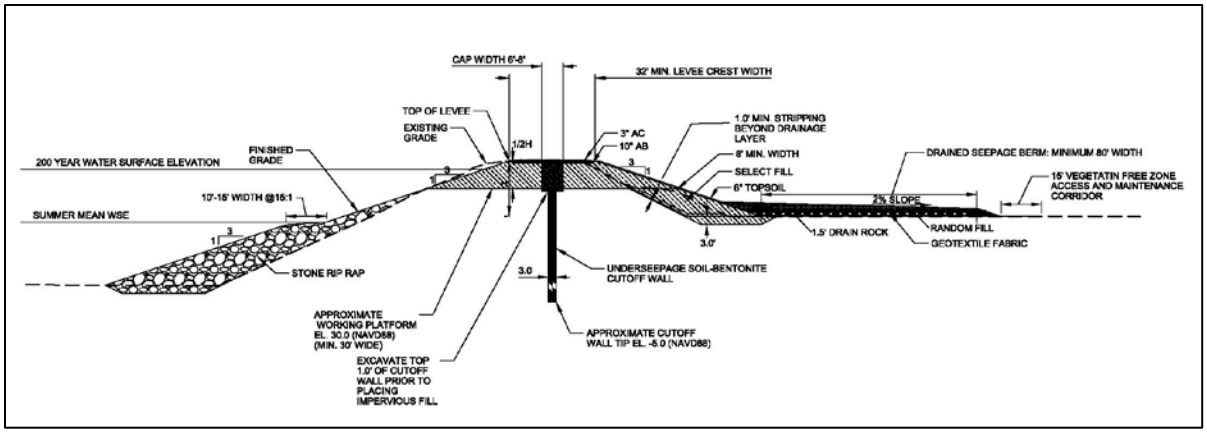


Figure 2-2. Fix in Place Levee Improvement with Seepage Berm.

Stability Berm

A stability berm would be constructed against the landside slope of the existing levee with the purpose of supplying support as a buttress. A stability berm is proposed along the South Cross levee as shown in Figure 2-3. The height of the stability berm would generally be 2/3 of the levee height, and would extend for a distance determined by the structural needs of the levee along that reach. Embankment fill material necessary to construct the berm is excavated by a bulldozer from a nearby borrow site. Front-end loaders would load haul trucks with the

borrow material and the haul trucks would transport the material to the stability berm site. Motor graders would spread the material evenly according to design specifications, and a sheepsfoot roller would compact the material. Water trucks would distribute water over the material to ensure proper moisture for compaction. The new seepage berm would be hydroseeded after construction.

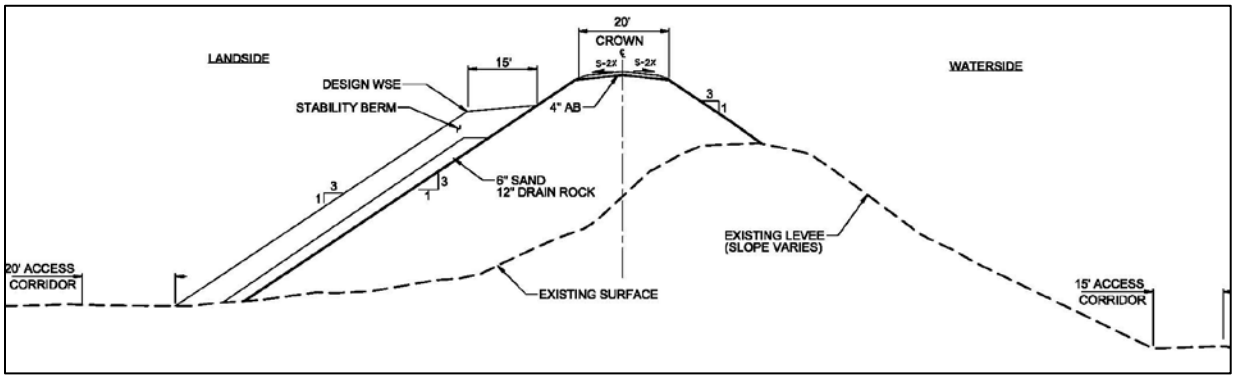


Figure 2-3. Levee Improvement with Stability Berm.

Adjacent Levee

Constructing an adjacent levee is one of the ways to improve levees and is proposed along some sections of the Sacramento River south levee. The adjacent levee essentially adds material to increase the cross section of the levee, thereby allowing the prescribed 3:1 landside slopes and 20-foot-wide crown to be established (Figure 2-4). The adjacent levee would be constructed on the landward side of the levee and would make it possible to leave all waterside vegetation in place.

The first construction phase would include clearing, grubbing, and stripping the work site and any construction staging areas, if necessary. A trapezoidal trench would be cut at the toe of the slope and the levee embankment may be cut in a stair-step fashion to allow the new material to key into the existing material. Bulldozers would then excavate and stockpile borrow material from a nearby borrow site. Front-end loaders would load haul trucks with the borrow material, and the haul trucks would subsequently transport it to the adjacent levee site. The haul trucks would dump the material, and dozers would spread it evenly. Sheepsfoot rollers would then compact the material, and water trucks would distribute water over the material to ensure proper moisture for compaction. The landside levee would be graded at a 3:1 slope, and the levee crown would be at least 20 feet wide. The slope may be track-walked with a dozer. The levee crown would be finished with an aggregate base or paved road, depending on the type and level of access desired. Either condition would require importation of material with dump trucks, placement with a loader and motor grader, and compaction. A paver would be required for asphalt placement.

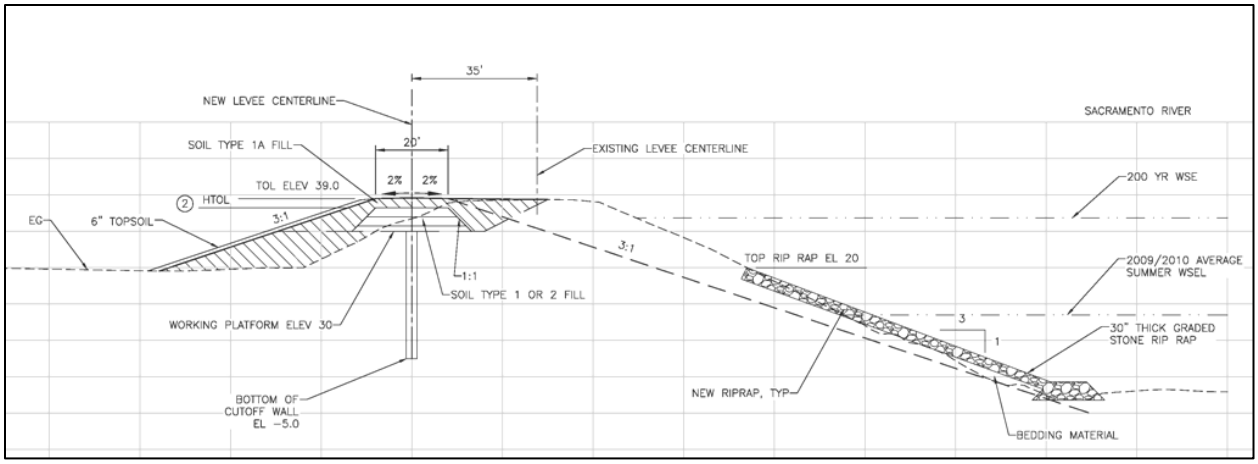


Figure 2-4. Adjacent Levee Improvement.

Setback Levee

A setback levee is proposed for the Sacramento River south levee to address seepage, slope stability, and erosion concerns (Figure 2-5). The typical offset distance of the setback levee from the existing levee is approximately 400 feet with a total length of roughly 4.25 miles. The setback levee would include seepage berms in areas where it has been determined by geotechnical investigations that they are necessary to further reduce seepage. Portions of the existing levee could be breached and degraded to allow water to flow in and out of the floodplain once further hydraulic analysis is completed to ensure no change in water surface elevations. Some sections of the existing levee may be degraded to allow flow between the existing levee and the proposed setback levee if there is no hydraulic impact. The setback would also open the Bees Lakes area to seasonal flow, hydraulically connecting it to the Sacramento River. The floodplain would be lowered through excavation of borrow areas in a portion of the area between the existing levee and the setback levee to provide surfaces and associated vegetation that would be inundated more frequently than the higher existing floodplain surfaces.

The new levee section would be constructed to meet current design standards, including height and slope requirements. To begin construction activities, the area would be cleared, grubbed, and stripped. To construct the new section of levee, bulldozers would excavate and stockpile borrow material from a nearby permitted borrow site. Front-end loaders would load haul trucks with the borrow material. The haul trucks would transport the material to the new levee site, where motor graders would spread it evenly. Sheepsfoot rollers would then compact the material, and water trucks would distribute water over the material to ensure proper moisture for compaction. Levee slopes would be graded to a 3:1 slope, and a crown at least 20 feet wide would be created. For the purpose of levee inspection, an aggregate base, all-weather patrol road would be constructed on the crown of the new levee. Post construction, construction staging areas, levee slopes, and any other disturbed areas would be hydroseeded with a native seed mix.

If the material from the existing levee is of sufficient quality and not intended to remain in place, it may be excavated and used as fill for the new setback levee. If the existing levee is excavated, grading may be necessary in the offset area (between the new levee and the river) to ensure proper drainage.

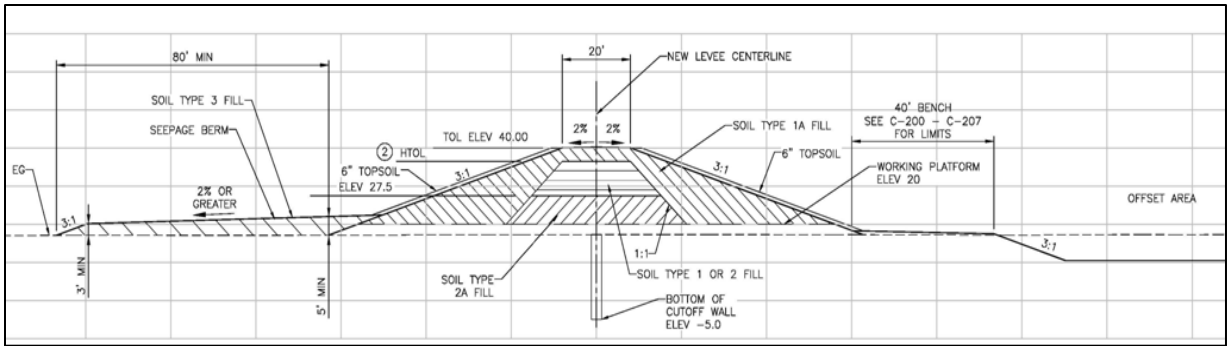


Figure 2-5. Setback Levee Improvement.

Sheet Pile Wall

A sheet pile wall is proposed at the Stone Locks to tie together the levees on either side of the Barge Canal (Figure 2-6). A trench would be excavated along the sheet pile alignment to allow the pile to be driven to the proposed depth (below the existing levee grade). A driving template fabricated from structural steel would be placed to control the alignment as the sheet pile is installed. A hydraulic or pneumatically operated pile driving head attached to a crane would drive the sheet pile into the levee crown to the desired depth (up to 135 feet). An additional crane or excavator would be used to facilitate staging of the materials. The conditions of the site, driving pressure, hydrostatic loads, and corrosion considerations would determine the thickness and configuration of the sheet piles. If conditions indicate that corrosion is an issue, the sheet piles could be coated, oversized to provide additional thickness as a corrosion allowance, and/or provided with a cathodic protection system.

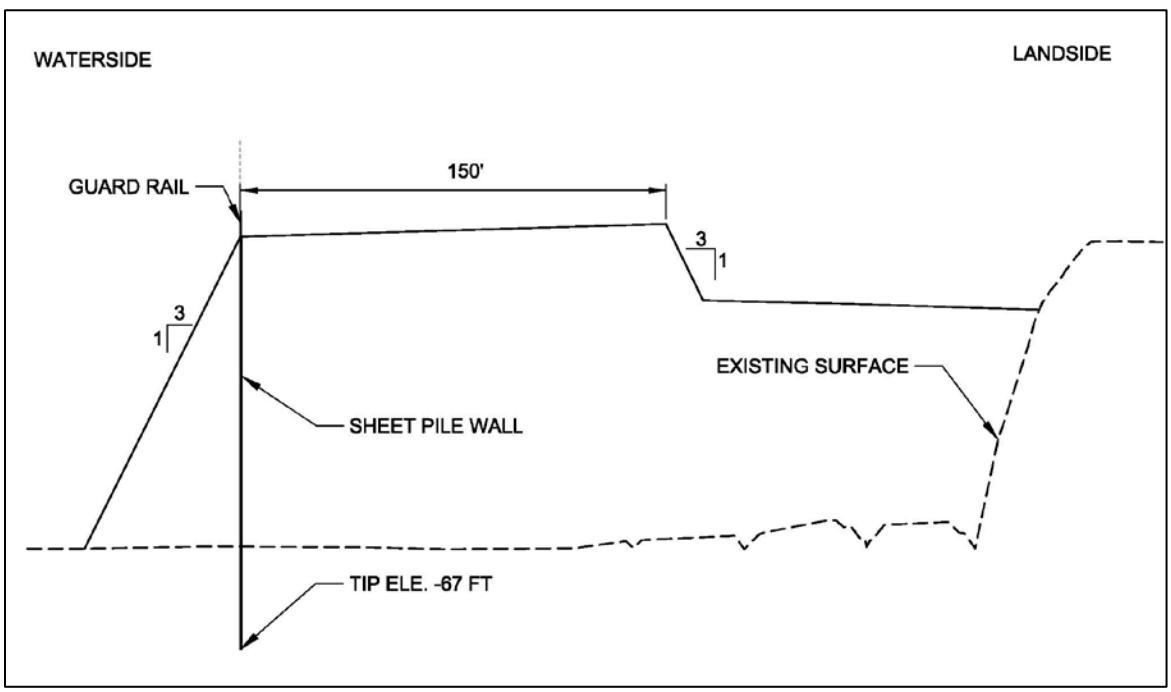


Figure 2-6. Sheet Pile Wall with Embankment Fill.

Jet Grouting

Jet grouting typically is used in constructing a slurry cutoff wall to access areas other methods cannot. In this regard, it is typically a spot application rather than a treatment to be applied on a large scale. Jet grouting

would be used around existing utilities not proposed for removal, and at bridges along the West Sacramento levees. It involves injecting fluids or binders into the soil at very high pressure. The injected fluid can be grout; grout and air; or grout, air, and water. Jet grouting breaks up soil and, with the aid of a binder, forms a homogenous mass that solidifies over time to create a mass of low permeability.

Equipment required for jet grouting consists of a drill rig fitted with a special drill string; a high pressure, high flow pump; and an efficient batch plant with sufficient capacity for the required amount of grout and water, supporting generators and air compressors, holding tanks, and water tanks, with bulk silos of grout typically used to feed large mixers. The high-pressure pump conveys the grout, air, and/or water through pipelines that run the length of the site through the drill string to a set of nozzles located just above the drill bit. Smaller equipment can be used in combination with the single phase–fluid system and can be permanently trailer-mounted to permit efficient mobilization and easy movement at the job site. Jet-grouted columns range from 1 to 16 feet in diameter and typically are interconnected to form cutoff barriers or structural sections. One construction crew, consisting of a site supervisor, pump operator, batch plant operator, chuck tender, and driller under ideal conditions, can construct two 6-foot-diameter, 50-foot columns per day consisting of approximately 100 cubic yards of grout injected per 8-hour shift. Ideal conditions would be characterized by no technical issues, such as loss of fluid pressure, breakdown of equipment, or subsurface obstructions to drilling operations occurring at either the batch plant or the drilling site.

To provide a wide enough working platform on the levee crown, the upper portion of some segments of the levee may require degradation with a paddle wheel scrapper. Material would be scraped and stockpiled at a nearby stockpile area. Hauling at the work area would involve scraper runs along the levee to the staging area, and grout, bentonite, and water deliveries to the batch plant. To initiate jet grouting, a borehole would be drilled through the levee crown and foundation to the required depth (to a maximum depth of approximately 130 feet) by rotary or rotary-percussive methods using water, compressed air, bentonite, or a binder as the flushing medium. When the required depth is reached, the grout would be injected at a very high pressure as the drill string is rotated and slowly withdrawn. Use of the double, triple, and superjet systems create eroded spoil materials that would be expelled out of the top of the borehole. The spoil material would contain significant grout content and could be used as a construction fill.

Relief Wells

Relief wells would be used to address under seepage and would be applied only on a limited basis for site-specific conditions rather than a segment-wide application. They would be located along adjacent and setback levee toes in the South Basin and only in segments where geotechnical analyses have identified continuous sand and gravel layers and the presence of an adequate impermeable layer (Figure 2-7). Relief wells are passive systems that are constructed near the levee landside toe to provide a low-resistance pathway for under-seepage to exit to the ground surface in a controlled and observable manner. A low-resistance pathway releases water pressure under the upper impermeable layer, allowing under seepage to exit without creating sand boils or piping levee foundation materials.

Relief wells are constructed using soil-boring equipment to drill a hole vertically through the upper fine-grained layer (usually clays or silty clays), through the coarse-grained aquifer layer of sand or gravel, and into the lower fine-grained clay layer beneath. Pipe casings and gravel/sand filters are installed to allow water to flow freely while preventing transportation and removal of material from the levee foundation, which can undermine the levee foundation. The water then is collected and discharged into a drainage system using a series of ditches or an underground piping system.

Relief wells generally are spaced at 50- to 150-foot intervals, dependent on the amount of under seepage, and extend to depths of up to 150 feet. Areas for relief well construction are cleared, grubbed, and stripped. During relief well construction, a typical well-drilling rig would be used to drill to the required depth and construct the well (including well casing, gravel pack material, and well seal) beneath the ground surface. The drill rig likely would be an all-terrain, track-mounted rig that could access the well locations from the levee toe.

Areas along the levee toe may be used to store equipment and supplies during construction of each well. Construction of each well and the lateral drainage system typically takes 10 to 20 days. Additional time may be required for site restoration.

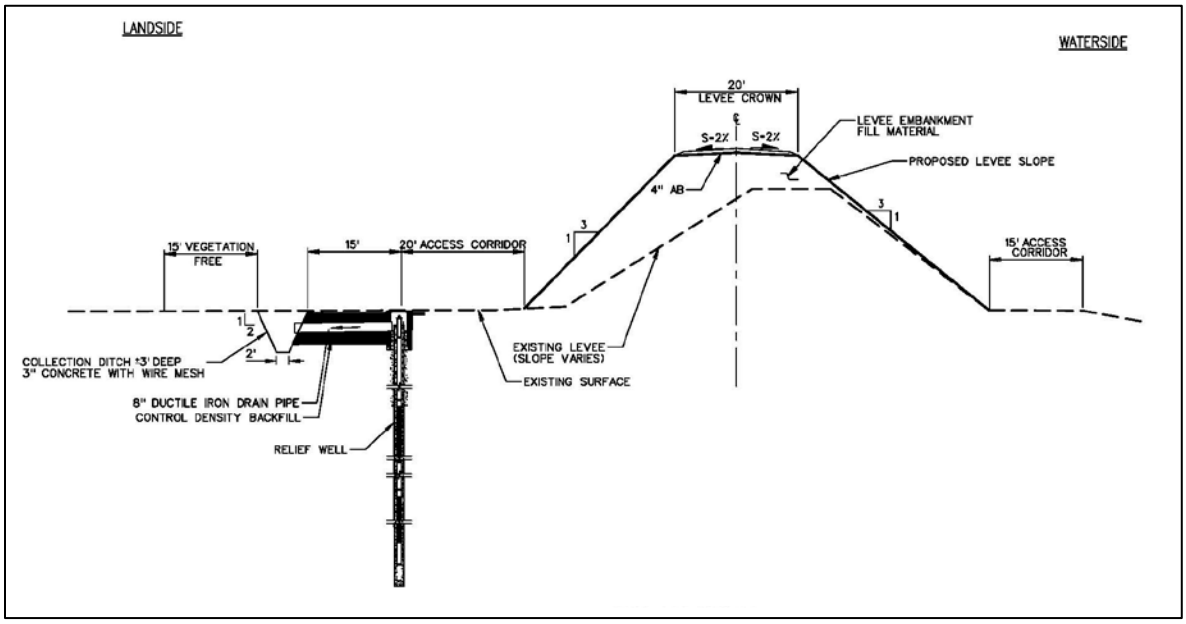


Figure 2-7. Fix in Place Levee Improvement with Relief Well.

<u>Overtopping Measures</u>

Levee Height Raise

To address identified height concerns, additional borrow material would be added after cutoff walls and levee reshaping improvements are completed (Figure 2-8). The additional material would be brought from nearby borrow sites, stockpiled in staging areas then hauled to the site with trucks and front end loaders. Material would be spread evenly and compacted according to levee design plans. The levee would be hydroseeded once construction was completed.

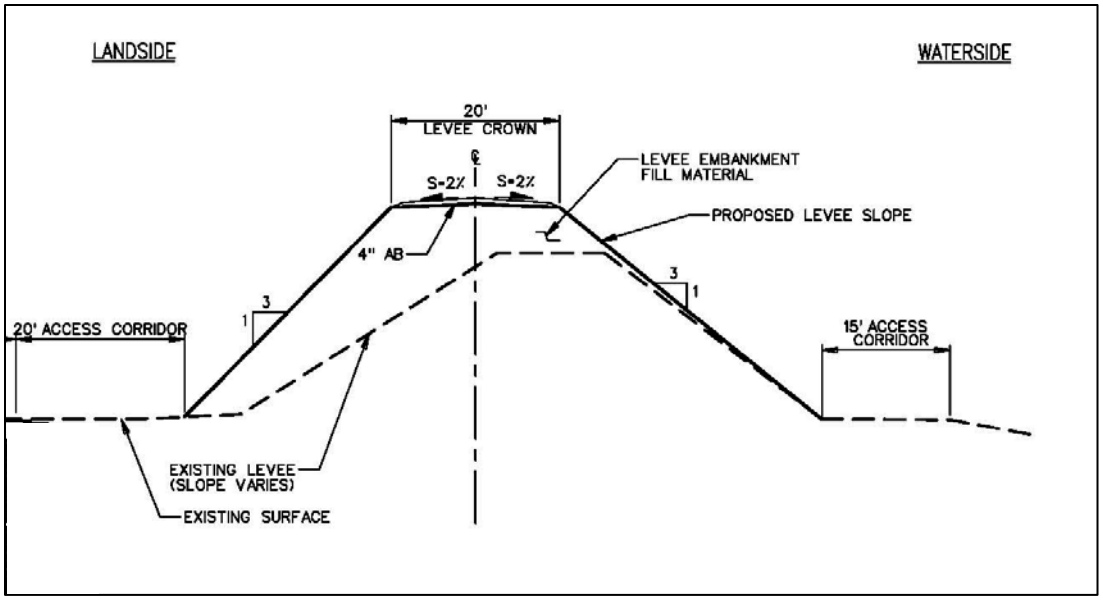


Figure 2-8. Levee Height Raise.

Floodwalls

Floodwalls are proposed along the waterside hinge point of the Port north levee and along the selected levee alignment around the Port of West Sacramento. Floodwalls are an efficient, space-conserving method for containing unusually high water surface elevations. They are often used in highly developed areas, where space is limited. To begin the floodwall construction, the area would be cleared, grubbed, stripped, and excavation would occur to provide space to construct the footing for the floodwall. The floodwall would primarily be constructed from pre-fabricated materials, although it may be cast or constructed in place, and would be constructed almost completely upright. Floodwalls mostly consist of relatively short elements, making their connections very important to their stability. The floodwalls would be designed to disturb a minimal amount of waterside slope and levee crown for construction (Figure 2-9). The height of the floodwalls varies from 1 to 4 feet, as required by water surface elevations. The waterside slope would be re-established to its existing slope and the levee crown would grade away from the wall and be surfaced with aggregate base.

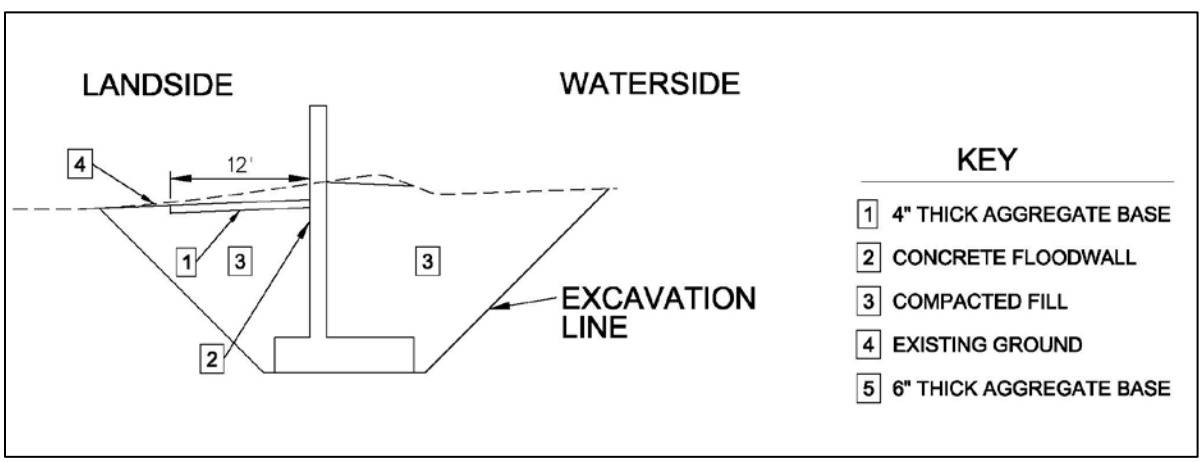


Figure 2-9. Floodwall Typical Design.

Erosion Protection Measures

Levee Bank Protection

The primary erosion protection measure consists of waterside armoring of the levees to prevent erosion and subsequent damage to the levee. This measure consists of placing rock revetment on the river's bank, and in some locations on the levee slope, to prevent erosion (Figure 2-10). The extent of the revetment would be based on site-specific analysis. Along the Sacramento Bypass Training levee, revetment would be placed on both sides of the levee slopes as shown in Figure 2-11. This would protect the levee in place when the Sacramento and Yolo Bypasses have water in them. When necessary, the eroded portion of the bank would be filled and compacted prior to the rock placement. The sites would be prepared by clearing and stripping the site prior to construction. Small vegetation and deleterious materials would be removed. Bank protection would be placed around existing trees on the lower portion of the slope. Trees on the upper portion of the slope would be removed during degrading of levees for slurry cutoff walls and bank protection would be placed following reconstruction of the levee. Temporary access ramps would be constructed, if needed, using imported borrow material that would be trucked on site.

Revetment would be imported from an offsite location via haul trucks or barges. Revetment transported by haul trucks would be temporarily stored at a staging area located in the immediate vicinity of the construction site. A loader would be used to move revetment from the staging area to an excavator that would place the material on site. Rock required on the upper portions of the slopes would be placed by an excavator located on top of the levee. Rock placement from atop the levee would require one excavator and one loader for each potential placement site.

Revetment transported by barges would not be staged, but placed directly on site by an excavator. Rock required within the channel, both below and slightly above the water line at the time of placement, would be placed by an excavator located on a barge. The excavator would construct a large rock berm in the water up to an elevation slightly above the mean summer water surface. A planting trench would be established on this rock surface for revegetation purposes. Construction would require two barges: one barge would carry the excavator, while the other barge would hold the stockpile of rock to be placed on the channel slopes.

The bank protection would be placed via the methods discussed above on the existing bank at a slope varying from 2V:1H to 3V:1H depending on site specific conditions. After rock placement has been completed, a small planting berm would be constructed in the rock, when feasible, to allow for some revegetation of the site outside of the vegetation free zone as required by ETL 1110-2-571.

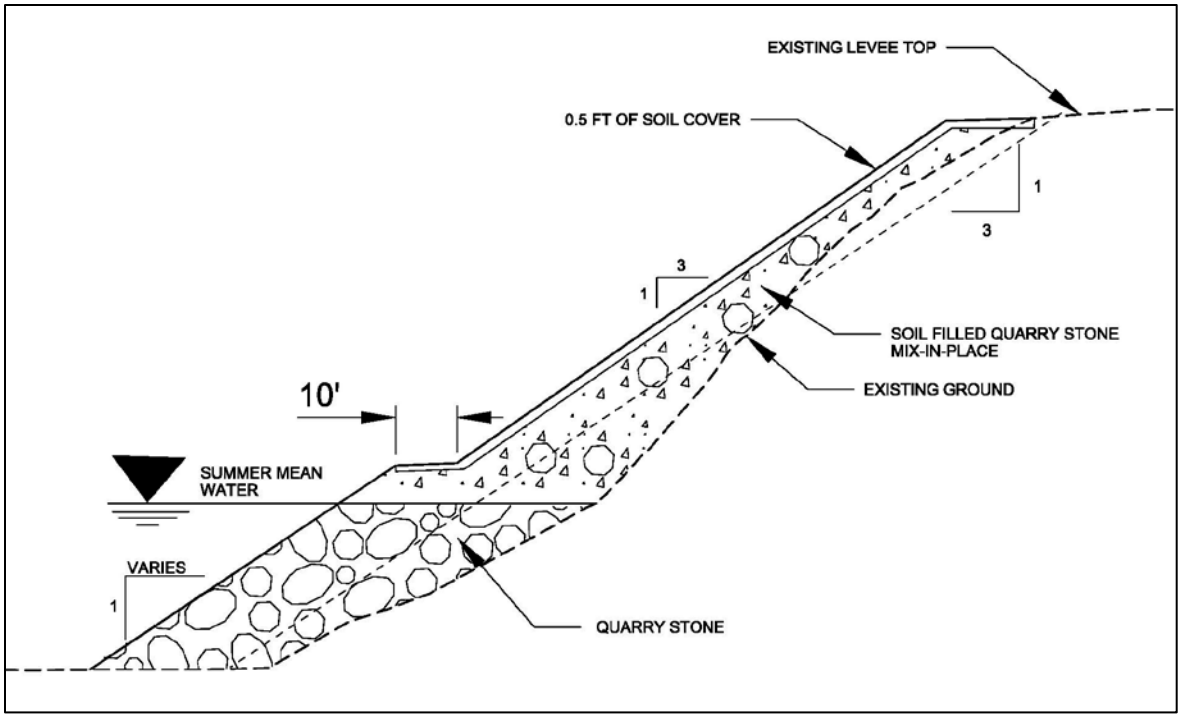


Figure 2-10. Bank Protection Typical Design.

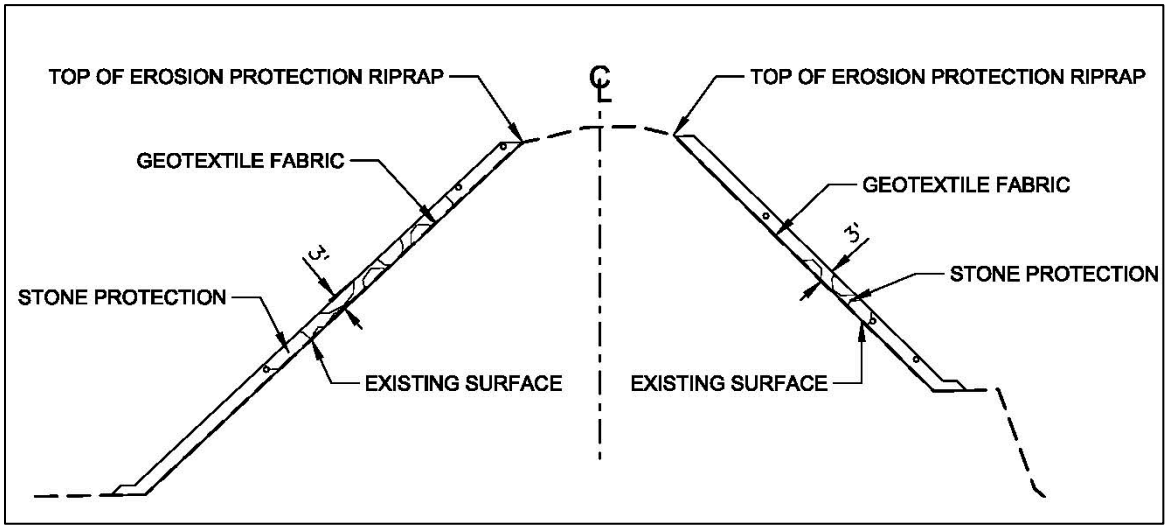


Figure 2-11. Bank Protection along Sacramento Bypass Training Levee.

Levee Biotechnical Measures

In addition to the bank protection measure, biotechnical measures have been proposed for several reaches. This remediation measure would be implemented for any of the proposed alternatives discussed in this document. This measure is being considered for lower velocity reaches to preserve existing vegetation. Under this measure, the Corps would use plant material and minimal amounts of rock to stabilize the eroded slope and prevent further loss of material.

<u>Additional Construction Measures</u>

In addition to the proposed levee improvements measures described above, the following measures and policies would apply to all of the alternatives, and would be addressed during construction:

- The Corps' standard levee footprint would be established during construction of structural improvements on all levees that are out of compliance. The standard levee footprint consists of a 20 foot crown width and 3:1 waterside and landside slopes. If the 3:1 landside slope is not possible based on site specific conditions then a minimum 2:1 landside slope would be established with supporting engineering analysis.
- A 20 foot landside and waterside maintenance access would be established. In areas where 20 feet cannot be obtained, 10 feet is allowable.
- Utility encroachments such as structures, certain vegetation, power poles, pump stations, and levee penetrations (e.g., pipes, conduits, cables) would be brought into compliance with applicable Corps policy or removed depending on type and location. This measure would include the demolition of such features and relocation or reconstruction as appropriate on a case-by-case basis (or retrofit to comply with standards). Utilities replacements would occur via one of two methods: (1) a surface line over the levee prism or (2) a through-levee line equipped with positive closure devices.
- Private encroachments shall be removed by the non-federal sponsor prior or property owner prior to construction.

Vegetation Removal/Vegetation Variance Request

Compliance with ETL 1110-2-571 vegetation requirements would be established. The vegetation requirements include a vegetation-free zone on the levee slopes and crown, 15 feet from both landside and waterside levee toes, and 8 feet vertically. When possible, a variance would be sought to allow vegetation to remain. If granted, the variance would allow for vegetation to remain on the lower portion of the waterside slope and within the waterside 15 foot vegetation-free zone. No vegetation would be permitted on the landside slope or within 15 feet of the landside toe. A vegetation variance would be requested to provide compliance for the Sacramento River portion of the project.

The levees within the study area require seepage, slope stability, height, and erosion improvements in order to meet Corps criteria. Construction of the levee improvement measures would require vegetation removal on the levee from approximately 15 feet landward of the landside toe to approximately one-third the height of the levee on the waterside slope. On the waterside, where construction does not remove vegetation, the vegetation on the lower one-third of the levee and waterward, would be left in place and a Vegetation Variance Request (VVR) would be sought by the Sacramento District. To show that the safety, structural integrity, and functionality of the levee would be retained, an evaluation of under seepage and waterside embankment slope stability would be completed.

Analysis was conducted for the index points at the Sacramento River West Levee Sta. 35+22 of the South Basin, and Sacramento River West Levee Sta. 96+00 of the North Basin. The analysis points were chosen for the VVR analyses because they were considered to be representative of the most critical channel and levee geometry, under seepage, slope stability conditions, and vegetation conditions of the respective basins. The cross-section geometry of the index points incorporated tree fall and scour by using a maximum depth of scour for cottonwoods as approximately 11.0 feet; the associated soil removed was projected at a 2:1 slope from the base of the scour toward both the landside, and waterside slopes. The base scour width was equal to the maximum potential diameter at breast height (dbh) of cottonwoods (12.0 feet) projected horizontally at a depth of 11.0 feet below the existing ground profile. The results show that the tree fall and scour did not significantly affect levee performance

and that the levee meets Corps seepage and slope stability criteria considering the seepage and slope stability improvement measures are in place ("with project" conditions). Therefore, it is a reasonable conclusion that with a VVR to allow vegetation to remain as stated above, the safety, structural integrity, and functionality of the Sacramento River levee would be retained.

3.0 Project Alternatives

3.1 Alternative 1

Due to environmental, real estate, and hydraulic constraints within the West Sacramento North Basin, Alternative 1 proposes fix in place remediation. For the South Basin, combinations of fix in place and/or adjacent levee measures are being proposed. The fix in place is valid where real estate is constrained, the existing levee meets or exceeds minimum levee standards, and/or vegetation and erosion are not considerations. In addition to the fix in place and adjacent levee measures, a seepage berm is proposed for the South Basin where there are not as many real estate constraints or the cutoff wall does not completely remove the through- and under seepage concerns. The purpose of this alternative would be to improve the flood damage reduction system to safely convey flows to a level that maximizes net benefits. Table 3-1 summarizes the levee remediation measure for each reach in each basin.

Table 3-1. Alternative 1 – Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
North Basin				
Sacramento River North	Cutoff Wall	Cutoff Wall	Levee Raise	Bank Protection
Port North*	---	---	Flood Wall	---
Yolo Bypass *	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training Levee	---	---	---	Bank Protection
South Basin				
Sacramento River South	Cutoff Wall, Seepage Berm	Cutoff Wall	---	Bank Protection
South Cross	Relief Wells	Stability Berm	Levee Raise	---
Deep Water Ship Channel East *	Cutoff Wall	Cutoff Wall	Levee Raise	---
Deep Water Ship Channel West*	Cutoff Wall	Cutoff Wall	Levee Raise	Bank Protection
Port South*	Cutoff Wall	Cutoff Wall	Levee Raise	---

* The entire levee reach does not need remediation, only specific sections.

It is estimated that a maximum of 7 million cy of borrow material would be needed for Alternative 1. Actual volumes exported from any single borrow site would be adjusted to match demands for fill. Construction of Alternative 1 is proposed to take approximately 18 years if each reach is constructed sequentially.

Table 3-2. Alternative 1 – Construction Sequence and Duration.

Construction Sequence	Construction Duration
Sacramento River South Levee	4 years
Sacramento Bypass Training Levee	1 years
Sacramento River North Levee	2 years

Yolo Bypass	1 years
Deep Water Ship Channel West	3 years
Port South	1 years
Deep Water Ship Channel East	3 years
South Cross	1 years
Port North	2 years

Levees in the North Basin require improvements to address seepage, slope stability, overtopping, and erosion. The measures proposed for each levee reach are described in the subsections below. Table 3.3 shows the lengths of levee reaches, the measures for those reaches, and the approximate length of improvements for the North Basin.

Table 3-3. Alternative 1 – Construction Lengths and Measures by North Basin Levee Reach

Levee Reach	Length of Reach (feet)	Length of Measure (feet)	Improvement	Measure
Sacramento River North Levee	30,700	30,000	Erosion Protection	Bank Protection
		11,000	Seepage	30 Foot Deep Slurry Wall
		1,500	Seepage	80 Foot Deep Slurry Wall
		500	Seepage	45 Foot Deep Slurry Wall
		5,500	Seepage	110 Foot Deep Slurry Wall
		4,600	Height	Embankment Fill
Stone Locks	570	550		Embankment Fill, Sheet Pile Wall
Port North	23,225	8,500	Height	4 to 10 Foot High Floodwall
		14,000	Height	Embankment Fill
Yolo Bypass	19,749	2,500	Seepage	40 Foot Deep Slurry Wall
		2,000	Seepage	100 Foot Deep Slurry Wall
Sacramento Bypass Training Levee	3,000	3,000	Erosion Protection	Bank Protection

The primary issues in the South Basin, as identified on Plate 2-3, are erosion, seepage, and slope stability, with minimal height concerns. Under Alternative 1, levees in the South Basin would be improved through a combination of fix in place and adjacent levee construction. The measures that would be implemented under Alternative 1 for the levees in the South Basin would be: (1) installation of cutoff walls or seepage berms to address seepage and slope stability concerns; (2) stability berms to address slope stability concerns; (3) levee raises to address height concerns; and (4) bank protection to address erosion concerns. Table 3.4 shows the lengths of levee reaches, the measures for those reaches, and the approximate length of improvements for the South Basin.

Table 3-4. Alternative 1 – Construction Lengths and Measures by South Basin Levee Reach

Reach	Length of	Length of Measure	Improvement	Measure

	Reach (feet)	(feet)		
Sacramento River South Levee	31,000	31,000	Seepage/Erosion	Slurry Wall, 80' Wide Seepage Berm, Bank Protection
South Cross Levee	6,273	1,100	Stability/Height	Stability Berm and Embankment Fill
		5,000	Seepage/Height	Relief Wells and Embankment Fill
DWSC East Levee	17,171	1,500	Seepage	120 Foot Deep Slurry Wall
		7,100	Seepage	130 Foot Deep Slurry Wall
		6,000	Seepage	50 Foot Deep Slurry Wall
		2,600	Height	Embankment Fill
Port South	16,262	15,600	Height	Embankment Fill
		1,000	Seepage	70 Foot Deep Slurry Wall
DWSC West Levee	100,260	9,000	Height/Seepage	85 Foot Deep Slurry Wall
		7,000	Height/Seepage	50 Foot Deep Slurry Wall
		9,000	Height/Seepage	75 Foot Deep Slurry Wall
		75,300	Height	Embankment Fill
		100,000	Erosion Protection	Bank Protection

2.2 Alternative 3 – Improve Levees and Deep Water Ship Channel Closure Structure

Alternative 3 would include all of the levee improvements discussed in Alternative 1, except that levee repairs on the Port north and Port south levees and portions of the DWSC east and west levees would be replaced by the construction of a closure structure in the DWSC, as shown on Plate 2-5. The levee improvement measures for Alternative 3 would be consistent with Alternative 1. The Sacramento River, Yolo Bypass, and South Cross levees would be improved to address identified seepage, slope stability, erosion, and height concerns. The adjacent levee would be constructed where there are fewer real estate constraints, the existing levee does not meets or exceed minimum levee standards, and/or vegetation and erosion are considerations. The levee remediation measures proposed under Alternative 3 are summarized in Table 3-5 below.

Table 3-5. Alternative 3 – Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
North Basin				
Sacramento River North	Cutoff Wall	Cutoff Wall	Levee Raise	Bank Protection
Port North*	Closure Structure	Closure Structure	Closure Structure	Closure Structure
Yolo Bypass *	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training Levee	---	---	---	Bank Protection
South Basin				

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
Sacramento River South	Cutoff Wall, Seepage Berm	Cutoff Wall	---	Bank Protection
South Cross	Relief Wells	Stability Berm	Levee Raise	---
Deep Water Ship Channel East *	Cutoff Wall	Cutoff Wall	Levee Raise	---
Deep Water Ship Channel West*	Cutoff Wall, Closure Structure	Cutoff Wall, Closure Structure	Levee Raise, Closure Structure	Bank Protection
Port South*	Closure Structure	Closure Structure	Closure Structure	Closure Structure

* The entire levee reach does not need remediation, only specific sections.

It is estimated that a maximum of 5 million cy of borrow material could be needed to construct the project. Construction of Alternative 3 is proposed to take approximately 17 years if each reach is constructed sequentially. The tentative schedule of construction is shown in Table 3-6.

Table 3-6. Alternative 3 – Construction Sequence and Duration.

Construction Sequence	Construction Duration
Sacramento River South Levee	4 years
DWSC Closure Structure	3.5 years
Sacramento Bypass Training Levee	1 year
Sacramento River North Levee	2 years
Yolo Bypass	1 year
Deep Water Ship Channel West	2 year
Port South	No construction
Deep Water Ship Channel East	1 year
South Cross	2 year
Port North	No construction

Table 3-7. Alternative 3 – Construction Lengths and Measures by North Basin Levee Reach

Levee Reach	Length of Reach (feet)	Length of Measure (feet)	Improvement	Measure
Sacramento River North Levee	30,700	30,000	Erosion Protection	Bank Protection
		11,000	Seepage	30 Foot Deep Slurry Wall
		1,500	Seepage	80 Foot Deep Slurry Wall
		500	Seepage	45 Foot Deep Slurry Wall
		5,500	Seepage	110 Foot Deep Slurry Wall
		4,600	Height	Embankment Fill
Stone Locks	570	550		Embankment Fill, Sheet Pile Wall
Port North	23,225	8,500	Height	Closure Structure
		14,000	Height	Closure Structure
Yolo Bypass	19,749	2,500	Seepage	40 Foot Deep Slurry Wall

		2,000	Seepage	100 Foot Deep Slurry Wall
Sacramento Bypass Training Levee	3,000	3,000	Erosion Protection	Bank Protection

Table 3-8. Alternative 3 – Construction Lengths and Measures by South Basin Levee Reach

Reach	Length of Reach (feet)	Length of Measure (feet)	Improvement	Measure
Sacramento River South Levee	31,000	31,000	Seepage/Erosion	Slurry Wall, 80' Wide Seepage Berm, Bank Protection
South Cross Levee	6,273	1,100	Stability/Height	Stability Berm and Embankment Fill
		5,000	Seepage/Height	Relief Wells and Embankment Fill
DWSC East Levee	5,671	5,700	Height/Seepage	50 Foot Deep Slurry Wall
Port South	16,262	15,600	Height	Closure Structure
		1,000	Seepage	Closure Structure
DWSC West Levee	12,300	9,000	Seepage	85 Foot Deep Slurry Wall
		11,200	Height	Embankment Fill
		11,000	Erosion Protection	Bank Protection

3.3 Alternative 5 – Improve Levees with Setback Levee along Sacramento River South

Alternative 5 would include the levee improvements discussed in Alternative 1, except for the levee fix along the Sacramento River south levee. Instead of the fix in place and/or adjacent levee fix along the entire reach, levee repairs would include the construction of new setback levees. The setback levees would be constructed roughly 500 feet west of the existing levee as shown on Plate 2-7. The existing levee may be degraded and breached in several places and/or the bank would need to be maintained in the current manner or could require erosion protection. The levee remediation measures proposed under Alternative 5 are summarized in Table 3-9 below.

Table 3-9. Alternative 5 - Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
North Basin				
Sacramento River North	Cutoff Wall	Cutoff Wall	Levee raise	Bank Protection
Port North	---	---	Floodwall	---
Yolo Bypass *	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training Levee	---	---	---	Bank Protection
South Basin				

Sacramento River South	Setback Levee, Cutoff Wall, Seepage Berm,	Setback Levee, Cutoff Wall, Seepage Berm	---	Setback Levee, Bank Protection
South Cross	Stability Berm, Relief Wells	---	Levee Raise	---
Deep Water Ship Channel East *	Cutoff Wall	Cutoff Wall	Levee Raise	Bank Protection
Deep Water Ship Channel West*	Cutoff Wall	Cutoff Wall	Levee Raise	---
Port South*	Cutoff Wall	Cutoff Wall	Levee Raise	---

* The entire levee reach does not need remediation, only specific sections.

It is estimated that 9 million cy of borrow material would be needed to construct Alternative. Construction of Alternative 5 is proposed to take approximately 19 years if each reach is constructed sequentially. The tentative schedule of construction is shown in Table 3-10. The durations are for construction activities only, and do not include the time needed for design, right-of-way, utility relocation, etc.

Table 3-10. Alternative 5 – Construction Sequence and Duration.

Construction Sequence	Construction Duration
Sacramento River South Levee	4 years
Sacramento Bypass Training Levee	1 years
Sacramento River North Levee	2 years
Yolo Bypass	1 years
Deep Water Ship Channel West	3 years
Port South	1 years
Deep Water Ship Channel East	3 years
South Cross	2 years
Port North	2 years

Table 3-11. Alternative 5 – Construction Lengths and Measures by North Basin Levee Reach

Levee Reach	Length of Reach (feet)	Length of Measure (feet)	Improvement	Measure
Sacramento River North Levee	30,700	30,000	Erosion Protection	Bank Protection
		11,000	Seepage	30 Foot Deep Slurry Wall
		1,500	Seepage	80 Foot Deep Slurry Wall
		500	Seepage	45 Foot Deep Slurry Wall
		5,500	Seepage	110 Foot Deep Slurry Wall
		4,600	Height	Embankment Fill
Stone Locks	570	550		Embankment Fill, Sheet Pile Wall
Port North	23,225	8,500	Height	4 to 10 Foot High Floodwall
		14,000	Height	Embankment Fill
Yolo Bypass	19,749	2,500	Seepage	40 Foot Deep Slurry Wall
		2,000	Seepage	100 Foot Deep Slurry Wall
Sacramento Bypass Training	3,000	3,000	Erosion Protection	Bank Protection

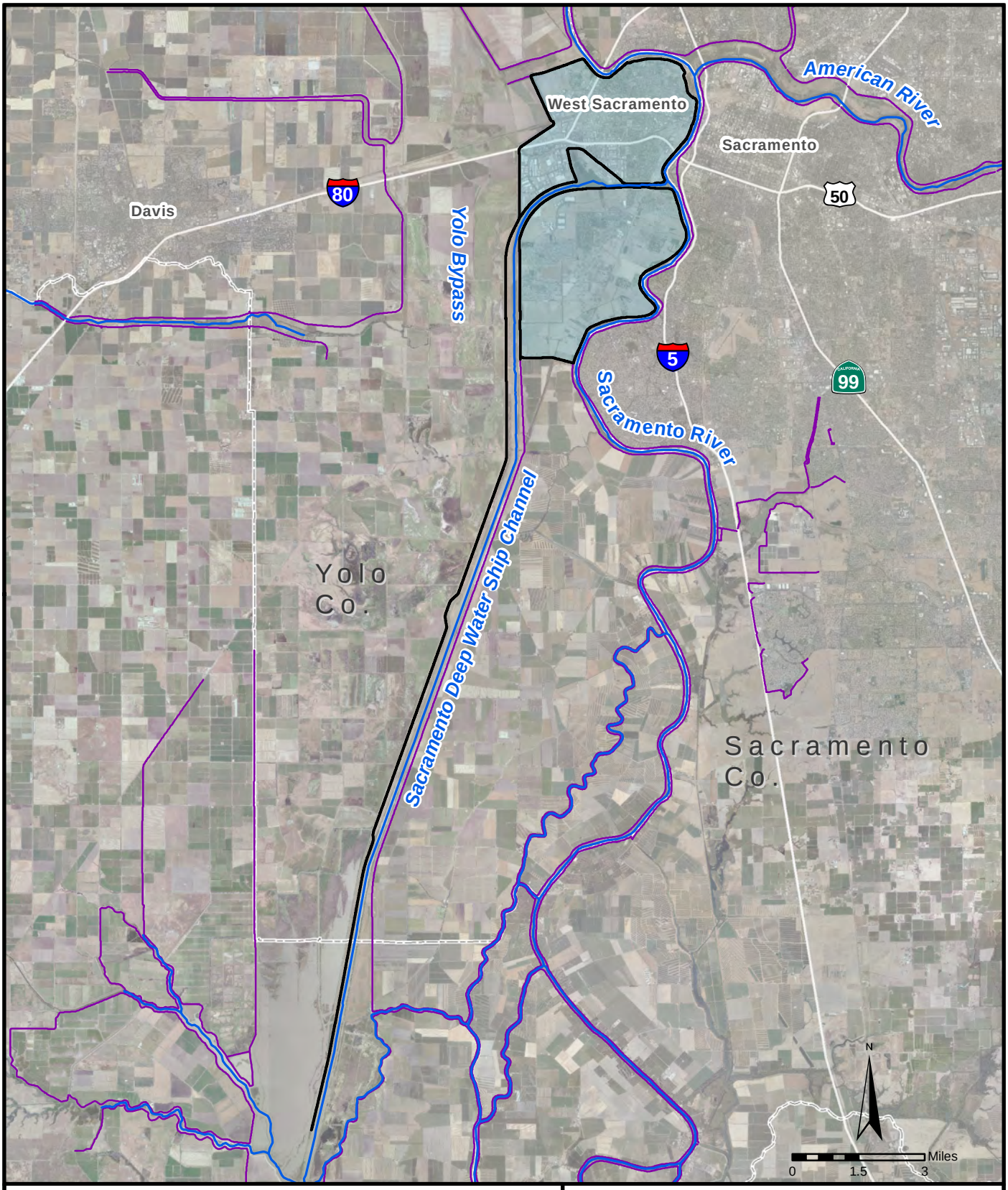
Levee				

Table 3-12. Alternative 5 – Construction Lengths and Measures by South Basin Levee Reach

Reach	Length of Reach (feet)	Length of Measure (feet)	Improvement	Measure
Sacramento River South Levee				
South Cross Levee	6,273	1,100	Stability/Height	Stability Berm and Embankment Fill
		5,000	Seepage/Height	Relief Wells and Embankment Fill
DWSC East Levee	17,171	1,500	Seepage	120 Foot Deep Slurry Wall
		7,100	Seepage	130 Foot Deep Slurry Wall
		6,000	Seepage	50 Foot Deep Slurry Wall
		2,600	Height	Embankment Fill
Port South	16,262	15,600	Height	Embankment Fill
		1,000	Seepage	70 Foot Deep Slurry Wall
DWSC West Levee	100,260	9,000	Height/Seepage	85 Foot Deep Slurry Wall
		7,000	Height/Seepage	50 Foot Deep Slurry Wall
		9,000	Height/Seepage	75 Foot Deep Slurry Wall
		75,300	Height	Embankment Fill
		100,000	Erosion Protection	Bank Protection

ATTACHMENT B

AREA OF POTENTIAL EFFECTS AND ALTERNATIVES



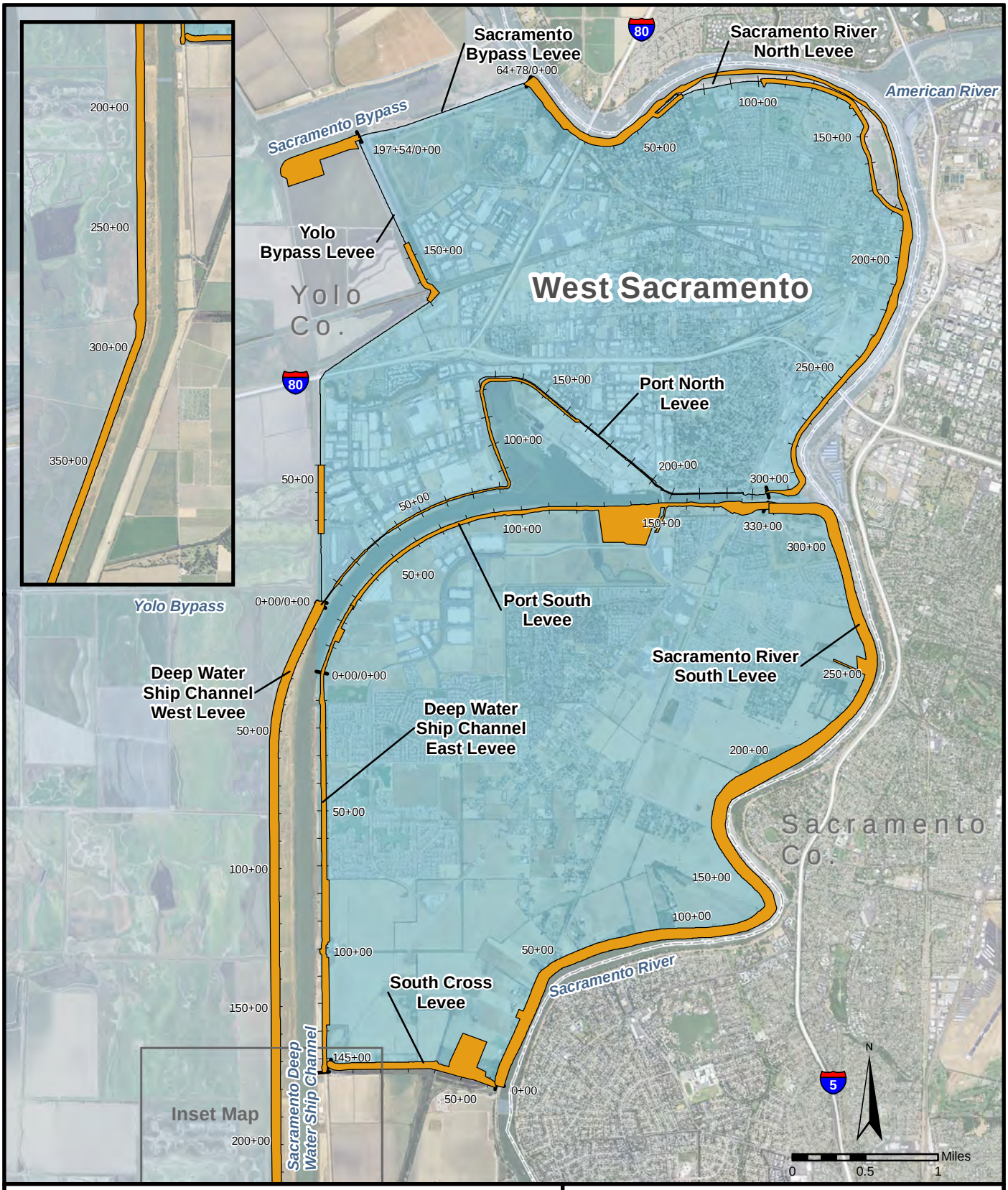
Legend

- Rivers
- Project Levee
- Other Federal Levees
- West Sacramento Project Area
- County Line

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

PROJECT AREA

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



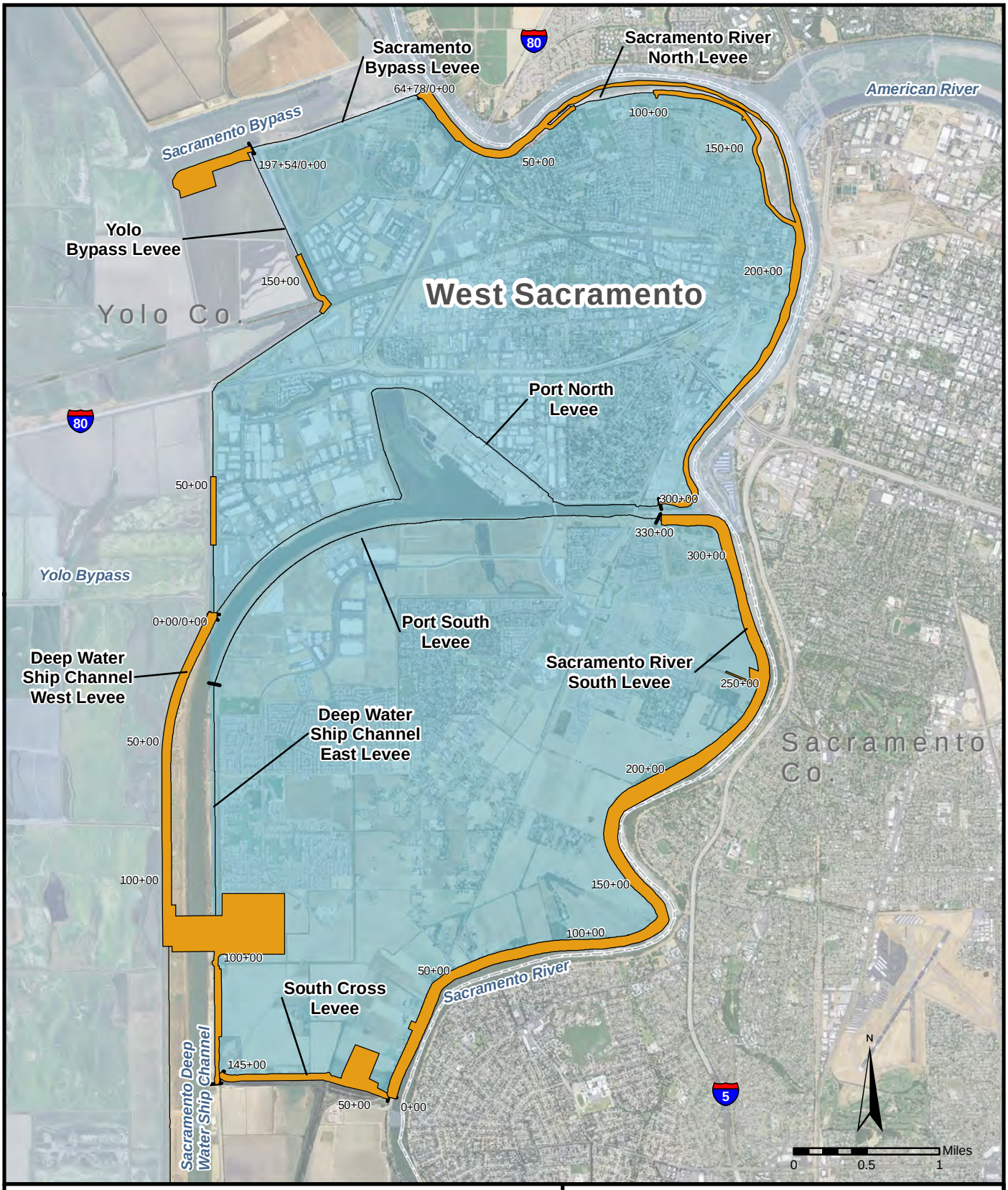
Legend

- Footprint
- Levee Centerline
- Floodways
- West Sacramento Project Area
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

FOOTPRINT ALTERNATIVE 1

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



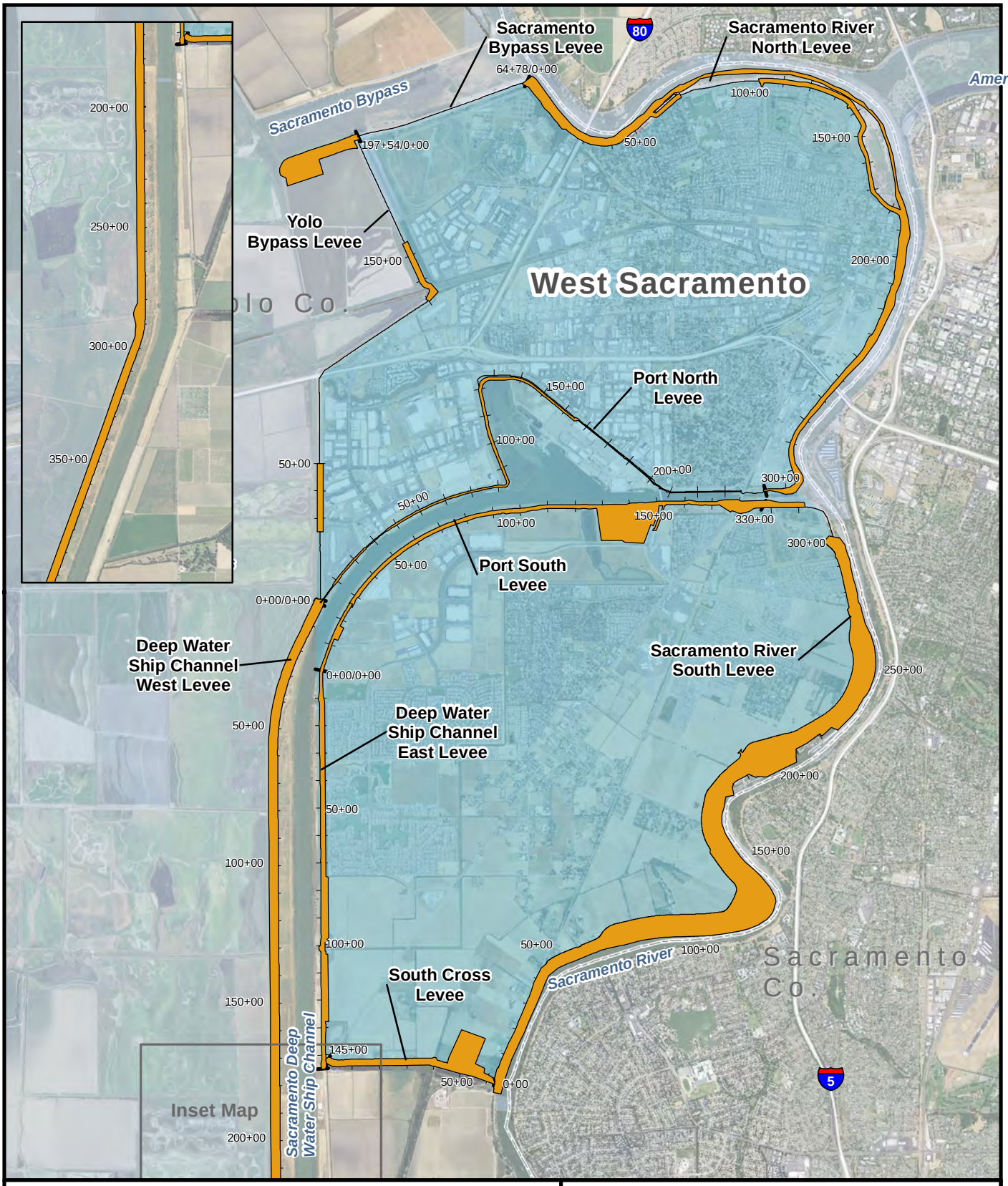
Legend

- Footprint
- Levee Centerline
- Floodways
- West Sacramento Project Area
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

FOOTPRINT ALTERNATIVE 3

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



Legend

- Footprint
- Levee Centerline
- Floodways
- West Sacramento Project Area
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

FOOTPRINT ALTERNATIVE 5

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

ATTACHMENT C

HISTORIC PROPERTIES MANANAGEMENT PLAN

DRAFT
WEST SACRAMENTO GENERAL REEVALUATION REPORT
HISTORIC PROPERTIES MANAGEMENT PLAN

United States Army Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922
Contact: Shellie Sullo, Social Science Study Manager
916.557.7628 and

West Sacramento Area Flood Control Agency
1110 West Capitol Avenue
West Sacramento, CA 95691
Contact: John Powderly
916.617.4674

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Acronyms and Abbreviations

APE	area of potential effects
Cal/OSHA	California Office of the Occupational Safety and Health Administration
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CHRIS	California Historical Resources Information System
Corps	U.S. Army Corps of Engineers
CRHR	California Register of Historical Resources
DPR	Department of Parks and Recreation
GPS	Global Positioning System
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HAER	Historic American Engineering Record
MLD	most likely descendant
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
NWIC	Northwest Information Center
PA	programmatic agreement
Plan	Historic Property Management Plan
project	Southport Sacramento River Early Implementation Project
SHPO	State Historic Preservation Officer
SPRR	Southern Pacific Railroad
TCPs	Traditional cultural properties
USC	United States Code
WSAFCA	West Sacramento Area Flood Control Agency

Introduction and Summary

The United States Army Corps of Engineers (Corps) is pursuing the West Sacramento General Reevaluation Report (West Sacramento GRR or Project) which consists of improvements to the following levees with the North and South Basin of West Sacramento:

The North Basin, which encompasses 6,100 acres, contains:

- Sacramento River north levee – 5.5 miles from the Sacramento Bypass south to the Stone Locks on the barge canal.
- Port north levee – 4.9 miles from the Stone Locks west to the Yolo Bypass levee.
- Yolo Bypass levee – 3.7 miles from the Port north levee north to the Sacramento Bypass.
- Sacramento Bypass levee – 1.1 miles from the Yolo Bypass levee to the Sacramento River.
- Sacramento Bypass training levee – 0.5 miles west into the Yolo Bypass from the Sacramento Bypass levee.

The South Basin, which encompasses 6,900 acres, contains:

- Sacramento River south levee – 5.9 miles south along the Sacramento River from the Stone Locks to the South Cross levee (just north of the waste water treatment plant).
- South Cross levee – 1.2 miles across the South Basin from the Sacramento River to the Deep Water Ship Channel (DWSC).
- DWSC east levee – 2.8 miles from the South Cross levee north to the point where it bends east.
- Port south levee – 4.0 miles east from the bend in the DWSC east levee to the Stone Locks.
- DWSC west levee – 21.4 miles from the intersection of the Port north levee and the Yolo Bypass levee south to Miners Slough.

This project requires authorization from the Corps to modify federal levees (see Attachment B of Programmatic Agreement for alternatives and examples of types of modifications that can occur) under Section 14 of the River and Harbors Act (33 U.S.C. § 408) and a permit to discharge fill to waters of the United States under Section 404 of the Clean Water Act (33 U.S.C. § 1344), and these actions constitute undertakings requiring compliance with Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C. § 470f). The Corps, as the lead federal agency, must comply with Section 106 of the National Historic Preservation Act (NHPA). The Corps is using a phased management approach to Section 106 compliance, as authorized in Code of Federal Regulations (CFR), Title 36, Part 800.4(b)(2). This phased management process will be guided by a programmatic agreement (PA), and this Historic Property Management Plan (plan). The purpose of this plan is threefold.

- To identify the kinds of properties that are likely to be affected by these undertakings (36 CFR Part 800.4[b][2] requires that the agency identify the likely presence of historic properties and nature of anticipated effects when a phased approach is used).

- To identify management methods necessary for completing management steps required in the PA (identification, evaluation, finding of effect, and resolution of adverse effects).

- To provide a vehicle for gathering input from stakeholders such as the Native American community and other concerned parties.

The plan first describes the current regulatory environment, the undertakings and the phased management approach, the cultural context, management efforts completed to date, and management methods necessary for completing the requirements of the PA. This document is intended to provide substantive guidance for implementing the PA but may be amended separately from the PA, based upon resources identified in the field, changes to the project, and input from stakeholders. This document cannot, however, revise the scope or coverage of the PA. Because the scope of identified resources is limited the plan provides an overview of the relevant setting and management steps rather than in-depth descriptions. The inventory reports that will be prepared pursuant to the PA will provide additional detail necessary to support property-specific National Register of Historic Places (NRHP) evaluation.

Regulatory Context

Section 106 of the National Historic Preservation Act

Section 106 of the NHPA requires federal agencies to consider the effects of their actions on historic properties (United States Code [USC], Title 16, Section 470f). *Historic properties* are resources listed on or eligible for listing on the NRHP (36 CFR 800.16[l] [1]). A property may be listed in the NRHP if it meets the following criteria provided in the NRHP regulations (36 CFR 60.4).

- The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association; and
    - that are associated with events that have made a significant contribution to the broad patterns of our history; or
    - that are associated with the lives of persons significant in our past; or
    - that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
    - that have yielded, or may be likely to yield, information important in prehistory or history.

Some property types do not typically qualify for the NRHP; however, these properties may qualify if they fall into one or more of the following criteria considerations (36 CFR 60.4).

- A religious property deriving primary significance from architectural or artistic distinction or historical importance; or
- A building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
- A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or
- building directly associated with his productive life;
- A cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
- A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
- A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or
- A property achieving significance within the past 50 years if it is of exceptional importance. The Section 106 review process typically consists of the following major steps.
- Identify the federal agency undertaking.
- Initiate Section 106 process.
- Identify historic properties.
- Assess adverse effects.
- Resolve adverse effects.

The Section 106 regulations define an adverse effect as an effect that alters, directly or indirectly, the

qualities that make a resource eligible for listing in the NRHP (36 CFR 800.5[a][1]). Consideration must be given to the property's location, design, setting, materials, workmanship, feeling, and association, to the extent that these qualities contribute to the integrity and significance of the resource. Adverse effects may be direct and reasonably foreseeable, or may be more remote in time or distance (36 CFR 8010.5[a] [1]).

Under Section 304(a) of the NHPA, "[t]he head of a Federal agency … shall withhold from disclosure to the public, information about the location, character, or ownership of a historic resource if the Secretary and the agency determine that disclosure may … risk harm to the historic resources …"

Section 106 Undertakings and Phased Management

The Corps will use a phased management approach as authorized in the Section 106 regulations (36 CFR 800.4[b][2]), which provides a mechanism for documenting compliance with Section 106 while phasing management activities after approval of federal undertakings. This phased management approach is defined in the PA. The PA requires that for each phase of the project, or other discrete action, the Corps will perform the following activities.

- Define an area of potential effects (APE)
- Complete an inventory of historic properties
- Evaluate identified properties for the NRHP
- Make a finding of effect for identified properties
- Resolve adverse effects through treatment or avoidance
- Consult with the Corps, the California SHPO (SHPO), and Native American tribes and the public regarding these management milestones.
- Develop a Historic Properties Management Plan [this document].

All management steps in the PA will be completed in consultation with the signatories and concurring parties. Because management steps will track with phase- or activity-specific APEs, this plan refers to the "study area" rather than an APE. The study area consists of the project construction footprint and areas where borrow may occur as depicted in Figure 1.

Cultural Context

This section of the plan describes the prehistoric, ethnographic, and historic setting of the study area. The prehistoric context includes a description of the potential for buried prehistoric resources with little or no surface manifestation to occur in the study area.

Prehistoric Context

Although the Sacramento Valley may have been inhabited by humans as early as 10,000 years ago, the evidence for early human occupation likely is buried by deep alluvial sediments that accumulated rapidly during the late Holocene Epoch. Although rare, archaeological remains of this early period allegedly have been identified in and around the Central Valley. Johnson (1967:283–284) presents evidence for some use of the Mokelumne River area, under what is now Camanche Reservoir, during the late Pleistocene Epoch. These archaeological materials and similar materials in the region have been termed the *Farmington Complex*. Recent work in the vicinity of Camanche Reservoir, however, calls into question whether Farmington Complex exceeds an age of 10,000 Before Present (B.P.) (Rosenthal et al. 2007:151).

Preliminary results from Tremaine & Associates' (2008) recent excavations at Sacramento City Hall (Sacramento City Hall overlies the Nisenan village of Sacum'ne, CA-SAC-38) reveal the earliest confirmed habitation of the immediate Sacramento vicinity. Obsidian hydration readings on artifacts may represent use of the site during 3000–8000 B.P. Tremaine & Associates also ran three radiocarbon assays, which yielded conventional dates of 5870, 6690, and 6700 B.P. The radiocarbon assays were taken between 9.8 feet and 11.5 feet below ground surface (Tremaine & Associates 2008:99–101).

Later periods of prehistory are better understood because of their more abundant representation in the

archaeological record. Fredrickson (1973) identified three general patterns of cultural manifestations for the period between 4500 and 100 B.P.—the Windmiller, Berkeley, and Augustine Patterns.

The Windmiller Pattern (4500–2800 B.P.) shows evidence of a mixed economy consisting of the generalized hunting of game, fishing, and use of wild plant foods. Settlement strategies during the Windmiller period reflect seasonal occupation of valleys during the winter and of foothills during the summer (Moratto 1984:201, 206).

Cultural changes are manifested in the Berkeley Pattern (3500–2500 B.P.). Technological changes in groundstone from handstones and milling slabs to the mortar and pestle indicate a greater dependence on acorns, and the presence of a wide variety of projectile points and atlatls indicates hunting was still an important activity (Fredrickson 1973).

The Berkeley Pattern was superseded by the Augustine Pattern around 1450 B.P., reflecting a change in subsistence and land use patterns similar to those of the ethnographically known people of the proto-historic era. This pattern exhibits a great elaboration of ceremonial and social organization, including the development of social stratification. Complex exchange systems, further reliance on acorns, and a wide variety of artifacts (flanged tubular smoking pipes, harpoons, clamshell disc beads, and an especially elaborate baked clay industry, which included figurines and pottery vessels called *Cosumnes Brownware*) are associated with the Augustine Pattern. Increased village sedentism, population growth, and an incipient monetary economy are also hallmarks of this pattern (Moratto 1984:211, 213).

Because human activity has occurred in the study area throughout the Holocene, as described above, and because the depositional environment consists of an alluvial floodplain, the study area is sensitive for buried sites that may have little or no surface manifestation. The following describes this sensitivity as part of the cultural context.

Sensitivity for Buried Prehistoric Archaeological Resources

Prehistoric resources have been documented along the Sacramento River and adjacent uplands on similar projects in the region (Sacramento Area Flood Control Agency 2007:3.8-17). In addition, two prehistoric resources have been documented on or near the borrow areas for this project, as described below. The relatively low number of prehistoric cultural resources documented in the landside parcels associated with the project likely reflects the dearth of previous studies rather than a low density of resources. In addition, soil in the study area consists of Pleistocene and Holocene deposits (Meyer et al. 2008:7). Soil types that occur in the study area and associated typical ages and sensitivity are summarized in Table 2. Of the 17 soil types identified in the study area, 11 have high to very high sensitivity for buried sites with little or no surface manifestation. These sites may also contain human remains. Landform sensitivity thus provides a proxy indicator of prehistoric site sensitivity in the absence of site-specific studies. Buried sites obscured by overlying soil layers are likely to contain deposits that remain intact despite surface disturbance such as agricultural land use; therefore, these sites are likely to have integrity. Because buried resources may qualify as historic properties, management methods are provided below that may be used to identify such resources.

Table 2. Study Area Soil Types, Ages, and Archaeological Sensitivity

Soil Type	Sampled Age	Sensitivity
Capay	late Holocene	4,000–2,000 B.P./high
Clear Lake	latest Holocene	2,000–150 B.P./very high
Columbia	historic modern	150 B.P.–present/variable
Egbert	latest Holocene	2,000–150 B.P./very high
Galt	late Holocene	4,000–2,000 B.P./high
Hollenbeck	late Holocene	4,000–2,000 B.P./high
Jacktone	mid-Holocene	7,000–4,000 B.P./moderate
Marcum	latest Pleistocene	15,000–11,500 B.P./very low
Omni	latest Holocene	2,000–150 B.P./very high
Ryde	no data	no data

Sacramento	latest Holocene	2,000–150 B.P./very high
Sailboat	latest Holocene	2,000–150 B.P./very high
San Joaquin	older Pleistocene	>15,000 B.P./very low
Shanghai	historic modern	150 B.P.–present/variable
Stockton	late Holocene	4,000–2,000 B.P./high
Sycamore	latest Holocene	2,000–150 B.P./very high
Valdez	latest Holocene	2,000–150 B.P./very high

Sources: Soil types identified by U.S. Department of Agriculture, Natural Resources Conservation Service (2012); landform sensitivity described by Meyer et al. (2008:161).

Ethnographic Context

The project vicinity is located at the interface of three Native American groups: the Patwin (or Wintun), the Nisenan, and the Plains Miwok. The banks of the Sacramento River and associated riparian and tule marshland habitats were inhabited by the River or Valley Patwin. The Plains Miwok and Nisenan (also called Southern Maidu), while primarily occupying territories east of the Sacramento River, used land west of the river as well (Johnson 1978:350, Figure 1; Levy 1978: Figure 1; Wilson and Towne 1978:Figure 1).

The material culture and settlement-subsistence behavior of these groups exhibit similarities, likely because of historical relationships and a shared natural environment. Historic maps and accounts of early travelers to the Sacramento Valley testify that tule marshes, open grasslands, and occasional oak groves (Jackson 1851, Ord 1843, Wyld 1849) characterized the project vicinity. The area was generally wet in the winter and often subject to flooding; the weather was exceedingly dry in summer. Much of the floodplain presumably was sparsely inhabited, and Native Americans typically situated their larger, permanent settlements on high ground along the Sacramento and American Rivers (Bennyhoff 1977; Kroeber 1925:351, 1932; Levy 1978; Wilson and Towne 1978:388).

The Native American economy in the project vicinity was based principally on the use of natural resources from the riparian corridors, wetlands, and grasslands adjacent to the Sacramento River. Fish, shellfish, and waterfowl

were important sources of protein in the diet of these groups (Johnson 1978:355, Kroeber 1932). Salmon, sturgeon, perch, chub, sucker, pike, trout, and steelhead were caught with nets, weirs, lines and fishhooks, and harpoons. Mussels were harvested from the gravels along the Sacramento River channel. Geese, ducks, and mud hens were hunted using decoys and various types of nets. The majority of important plant resources in the Patwin diet came from the grasslands of the Sacramento River floodplain (Stevens 2004a: Table 1). Plants important to California Indians also were obtained from and managed in valley wetlands (Stevens 2004b:7). In addition to the staple acorn, numerous plants were important secondary food sources, including sunflower, wild oat, alfalfa, clover, and bunchgrass (Johnson 1978:355).

Historic Context

Early History

The study area is located in Yolo County, one of the original 27 counties created when California became a state in 1850. Woodland serves as the county seat (Hoover et al. 2002:566). Spanish explorers visited Yolo County as early as the 1700s in their search for suitable inland mission sites. In 1772, Pedro Fages passed through San Francisco Bay and the Delta and reached the San Joaquin and Sacramento Rivers. Between 1793 and 1817, several other mission site reconnaissance expeditions were conducted. The first European-American to travel through the area was Jedediah Strong Smith who, in the late 1820s, reported on the quantity and quality of furs in California. Joseph Walker and Ewing Young, during separate excursions, followed his general path in the 1830s. Mexican, American, and European settlers began to arrive and set down roots within the bounds of present-day Yolo County in the 1840s and 1850s (Hoover et al. 2002:566–567).

Sacramento River

The Sacramento River played an important role in the development of Yolo County prior to and during EuroAmerican occupation of the region. The river was a convenient landmark for the early explorations that also facilitated reconnaissance of the Sacramento Valley. The Spanish, in 1817, were the first Europeans to traverse the portion of the Sacramento River that passes through the project study area, having made an exploratory boat trip up the river as far as its confluence with the Feather River (Goldfried 1988:8). This expedition was followed by a series of Spanish, Russian, British, and American land and water forays up the Sacramento River from the 1820s through 1840s (Goldfried 1988:8–9).

River traffic through the project study area became more frequent between 1839 and 1848 with the establishment of John Sutter's fort at his New Helvetia Rancho, as well other settlements upriver hosted by Peter Lassen, John Sinclair, John Bidwell, and others (Goldfried 1988:9, Lydecker and James 2009:9, Sutter et al. 1939 [1845–1848]:1–3). The 1848 gold discovery at Coloma, however, was responsible for the vast increase in Sacramento River traffic in the project study area through the 1850s, as Sutter's embarcadero, at what is now Old Sacramento, served as the principal point of departure for persons and goods headed for the Sierra Nevada diggings. Crews frequently abandoned their ships at the embarcadero during the Gold Rush, leaving them to sink or be converted by others into warehouses, stores, and hotels on the river (Goldfried 1988:11).

The city of Sacramento and the communities of Washington and Riverbank/Bryte provided a lasting draw to river traffic through the 1920s because water transportation was a convenient and efficient way to move large amounts of goods and people to and from San Francisco and points beyond. River transportation from the mid-nineteenth century through the early twentieth century resulted in numerous marks along the river corridor, including ferries, wharves, shipwrecks, and many communities (Lydecker and James 2009:28, Figure 2-2).

Yolo County

The decline of the California gold rush resulted in disenchanted miners who realized they could make a greater fortune through farming and ranching than in gold prospecting, transforming Yolo County from an isolated farming community into a booming agricultural region. Through both the mid-nineteenth and twentieth centuries, Yolo County commerce was generally agrarian in focus, the main crops being wheat, barley, and other grains. Commercial enterprises related to agriculture and livestock also sprang up during this period, furthering the development and growth of the region (Larkey and Walters 1987:25–45).

Development

Yolo County's first town was Fremont, founded in 1849 near the confluence of the Sacramento and Feather Rivers (south of present-day Knights Landing). It became the first county seat in 1850. After the damaging flood of 1851, the county seat was moved to the town of Washington (part of present- day West Sacramento). Between 1857 and 1861, the county seat moved from Washington to Cacheville (present-day Yolo) and back to Washington. However, in 1862, more flooding episodes had motivated the community voters to select the centrally located town of Woodland as the permanent county seat (Hoover et al. 2002:566, 568–569).

Present-day West Sacramento experienced little growth until the early 1900s, when levee construction along the Sacramento River encouraged settlement and development of the area. Early settlers included Jan Lows de Swart (holder of the Rancho Nueva Flandria land grant) and James McDowell. In 1911, the West Sacramento Company laid out the community of Riverbank (later called Bryte) just west of the Sacramento River. Shortly thereafter, plans were under way for the establishment of the town of West Sacramento (Corbett 1993, Hoover et al. 2002: 568).

Following World War I, West Sacramento remained an unincorporated area populated primarily by small farms and a handful of industries. By the 1920s, the main east–west transcontinental highway (U.S. Highway 40, now West Capitol Avenue) extended through West Sacramento; within a few years several hotels and motels were constructed along its route through town. During World War II, factories and other industries began to prosper along the west bank of the Sacramento River. Following the war, the region—like much of the state—experienced a housing boom that would last for several decades (Corbett 1993).

In 1987, after numerous attempts, the City of West Sacramento was officially incorporated. The new city included the former communities of Broderick, Bryte, and surrounding urban and rural areas on the west

side of the Sacramento River into Southport (Walters 1987:46).

Reclamation and Flood Management

Historically, much of the Sacramento Valley was marsh and swampland, and there was seasonal flooding and periodic inundation of usually dry areas. Starting in the nineteenth century, flood management and land reclamation projects were undertaken to make the area habitable for larger populations and to expand agriculture.

In 1861, the legislature created the State Board of Reclamation Commissioners (Board) and authorized the formation of reclamation districts to protect the American and Yolo Basins and lower Sacramento County from flooding. In an attempt to enclose large areas bounded by natural levees, 32 districts were formed (Thompson 1958:196–198, McGowan 1961:284). Swampland Districts 1, 2, and 18 were organized to protect the American and Yolo Basins and lower Sacramento County from flooding and to allow reclamation of agricultural lands. Improvements began in 1863; by 1865, 26 miles of levees and 20 miles of drainage canals had been constructed (Bouey and Herbert 1990).

Because of the onset of the Civil War and modification of the assembly bill that established the Board, the levee improvement work was not completed (Bradley and Corbett 1995). The Board was dissolved in 1866, and control of swamp and overflow land fell to the counties (Thompson 1958:198). The Green Act of 1868 removed acreage limitations, and incentive programs were instituted. When a landholder certified that $2 per 1 acre had been spent on reclamation, the purchase price of the land was refunded and the owner was given the deed. Speculators took advantage of this offer, and a period of opportunistic and often irrational levee building followed (McGowan 1961:285, Thompson 1958:199–202).

In 1911, the State Reclamation Board was established; the new board had jurisdiction over reclamation districts and levee plans. That year, with approval from the state, the Sacramento Flood Control Plan was implemented. The plan proposed the construction of levees, weirs, and bypasses along the river. By 1918, hundreds of miles of levees were constructed in order to control flooding in the Sacramento Valley. As early as 1892, farmers of Yolo County came together to construct levees along the Sacramento River from the town of Washington to roughly 9 miles downstream. In March 1911, the Sacramento Land Company (formerly the West Sacramento Land Company) assisted with the establishment of RD 900 in what is now West Sacramento. The formation of this reclamation district created a framework for using public funds through bonds, levies, and taxes to drain the land (Corbett 1993; Walters 1987:21–23).

Under the direction of civil engineers Haviland & Tibbetts, formation of RD 900 began. The district spanned 11,500 acres from the east–west line of the Southern Pacific Railroad (SPRR) tracks, south to the vicinity of Riverview. Construction involved installing drainage canals, levees, and pumphouses. The canals carried drainage to the pumphouses, which in turn moved the water over the levees into the Yolo Bypass. As the land was drained of water, the fields of tules were removed, establishing acres of agricultural land (Corbett 1993). Reclamation districts such as RD 900 frequently result in historically and functionally cohesive, patterned modifications of rural areas through their networks of irrigation works, roads, boundary markers, and buildings. Such rural historic landscapes have been documented in the Sacramento Valley, some of which—such as RD 1000 in Sacramento and Sutter Counties—have been determined eligible for listing in the NRHP (Bradley and Corbett 1995, Jones & Stokes 2004:22, JRP Historical Consulting Services 1994, Peak 1997).

Sacramento Deep Water Ship Channel

In 1945, the Corps recommended the construction of a deep water ship channel to connect Sacramento to the San Francisco Bay Area. After Congress approved the project, construction on the Barge Canal began in 1949. Although construction temporarily halted during the Korean Conflict, the channel (which included a harbor and turning basin) eventually was completed in 1962 (Hart 1978).

With the growth of populations and increased agricultural output in the Sacramento Valley, the need to move large amounts of cargo inexpensively fostered the Sacramento River Deep Water Ship Channel (DWSC) project. The DWSC was originally authorized by the River and Harbor Act of 1946 (PL 79-525). The DWSC is located on the Sacramento River between Collinsville and the Port of West Sacramento, and continues south/southwest, in the counties of Sacramento, Contra Costa, Solano, and Yolo. The DWSC was completed in 1963 with the Sacramento – Yolo Port District as the local sponsor (Seldomridge 1976).

The DWSC provided a 30 foot deep draft channel from Suisun Bay to an inland harbor at Lake Washington in the City of West Sacramento. The completion of the channel not only allowed large marine vessels to dock in West Sacramento, but also shortened the route along the river from 59 miles to approximately 46 miles through the artificial canal. The channel was formed by widening and deepening existing channels from Suisun Bay to Rio Vista and by excavating a new channel from Rio Vista to Lake Washington in West Sacramento. The project also included a 1.5-mile long shallow draft barge canal with an 86-foot wide and 600-foot long navigation lock between the harbor and the Sacramento River. The barge canal and lock, which had a 4-foot lift at normal pool elevation, provided for the transfer of barges between the two different water surface elevations. A 135-foot single leaf combination highway and railroad bascule bridge originally crossed the canal at the harbor end of the lock. Construction of the Barge Canal divided RD 900 into two parts and rerouted Highway 84 to its present location along Jefferson Boulevard.

Solano County

Throughout the 19th century, land in Solano County was used primarily for wheat and alfalfa crops, cattle ranching, and some small orchards. Tall and expansive stands of wild oats attracted cattle and sheep ranchers to central Solano County and contributed to the region's early growth. Over time, however, prosperous grain and stock farms occupied land in the area. With collapse of the "wheat boom" in the 1890s, alfalfa supplanted wheat as the dominant grass crop, and it remained the area's primary crop through the turn of the 20th century. In addition to growing crops, settlers also raised poultry, pigs, sheep, dairy cows, and beef cattle (Hunt 1926; Thompson and West 1878).

The cultivation of fruits and vegetables was also extremely successful. Small orchards initially made up of a few fruit trees grown for private consumption of fruit quickly developed into large commercial orchards. Solano County continued to be a major fruit-producing region through the early twentieth century, when the region's growth and prosperity became increasingly unstable because of the faltering post-World War I economy.

Additional problems included soil exhaustion, flooding, erosion, periods of drought, and diseases harmful to the fruit trees. The combination of these forces contributed to the general decline of the fruit industry, and many orchards gave way to the bulldozer or were abandoned (Wickson 1888; Keegan 1989). Vacaville and Fairfield are two major cities in Solano County. In 1843, Mexico granted ten leagues named *El Rancho Los Putos* to Manuel Cabeza de Vaca and Juan Felipe Peña in the area that is now part of Vacaville. In 1850, settler Manuel Vaca deeded 23.3 square kilometers (9 square miles) of his land to settler William McDaniel with the proviso that a town be established and named after Vaca. Surveyors drafted plans for the new town and within a few years, the settlement featured numerous businesses that were established to serve the growing agricultural community, which was almost solely dependent on fruit production. The town incorporated in 1892 (Limbaugh and Payne 1978).

The city of Fairfield is located on lands that were originally part of the Tolenas and Suisun land grants. In 1858 Captain R. H. Waterman acquired the land and offered Solano County 16 acres for use as a county seat. The county voters accepted Waterman's offer, making the new town of Fairfield (named after Waterman's hometown in Connecticut) the new county seat, which it has been ever since. Fairfield developed more slowly than nearby communities, and it was not until the mid-20th century completion of Travis Air Force Base (originally Fairfield-Suisun Army Air Base) that the city's population began to thrive (Hunt 1926; Kyle et al. 1990).

In addition to Travis Air Force Base, the expansion of Basic Vegetable Products Company and the California State Prison contributed to the county's overall development in the 20th century. In recent years, the Vacaville/Fairfield area has grown into a bedroom community of the San Francisco Bay Area.

Until the middle of the 20th century, there were no large-scale irrigation systems in Solano County, and farmers relied on small irrigation efforts and annual rainfall to water their crops. In 1916, William Pierce of Suisun City proposed the damming of Putah Creek at Devil's Gate west of the town of Winters to create a 1.5-million-acre-foot reservoir in the Berryessa Valley. Pierce's idea was not adopted until more than 20 years later. In 1940, the Solano County Board of Supervisors created the Solano County Water Council to study local water needs, investigate available water sources, collect data, and make recommendations. Around the same time, the USBR and the Corps began developing the Solano Project, which would tap into the Putah and Cache Creeks for water to supply the nearby agricultural and urban areas. The project consisted of three main facilities: the Monticello Dam and Lake Berryessa, the Solano Diversion Dam, and

the Putah South Canal, which originates at the diversion dam and conveys water south to Solano County. All three projects were completed in 1957. The water provided by the Solano Project, in conjunction with later efforts, allowed continued urban and agricultural growth in the county (Goerke-Shrode 2002; Harnes 2002).

Summary of Completed Management Efforts

Records Search

A records search was conducted by the Corps in February 2010 at the Northwest Information Center of the California Historical Resources Information System located at Sonoma State University. Additional records searches were conducted as part of The Rivers and the CHP Academy 408 projects in the North Basin by ICF International and the Southport 408 project by ICF International; which encompasses three project reaches in the South Basin. These additional records search were conducted in 2007 and 2011 at the Northwest Information Center and the North Central Information Center of the California Historical Resources Information System located at Sonoma State University and California State University, Sacramento, respectively. The research consisted of a database search of all previously recorded sites and studies within the study area, established as a 0.25-mile-wide corridor from the center of the river to along both shorelines for the entire length of the study area, including the DWSC. The search also consulted the current listings for the NRHP, the California Register of Historic Resources (CRHR), and pertinent historic inventories and historic maps. The following sources were consulted as part of the record search efforts:

- *California Inventory of Historic Resources*. California Department of Parks and Recreation, 1976;
- *California Historical Landmarks*. California Department of Parks and Recreation 1996;
- *California Historical Resources Information System*, Directory of properties in the historic property data file for Yolo and Sacramento Counties, Office of Historic Preservation 2007;
- *California Historical Resources Information System*. Archeological determinations of eligibility, Sacramento County. Office of Historic Preservation. 2007;
- U.S. Geological Survey 1907, 15-minute Davisville, California, topographic quadrangle; and
- U.S. Geological Survey 1908, 15-minute Courtland, California, topographic quadrangle.

The records search identified numerous studies previously conducted in the study area. Most were small studies that included a portion of the study area. However, a limited number of the previous studies were linear studies conducted along a larger portion of the levee or adjacent to it. The more recent studies were located in areas that incorporated portions of the project-level areas and will be discussed in the project-level analysis below. The majority of the study area has not been subjected to cultural resource studies more recently than 1993, and the three primary studies conducted along the DWSC were conducted in 1976 and 1985 (Seldomridge and Smith-Madsen 1976; Werner 1985a, 1985b). Studies of submerged cultural resources along study area portions of the Sacramento River have also been conducted (Allan 2002a; Allan 2002b; Allan et al. 2002; California State Lands Commission 1988).

Having been conducted more than 10 years ago, the majority of these previous studies are now outdated. Since the time of those studies, ground surface conditions in the study area may have changed, and built environment features such as buildings and structures, and or linear features are likely to have become at least 45 years old. Advancements in the field of cultural resource management make it likely that previously unidentified or unrecognized resources would be identified if a survey were to be conducted today. In other words, the passage of 10 years or more renders it likely that previously unidentified cultural resources would be identifiable at present in portions of the study area. Therefore, the majority of the Area of Potential Effect (APE) (See Attachment B) is considered in need of being resurveyed either at an intensive or at least a reconnaissance-level of investigation.

Table 1. Cultural Resources Located in the APE by Reach.

Resource Name/Number	Resource Description	Resource Eligibility
Sacramento River North Levee		
CA-YOL-24	Prehistoric mound site	Unevaluated
CA-YOL-25	Prehistoric mound site	Unevaluated, site appears to have been destroyed (Bouey with Herbert 1990)
CA-YOL-HRI-8/219	Historic- water tower	Unevaluated
CA-YOL-HRI-8/221	Historic—John White House 610 Second Street	Not eligible; has been demolished (Les 1986)
P-57-000423	Historic (waterside) remains of four wood dolphins and pilings, remains of Texas Company wharf	Unevaluated
CA-YOL-27	Prehistoric mound site	Unevaluated
Sacramento River Levee	Historic Levee	Portions Eligible
Yolo Bypass Levee		
P-57-000400	Historic—California Pacific Railroad	Unevaluated
Port North Levee		
C-1112	Prehistoric—single human vertebrae	Unevaluated
Port South Levee		
No resources previously recorded.		
Sacramento River South Levee		
P-57-000425	Historic—waterside remains of wood pilings, possible remains of Lufkin Landing wharf.	Ineligible
P-57-000607 (CA-YOL-222-H)	Historic—waterside wharf remnants	Recommended ineligible
CA-YOL-132	Prehistoric midden site	Unevaluated
Sacramento River Levee	Historic Levee	Portions Eligible
South Cross Levee		
No resources previously recorded		
Deep Water Ship Chanel East		
P-48-787	Historic Prospect Island Levee	Unevaluated

Shipwrecks Database

In addition to the cultural resources identified in Table 1, the State Lands Commission's shipwreck database indicates that approximately 16 shipwrecks have been reported in the study area. Their presence in the study area has not been confirmed, however (California State Lands Commission 1988). The shipwrecks are subject to displacement by river currents, salvaging, and destruction by waterside development. The wreck of the side-wheel steamer *Alviso*, burned at Brytes Bend on December 15, 1920, may be present in the project vicinity (California State Lands Commission 1988). This site has not been relocated nor evaluated for NRHP and/or CRHR listing.

Additional Research

In an effort to identify important historic people, events, and trends that may have been associated with the study area, archival research was conducted at the California State Library and the Yolo County Assessor's Office. These two facilities revealed chain of ownership information for properties within the study area.

Historic maps and aerials and County biographies also revealed information relevant to the development of the subject properties.

Field Survey

Field Survey Results

North Basin

No systematic field surveys have been conducted in the North Basin.

South Basin

Through April and May of 2011, archaeologists conducted a reconnaissance-level survey of some parcels in the South Basin as part of the Southport 408 action. The Southport 408 action encompasses the Sacramento River south levee from the Port south levee to the South Cross levee. Access to several parcels of the proposed survey area was not obtained prior to the survey. The majority of the project area consisted of both fallow and planted agricultural fields with some residential properties. Residential properties typically were graded and landscaped. No previously unidentified archaeological resources were noted in the project area as a result of the reconnaissance-level survey.

On June 9, 2011, as part of the Southport project, an architectural historian conducted an initial field survey of the project area. As part of the field process, buildings and structures 50 years old or older were inspected, photographed, and documented. Roughly 30% of the Southport study was accessible for survey. Due to access restrictions, several properties were recorded from South River Road at a distance of 100 to 400 yards away from partially visible buildings and structures. Dense vegetation in the form of trees and shrubs presented further problems as they obstructed any available line of sight.

In April of 2013, as part of the Southport project architectural historians conducted an additional field survey to identify all buildings and structures 50 years old or older in the study area. At this time, access was granted to several of the parcels, making it possible to survey all of the buildings and structures in the study area. This survey resulted in the identification of 31 properties containing buildings or structures at least 50 years of age. All properties were photographed and documented.

No other systematic field surveys have been conducted in the South Basin by the Corps. Prior to the implementation of any of the proposed alternatives to this project and in accordance with the Programmatic Agreement and detailed in the HPTP, cultural resources inventories will be conducted and determinations of effects will be made for resources.

Cultural Resource Site Types that May be Present in the APE

Due to the large geographic scope of the APE, limitations in access, the alluvial nature of the watershed, because levees and other structures have been built on top of much of the original native soil of the APE, and due to the high potential for buried cultural resources that will not be discovered until during construction, a 100% pedestrian survey of the APE area could not be completed.

However, data from the records and literature search, concerns relayed by American Indians, knowledge of the prehistory and history of the study area, and recent archaeological surveys conducted as part of Southport Levee Project provide information on the types of cultural resource sites that may be found within the study areas. The known cultural resources within the study area can be categorized as the following general types within the Sacramento Valley:

- **Mounds** – Refers to relatively low natural or anthropogenic mounds occupied by Native Americans as habitation sites and burial locations. Discarded refuse and numerous fires frequently generated significant accumulations of midden soil on these features.
- **Midden** – Refers to prehistoric or proto-historic trash deposits containing food refuse, such as discarded bone, shell, and other organic matter; along with broken, discarded or lost artifacts made of various raw materials, including stone, wood, bone, antler, etc. The organic nature of middens tends to produce softer,

darker, and greasier soils in contrast to the natural soils on which they rest. Deposition of midden often expanded the size of natural knolls or mounds both horizontally and vertically. Because of the softer soils in middens, they were also used as locations for human and/or animal burials. Middens generally include the full suite of artifacts, materials, and remains that would be encountered in a lithic scatter.

- **Lithics/Lithic Scatter** – The term "lithic scatter" refers to scatters of lithic (stone) debris (or debitage) resulting primarily from manufacture of chipped stone tools such as knives, dart points, arrow points, scrapers, adzes, and other tools. The process of manufacture by chipping or "knapping" resulted in percussion and pressure flakes removed from the raw natural resources of chert, obsidian, basalt, felsite and any other stone raw materials. Lithic scatters often contain fire-cracked rock distinguished by its fire reddened colors and sharp fracture patterns. Such rocks were often used for cooking by dropping heated rocks into baskets full of water and food. The sudden temperature change would commonly cause the rocks to fracture in a distinctive way. Ground stone tools used for processing foods and pigments are also common in lithic scatters. Less commonly, baked clay artifacts and shell or bone tools and ornaments may also occur. Finally, broken fragments of tools used for lithic manufacture such as hammerstones may also be associated with lithic scatters.
- **Traditional Cultural Properties** – Often referred to as "TCPs," Traditional Cultural Properties may be geographic features, locations, rural communities, urban neighborhoods, or other areas associated with cultural practices or beliefs of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community. TCPs may include locations associated with the traditional beliefs of an American Indian group about its origins, its cultural history, or the nature of the world; may include buildings and structures, objects or landscapes; and may be associated with religious or cultural practices of American Indians.
- **Historic Debris** – This term may refer to a great number of different artifacts 50 years of age or older that may be considered historical in nature. Cans, metal fragments, nails, glass fragments, glass bottles, and a variety of remnant material may be considered historic debris. In the Sacramento Valley this occasionally includes material thrown from railroad cars as passengers passed through the area, as well as abandoned machinery and equipment. Historic debris may be linked to a number of different historic subsistence activities such as farming, irrigation, construction of infrastructure, and homesteading.
- **Water Related** – The history of the Sacramento Valley is intertwined with that of flood control, reclamation, farming, and irrigation in the city of Sacramento and the surrounding areas. Much of the flood control infrastructure of the area dates back to the turn of the twentieth century. Water-related features may include levees, canals, weirs, bypass channels, drainage ditches, pump houses, wells, pipes, and farm-related structures and equipment.
- **Transportation** – A great number of roads, bridges, railroad tracks, and railroad trestles appear within the study area. These may include dirt or paved roads; bridges over canals, culverts, or other topographic features; and a variety of railroad features. Railroad features may include portions of the Transcontinental Railroad, the Walnut Grove Branch Line Railroad, raised berms that supported railroad rights-of-way, railroad trestle bridges, and lengths of railroad alignments. Within Sacramento, a number of historic railroad features are still in use today, both for the transport of goods, and recreationally and educationally associated with the California Railroad Museum in Old Town Sacramento just east of the Sacramento River.
- **Structures** – This refers to a variety of buildings or structures 50 years of age or older. Within the project area these may include government offices, farmsteads, homesteads, residential structures, barns, ranches, power plants, and sheds. These structures may be made from materials such as wood, concrete, brick, masonry, stucco, and corrugated metal.

Native American and Public Consultation

Native American Consultation

A list of potentially interested Native Americans from Yolo and Solano Counties was obtained from the California Native American Heritage Commission in June 2013. Those individuals were contacted in 2013 regarding the project and the Corps' efforts to identify cultural resources within the study area. In 2014, the Corps consulted with the Yoche Dehe, Wilton Rancheria, United Auburn Indian Community of the Auburn Rancheria and the Buena Vista Rancheria to discuss the project. The Wilton Rancheria and the Yoche Dehe Tribes will be asked to be concurring parties for the Programmatic Agreement being developed for this project.

Historical Society Consultation

As part of the earlier Southport early implementation notification letters were sent to the Yolo County Historical Museum, the Yolo County Historical Society, the Portuguese Historical and Cultural Society, the West Sacramento Historical Society, and the California Institute for Rural Studies requesting information regarding cultural resources that may be located within the study area. To date, no responses have been received.

Future Consultation

As called for in the PA, the Corps will consult with appropriate Native American groups and interested historical groups at each phase of construction. Native American groups and historical groups will be asked to comment on NRHP-eligibility for resources, Project effects, and measures to resolve adverse effects.

Inventory Methods for Completing Identification Efforts

This section defines methods necessary to complete inventory, evaluation, and treatment of archaeological and built environment resources.

Defining the Area of Potential Effects

The PA for the Project specifies that an APE shall be defined for each phase of construction. The Corps shall establish two APEs for the Project: one for the archaeological resources inventory effort and one for the inventory of built environment resources. The use of two APEs for archaeological and built environment resources is an accepted practice and consistent with industry best practices.

The archaeological APE will consist of the areas of direct and indirect impact from all construction-related activities. Note that these areas also include locations such as borrow areas and haul roads. The built environment APE will be somewhat more expansive, recognizing that the Project has the potential for indirect impacts on historic buildings and structures and landscapes, chiefly through changes to the setting. The built environment APE will take into account the different conditions in its urban and rural reaches. In the urban reaches, the built environment APE will comprise one urban lot on the land side of the levee (there are no urban parcels on the water side of the levee. In rural areas, the built environment APE will comprise a 200 foot (ft)-wide zone on either side of the levee. This 200-ft zone is designated in recognition of the fact that parcels in rural reaches are typically large and often the only buildings or structures on adjacent parcels are located far from the levee. The 200-ft zone will be diminished in those cases when a major roadway passes through it, effectively creating a visual edge to the built environment APE. In those circumstances, the inner edge of the roadway will be the edge of the built environment APE.

General Archaeological Inventory Methods

Archaeologists that meet the professional qualification standards defined in the PA will complete a pedestrian survey of all areas where the undertaking may directly or indirectly result in effects on historic properties. Transect intervals for archaeological surveys will be determined in the field based on the nature of land cover and access, but will not be wider than 10 meters. Identified resources will be mapped with global positioning system software and recorded on California Department of Parks and Recreation (DPR) forms. Methods to identify buried sites are provided below; and are consistent with the PA, as appropriate.

General Built Environment Inventory Methods

Architectural Historians that meet the professional qualification standards defined in the PA will complete a pedestrian survey of all areas where the undertaking may directly or indirectly affect built environment resources. All built environment resources will be documented in the field with DPR forms, as well as photographic depictions of the properties subject to management. Where feasible each elevation (side) of each property will be documented in photographs; where infeasible as many elevations as are accessible will be documented. The address or assessor's parcel number for each property will also be documented as a means of uniquely identifying each built environment resource subject to management. Technical reports will be completed prior to construction of each project phase or other project activity, consistent with the PA.

Methods for Identifying Buried Sites

As described above in "Prehistoric Context," portions of the study area where borrow sites may be developed are sensitive for buried sites associated with deposits that have been stable throughout the Holocene. Because the specific borrow sites have not yet been developed, subsurface sampling of these locations is premature. However, the following methods may be used to identify buried sites once borrow locations are certain.

Sensitivity Assessment

The first step in identifying buried archaeological sites is to assess relevant variables that predict locations where high sensitivity exists and therefore subsurface excavation is warranted. There are three factors that predict sensitivity.

- Geological landform sensitivity (see Table 2 above)
- Distance to water
- Presence of elevated landforms that would provide some respite from flooding and high water events

Table 2 above describes landform sensitivity. Distance to water and elevated landforms are discussed below. These three variables will be analyzed when specific borrow sites are selected, to determine if subsurface testing for buried sites is warranted.

Distance to Water

The majority of the study area is located along alluvial terraces that border the Sacramento River. Although the timing and extent of precontact channel migration along the Sacramento River is unknown, the floodplain likely represents the extent of channel migration during the late Holocene epoch. Therefore, the majority of the potential borrow sites consist of locations that may have been proximate to the river during its prehistoric meandering. Once specific studies for discrete borrow sites are performed additional geomorphological or geological investigation to identify proximity to prehistoric channels may be appropriate.

Trends in the Local Archaeological Record

The definitive study of site location and geomorphology for the region indicates an archaeologically and ethnographically observed pattern of "large settlements along levee ridges and other elevated landforms along the major rivers and tributary streams" in the Sacramento Valley during the Late Holocene (Meyer and Rosenthal 2008:68). These locations were likely preferred because they offered some protection against flooding relative to lower elevations. While grading and development may have obscured such features by leveling them, the presence of such features will be used or inferred based on historic maps where feasible.

Work Approach

Once the areas with substantial buried site sensitivity are located, the following methods may be employed to identify these resources.

Mechanical Trenching

The primary goals for mechanical trenching will be to determine the depth at which Pleistocene- aged or older landforms are buried below Holocene-aged deposits, characterize the sedimentary attributes of Pleistocene-aged or older and Holocene-aged deposits, and identify buried surfaces where prehistoric archaeological sites are likely to occur. The archaeologist in coordination with a geoarchaeologist, will direct the excavation of strategically placed trenches at appropriate intervals within borrow sites. The intervals will be spaced typically not greater than 30 meters apart, as most significant sites span at least 30 meters in diameter. The specific size and dimensions of each trench will depend upon location-specific logistical conditions—such as land access and utility/infrastructure locations—but will generally be around 1 meter wide, 5 meters long, and 3 meters deep.

The archaeologist will collect a 5-gallon sediment sample at arbitrary 2-foot vertical depth intervals and at all buried surfaces. These sediments samples will be passed through 6-millimeter (0.25-inch) hardware cloth to perceive and recover artifacts. In the event that archaeological deposits are encountered, the approach outlined under the provisions for archaeological discoveries, below, will be followed.

Each trench will be terminated once a 3 meter long depth is achieved or if utilities are encountered. At the completion of each trench, the archaeologist will document sedimentary and stratigraphic information, as well as any other pertinent observations, and take photographs of representative stratigraphic profile walls. Following documentation, each trench will be backfilled and recorded with a handheld Global Positioning System (GPS) unit.

Hand Auger Survey

Some locations may not be suitable for the use of mechanical trenching due to the proximity of sensitive land uses or the preferences of consulting parties. Hand augers offer a means of subsurface sampling that is slightly less intrusive and presents less potential for damage to subsurface deposits, including human remains. Hand auger bores will be excavated at approximately 150-foot intervals in study areas with the potential for buried archaeological sites depending on accessibility at the time of the survey. This approach is particularly well suited for rapidly identifying horizontally continuous deposits, such as midden and buried surfaces, with a limited excavation footprint. However, given the size and means of sediment extraction associated with this method, it provides limited stratigraphic resolution and sample coverage, attributes that are best obtained through mechanical trenching.

All sediments collected during hand auger excavations will be passed through 6-millimeter (0.25- inch) hardware cloth to perceive and recover artifacts. In the event that archaeological deposits are encountered, the approach outlined for archaeological discoveries below will be followed.

Each trench will be terminated once a 6-foot excavation depth is achieved or if impassible gravels are encountered. Each auger bore location will be recorded with a handheld GPS unit and the depth at which archaeological deposits, buried surfaces, Pleistocene-aged or older deposits, or impassible gravels are encountered will be recorded on a standard field form.

Archaeological Discoveries during Subsurface Investigations for Buried Sites

In the event that an archaeological site is identified during subsurface investigations, the site’s contents (in the trench or bore where it is discovered) will be recorded and photographed, and the location recorded with a handheld GPS unit. The site characteristics, location, and cultural constituents will be documented on DPR forms.

Evaluation

All identified resources will be evaluated as required under the PA, with respect to the NRHP criteria.

- **Criterion A**—Properties associated with events that have made a significant contribution to the broad patterns of history.

- **Criterion B**—Properties associated with persons significant in our past.

- **Criterion C**—Properties that embody distinctive characteristics of a type, period or method of construction, or are the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.

- **Criterion D**—Properties that yield, have yielded, or are expected to yield information important to history.

To evaluate a property's eligibility, its period of significance must be defined. The period of significance represents that time period in which the property established its historical associations with events or persons, or when the property achieved its defining physical characteristics. The period of significance may span several years or may be only a single year.

As mentioned above, in addition to meeting one of the NRHP criteria, a property must retain integrity. The NRHP evaluates integrity based on seven aspects.

- **Location—**The place where the historic property was constructed or where the historic event occurred.

- **Design—**The combination of elements that create the form, space, structure, and style of the property.

- **Setting—**The physical environment of a historic property.

- **Materials—**The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.

- **Workmanship—**The physical evidence of the crafts of a particular culture or people during any given period in history.

- **Feeling—**The property's expression of the aesthetic or historic sense of a particular period of time.

- **Association—**The direct link between an important historic event or person and a historic property.

It is not necessary for a property to retain all seven aspects of integrity. A property must simply retain those essential aspects necessary to convey its significance.

Methods for Evaluation of Archaeological Resources

Archaeological resources will be evaluated with respect to all four of the NRHP eligibility criteria described above. Evaluation will be supported by appropriate contextual information as well as data gathered through surface and subsurface documentation necessary to determine if significance and integrity within the meaning of the NRHP occur within each resource subject to management. These elements of the evaluation process are described in detail below.

Data Gathering

Research, data gathering through excavation, surface collection, and other physical means, and consultation are used to determine the significance of prehistoric archaeological properties.

Research

The Corps is responsible for ensuring that adequate research is conducted to accurately assess the NRHP eligibility of identified resources. Such research will be conducted with recourse to published

ethnographic and archaeological literature and gray literature covering the region, as well as applicable theoretical discussions and agency guidance concerning archaeological properties. The Corps will develop property-specific contexts in order to define relevant significance themes for identified archaeological resources. These contexts will build upon the general themes described above, with any necessary additional specificity relevant to particular resources subject to evaluation. These contexts will be provided in reports that document inventory and evaluation of archaeological resources subject to management.

Consultation

The Corps will consult with the PA signatories and consulting parties regarding evaluations and findings of effect. This consultation will be completed as required under the PA, in order to identify information relevant to both the significance of identified resources, and the management preferences of these stakeholders.

Archaeological Study and Excavation

The following discussion summarizes methods appropriate for data gathering for documentation and evaluation of archaeological resources.

Surface Inspection and Collection

To better understand the distribution of archaeological material as exposed by construction and to assess the potential distribution of subsurface deposits, the following methods may be employed.

- Intensive pedestrian survey of exposed ground surfaces.
- Documentation of selected surface artifacts, including location.
- Field documentation and analysis of features or large artifacts.
- Collect formal tools for subsequent analysis – this is to be determined on a case by case basis. If tools can be adequately documented in the field, the tool should be left in place.

Mechanical Trenching

Mechanical trenching employs a toothed bucket backhoe and is typically used to determine the presence, absence, or approximate boundaries of buried portions of known archaeological deposits during initial investigations. The size (length, depth, width) and location of trenches should be determined according to the location and depth of proposed disturbance or the depth of sterile soil. Trenches that measure greater than 1.5 meters in depth are reinforced by shoring, or graded to 1:1.5 slopes in accordance with the California Office of the Occupational Safety and Health Administration (Cal/OSHA) guidelines. Stratigraphic profiles of selected vertical exposures would be drawn and described. Sediments and artifact samples may be collected and labeled for future laboratory analysis. Mechanical trenching is also discussed below under methods for identifying buried sites in areas of high sensitivity for archaeological resources.

Mechanical Area Exposure

The mechanical area exposure technique utilizes a toothed bucket backhoe to remove overlying non-cultural sediments (overburden) from a newly discovered cultural deposit. When intact areas or archaeological features are encountered, mechanical excavation would cease and hand excavation or a more refined mechanical method of excavation would typically commence.

Auger Boring

Auger boring employs a small hand auger to quickly determine the absence or presence of archaeological materials. Sediments sampled can be selectively screened or visually inspected, whichever is appropriate and on a case-by-case basis. Stratigraphic results would be documented and locations mapped in relation to a permanent datum. Augers may also be used to define boundaries if hand excavated units cannot be used.

Hand Excavation Units

Hand excavated units typically measure 0.5 by 0.5, 0.5 by 1.0, or 1.0 by 1.0 meter. The size and placement of the unit is based on the specific investigation needs of the area or known site. Excavation units can be used as a more formal method to determine presence or absence of cultural materials, to determine the vertical and horizontal extent of a site's boundaries, to determine if a deposit has stratigraphic integrity, and to recover a variety and quantity of site materials sufficient to either determine NRHP eligibility or to recover important data. Units are typically excavated in arbitrary 10 to 20 centimeter levels unless intact stratigraphic sequences are present. Hand excavated units will be used to both define site boundaries and recover material to support evaluation of archaeological resources.

Exposure Units

Graduated area exposure units are useful in locations known to contain archaeological deposits deeper than the maximum depth allowed by Cal/OSHA guidelines for a single excavation unit. This strategy employs an initially large unit area that is reduced in size on all four-unit walls following a slope format of 1:1.5 from surface to base, allowing no sidewall to exceed 1 meter in height. The resulting excavated area has the shape of an inverted pyramid. For deeply stratified deposits where the slope gradation cannot be maintained, excavation walls would be shored using hydraulic jacks or other means of earth stabilization.

Excavation of these units would utilize some combination of mechanical and hand excavation techniques. As with excavation units, hand excavation of subunits would be dug concurrently in 10 to 20 centimeter levels correlated with a permanent site datum. In areas with midden soils or high potential for features, subunits can be excavated entirely using hand tools, incorporating a combination of selective and control screening techniques.

The graduated area exposure strategy provides large surface exposures and samples of stratified deposits, maximizes samples of safe deposits under safe working conditions, and provides large stratigraphic wall profiles for analysis of sedimentary contexts.

Feature Excavation

When an archaeological feature (e.g., hearth, cairn, house pit, or trash pit) is encountered, excavation would proceed with refined excavation techniques and detailed field documentation. Upon discovery, each feature would be assigned a unique number. Feature contexts would be explored using hand tools to excavate in arbitrary or natural stratigraphic levels, and documented by a scaled drawing on graph paper. Selected constituents and special samples (e.g., radiocarbon, flotation, pollen, and fire-cracked rock) may be packaged separately from surrounding matrix for analysis by the various specialists. Standardized unit-level and feature records would be employed to document removal of the feature.

Special Studies Sampling

Special studies sampling, also known as "column sampling," includes the systematic collection of successive 0.25 by 0.25 meter soil samples from vertical exposures in middens or other contexts of archaeological interest. The collected sediment column would be analyzed for radiocarbon dates, faunal remains, plant macrofossil, fossil pollen, or other microconstituents. These data would allow, depending on the materials extracted and analyzed, for detailed study of prehistoric diet, paleoenvironment, and site chronology. Extraction methods will vary according to accepted standards for each type of analysis.

Screening Techniques

A number of screening techniques can be employed according to the nature of the property type. Screening usually involves processing excavated dry soils through shaker screens or by washing extracted matrix in screens using a high-pressure water nozzle. The 6 millimeter *selective* technique involves processing sediment through 6-millimeter mesh screen, and is used primarily for the collection of specific materials such as formed artifacts and bone. The 6 millimeter *controlled* technique also employs 6-millimeter mesh, but, unlike the selective technique, all cultural materials remaining in the screen are collected. Likewise, the 3 millimeter controlled technique uses a 3- millimeter mesh screen, with all cultural materials collected. Smaller-sized mesh facilitates collection of materials that would normally pass through 6 millimeter mesh,

such as late-stage pressure-flaking debris, fish bone, and small shell or glass beads. The 6- and 3-millimeter mesh sizes correspond to ¼ and 1/8 inch screen in common terminology.

Geoarchaeological Investigations

Geoarchaeological assay offers a means of reconstructing the history of landforms within a particular site. Where feasible or useful, a geoarchaeologist would thoroughly record a stratigraphic profile at the location of each discovery of archaeological deposits. At a minimum, the stratigraphic profile of the site would be recorded, including those strata with cultural material. In the absence of other locally viable chronometric techniques, the geoarchaeologist would obtain radiocarbon assays of soil humate samples from each stratum of a profile.

Field Documentation

Mapping

The location of archaeological deposits, features, and materials would be recorded using any one of a number of instruments, such as a compass, theodolite, or GPS unit. Deposits and any other pertinent information would be referenced to an established permanent datum.

Records

Information resulting from archaeological site investigation methods would be recorded on standardized DPR forms that could include level records for each excavation unit level, an overall plan drawing for each level, and plans and section drawings for each feature encountered. Additional records will be maintained by documenting communication with Native Americans, news media, and the public. Hard copies of DPR forms will be prepared in the field; electronic copies will be prepared based on the original hard copies.

Photographic Documentation

Digital photographs would be used to document important artifacts and features encountered during fieldwork. Digital photography will be performed using raw file formats (a lossless format) rather than .jpg images, in order to preserve the maximum amount of information recoverable in later processing of images. Additional documentation may include video recording. A record form would be maintained for each photograph, detailing the date, time, number, subject description, view direction, and file name.

Wall Profiles

Stratigraphic profiles would be documented for at least one wall of each excavation unit, as well as selected sections of trenches. Profile documentation would include the site designation, unit number, wall orientation, and location of the section along the trench. Descriptions of each stratum would include Munsell color descriptions, textures, structures, natural inclusions, cultural inclusions, and contacts between strata.

Backfilling and Restoration

Open trenches and units would be covered and/or barricaded at the end of each workday. All trenches and excavation units would be backfilled upon the completion of fieldwork. The Contractor would restore the excavation area after construction in the immediate area is completed.

Remote Sensing

In addition to surface inspection and excavation of prehistoric archaeological properties, remote- sensing techniques may be employed during archaeological site investigation. Remote-sensing techniques applicable to evaluating a prehistoric archaeological property include ground- penetrating radar, electromagnetic survey, resistivity survey, and burial identification survey using cadaver dogs. However, remote sensing does not obviate the need for archaeological excavation as the results of remote-sensing investigations must be verified.

Artifact Processing and Analysis

- In the event that cultural material is collected, they will be cleaned before they are cataloged, with the possible exception of delicate or perishable materials such as bone, shell, textile, and fired clay. Artifacts will then be sorted by provenience and functional type. Artifacts will be labeled according to each unit/feature. Artifacts will then be permanently labeled with a sequential catalog number, which will be added during cataloging. Diagnostic artifacts will be arranged by provenience and/or material type (as suits the research design and management needs for particular properties) and photographed.
- Based on the results of testing and data recovery a number of analyses may be performed, including the following.

- **Flaked stone** analysis of formed tools and debitage.

- **Ground stone** analysis of artifacts that have been deliberately shaped or shaped as a byproduct of use wear.

- **Vertebrate** and **invertebrate faunal** analyses, involving the identification of skeletal remains from mammal, bird, fish, reptile, amphibian, and shellfish species and the interpretation of the patterns that result from the identification.

- **Archaeobotanical** analysis of plant remains contained in archaeological sediments.

- **Soil and sediment** analyses to discern site formation processes and degree of differential preservation of archaeological materials.

- Other techno-functional analyses.

Methods for Evaluation of Built Environment Resources

Data Gathering

Research

For each project phase or activity, the Corps will consult with the PA signatories and concurring parties to develop a phase or activity-specific APE. When a historic property is identified within the APE for a specific phase or activity, research should begin with an examination of the existing historic context represented in this plan. The context and information in this document will provide a foundation for additional research, if such is deemed necessary. Initial research will help determine the basic information about the subject property type, which will help determine significance and integrity. Research should focus on materials such as historic maps, plans, and photographs. The information gained from this research may reveal dates of construction, original materials, ownership, and, for linear features, their alignments and history of alteration. Intensive research also aids in establishing the property's period of significance. Table 5 lists suggested resources to be consulted based on the property type under investigation.

Table 5. Suggested Historic Structure Property Types and Research Materials

Property Type	Research Materials

Residences, commercial buildings, farm/ranch complexes, civic buildings, social buildings	USGS Topographic Maps County Recorder/Survey/Assessor Maps and Property Characteristics Historic Property Maps City Directories Recorded Deeds Local Government Meeting Minutes Newspaper Articles Historic Photographs
Levees, weirs, slips, canals/ ditches, pumping stations, water towers, bridges, roads	USGS Topographic Maps Bureau of Land Management (BLM) Maps/Surveys Bureau of Reclamation Maps/Records Engineering Journals As-Builts Aerials

Relevant Themes

Relevant themes help to identify potential NRHP significance of the property. Although not exhaustive, the following list provides potential areas of significance identified in the historic context for the expected property types.

- **Agriculture/Ranching:** Properties associated with the process and technology of cultivating soil, crop production, or raising livestock.
- **Architecture:** Properties associated with the design and construction of buildings that shelter human activity.
- **Engineering:** Properties associated with the design, construction, and operation of structures.
- **Flood Control:** Properties associated with controlling rivers to reduce the occurrence of flooding.
- **Irrigation/Reclamation:** Properties associated with the application of water to lands for the production of crops or those associated with the reclaiming of land for agricultural production.
- **Settlement/Community Development in Yolo County:** Properties associated with the establishment and design of communities in Yolo County.

Evaluation Criteria

Applicable NRHP Criteria

Using the historic context and the relevant themes will be described in the evaluation report; identified built environment properties will be evaluated to determine if they have significance. In addition to meeting one or more of the four NRHP significance criteria, properties must retain integrity. The specific aspects of integrity required will depend on the property type and which of the NRHP criteria the property meets. However, integrity can be accurately assessed only when the following are true:

- The character-defining features of the property have been identified.
- The determination has been made that the character-defining features are extant.
- The historic context and area of significance which the property represents has been identified,

In some instances a lesser degree of integrity can be justified if the property is a rare example. However, the property must be compared with similar properties, and a sufficient portion of the

property must be intact.

When assessing integrity, it is important not to confuse *condition* with *integrity*. Properties considered to be in poor condition might still retain the essential aspects of integrity sufficient to convey significance.

Data Requirements

Data requirements translate to character-defining features. For historic structures, character- defining features include the building's overall mass, materials, craftsmanship, decorative detailing, openings, and fenestration. The building's architectural style will define the specifics for each of these elements. This is also true for structures. For levees, such features might include the levee's slope, crown, hinge point, height, width, and pyramidal shape. The design of canals and ditches will also be defined by the material used to construct the canal. Earthen canals, for example, tend to display a trapezoidal shape. Rural landscape "… characteristics are the tangible evidence of the activities and habits of the people who occupied, developed, used, and shaped the land to serve human needs; they may reflect the beliefs, attitudes, traditions, and values of these people. Ultimately, the character-defining features of a property will vary depending on the property type.

Finding of Effect

Application of the Criteria of Adverse Effect under Section 106

The PA for this Project specifies that a Finding of Effect (FOE) will be prepared for each phase of implementation of the Project. The FOE will apply the criteria of adverse effect, as set forth under federal law in 36 CFR Part 800.5, to any historic property, as defined by the NHPA that may be affected by that phase of construction. As codified in 36 CFR Part 800.4(d) (2), if there are historic properties which may be affected by a federal undertaking, the agency official shall assess adverse effects, if any, in accordance with the criteria of adverse effect. The criteria of adverse effect states that an adverse effect occurs if the undertaking would:

- ". . .alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR Part 800.5[a][1]).

Relevant examples of adverse effects include physical demolition, alteration of character defining elements, removal from the setting (where the setting conveys the significance), and introduction of new inconsistent features to the setting (36 CFR Part 800.5[a] [2]).

Treatment Methods

The Corps will develop treatment methods to resolve or avoid adverse effects, in consultation the signatories and concurring parties, as provided in the PA. The following discussion offers a range of treatment methods that may be used and expanded; where necessary property-specific treatments will be developed to resolve or avoid adverse effects on specific resources.

Archaeological Property Treatments

Avoidance

An avoidance strategy may be used in which all archaeologically damaging engineering operations are excluded from an area of archaeological sensitivity (Sullivan and McKay 2012). This type of strategy could be either temporary during construction through buffers, barriers, flagging, or fencing or a redesign of the a portion of the project to permanently avoid the historic resource.

Preservation in Place

If avoidance of adverse effects on an archaeological property is determined infeasible, preservation in place will be the preferred means of resolving adverse effects under the NHPA (Advisory Council on Historic Preservation 1999:3) Preservation is taken here to mean protection of a historic property's historic integrity via non-invasive (or non-destructive) means. Historic properties may be preserved via capping and site stabilization, as described below.

Capping

Much precedent exists for capping archaeological properties as a treatment measure under the NHPA and CEQA (Environmental Laboratory 1988a, 1988b, 1988c, 1989a, 1989b, 1992a; 14 CCR15126.4[b] [3] [B] [2–4]). Capping an archaeological property under protective material is arguably a means to preserve it in place, shielding the property from effects such as looting, inadvertent construction and recreational damage, and exposure to the elements. Additionally, capping does not result in the degree of damage to the property that archaeological excavation entails. A number of practical issues must be considered before the Corps decides to cap an archaeological property.

The goal of capping is in-place preservation of the subject historic property. The type of protective covering selected will vary with the characteristics of the property, the property's environmental character, and the nature of known or anticipated effects on the property. The Environmental Laboratory (1989a:4–5, Figure 2) identifies a number of natural and cultural processes that affect the characteristics and potentially the historic integrity of archaeological properties.

Effective capping programs depend on balancing and, where possible, maximizing the preservation of archaeological materials contained in the subject property. Priority must be given to those archaeological constituents that convey the archaeological property's historic significance. An effective capping program, therefore, hinges on appropriate identification efforts within archaeological sites.

Once the Corps has identified the archaeological constituents that require preservation and the desired conditions to effect preservation, qualified staff should work with engineers and other specialists as needed to design a suitable cap for the archaeological property. The Corps should incorporate a preservation monitoring program into the capping design to ensure that the capping design has the desired preservation outcome. The Corps has tested a variety of capping and preservation monitoring programs, which should be consulted during design (Environmental Laboratory 1988a, 1988b, 1988c, 1989a, 1989b, 1992a).

Where capping is a feasible treatment measure, it is probably best employed on archaeological properties eligible for the NRHP under Criterion D and perhaps Criterion C. Capping may not protect important aspects of integrity for archaeological properties eligible under NRHP Criteria A and B.

Site Stabilization

Archaeological resources along river and levee systems are frequently exposed to erosion due to fluvial processes and human-induced erosion, such as water discharge into streams. Levee deficiencies also cause erosion at archaeological sites. In cases where an archaeological property is losing data potential to erosion, simple avoidance may not preserve the property in place in such a manner that its historic significance is maintained because archaeological materials would continue to erode. To effectively preserve in place an archaeological property that is threatened by erosion, the Corps may need to implement stabilization methods to prevent further destruction. Site stabilization methods are often employed in concert with other preservation methods and are suitable for treatment of archaeological properties that are eligible for listing on the NRHP under any of the criteria, although properties eligible under Criterion C may suffer some loss of integrity with some stabilization methods.

The Corps has tested a variety of site stabilization methods in stream bank contexts. Such methods include protective structures (concrete retaining walls, fencing, revegetation, rock-filled log cribs, rock-filled gabion groins, riprap, flexible concrete revetment), benching and sloping stream banks, and drainage routing (Environmental Laboratory 1988d, 1988e, 1989c, 1989d, 1989e, 1992b). The results of these studies have implications for site stabilization within the study area.

Data Recovery

Where preservation in place is not a feasible treatment measure and an NRHP-eligible archaeological

property will be damaged or destroyed by activities associated with the undertakings, the archaeological property may be subjected to data recovery. The approach to data recovery will vary with the property type and the information it contains. In the case of hollow-filled features, which likely will already have been cross sectioned during evaluative test excavation, an additional percentage of the features will be removed for analysis, representing complete data recovery. The Secretary of the Interior's guidance titled *Standards for Archeological Documentation* encourages the use of noninvasive data recovery methods "if nondestructive methods are practical." Such methods may include ground-penetrating radar, electromagnetic survey, and satellite imaging. For archaeological properties found eligible under NRHP Criterion A, B, or C, other treatment options may be necessary because data recovery is often applicable to Criterion D concerns only.

More varied considerations are required to conduct data recovery of middens, and lithic scatters. The amount of data recovery excavation at these property types depends on the overall size of the resource, density and types of constituents present, and depth of the deposit, which affects its accessibility and the practicality of excavating large portions of the resource. Where the depth of deposit is not prohibitive of access, qualified staff will determine the amount of excavation required to accomplish data recovery. The Corps will prepare a property- specific plan describing the program of data recovery for each property subject to this treatment. Excavation and laboratory methods employed in data recovery for archaeological resources are typically similar to those described above for evaluation and test excavation. The methods entailed in data recovery, unless otherwise specified in this chapter, differ from evaluative test excavation and analytical efforts primarily in terms of scale. Plans describing data recovery need not recapitulate methods covered in this document; they only need to add detail necessary to refine site- specific efforts.

Analysis of Existing Archaeological Collections

Aside from avoidance, the most common approach to archaeological property treatment entails excavation to recover the important data. Data recovery excavation, however, is not always the most desirable treatment, even in cases where avoidance is not feasible. Whereas data recovery excavations often constitute the surest way to recover, analyze, and preserve (through documentation and dissemination of said documentation) significant archaeological data, site excavations permanently remove archaeological materials from their depositional context. Archaeological properties, therefore, are irrevocably altered through this treatment measure. Furthermore, archaeological research priorities and methods change over time; the removal of archaeological constituents from their depositional context has the potential to controvert the application of new analytical or excavation methods and the analysis of new or modified research questions. Finally, descendant groups that frequently attribute significance to archaeological properties (usually for reasons unrelated to NRHP Criterion D) typically prefer nondestructive treatments of archaeological properties (e.g., Tomaras 2008:5).

California contains numerous museums and curation facilities that hold collections from archaeological properties throughout the state. The state of the collection and documentation of such materials vary widely; some collections have been thoroughly analyzed, documented, and curated, while other collections constitute an assortment of artifacts and ecofacts still in field bags. If the undertakings would adversely affect a previously excavated archaeological property, existing archaeological collections may provide source material for documenting the site (Bouey 1995). Analysis of existing collections would provide a viable alternative to data recovery excavation where the archaeological property is either undocumented or under documented. Analysis of existing collections has several important limitations.

- Archaeological properties that have not been investigated previously will not have existing collections.
- The condition of the collections will vary.
- The quality of field documentation will vary.
- Previous excavations may have been made outside the portion of the archaeological property threatened by an Undertaking activity. Such collections may have limited applicability to the materials contained in the affected area of the property.

Potential sources for existing collections can be ascertained via archaeological site records on file at the California Historical Resources Information System (CHRIS) centers, contract reports, publication series

such as the University of California's *University of California Publications in American Archaeology and Ethnology*, *Anthropological Notes*, and *Archaeological Survey Reports*, articles in scholarly archaeological journals, and university museums.

Public Interpretation

Standard IV of the Secretary of the Interior's *Standards for Archaeological Documentation* mandates that "the results of archaeological documentation are reported and made available to the public" (*Federal Register*, volume 48, page 44734). Information that is of interest to the general public will be made accessible through a public interpretation document such as a nontechnical pamphlet, website, interpretive board, plaque, or another format deemed appropriate, prepared under the direction of qualified staff and the signatories. Consideration will be given in any public interpretation to the need to maintain confidentiality of location, character, and ownership pursuant to Section 304 of the NHPA and 36 CFR 800.11(c).

Built Environment Property Treatments

The Secretary of Interior's *Standards for the Treatment of Historic Properties* provide four general treatment types: Preservation, Rehabilitation, Restoration, and Reconstruction. According to 36 CFR 68.3, the application of the standards depends on the particular property. Factors to be considered include the physical condition of the building, the property's significance, the amount of existing documentation, and the economic and technical feasibility of applying the standards. The following section provides typical built environment property treatments followed by treatment options for the Sacramento River West Levee. The general methods described below may be used for properties that may be identified in addition to the levee; it is anticipated that levee improvements will alter character defining elements of the levee so that documentation and interpretation are likely to constitute the only feasible methods of resolving adverse effects on the levee.

Preservation

Preservation allows for the retention of the historic qualities of the property, including its form, materials, and integrity. As a treatment, Preservation is the preferred method for historic properties. Preservation includes continued use of a building as it was used historically and retention of character-defining materials, elements, spaces, and spatial relationships. Exterior additions that have not already achieved historical significance are not allowed under this treatment (36 CFR 68.3; Weeks 2001). Preservation typically also requires avoidance of direct and indirect effects by relocating or altering activities associated with an undertaking so that preservation can be achieved.

Rehabilitation

Rehabilitation is the second preferred treatment. Rehabilitation allows for a property to be used as it was historically or in a compatible manner that will have minimal changes to the property. Rehabilitation can incorporate repairs, alterations, and additions that do not affect the character- defining features of a property (36 CFR 68.3; Weeks 2001).

Restoration

As a treatment option, Restoration is the third choice. With this treatment, a historic property is accurately depicted as it was during a specific time period. Elements from other historic periods are removed, and other elements that reflect the desired time period are added. The restoration of those missing elements is based on historic documentation to provide an accurate depiction of the property and not give a false sense of history. As part of this treatment, materials that are removed are documented before removal. Restoration provides an option to use the building as it was used historically or give the property a new use to interpret the property during a specific period (36 CFR 68.3; Weeks 2001).

Reconstruction

The last treatment under the *Standards for the Treatment of Historic Properties* is Reconstruction, which is the least desirable. This treatment is to be used with existing documentation and when physical

evidence is available to allow an accurate depiction of a historic property that is no longer extant or is missing significant features from its historic period. Reconstruction requires that existing historic fabric be preserved. (36 CFR 68.3; Weeks 2001.)

Documentation

When an adverse effect cannot be avoided, measures should be taken to properly document the historic property before those activities that will cause the adverse effect. The necessary documentation will be influenced by the type of property and adverse effect.

Depending on the reasons for significance and the character-defining features, documentation of a historic structure in accordance with the Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) standards may be an appropriate measure to resolve adverse effects. This documentation often provides the last means of the preservation of a historic resource.

The HABS/HAER program is a federal program within the National Park Service (NPS) that is charged with creating a permanent public record of historic buildings, structures, sites, and objects that are significant in American history and the growth and development of the built environment. There are four levels of HABS/HAER documentation approved by NPS that are considered adequate for inclusion in these collections. Guidance for the HABS/HAER is found in the *Secretary of the Interior's Standards and Guidelines for Architectural and Engineering Documentation: HABS/HAER Standards* (National Park Service 2000).

Public Interpretation

Standard IV of the Secretary of the Interior's *Standards for Historical Documentation* recommends that research results be made available to the professionals in the industry of cultural resources management and historic preservation, as well as the public. Making such documentation available allows for decisions to be made concerning treatment, preservation planning, and interpretation of the historic property. Interpreting historically significant properties encourages an understanding of the mission and goals of public agencies striving to protect historic properties. It also promotes preservation and protection of historic properties. Public interpretation may include walking tours, web-based distribution of information, and preparation of printed matter such as reports or property histories that are accessible to the layperson.

Construction Monitoring and Inadvertent Discoveries

Workforce Training

Qualified archaeologists will provide training to construction personnel covering both identification of cultural resources in the field and proper procedures and conduct in the event that archaeological materials are encountered during construction. A preconstruction training session will be held before the beginning of construction for each ground-disturbing activity authorized under the PA (typically each construction year associated with a levee segment or specific borrow site). This training will be provided for all construction personnel, followed by periodic in-field training sessions as needed. These training sessions will be conducted as part of the comprehensive environmental training sessions attended by construction staff. The Corps' representatives or designated qualified archaeologists will provide in-field cultural resource education during major construction personnel changes. All training sessions will be conducted in person. Construction personnel will be educated regarding the purpose for archaeological monitoring (if any is being conducted), cultural resource regulations, basic identification of archaeological resources, and proper discovery protocols during construction.

Monitoring

As required in the PA, the Corps will ensure that monitoring of construction where necessary is conducted to ensure that identified resources are protected or where there is a high sensitivity for previously

unidentified resources. Monitoring requirements will be determined for each phase of the undertaking, based on the findings of the inventory report. The inventory report will be used as a means of assessing the overall sensitivity and appropriate location and staffing level necessary to manage the potential for inadvertent discoveries during construction.

Procedures for Inadvertent Discoveries

The PA describes procedures for inadvertent discoveries in detail. This section recites these provisions so that they are consistently followed. If cultural resources are discovered during construction, all construction will immediately stop within 100 ft. (30 m) of the discovery and the location of the discovery will be flagged for avoidance. The contractor must notify the Corps and then the Corps will notify the American Indian tribal governments and Native American groups (if no representatives are on location). The Corps will determine whether the discovery is a potential NRHP-eligible resource by evaluating the resource per the criteria in 36 C.F.R. § 60.4. If the Corps in consultation with the American Indian tribal governments determines that the discovery is not an NRHP-eligible resource, the discovery will be documented and construction may proceed at the direction of the Corps. If the resource is considered an NRHP-eligible resource, the location will be temporarily fenced for protection during construction.

If the Corps in consultation with the signatories and concurring parties determine that the discovery may be eligible for the NRHP, the Corps will notify the SHPO and other relevant parties within 48 hours of the discovery (36 C.F.R. § 800.13(b)(3)). Notification should include a description of the discovery, the circumstances leading to its identification, and recommendations for further action. Where feasible, the notification will also include a tentative NRHP-eligibility recommendation per 36 C.F.R. § 60.4 and a finding of effect per 36 C.F.R. § 800.5(a) (1). If the resource cannot be evaluated based upon available evidence (for example, where test excavation is required), the Corps in consultation with the American Indian tribal governments will use testing and evaluation methods provided in the attached Plan for further technical work necessary to determine the eligibility of the resource and make a finding of effect per 36 C.F.R. § 800.5(a) (1). For NRHP-eligible resources subject to adverse effects, treatment will be implemented where necessary to resolve adverse effects on inadvertently discovered historic properties. The SHPO has forty-eight (48) hours to respond after notification of post-review discovery. 36 CFR 800.13(b) (3).

Procedures for Discovery of Human Remains

If human remains are discovered during survey, testing, evaluation, or construction, the Corps will follow California Health and Safety Code Section 7050.5 and PRC Section 5097.98. In addition, the Corps will consider and implement, to the extent feasible, the principles adopted in the Advisory Council on Historic Preservation's *Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects* (2007). Relevant principles included in the policy statement include but are not limited to respectful treatment of human remains, disturbance of such remains only when necessary, and early consultation with affiliated tribes to manage such resources. The specific requirements of the PRC and Health and Safety Code are as follows.

- The Corps will notify the Yolo County Coroner; the Coroner will then determine if an investigation regarding the cause of death is required (such investigation would be necessary if the find is not archaeological, but modern, Cal. Health and Safety Code Section 7050.5). If the find is archaeological and no investigation is required, the find shall then be treated as an archaeological discovery.

- If the coroner determines that the remains are of Native American origin, the Corps will contact the Native American Heritage Commission (NAHC). The NAHC will designate a most likely descendant (MLD). The MLD will have the power to make recommendations for the reburial or alternate treatment of the remains with appropriate dignity.

- If the MLD and land owner cannot reach agreement, or the MLD fails to make a recommendation, the land owner will reinter the remains at a location where further disturbance will be avoided and record the location through one of the methods specified in California PRC Section 5097.98.

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