DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1399

REPLY TO
ATTENTION OF

CESPD-DE

18 Aug 2015

MEMORANDUM FOR Commander, US Army Corps of Engineers, Los Angeles District, (ATTN: CESPL-PM-C, Mr. John Drake)

Subject: Lower Santa Cruz River, AZ, Flood Risk Management Feasibility Study, Review Plan Approval

1. Lower Santa Cruz River, AZ, Flood Risk Management Feasibility Study Review Plan that is enclosed is in accordance with Engineering Circular (EC) 1165-2-214, Review of Decision Documents, dated 15 Dec 2012. The South Pacific Division, Planning and Policy Division, Regional Business Technical Division, and Los Angeles District Support Team have reviewed the Review Plan that has been submitted. The South Pacific Division approves the Lower Santa Cruz River, AZ, Flood Risk Management Feasibility Study Review Plan.

2. With MSC approval the Review Plan will be made available for public comment via the internet and the comments received will be incorporated into future revisions of the Review Plans. The Review Plan includes Independent External Peer Review Type I.

3. I hereby approve the Review Plan which is subject to change as study circumstances require. This is consistent with study and project development under the Project Management Business Process. Subsequent substantive revisions to the Review Plan after public comment or during project execution will require new written approval from this office.

4. Points of contact for this action are Mr. Kurt Keilman, CESPD-PDP, 415-503-6596, kurt.keilman@usace.army.mil , and Mr. Paul Bowers, CESPD-PDC, 415-503-6556, paul.w.bowers@usace.army.mil .

BUILDING STRONG *and Taking Care of People!*

Encl

R. MARK TOY
Brigadier General, USA
Commanding

REVIEW PLAN

LOWER SANTA CRUZ RIVER, AZ
FLOOD RISK MANAGEMENT FEASIBILITY STUDY

LOS ANGELES DISTRICT

FRM-PCX Endorsement Date: 20 JULY 2015
MSC Approval Date: 18 AUG 2015
Last Revision Date:

US Army Corps
of Engineers ®

REVIEW PLAN

LOWER SANTA CRUZ RIVER, AZ
FLOOD RISK MANAGEMENT FEASIBILITY STUDY

TABLE OF CONTENTS

1. PURPOSE AND REQUIREMENTS

a. Purpose. This Review Plan (RP) defines the scope and level of peer review for the Lower Santa Cruz River, Pinal County, Arizona Feasibility Study. This RP is a component of the Lower Santa Cruz River, AZ Feasibility Study Project Management Plan (PMP) dated June 2015 (P2# 332235). This single-purpose flood risk management feasibility study process is anticipated to culminate with a recommendation to Congress for authorization.

b. References

1) Engineering Circular (EC) 1165-2-214, Civil Works Review Policy, 15 Dec 2012
2) EC 1105-2-412, Assuring Quality of Planning Models, 31 Mar 2011
3) Engineering Regulation (ER) 1110-1-12, Quality Management, 30 Sep 2006
4) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 2007
5) CESPD R 1110-1-8, South Pacific Division Quality Management Plan, 30 December 2002
6) Cost Schedule Risk Analysis Guidance, 17 May 2009
7) Lower Santa Cruz River Feasibility Study Project Management Plan, 2015

c. Requirements. This RP was developed in accordance with Engineering Circular (EC) 1165-2-214, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products by providing a seamless process for review of all Civil Works projects from initial planning through design, construction, operation, maintenance, repair, replacement and rehabilitation (OMRR&R). The EC outlines four general levels of review: District Quality Control/Quality Assurance (DQC), Agency Technical Review (ATR), Independent External Peer Review (IEPR), and Policy and Legal Compliance Review. In addition to these levels of review, decision documents are subject to cost engineering review and certification (per EC 1165-2-214) and planning model certification/approval (per EC 1105-2-412).

2. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION

The RMO is responsible for managing the overall peer review effort described in this Review Plan. The RMO for decision documents is typically either a Planning Center of Expertise (PCX) or the Risk Management Center (RMC), depending on the primary purpose of the decision document. The Review Management Organization for the peer review effort described in this Review Plan is the Flood Risk Management Planning Center of Expertise (FRM-PCX) managed by the South Pacific Division. The RMO will coordinate with the Cost Engineering Mandatory Center of Expertise (MCX) to ensure the appropriate expertise is included on the review teams to assess the adequacy of cost estimates, construction schedules, and contingencies.

The RMO for project implementation, including Type II IEPR (Section 6 below), is the US Army Corps of Engineers (USACE or Corps) Risk Management Center (RMC). Panel members will be selected using the National Academies of Science (NAS) policy for selecting reviewers. The District Chief of Engineering, as the Engineer-In-Responsible-Charge, will ensure that Type II IEPR is conducted in accordance with EC 1105-2-214, and will fully coordinate with the Chief of Construction, the Chief of Operations, and the Project Manager through the Pre-Construction Engineering and Design (PED) and Construction phases. The Project Manager will coordinate with the RMO to develop the review requirements and to include them in the Review Plan.

3. STUDY INFORMATION

a. Decision Document. The authorized name of the study is the "Lower Santa Cruz River, AZ". The decision document will be an integrated Feasibility Report (FR) and National Environmental Policy Act (NEPA) documentation. The NEPA document will either be an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). For simplicity's sake, the integrated document will be referred to as a FR/EIS in this Review Plan. This report will present planning, engineering, and implementation details of the recommended plan for approval by the Chief of Engineers and subsequent Congressional authorization. The purpose of the FR/EIS is to document the Project Delivery Team's evaluation of Federal interest in flood risk management to increase net National Economic Development (NED), environmental, and public and life safety benefits. The FR/EIS will require approval from the South Pacific Division Major Subordinate Command (MSC), USACE Headquarters (HQUSACE), and the Chief of Engineers, as well as Congressional authorization. The feasibility phase is cost-shared 50 percent Federal and 50 percent non-federal. The non-federal sponsor is the Pinal County Flood Control District.

b. Study Area/Project Description. Pinal County is located between Arizona's two largest metropolitan areas, Phoenix and Tucson, which has contributed to growth rates among the highest in the Nation. Most growth has been concentrated in the Cities of Florence, Eloy, Casa Grande, and Maricopa. The Metropolitan Sun Corridor is highlighted in Figure 1. It stretches from the Prescott region to the border of Mexico along the central transportation corridor of Arizona. This corridor indicates where the concentration of future development is expected.

The Lower Santa Cruz River begins in Southern Arizona. It flows south on its way through a 35-mile loop in northern Mexico, before reentering the United States near Nogales, Arizona, where it flows northwestward through southern and central Arizona to its location in the study area. On its northwestward journey the river flows from Tucson to the confluence with Greene's Canal in Southern Pinal County. Virtually all annual flows, and the larger volume of flood flows, flow into Greene's Canal. At the west end of Greene's Canal, the Santa Cruz River, Greene's Wash and Santa Cruz Wash, form a mixed system of channelized, and poorly defined streams for another 60 miles, before their confluence with the Gila River. The river and its tributaries are ephemeral and dry for long periods of time. Flows are the direct result of upstream precipitation, and irrigation tail-water. For a short distance downstream of Tucson, the river is perennial due to discharge from a water treatment plants. Other than local small flood control improvements, there are no flood control projects on the Lower Santa Cruz River.

The LSCR study area is located in south/central Arizona and roughly follows or parallels Interstate 10 from the southern to northern boundaries of Pinal County. The area is bounded by the border with Maricopa County to the west and the confluence with the Gila River to the north (Figure 2).

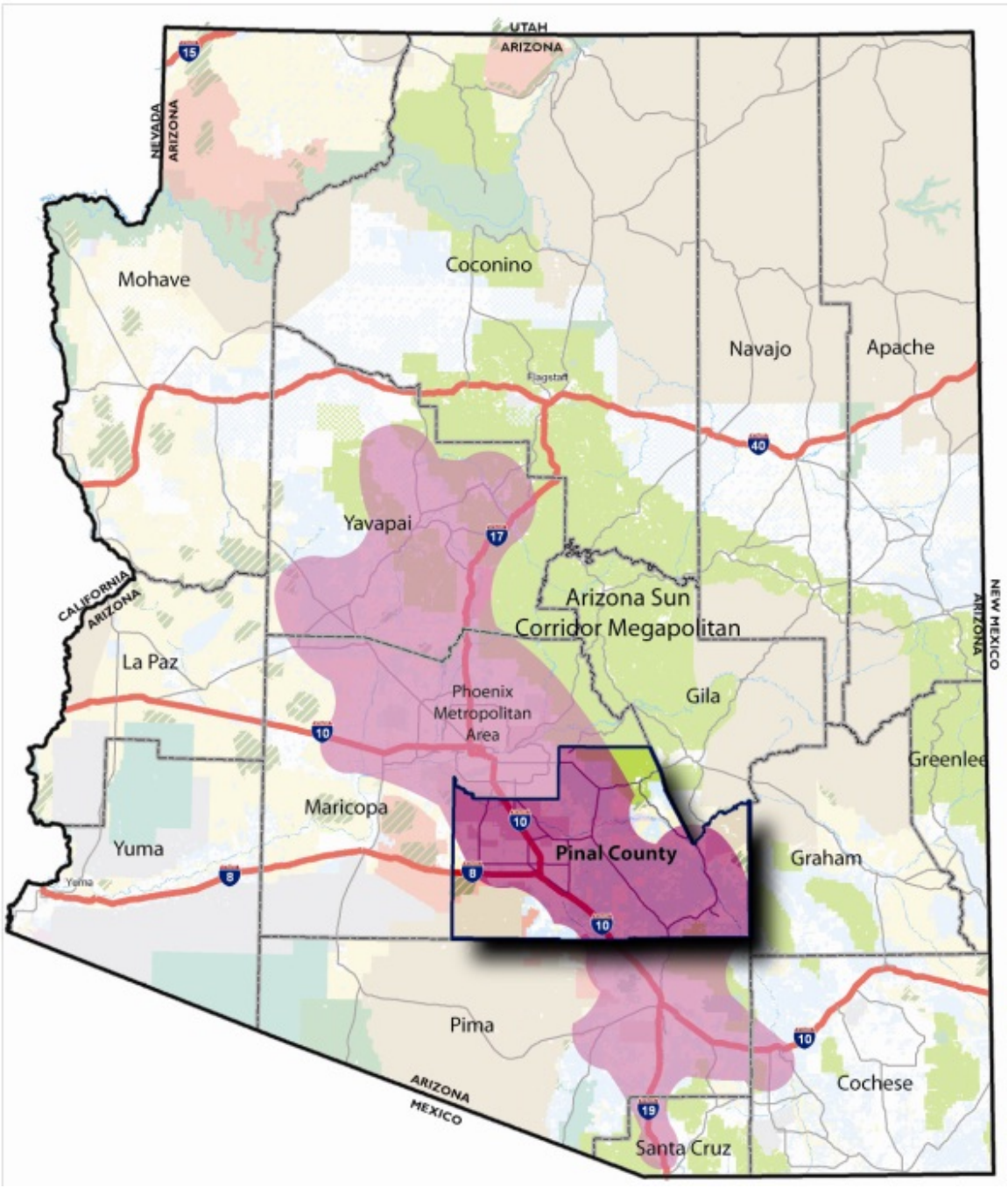

Figure 1 – Vicinity Map of Pinal County, Arizona

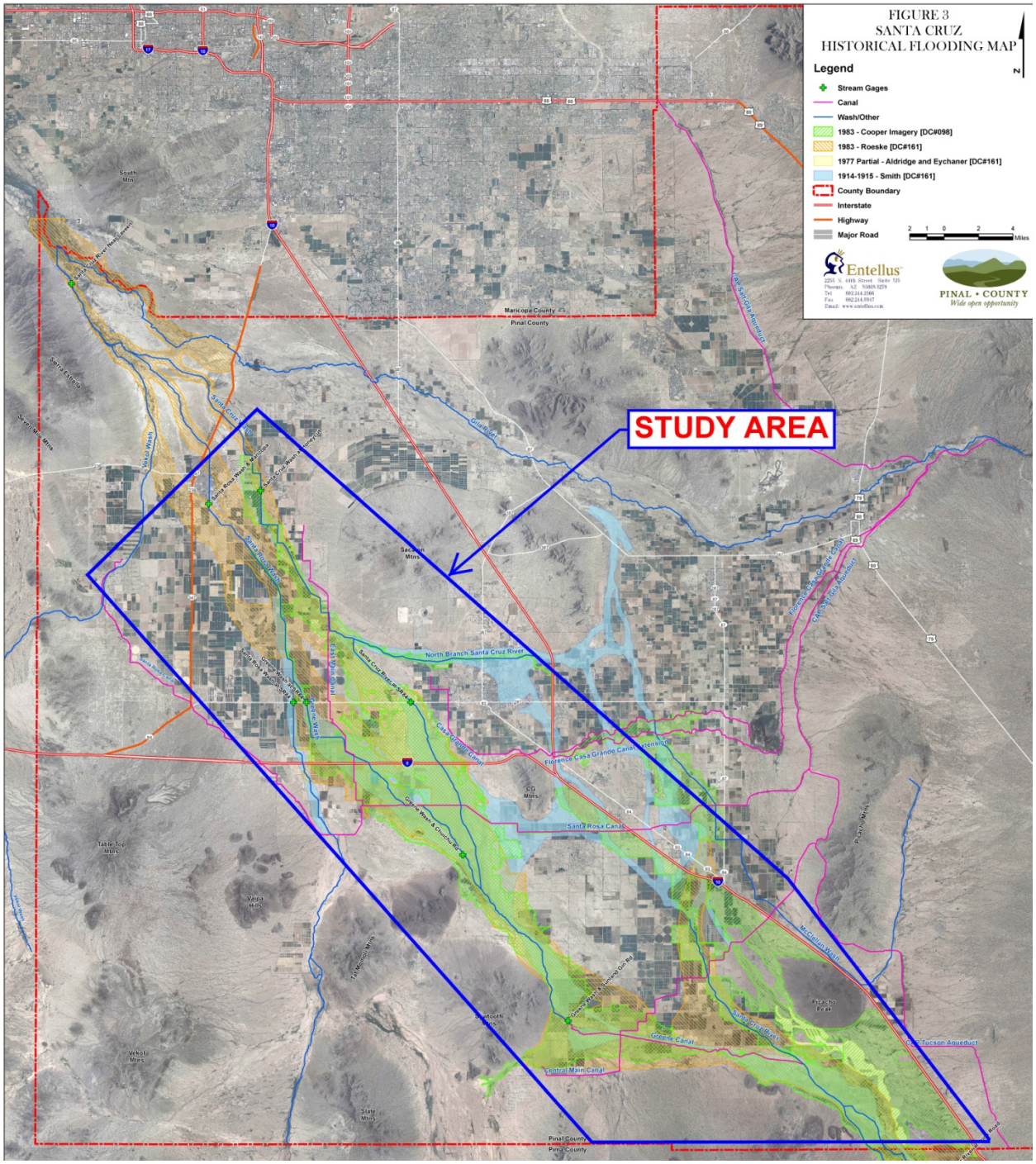

Figure 2 - Study Area: Lower Santa Cruz Floodplain (Western Pinal County)

The study purpose is to investigate problems and opportunities and potential alternatives to provide flood risk management (FRM) for the Lower Santa Cruz River and tributaries. Potential FRM measures include both structural and nonstructural measures. Structural measures may include construction of new levees, channel improvements to increase conveyance capacity, grade control structures, bank stabilization, construction of on-line or off-line detention facilities, widening channels and floodway areas, dredging, and constructing/modifying weirs and bypasses.

Nonstructural floodplain management measures would include assisting communities with floodplain management and flood warning systems in areas where needed. In addition, flood proofing, retrofitting, dry flood-proofing and/or elevation of structures, and relocations will be considered.

c. Factors Affecting the Scope and Level of Review.

- This study is not expected to contain influential scientific information nor be a highly influential scientific assessment.
- The study is unlikely to involve novel methods, present complex challenges to interpretation, contain precedent-setting methods or models, or present conclusions that are likely to change prevailing flood risk management practices.
- The final FR/EIS and supporting documentation will contain standard engineering, economic, and environmental analyses and information.
- The study will likely have significant interagency interest. The study will require close coordination with SHPO and Native American Tribes.
- The study will likely have significant public and stakeholder interest.

d. Life Safety. In accordance with EC 1165-2-214, for any project where potential hazards pose a significant threat to human life (public safety); the Federal action is justified by life safety; or the failure of the project would pose a significant threat to human life, (i.e. when life safety issues exist, a Type I IEPR is required). In addition, since design initiates in the decision document phase, a Safety Assurance Review (SAR) should be incorporated into the Type I IEPR when life safety issues exist.

Damages from historic flooding (1983) were estimated to be in excess of $45 million (*USACE, 1994*) and inundated approximately 600 square miles. Damages included a broad range of categories, including agricultural, commercial and residential structures, utility lines, and transportation facilities. The frequency of the 1983 flood was estimated have been greater than a 100-year event (*USACE, 1994*). Since 1983, the area has developed rapidly and potential damages from future flooding have increased substantially. Before the 1990s the study area was used primarily for agriculture. Pinal County was the second fastest growing county in the United States during the past decade, nearly doubling its population to 375,000, with a projected population of one million by 2030. The City of Maricopa saw its population grow from 750 people in 1983, when the city was essentially destroyed by the flood, to 44,000 residents in 2012. While no historical loss of life has been documented, damages from a major flood the magnitude of 1983 today could devastate the entire region.

While incomplete depth and velocity data limits the accuracy of these estimates, damage estimates for the entire floodplain, including hypothetical flood depths, are expected to be a closer approximation of actual damages from the 1% ACE flood (USACE 2013). New depth / velocity data, including flood warning times, will be developed by the PDT before the Alternatives Milestone to better assess life safety risks.

The Los Angeles District Chief of Engineering has determined that, due to the history of flooding along the Lower Santa Cruz River (LSCR), there is a the potential for significant threat to human life. If life safety issues are not minimized during the formulation of the Tentatively Selected Plan (TSP), a Type II IEPR, or Safety Assurance Review (SAR), will be conducted on the design and construction activities for the authorized project.

e. In-Kind Contributions. Products and analyses provided by non-Federal sponsor as work in-kind services are subject to DQC, ATR, and IEPR. The in-kind products and services to be provided by the non-Federal sponsor include:

- Public involvement;
- Participation in scoping activities (including public meetings); and
- GIS / graphics support.

A Public Involvement Appendix will be prepared by the non-Federal sponsor to document public participation in the study. While the Public Involvement Appendix is not a technical document, it is subject to DQC and ATR, as needed.

4. DISTRICT QUALITY CONTROL (DQC)

All decision documents (including supporting data, analyses, environmental compliance documents, etc.) shall undergo DQC. DQC is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan (PMP). The Los Angeles District shall manage DQC. Documentation of DQC activities is required and should be in accordance with the Quality Manual of the District and MSC.

a. Documentation of DQC. Non-Project Delivery Team (PDT) members and/or supervisory staff will conduct DQC review for major draft and final products, including products provided by the non-federal sponsor as in-kind services, following review of those products by the PDT. It is expected that the MSC/District QMP will address the conduct and documentation of this fundamental level of review. A Quality Control Plan (QCP) is included in the PMP for the subject study and addresses DQC.

The conclusions/agreements reached should be documented, with copies retained by each participant and distributed to the ATR leader and the PDT leader. The documentation shall become part of the project technical review file.

The review team member shall prepare the memorandum that shall become part of the review team's records. Specific issues raised in the review shall be documented in a comment, response, discussion, action required, action taken and, if appropriate, lessons learned format. Unresolved differences between the PDT and review team members shall be documented, along with the basis for the functional Chief's decision on the issue. The software system DrChecks™ will be used for DQC. These reviews shall be completed prior ATR and major decision points in the planning process so that the technical results can be relied upon in setting the course for further study activities.

b. Products to Undergo DQC. All products are subject to DQC. The draft and final FR/EIS (decision document), including feasibility level design of the recommended plan and all technical appendices, will undergo DQC prior to release from the District for external review (e.g., ATR, Type I IEPR, Public and Policy Review). Technical products subject to ATR prior to use in the study will be identified by the Alternative Milestone, at which time the RP will be updated appropriately. All DQC reviews will be complete and closed out before external reviews are initiated.

c. Required DQC Expertise. Required expertise for DQC will include senior experienced staff from Plan Formulation, Economics, Hydrology & Hydraulics, Environmental and Cultural Resources, Cost Engineering, Geotechnical and Soils Engineering, Civil Design, Real Estate, and Office of Counsel. A goal will be the establishment of an informed review team with full accountability to maintain objectivity. To ensure this objectivity, the members of the DQC review team must be independent from those who perform the work. DQC reviewers will need to have expertise similar to that outlined for the ATR team in Table 1.

5. AGENCY TECHNICAL REVIEW (ATR)

ATR is mandatory for all decision documents (including supporting data, analyses, environmental compliance documents, etc.). The objective of ATR is to ensure consistency with established criteria, guidance, procedures, and policy. The ATR will assess whether the analyses presented are technically correct and comply with published USACE guidance, and that the document explains the analyses and results in a reasonably clear manner for the public and decision makers. ATR is managed within USACE by the designated RMO and is conducted by a qualified team from outside the home district that is not involved in the day-to-day production of the project/product. ATR teams will be comprised of senior USACE personnel and may be supplemented by outside experts as appropriate. The ATR Lead will be from outside the home MSC.

a. Products to Undergo ATR. All products used in this study will undergo ATR. ATR will be conducted seamlessly, and the ATR team will be engaged at the beginning of the study during the Charette. Initial study documents include the report synopsis, risk register, and decision management plan. Later documents include the draft report and including NEPA documents and supporting technical appendices or memoranda. Where practicable, technical products that support subsequent analyses will be reviewed prior to being used in the study and may include: hydrology & hydraulics, geotechnical investigations, economic, environmental, cultural, and social inventories, annual damage and benefit estimates, cost estimates, etc. Technical products subject to ATR prior to use in the study will be identified by the Alternative Milestone, at which time the RP will be updated appropriately.

b. Required ATR Team Expertise. The Agency Technical Review Team will be comprised of individuals that have not been involved in the development of the decision document and will be chosen based on expertise, experience, and/or skills. The members will roughly mirror the composition of the PDT. The ATR team may consist of as many as 11 reviewers (Table 1). ATR reviewers should be experienced in reviewing products resulting from risk-informed decision making following the SMART Planning process. Not all reviewers will be needed for every stage of review. For instance, review of a Real Estate product will not be needed for the without-project documentation. The ATR team members assigned to the study will be included in Attachment 1 once the ATR team is established. All Engineering and Construction ATR reviewers in Table 1 are required to be listed in the Corps of Engineers Reviewer Certification and Access Program (CERCAP) Database per USACE Engineering and Construction Bulletin 2013-28, Use of Certified Engineering and Construction (E&C) Community of Practice (CoP) Members for Agency Technical Reviews (ATRs) on Civil Works Projects.

Table 1: Agency Technical Review Team

Discipline	Expertise Needed for Review
ATR Lead	The ATR lead should be a senior professional with extensive experience in preparing Civil Works decision documents and conducting ATR. The lead should also have the necessary skills and experience to lead a virtual team through the ATR process. The ATR lead should also be a senior water resources planner with experience in formulation, evaluation, and selection of alternatives for FRM projects.
Plan Formulation	The planning reviewer should be a senior water resources planner with experience in ecosystem restoration planning. Experience with habitat connectivity is desired.
Environmental Resources	The Environmental Resources reviewer should have extensive experience with environmental evaluation and compliance requirements pursuant to the "Procedures for Implementing NEPA" (ER 200-2-2), national environmental laws and statutes, applicable Executive Orders, and other federal planning requirements for Civil Works projects.
Cultural Resources	The Cultural Resources reviewer (i.e., Archaeologist) should have extensive experience with the Southwest, cultural resource survey methodology, area of potential effects, Section 106 of the National Historic Preservation Act, and state and federal laws/executive orders pertaining to American Indian Tribes.
Hydrology and Hydraulics	The Hydrologist/Hydraulics reviewer will be proficient with arid regions river hydraulics, GEO-RAS, HEC-RAS and associated one and/or two-dimensional models, floodplain delineation, hydrologic statistics, sediment transport analysis, channel stability analysis, risk and uncertainty analysis, and a number of other closely associated technical subjects.
Geotechnical Engineering and Soils	The Geotechnical reviewer must be familiar with sampling and laboratory testing, channel/embankment stability and seepage analyses, planning analysis, and a number of other closely associated technical subjects.
Economics	The Economics reviewer will have experience with analysis of demographics, land use, and flood damage assessments using HEC-FDA; use of RECONS model to address regional economic development associated with a project; discussion of other social effects (OSE) associated with flood risk; and economic justification of FRM projects in accordance with current USACE policy.
Civil Design	The Civil Design reviewer will have experience in designing FRM measures and alternatives.
Cost Engineering[1]	The Cost Engineering reviewer will be identified by the Cost MCX and should have SMART Planning cost estimating experience using MCACES/Mii; working knowledge of construction and FRM; capable of making professional determinations based on experience.

Discipline	Expertise Needed for Review
Real Estate/Lands	The Real Estate reviewer will have experience in development of SMART Planning Real Estate Plans and have experience in real estate valuation, gross appraisal, utility relocations, takings and partial takings as needed for implementation of Civil Works projects.
Risk Analysis	The Risk Analysis reviewer should be an interdisciplinary team member who can ensure that the decision document includes appropriate identification, analysis and written communication of risk and uncertainty.

[1]Coordination with the USACE Mandatory Center of Expertise (MCX) located in the Walla Walla District will be conducted as required by EC 1165-2-214.

c. Documentation of ATR. DrChecks™ review software will be used to document all ATR comments, responses and associated resolutions accomplished throughout the review process. Comments should be limited to those that are required to ensure adequacy of the product. The four key parts of a quality review comment will normally include:

1) The review concern – identify the product's information deficiency or incorrect application of policy, guidance, or procedures;
2) The basis for the concern – cite the appropriate law, policy, guidance, or procedure that has not be properly followed;
3) The significance of the concern – indicate the importance of the concern with regard to its potential impact on the plan selection, recommended plan components, efficiency (cost), effectiveness (function/outputs), implementation responsibilities, safety, federal interest, or public acceptability; and
4) The probable specific action needed to resolve the concern – identify the action(s) that the reporting officers must take to resolve the concern.

In some situations, especially addressing incomplete or unclear information, comments may seek clarification in order to then assess whether further specific concerns may exist.

The ATR documentation in DrChecks™ will include the text of each ATR concern, the PDT response, a brief summary of the pertinent points in any discussion, including any vertical team coordination (the vertical team includes the District, RMO, MSC, ATR Lead, and HQUSACE), and the agreed upon resolution. If an ATR concern cannot be satisfactorily resolved between the ATR team and the PDT, it will be elevated to the vertical team for further resolution in accordance with the policy issue resolution process described in either ER 1110-1-12 or ER 1105-2-100, Appendix H, as appropriate. Unresolved concerns can be closed in DrChecks™ with a notation that the concern has been elevated to the vertical team for resolution.

At the conclusion of each ATR effort, the ATR team will prepare a Review Report summarizing the review. Review Reports will be considered an integral part of the ATR documentation and shall:

- Identify the document(s) reviewed and the purpose of the review;
- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;

- Describe the nature of their review and their findings and conclusions;
- Identify and summarize each unresolved issue (if any); and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

ATR may be certified when all ATR concerns are either resolved or referred to the vertical team for resolution and the ATR documentation is complete. The ATR Lead will prepare a Statement of Technical Review certifying that the issues raised by the ATR team have been resolved (or elevated to the vertical team) for the Draft and Final FR/EIS. A sample Statement of Technical Review is included in Attachment 2.

d. Role of ATR Lead. In addition to facilitating ATR of individual study products, the ATR Lead will be involved throughout the study process. The ATR Lead will review all key study management documents (e.g., risk register, decision management plan, review plan, etc.); participate in all In-Progress Reviews (IPRs) and milestone meetings; advise the PDT on FRM planning policy; and recommend if/when to conduct ATR of products other than those included in the draft decision document.

6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

IEPR may be required for decision documents under certain circumstances. IEPR is the most independent level of review, and is applied in cases that meet certain criteria where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside of USACE is warranted. A risk-informed decision, as described in EC 1165-2-214, is made as to whether IEPR is appropriate. Type I IEPR reviews are managed outside the USACE. Panel members will be selected using the National Academies of Science (NAS) policy for selecting reviewers. IEPR panels will consist of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of areas of expertise suitable for the review being conducted. There are two types of IEPR:

- Type I IEPR. Type I IEPR reviews are managed outside the USACE and are conducted on project studies. Type I IEPR panels assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and any models used in the evaluation of environmental impacts of proposed projects. Type I IEPR will cover the entire decision document or action and will address all underlying engineering, economics, and environmental work, not just one aspect of the study. For decision documents where a Type II IEPR (Safety Assurance Review) is anticipated during project implementation, safety assurance shall also be addressed during the Type I IEPR per EC 1165-2-214.

- Type II IEPR. Type II IEPR, or Safety Assurance Review (SAR), is managed outside the USACE and is conducted on design and construction activities for hurricane, storm, and flood risk management projects or other projects where existing and potential hazards pose a significant threat to human life. Type II IEPR panels will conduct reviews of the design and construction activities prior to initiation of physical construction and, until construction activities are completed, periodically thereafter on a regular schedule. The reviews shall consider the

adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health safety and welfare.

a. Decision on IEPR. Based on a risk-informed decision process, Type I IEPR will be required. EC 1165-2-214 set forth thresholds that trigger IEPR. Details of the Type I IEPR risk informed decision summary is provided below:

- The project may involve significant threat to human life (see Section 4.d);
- The NEPA document may be an EIS;
- The estimated total project cost (including mitigation) is not likely to be greater than $200 million;
- The Governor of Arizona has not requested peer review by independent experts;
- It is not anticipated that the public, including scientific or professional societies, will be asked to nominate potential external peer reviewers.
- Aside from having a potential threat to human life, there is some chance that the study could encounter a high level of public concern.

b. Products to Undergo Type I IEPR. Type I IEPR will be performed for the Draft Feasibility Report and the supporting technical appendices and analyses concurrent with public and agency review.

c. Required Type I IEPR Panel Expertise. The following provides a description of the proposed IEPR panel members and expertise. The proposed six member panel includes the necessary expertise to assess planning, engineering, environmental, and economic adequacy of the decision document, as required by EC 1165-2-214, Appendix D. Reviewers will be selected by an OEO. The likely disciplines and expertise for IEPR are presented in Table 2. Each discipline will review products related to their expertise and focus their review on the previously listed items. Additional technical areas requiring IEPR may be identified during the study/review process. The PDT should make the initial assessment of what expertise is needed based on the PMP and the factors affecting the scope and level of review outlined in Section 3 of the review plan.

Table 2: IEPR Panel Disciplines and Expertise

IEPR Panel Members/Disciplines	Expertise Needed for Review
Plan Formulation	The Plan Formulation panel member should also be an expert in the USACE plan formulation process, procedures, and standards with experience in the evaluation of alternative plans for flood risk management.
Economics	The Economics panel member should be a senior Economist with extensive knowledge of cost/benefit analysis for flood risk management. Candidate should be familiar with the USACE flood risk management analysis and economic benefit calculations, including use of standard USACE computer programs including Hydrologic Engineering Center's Flood Damage Reduction Analysis (HEC-FDA).

IEPR Panel Members/Disciplines	Expertise Needed for Review
Environmental Resources	Panel Member should be familiar with the habitat, fish and wildlife species, and tribal cultures and archeology that may be affected by the project alternatives in this study area. Additionally, the panel member should be an expert in compliance with additional environmental laws, policies, and regulations, including compliance in Fish and Wildlife Coordination Act, Endangered Species Act, Section 106 of the National Historic Preservation Act, and state and Federal laws/executive orders pertaining to American Indian Tribes.
Hydrology and Hydraulics	Panel member will be familiar with floodplain mapping, hydrologic statistics, sediment transport analysis, channel stability analysis, and risk and uncertainty analysis. Panel member should also be knowledgeable of southwest riverine hydrology. The team member will be proficient with the Hydraulic Engineering Center River Analysis System (HEC-RAS) model.
Geotechnical Engineering and Soils	The Geotechnical panel member must be familiar with sampling and laboratory testing, channel/embankment stability and seepage analyses, planning analysis, and a number of other closely associated technical subjects.
Civil Design/Cost Engineering	The Civil/Cost panel member should be experienced in designing channel modifications, levee systems, earthwork, structural diversion on arid regions riverine systems; have working knowledge of construction; and capable of making professional determinations based on experience.

d. Documentation of Type I IEPR. The IEPR panel will be selected and managed by an Outside Eligible Organization (OEO) per EC 1165-2-214, Appendix D. Panel comments will be compiled by the OEO and should address the adequacy and acceptability of the economic, engineering and environmental methods, models, and analyses used. IEPR comments should generally include the same four key parts as described for ATR comments in Section 5.c above. The OEO will prepare a final Review Report that will accompany the publication of the final decision document and shall:

- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions; and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

The final Review Report will be submitted by the OEO no later than 60 days following the close of the public comment period for the draft decision document. USACE shall consider all recommendations contained in the Review Report and prepare a written response for all recommendations adopted or not adopted. The final decision document will summarize the Review Report and USACE response. The Review Report and USACE response will be made available to the public, including through electronic means on the Internet.

e. Type II IEPR (SAR). A Type II (SAR) shall be conducted on design and construction activities for any project where potential hazards pose a significant threat to human life (public safety). Since Type II IEPR will be required, the SAR will be incorporated into the Type I IEPR (EC 1105-2-214, Appendix D, paragraph 1.b(1)). The Review Panel will consider the following during the Type I IEPR:

1) Is the quality and quantity of the surveys, investigations, and engineering sufficient for a concept design (ER 1110-2-1150)?
2) Are the models used to assess hazards appropriate?
3) Are the assumptions made for the hazards appropriate?
4) Does the analysis adequately address the uncertainty given the consequences associated with the potential for loss of life for this type of project?

7. POLICY AND LEGAL COMPLIANCE REVIEW

All decision documents will be reviewed throughout the study process for their compliance with law and policy. Guidance for policy and legal compliance reviews is addressed in Appendix H of ER 1105-2-100. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy, and warrant approval or further recommendation to higher authority by the home MSC Commander. DQC and ATR augment and complement the policy review processes by addressing compliance with pertinent published Army policies, particularly policies on analytical methods and the presentation of findings in decision documents.

8. COST ENGINEERING MANDATORY CENTER OF EXPERTISE (MCX) REVIEW AND CERTIFICATION

All decision documents shall be coordinated with the Cost Engineering MCX, located in the Walla Walla District. The MCX will assist in determining the expertise needed on the ATR team and Type I IEPR team, and in the development of the review charge(s). The MCX will also provide the Cost Engineering MCX certification. The RMO is responsible for coordination with the Cost Engineering MCX.

9. MODEL CERTIFICATION AND APPROVAL

EC 1105-2-412 mandates the use of certified or approved models for all planning activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. Planning models, for the purposes of the EC, are defined as any models and analytical tools that planners use to define water resources management problems and opportunities, to formulate potential alternatives to address the problems and take advantage of the opportunities, to evaluate potential effects of alternatives and to support decision making. The use of a certified/approved planning model does not constitute technical review of the planning product. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to DQC, ATR, and IEPR (if required).

EC 1105-2-412 does not cover engineering models used in planning. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed. As part of the USACE Scientific and Engineering Technology (SET) Initiative, many engineering models have been identified as preferred or acceptable for use on Corps studies and these models should be used

whenever appropriate. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to DQC, ATR, and IEPR.

a. Planning Models. The following planning models are anticipated to be used in the development of the decision document:

Table 3: Planning Models

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Certification / Approval Status
HEC-FDA 1.4 (Flood Damage Analysis)	The Hydrologic Engineering Center's Flood Damage Reduction Analysis (HEC-FDA) program provides the capability for integrated hydrologic engineering and economic analysis for formulating and evaluating flood risk management plans using risk-based analysis methods. The program will be used to evaluate and compare the future without- and with-project plans along the Lower Santa Cruz River to aid in the selection of a recommended plan to manage flood risk.	Certified
IWR-Planning Suite	This software assists with the formulation and comparison of alternative plans. While IWR-PLAN was initially developed to assist with environmental restoration and watershed planning studies, the program can be useful in planning studies addressing a wide variety of problems. IWR-PLAN can assist with plan formulation by combining solutions to planning problems and calculating the additive effects of each combination, or "plan." IWR-PLAN can assist with plan comparison by conducting cost effectiveness and incremental cost analyses, identifying the plans which are the best financial investments and displaying the effects of each on a range of decision variables.	Certified
RECONS	RECONS is a Corps corporate model specifically developed to assess the Regional Economic Development (RED) impacts of Corps civil works projects. This model will be used to support discussion of the RED benefits associated with project implementation. The RECONS model will estimate the impacts to the local economy, in terms of income, employment and tax revenues, resulting from project construction.	Certified

b. Engineering Models. The following engineering models are anticipated to be used in the development of the decision document:

Table 4: Engineering Models

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Approval Status
HEC-HMS	The Hydrologic Modeling System (HEC-HMS) is designed to simulate the complete hydrologic processes of dendritic watershed systems. The software includes many traditional hydrologic analysis procedures such as event infiltration, unit hydrographs, and hydrologic routing. HEC-HMS also includes procedures necessary for continuous simulation including evapo-transpiration, snowmelt, and soil moisture accounting. Advanced capabilities are also provided for gridded runoff simulation using the linear quasi-distributed runoff transform (ModClark). Supplemental analysis tools are provided for parameter estimation, depth-area analysis, flow forecasting, erosion and sediment transport, and nutrient water quality.	H&H Community of Practice (CoP) Preferred Model
HEC-RAS 4.0 (River Analysis System)	The Hydrologic Engineering Center's River Analysis System (HEC-RAS) program provides the capability to perform one-dimensional steady and unsteady flow river hydraulics calculations. The program will be used for steady flow analysis to evaluate the future without and with-project conditions along the LSCR.	H&H Community of Practice (CoP) Preferred Model
Seep/W	Seep/W is a finite difference seepage modeling tool. The tool is used to estimate exit seepage gradients due to channel loading and also to estimate pore pressures used in the seepage analysis. Inputs for the tool include cross section geometry and hydraulic boundary conditions, as well as soil layer hydraulic conductivity (including anisotropic ratios, and material property orientation).	Geotechnical CoP Recommended
Slope/W	Slope/W is used to calculate slope stability factors of safety using limit equilibrium methods. Cross section geometry, soil engineering properties and pore water pressures (calculated from Seep/W) are required inputs to calculate stability factors of safety. The program uses an iterative approach to evaluate thousands of potential	Geotechnical CoP Recommended

	slip surfaces that meet input criteria, and the surface with the lowest factors of safety are reported.	
MCACES/Mii	Used to estimate cost of alternatives and the recommended plan.	Enterprise Model

10. REVIEW SCHEDULES AND COSTS

a. ATR Schedule and Cost. ATR will be conducted seamlessly throughout the study. During Fiscal Year 2016, the ATR team will be engaged during the Charette in the 1st Quarter of FY 2016 and will review documents in advance of the Alternatives Milestone per Table 6 below. After review of the Draft Report, following the Tentatively Selected Plan milestone scheduled for JAN 2017, the ATR Lead will prepare the ATR Review Report. The tentative feasibility study schedule is shown in Table 5 below. The schedule for ATR activities is presented in Table 6. The current cost estimate for ATR is $200,000. The cost for ATR will be negotiated with the PCX and the ATR team.

Table 5: Milestone Schedule

Milestone	Timing
FCSA Execution	AUG 2015
Planning Charette	OCT-NOV 2015
Alternatives Milestone (CW261)	MAY 2016
Tentatively Selected Plan (CW262)	JAN 2017
Agency Decision Milestone (CW263)	JUN 2017
Division Commander's Transmittal (CW260)	SEP 2017
Civil Works Review Board (CW245)	JAN 2018
Chief's Report (CW270)	AUG 2018

Table 6: Schedule and Cost for Agency Technical Review

Task	Date	Estimated Cost
ATR prior to Alternatives Milestone and/or TSP Milestone	FEB – APR 2016; OCT 2016	$20,000
ATR of draft FR/EIS Prior to Agency Decision Milestone (ADM)	APR-MAY 2017	$130,000
ATR of final FR/EIS (After ADM and at conclusion of Feasibility Level Design)	JUL-AUG 2017	$50,000

b. Type I IEPR Schedule and Cost. The IEPR schedule and cost estimate is presented in Table 7.

Table 7: Schedule for IEPR

Task	Date	Estimated Cost
FRM-PCX Initial Coordination of IEPR	JAN 2017	$5,000
RMO Management of IEPR	JAN – JUL 2017	$25,000
Type I IEPR of draft FR/EIS (prior to Agency Decision Milestone)	MAY-JUL 2017	$170,000

c. Model Certification/Approval Schedule and Cost. Not applicable. There are no models requiring certification for this study.

11. PUBLIC PARTICIPATION

The public will be invited to comment directly to the PDT through informal and formal public scoping meetings, workshops/open houses, and public review comment periods programmed into the feasibility schedule. This includes a public review of the draft FR/EIS. Public review occurs concurrently with ATR, IEPR, and HQUSACE policy reviews). Public input will be made available to the IEPR team to ensure public comments have been considered in development of the draft and final FR/EIS. Public workshops will be held during the public and agency review period. Formal State and Agency review will occur following the Civil Works review Board Milestone. Upon completion of the review period, comments will be consolidated in a matrix and addressed, if needed. A summary of the comments and resolutions will be included in the Public Involvement Appendix.

This Review Plan will be posted to the District web site for public review once it is approved by the MSC.

12. REVIEW PLAN APPROVAL AND UPDATES

The South Pacific Division Commander is responsible for approving this Review Plan. The Commander's approval reflects vertical team input (involving District, MSC, RMO, and HQUSACE members) as to the appropriate scope and level of review for the decision document. Like the PMP, the Review Plan is a living document and may change as the study progresses. The home district is responsible for keeping the Review Plan up to date. Minor changes to the review plan since the last MSC Commander approval are documented in Attachment 3. Significant changes to the Review Plan (such as changes to the scope and/or level of review) should be re-approved by the MSC Commander following the process used for initially approving the plan. The latest version of the Review Plan, along with the Commanders' approval memorandum, will be posted on the Home District's webpage. The latest Review Plan will also be provided to the RMO and home MSC.

13. REVIEW PLAN POINTS OF CONTACT

Public questions and/or comments on this review plan can be directed to the following points of contact:

- Los Angeles District: Kim M. Gavigan, P.E., CFM
  (602) 230-6902

- South Pacific Division: Paul Bowers
  (415) 503-6556

- Flood Risk Management Planning Center of Expertise: Eric Thaut
  (415) 503-6852

ATTACHMENT 1: TEAM ROSTERS

PROJECT DELIVERY TEAM

Name	Discipline	Phone	Email
John Drake	Project Manager	602-230-6933	John.E.Drake@usace.army.mil
Kim Gavigan	Lead Planner	602-230-6902	Kim.M.Gavigan@usace.army.mil
Chadi Wahby	Civil Design	213-452-3652	Chadi.Wahby@usace.army.mil
Tony Wong	Structural	213-452-3700	Tony.Y.Wong@usace.army.mil
TBD	Environmental/Biology	213-452-	@usace.army.mil
TBD	Environmental Coordinator	213-452-	@usace.army.mil
Robert Mrse	Hydrology & Hydraulics	213-452-3570	Robert.D.Mrse@usace.army.mil
Jacob Hensel	Economics	760-602-4839-	Jacob.R.Hensel@usace.army.mil
TBD	Cost Engineering	213-452-	@usace.army.mil
Miles Pillars	Real Estate/Lands	602-230-6965	Miles.D.Pillars@usace.army.mil
Danielle Storey	Cultural Resources	213-452-3855	Danielle.L.Storey@usace.army.mil
Mark Chatman	Geotechnical Engineering	213-452-3585	Mark.Chatman@usace.army.mil
Anabel Pho	Soils & Materials	213-452-3605	Anabel.Pho@usace.army.mil

AGENCY TECHNICAL REVIEW TEAM

Name	Discipline	Phone	Email
TBD	ATR Lead		
TBD	Plan Formulation		
TBD	Environmental Resources		
TBD	Cultural Resources		
TBD	Hydrology		
TBD	Hydraulics		
TBD	Geotechnical Engineering		
TBD	Economics		
TBD	Civil Design		
TBD	Cost Engineering MCX		
TBD	Real Estate/Lands		

INDEPENDENT EXTERNAL PEER REVIEW PANEL

Name	Discipline	Phone	Email
TBD	Plan Formulation		
TBD	Environmental Resources		
TBD	Hydrology and Hydraulics		
TBD	Geotechnical Engineering		
TBD	Economics		
TBD	Civil Design/Cost Engineering		

VERTICAL TEAM

Name	Discipline	Phone	Email
Paul Bowers	District Support Team Lead	415-503-6556	Paul.W.Bowers@usace.army.mil
Bradd Schwichtenberg	Regional Integration Team	202-761-1367	Bradd.R.Schwichtenberg@usace.army.mil

PLANNING CENTER OF EXPERTISE
FLOOD RISK MANAGEMENT

Name	Discipline	Phone	Email
Eric Thaut	Program Manager, PCX Flood Risk Management	415-503-6852	Eric.W.Thaut@usace.army.mil

ATTACHMENT 2: SAMPLE STATEMENT OF TECHNICAL REVIEW FOR DECSION DOCUMENTS

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the *<type of product>* for *<project name and location>*. The ATR was conducted as defined in the project's Review Plan to comply with the requirements of EC 1165-2-209 and, subsequently, EC 1165-2-214. During the ATR, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing US Army Corps of Engineers policy. The ATR also assessed the District Quality Control (DQC) documentation and made the determination that the DQC activities employed appear to be appropriate and effective. All comments resulting from the ATR have been resolved and the comments have been closed in DrChecks[sm].

SIGNATURE _____ _____

Name Date
ATR Team Leader
Office Symbol/Company

SIGNATURE _____ _____

Name Date
Project Manager
Office Symbol

SIGNATURE _____ _____

Name Date
Architect Engineer Project Manager[1]
Company, location

SIGNATURE _____ _____

Name Date
Review Management Office Representative
Office Symbol

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows: *Describe the major technical concerns and their resolution.*

As noted above, all concerns resulting from the ATR of the project have been fully resolved.

SIGNATURE _____ _____

Name Date
Chief, Engineering Division
Office Symbol

SIGNATURE _____ _____

Name Date
Chief, Planning Division
Office Symbol

[1] Only needed if some portion of the ATR was contracted

ATTACHMENT 3: REVIEW PLAN REVISIONS

Revision Date	Description of Change	Page / Paragraph Number

ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS

Term	Definition	Term	Definition
ASA(CW)	Assistant Secretary of the Army for Civil Works	OMB	Office and Management and Budget
ATR	Agency Technical Review	O&M	Operation and Maintenance
CEFMS	Corps of Engineers Financial Management System	OEO	Outside Eligible Organization
CESPD	Corps of Engineers, South Pacific Division	OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
DGC-CEO	Deputy Commanding General of Civil and Emergency Operations	OSE	Other Social Effects
DQC	District Quality Control	OWPR	Office of Water Project Review
DST	District Support Team	PCX	Planning Center of Expertise
EA	Environmental Assessment	PDT	Project Development Team
EC	Engineering Circular	PED	Preconstruction Engineering and Design
EIS	Environmental Impact Statement	PMP	Project Management Plan
EO	Executive Order	PMIP	Planning Models Improvement Program
ER	Engineering Regulation or Ecosystem Restoration	QA	Quality Assurance
FDR	Flood Damage Reduction	QC	Quality Control
FEMA	federal Emergency Management Agency	QCP	Quality Control Plan
FRM	Flood Risk Management	QMP	Quality Management Plan
HQUSACE	Headquarters, USACE	RED	Regional Economic Development
IEPR	Independent External Peer Review	RIT	Regional Integration Team
IPR	In Progress Review	RMC	Risk Management Center
ITR	Independent Technical Review	RMO	Review Management Organization
LCR	Little Colorado River	RP	Review Plan
MCX	Mandatory Center of Expertise	RTS	Regional Technical Specialist
MSC	Major Subordinate Command	SAR	Safety Assurance Review
NAS	National Academies of Science	SPD	South Pacific Division
NED	National Economic Development	TSP	Tentatively Selected Plan
NEPA	National Environmental Policy Act	USACE	US Army Corps of Engineers
		WRDA	Water Resources Development Act