September 2025

Long Term Operations of the State Water Project and the Central Valley Project – Adaptive Management Program

1. Introduction

Adaptive management is a science and decision analytic-based approach to evaluate and improve management actions, with the aim to reduce uncertainty over time and increase the likelihood of achieving and maintaining a desired management objective. Decision analysis tools can be used to determine which uncertainties are important for management decisions, and which scientific approaches should be deployed to address those uncertainties considered necessary to inform subsequent decisions. When correctly designed and executed, adaptive management provides a means to evaluate management actions or programs (collectively "actions") and allows for evidence-based adjustments to the actions defined, to improve their effectiveness in achieving management objectives, if warranted. The adaptive management approach can provide a scientific basis for continuing or modifying an action or allow for an alternative action to be evaluated and implemented, if determined.

The Department of Water Resources (DWR), the Department of Fish and Wildlife (CDFW), Bureau of Reclamation (Reclamation), U.S. Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) (collectively, "the Implementing Entities") intend to utilize adaptive management to inform the long-term operations of the State Water Project (SWP) and the Central Valley Project (CVP) and related activities described as a part of this Adaptive Management Program (Program).

The Implementing Entities anticipate that it may be necessary to undertake additional monitoring and research that builds on existing efforts in order to carry out this Program. The Implementing Entities will establish an Adaptive Management Steering Committee (AMSC) that will serve as the primary decision group for implementation of this Program. Members of the AMSC will include one designated sub-Director representative[1] and one designated alternate each from DWR, CDFW, Reclamation, USFWS, and NMFS. The AMSC's role in implementing this Program is described in Section 4a.

The Implementing Entities intend to use the AMSC to provide direction and guidance for work under this AMP through Adaptive Management Technical Teams (AMTs), coordinate each agencies participation, and assign existing work groups to the extent possible to serve as AMTs, only creating new work groups if needed. Appendix A describes the role of adaptive management, as envisioned by this Program, to inform the long-term operations of the SWP and CVP. The AMSC will utilize AMTs and outside experts (as needed) to develop adaptive management plans or work plans to implement Adaptive Management Actions (AMAs) identified in this Program (Appendix B) and track required monitoring, data collection, research, and publications that inform future decisions (see Section 4b).

The Program will utilize a suite of decision support tools tailored to each action with consideration of each AMA's management objective, timeline, stage of development (i.e., initiating a new AMA or continuing an existing longer-term effort), the anticipated application and or incorporation of information gained. The AMSC and its AMTs agree to use the fundamental components of Structured Decision Making (SDM) for AMAs identified in the Program including independent, floating facilitators to assist with problem framing, objective development, and information synthesis. Floating facilitators are intended to serve as independent, neutral facilitators of the entire AMP. Their role is to facilitate each individual AMT, ensuring the AMTs follow guidance and sideboards provided by the AMSC, fostering

[1] "Designated Sub-Director Representative" means the official representative designated by the director of an Implementing Entity to act on her or his behalf.

cross communication among AMTs when helpful, and working closely with assigned leads of each AMT. In addition to working directly with AMTs they will also facilitate the AMSC, foster communication between AMTs and the AMSC as needed to inform discussions and decision making, and assist in communicating guidance and sideboards from the AMSC to individual AMTs. Given the scope of the AMP, it is likely that a team of independent facilitators will be needed to serve these roles.

Appendix B provides an initial list of AMAs and expectations for monitoring and science activities to be implemented by the AMTs. Roles and responsibilities of the AMSC and AMTs are described in Sections 4a and 4b of this document. Independent science reviews may be used to evaluate progress towards reducing uncertainty and utilizing the best available science for informing CVP and SWP management (see Section 7c). Appendix B also sorts AMAs into Bins (1-3) based on the timeframe of their evaluation and the level of SDM tools anticipated to be needed for evaluation and decision making. AMAs to be included in Bin 1 will be managed adaptively based on present conditions, such as hydrology or annual species status, and will require quick decision-making relative to full SDM. Consultation and ITP amendment inquiries will be conducted, but reinitiation of consultation or an ITP amendment is not expected to be required to refine the approach to implementation after each evaluation. Bin 2 will apply to those AMAs that are iterated or linked over time whereby actions taken early on may result in learning that improves management within the next 3-8 years. The evaluation may trigger re-initiation of consultation or an ITP amendment for the actions, or not, depending on scope and scale of recommended change. Bin 3 will include AMAs for which agencies evaluate data over longer periods of implementation, on the order of 10-15 years. These AMAs require a full SDM process whereby qualified and independent facilitators will guide a structured decision-making process. It is anticipated that Bin 3 AMAs will require substantial time to plan, evaluate, and implement to facilitate learning opportunities for future action management.

The use of decision support tools will help the AMSC make transparent, evidence-based decisions by comparing the expected outcomes of alternative actions with regard to meeting management objectives, identifying key sources of uncertainty affecting the ability to predict action outcomes, and highlighting tradeoffs between competing management objectives. There are additional studies that may be at different stages of development and do not provide for the shared consideration of alternatives but warrant the sharing of information and the use of components of SDM.

Working through the collaborative process outlined in this Program, the Implementing Entities commit to reach consensus within the AMSC to the maximum extent possible, while still retaining individual agency discretion to make decisions (as appropriate). Should the AMSC not come to consensus, the Implementing Entities would follow the governance process identified in the associated Biological Opinion and ITP. The Implementing Entities seek to use the potential flexibility provided by an adaptive management approach to ensure the specific management objectives identified for each action are met, maintained, and/or improved upon. The full implementation of an independently facilitated AMP is an approach that the Implementing Entities believe best balances positive outcomes for species listed under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA) with operation of the CVP and SWP.

Nothing in this Program is intended to modify each Implementing Entity's roles, authorities, or obligations under statute or regulation. Each Implementing Entity retains discretion to make decisions as appropriate within its authority after considering the available information and considering the input of the other Implementing Entities through the AMSC.

2. Purpose and Intent

Scientific uncertainty will always exist regarding Central Valley rivers and Bay-Delta ecosystems, including the needs of the listed species, the effects of coordinated CVP and SWP operations on those species and their habitats, and the efficacy of actions intended to minimize or mitigate those effects. Further, even when scientific certainty is relatively high, the real-world need for trade-offs will increase the complexity of implementing decisions. This Program is being implemented to help reduce important scientific uncertainty where it exists, and to enhance application of decision tools to support decision making related to the long-term operations of the CVP and SWP.

Adaptive management is a structured, iterative process for decision making when confronted with uncertainty. It emphasizes learning through management where knowledge is incomplete and provides a process for building knowledge through monitoring and science, reducing uncertainty, and improving management over time in a goal-oriented and structured way. Key components of adaptive management are establishing clear and measurable objectives, identifying action goals, and determining management options for best achieving those desired goals.

The broad purposes of this Program are: 1) to promote collaborative, participatory, accountable, relevant, innovative, and transparent science and documentation of the decision process, 2) guide (by identifying, prioritizing, and funding) the development and implementation of scientific investigations and monitoring for CVP and SWP management actions necessary to evaluate if management objectives are being achieved, 3) incorporate new information into decision support tools to gain insights to management decisions, actions, and constraints, and 4) maximize the effectiveness of an action toward achieving the management objectives for the operation of the CVP and SWP while considering potential tradeoffs.

This Program creates a structure whereby participants in science workgroups (i.e., AMTs) working with floating, independent facilitators to implement scientific investigations and monitoring that will best reduce important uncertainties specific to each AMA (Appendix B). The science-based decision products of the AMTs are rolled up by the floating, independent facilitators and presented to the steering committee (i.e., AMSC) for consideration by each agency. The members of the AMSC can then make informed resource management decisions such as whether to propose changes to an existing AMA determine whether particular lines of inquiry are no longer able to generate further insight, and other kinds of decisions that can be expected to typify an adaptive response to a set of recurring actions. Decisions regarding potential changes to regulatory approaches will be handled separately, as described in Section 5 of this document.

The intents of this Program are to:

a. Describe the steps required to implement the adaptive management process (see Appendix A) and explain how the process links to the operations of the CVP and SWP.

b. Describe how adaptive management for ongoing engagement on the operations of the CVP and SWP will be utilized for specific actions (see Appendix B).

c. Inform future consultation and permitting processes for the CVP and SWP through the science produced by the Program, which can be thought of as adaptive management of more involved decisions occurring over longer time scales.

d. If necessary and agreed upon by the Implementing Entities, develop and implement new AMAs.

e. Describe the decision-making and governance structure that will be used to implement the adaptive management process including how adaptive changes will be made to the AMAs with consideration of how these changes will be coordinated and reflected in corresponding state and federal authorizations.

f. Describe the structure for communication among the Implementing Entities and the broader stakeholder community regarding implementation of this Program.

g. Describe the role of the AMSC in tracking, on an annual basis, funding for this Program.

3. Scope of Adaptive Management Program

a. Actions

The CVP and SWP have been operated for decades. Scientific research and monitoring of the projects' ecological impacts has been extensive, and these impacts are thoroughly discussed and described. Operational approaches have varied over time, in part guided by the accumulation of ecological data and improved understanding of the projects' impacts on species and their habitats. However, constraints on successfully reducing impacts to listed species caused by operations of the projects under varying climatic conditions are also understood and documented, yet difficult to achieve while maintaining project objectives. The initial adaptive decision space proposed in this Program involves the application of decision analysis and scientific inquiry into topic areas where the Implementing Entities believe that further understanding might improve one or more aspects of CVP and SWP operations. Decision support tools will be used to facilitate evaluation of effects of components of the AMAs identified (Appendix B) and inform Implementing Entities about whether and how best to adapt those AMAs, if needed. The AMAs to be evaluated include, but are not limited to, the following:

- Winter-run Chinook Salmon OMR Management
- Spring-run Chinook Salmon OMR Management
- Larval and Juvenile Delta Smelt OMR Management
- Larval and Juvenile Longfin Smelt OMR Management
- Summer-Fall Habitat Action for Delta Smelt
- Tidal Habitat Restoration Effectiveness for Smelt Fishes
- Tributary Habitat Restoration Effectiveness for Salmonid Fishes
- Shasta Spring Pulse Flow Studies
- Winter-run Chinook Salmon Through Delta Survival and Salvage Thresholds
- Longfin Smelt Science Plan Actions
- Steelhead JPE
- Alternative Salmonid Loss Estimation Pilot Study
- Shasta Cold Water Pool Management
- Georgiana Slough Migratory Barrier Effectiveness for Salmonid Fishes
- Spring Outflow
- Clear Creek

b. Compliance and Effectiveness Monitoring

Compliance and effectiveness monitoring programs will include the elements as described in Appendix B, unless the AMSC, through its adaptive management process, recommends a modification, DWR and Reclamation request modifications, and the regulatory agencies accept those modifications. Such modifications may be subject to independent review (see Section 7). Changes to the compliance and effectiveness monitoring (see Section 3.10 of the ITP) may require ESA consultation and may require amendments to the relevant CESA authorization before being implemented (see Section 5).

4. Program Structure, Roles, and Responsibilities

a. Adaptive Management Steering Committee (AMSC)

The Implementing Entities will establish the AMSC to implement the Program. The Implementing Entities through the AMSC are responsible for support, coordination, and implementation of the Program. The Program will address important uncertainties and trade-offs (policy and ecological) associated with adaptively managing actions identified in Appendix B. AMSC decisions will be informed by AMTs dedicated to each individual AMA identified in Appendix B. The agencies comprising the AMSC will hire a team of floating independent facilitators to help each AMT identify management objectives and goals, identify and synthesize information areas related to those objectives, determine critical uncertainties affecting management decisions, define additional information needs to reduce critical uncertainties, and integrate products of the various AMTs in a way that clarifies what decisions need to be made, what trade-offs may need to be considered, and how confidently the outcomes of those decisions can be predicted.

i. Purpose and Function

The purpose of the AMSC is to provide guidance and direction for the Program and ensure effective and efficient implementation of all AMAs. Specifically, the AMSC will:

- Provide recommendations to Agency Directors based on recent science, including the need to re-initiate consultation and request an ITP amendment.
- Elevate issues for resolution to Agency Directors, as needed, including disputes and results of adaptive management processes conducted through AMTs and the AMSC.
- Serve as primary management level review of AMA implementation. All considerations involving a regulatory change under CESA or ESA do not fall under the perview of the AMSC, see Section 5.
- Provide direction and guidance for action-specific AMTs including articulation of management objectives, dispute resolution, and coordinating participation by each agency.
- Request annual presentations from each AMT to track the status of AMA implementation and look ahead to next steps.
- Review AMT suggestions for identified areas of uncertainty, needed data improvements, proposals for enhanced monitoring or focused research, as appropriate, to assure they are effectively supporting the information needs of the members of the AMSC.

- Request proposals from AMTs to conduct new data collection or conduct focused research to reduce uncertainty or fill data gaps relevant to components of identified AMAs.
- Discuss recommendations from AMTs based on the decision-making process.
- Form and direct AMTs as necessary. Existing teams and workgroups will be used to the maximum extent practicable.
- Assure that all AMSC and AMT activities are conducted in a transparent manner. To allow time for coordination with interested parties meeting schedules will allow for at least 30-day review and consideration of relevant documentation prior to any decision making regarding potential changes to an action in the ITP or PA by the AMSC.
- Post meeting notes, AMT presentations, documentation of decisions, and rationale to support decisions on a publicly available website.
- Identify the need for independent review of specific adaptive management plans and results.
- Set the course for scope and facilitation of reviews, identify the appropriate group to conduct independent reviews, and develop any draft charges for independent review.
- Conduct outreach to the broader stakeholder community regarding implementation of the Program.
- Review annual AMP budget annually to assess potential gaps in funding relevant to overall implementation.

ii. Membership

The AMSC will include one designated sub-Director level representative and one designated alternate each from each of the Implementing Entities. Upon unanimous approval, the members of the AMSC may invite additional staff from any of the Implementing Entities or consultants engaged by one or more of the Implementing Entities to provide technical assistance or other support for specific topics. AMSC meetings will be organized and facilitated by a floating, independent facilitator (or team of facilitators) agreed upon by all Implementing Entities to ensure continuity across meetings and efficient use of time.

b. Adaptive Management Technical Teams (AMTs)

AMTs will be dedicated to each AMA identified in Appendix B. AMTs are charged with identifying uncertainty, building knowledge, and implementing each AMA.

i. Purpose and Function

The purpose of individual AMTs is to convene scientific technical staff from each of the Implementing Entities and interested parties in working groups to plan, implement, and assess each of the actions identified in Appendix B. AMTs formed by the AMSC will have at least one designated team leader from an Implementing Entity and will report to the members of the AMSC on progress in addressing uncertainty associated with each AMA identified in Appendix B (see Appendix A for additional details regarding required reporting). The AMTs will design and implement monitoring and science plans to gather data necessary to build knowledge and decrease uncertainties and conduct the analysis and synthesis of the information gained. The AMTs will evaluate whether actions identified in Appendix B

are achieving their intended management goal, and identify potential adaptive management changes based on the science if objectives and or those goals are not being achieved, to be considered by the members of the AMSC for implementation in the future. Generally, each AMT will:

- Utilize decision support tools to define relevant uncertainty, develop action alternatives, estimate expected consequences of the alternatives, and evaluate trade-offs and preferences when making choices between alternative courses of action. Depending on the scope and timeline of each AMA, and the level of SDM tools used by the AMA, these could include:
  - Development of performance metrics for each AMSC-defined management objective to allow evaluation of ongoing and proposed actions relative ability to achieve those objectives.
  - Development of potential alternative actions and synthesis of existing information to evaluate expected action performance.
  - Identification of uncertainties in expected action performance that are most influential in decision tradeoffs.
  - Development of monitoring and science plans to reduce uncertainty around management action outcomes.
  - For AMAs in Bin 1, develop experimental actions supported by monitoring and science, and review outcomes of experimental actions and revise experimental actions as appropriate.
- As requested by the AMSC, prepare necessary documentation for independent reviews, and participate in post-review dialogue.
- Provide data to support the members of the AMSC to track Adaptive Management Program implementation.
- Track other monitoring and research relevant to the subject of the AMA.
- Assure transparency in the implementation and investigation of the AMA.
- Prepare annual presentations of AMA implementation status to the AMSC and subsequently post presentations on a publicly available website.

The scope and responsibilities of each AMT, and timelines for deliverables, are described in more detail for each AMA in Appendix B. The descriptions in Appendix B may be refined using decision support tools by each AMT and documented in a work plan describing the monitoring and or science that the AMTs plan to conduct, which will be submitted to the AMSC for review and approval.

ii. Membership

Membership in individual AMTs will be open to technical staff from each of the Implementing Entities. AMTs will also be open to tribes, consultants, stakeholders, other local, State or federal agencies, or academic researchers, as described in the individual team charter.

c. Decision-making

The Implementing Entities commit to working collaboratively through the AMSC and AMTs to reach consensus on adaptive management changes (including decisions not to make changes) to the maximum extent feasible, and to elevate any disputes over decisions to the Directors for each Implementing Entity. In the event that resolution of the dispute cannot be reached by the AMSC, review of the issue in

dispute may occur through the presentation of alternative viewpoints as part of an annual review, or a separate independent science review. Decision support tools, including structured decision making, as described in Appendices A and B, will be used to provide a rational and organized framework for evaluating management objectives relative to each action's goal, as well as any alternative decisions.

Nothing in this Program is intended to modify each Implementing Entity's roles, authorities, or obligations under statute or regulation. Each Implementing Entity retains discretion to make decisions as appropriate within its authority after considering the available information and considering the input of the other Implementing Entities through the AMSC.

5. Link between AMP and Regulatory Processes

    a. Federal Endangered Species Act

The Code of Federal Regulations at 50 CFR § 402.16 describe the process for reinitiating ESA section 7 consultation. Specifically, reinitiation is required and shall be requested by the Federal action agency (in this case, Reclamation) or by the USFWS or NMFS (depending on which species are involved) if any one or more of several criteria are met. Although, there is no regulatory mechanism to modify ESA section 7 biological opinions absent reinitiating the section 7 consultation, there are options to improve understanding or modify an action without reinitiating the section 7 consultation so long as doing so does not meet a reinitiation trigger. Specifically, new information or a change in the proposed action would require reinitiation of consultation if:

1. new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; or

2. the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence.

Therefore, the additional objectives of this Program, as it pertains to ESA section 7 consultation, are to:

1. identify the areas of potential action uncertainty and the range of effects to species that may occur as the AMP is implemented such that the potential range of effects of the action may be considered during consultation; reinitiation will be required if that range of anticipated effects is exceeded; and

2. provide the mechanism for regular inquiries and evaluation to determine if reinitiation is required as the AMP is implemented.

In the event that a change is required to the Incidental Take Statement (ITS), and the change is fully consistent with the analysis in the biological opinion, the Services can revise the ITS without reinitiating the consultation. Examples include where new information allows for a more specific take surrogate, reduction in the amount or extent of take (which would include surrogates), or for clarification of the terms and conditions. Under these scenarios, the Services would issue a new ITS to the Federal action agency.

    b. California Endangered Species Act

Title 14 of the California Code of Regulations (CCR), section 783.6, subdivision (c) describes general criteria and information pertaining to minor and major amendments to ITPs. If permittee (in this case, DWR) submits a request for changes to an ITP that do not significantly modify the scope or nature of the project or any of the minimization, mitigation, or monitoring conditions of the ITP, as determined by the CDFW, a minor amendment may be processed. However, if a permittee is seeking changes that will significantly modify the scope or nature of the project, or if those changes trigger additional review under the California Environmental Quality Act, as determined by CDFW, the amendment would be processed as a major amendment. CDFW reviews major amendment requests according to processes set out for initial permit applications, including submittal of an application and supporting information, although the amendment application may rely on and supplement the information from the initial application. Approval of both minor and major amendments to ITPs are subject to CDFW finding that the ITP issuance criteria in CCR title 14, section 783.4 continue to be met.

6. Funding

Funding is anticipated from a variety of sources including CDFW, DWR FWS, NMFS, and Reclamation. Federal funding is subject to appropriations. CDFW cannot fund DWR permit obligations but may allocate staff time to provide technical assistance and engage in implementation of this program.

It is expected that the Adaptive Management Plan will require substantial resources to support the required evaluations and independent review. The specific level of support remains to be determined and will likely vary depending on the Adaptive Management Actions conducted each year.

7. Relationship of the Adaptive Management Program to Other Processes

    a. Real-time Operations

The adaptive management and decision-making processes described here do not directly apply to real-time operations; where individual real-time operation decisions must be made on a daily, weekly, or monthly time scale. However, real-time operational criteria may be changed over time through the adaptive management process based on new information. Such a change may require an ESA reinitiation of consultation inquiry and an ITP amendment (See Section 5, Link between AMP and Regulatory Processes).

    b. Voluntary Agreements

The Voluntary Agreements are a package of flow and non-flow measures proposed by a diverse range of interests for adoption by the SWRCB as an approach to implement the Bay-Delta Water Quality Control Plan (Bay-Delta Plan). The Voluntary Agreements would state commitments of water, funding, and other measures to implement Bay-Delta Plan water quality objectives related to protection of native fishes, including the Covered Species. The Voluntary Agreements offer a watershed-wide approach that includes new flows, habitat restoration in the Delta and Suisun Marsh as well as tributary systems, and a governance and science program that would use a structured decision-making approach to guide adaptive management. Voluntary Agreements include commitments to fund and undertake new science (monitoring and research) to address hypotheses related to the efficacy of flow and habitat restoration actions, including increases in Delta outflow in March – June to benefit Covered Species. As information is gained through the VA Science Program pertaining to actions contained in the AMP, it may be used to

inform AMT discussions and recommendations and may be considered in decision-making processes of the AMSC.

The Voluntary Agreements are subject to ongoing discussion and have neither been finalized nor adopted by the State Water Resources Control Board.

c. Independent Peer Review

Independent peer review can play an important role in guiding the evaluation and response stages of the adaptive management cycle by providing unbiased, transparent reviews of the science and advice for the processes used to guide management decisions. The AMSC will oversee the use of independent peer review processes on an as-needed basis for individual adaptive management actions. The need for independent peer review may rise from a lack of consensus on the relevant science and its application to the management action, from a need for additional expertise on a specific subject matter, or when specific management actions have reached a milestone in terms of the volume of available information. In the latter situation, independent review is advisable for informing key management decisions.

Independent review may consist of letter reviews without associated formal meetings, or panel reviews in which reviewers have a public opportunity receive information from the members of the AMSC or relevant AMT in a meeting. The members of the AMSC may initiate an independent review for any adaptive management action if there is a consensus on the need for the review. The members of the AMSC can request the services of an impartial organization to facilitate the peer review process (e.g., the Delta Science Program, National Academy of Sciences, or similar organizations). In the interest of transparency, materials and recommendations from panel or letter reviews will be available publicly on agency websites. The AMSC members will encourage and support the development of peer-reviewed publications in scientific journals. Article publications, along with reports and datasets, may inform the evaluation of the adaptive management actions.

Attachments

Appendix A: Adaptive Management Program Framework and Implementation

Appendix B: Adaptive Management Actions and Programs

Appendix A: Adaptive Management Program Framework and Implementation

1 Overview

In the broadest sense, the set of decisions that collectively answer the question what is the 'best' way to operate the Central Valley Project (CVP) and State Water Project (SWP) (hereafter, Projects) is a complex series of recurring decisions based on an ever-changing knowledge base and set of socio-ecological circumstances. The decisions about how best to operate the Projects have increased in complexity over time due to a growing number of constraints on the decision space (Figure A.1). The accumulation of constraints is one 'certainty' in 'wicked problems', which are problems that morph over time and change in response to intervention (Rittel and Webber 1973; Luoma et al. 2015).

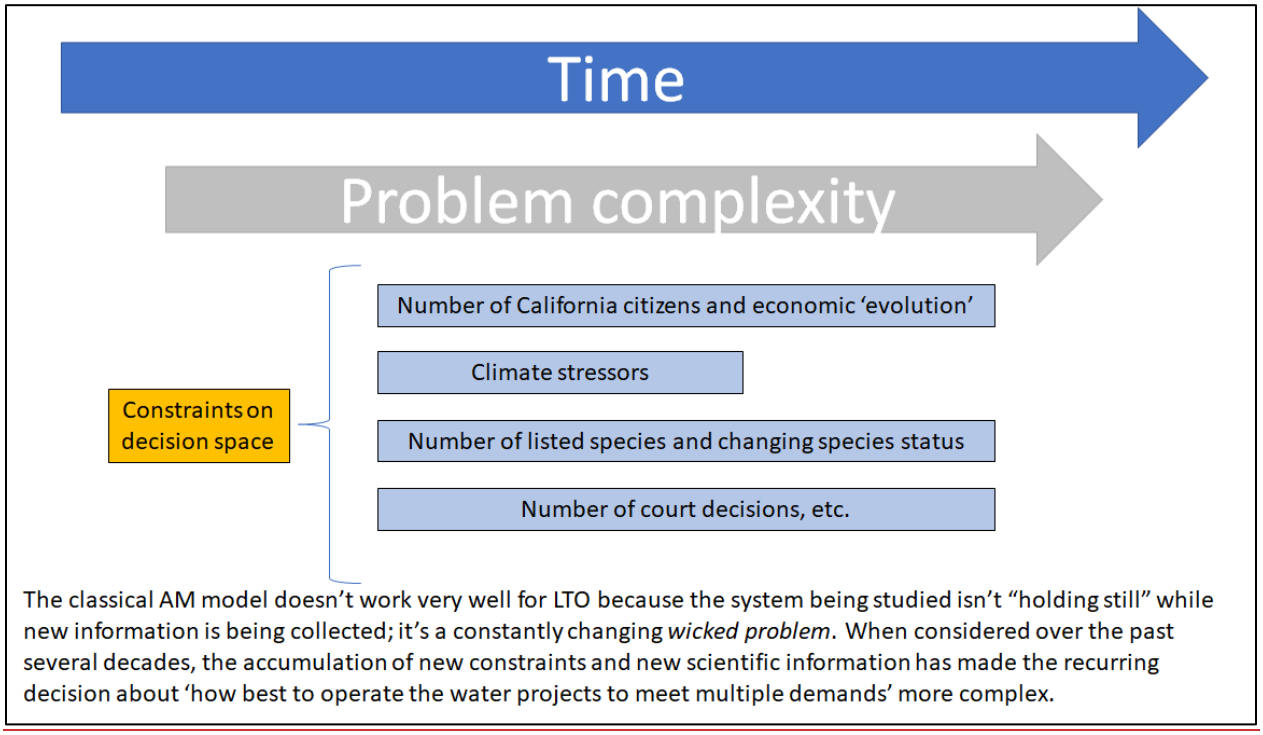

Figure A.1. Conceptual diagram of the increasing complexity of water operations consultations over time as constraints on decision space have increased.

The classical adaptive management (AM) model posed by Walters and Hilborn (1978) suggests that applying the scientific method to complex natural resource management problems is an objective way to navigate complex problems, and as such, AM has frequently been suggested as a best management practice for Project operations. However, AM as originally described does not work well in the management of systems experiencing constant change, i.e., systems that are of themselves wicked problems (DeFries and Nagendra 2017). Rather, wicked problems require a more nuanced version of 'adaptive management' that is better integrated in decision theory or structured decision-making (SDM; Figure B.2).

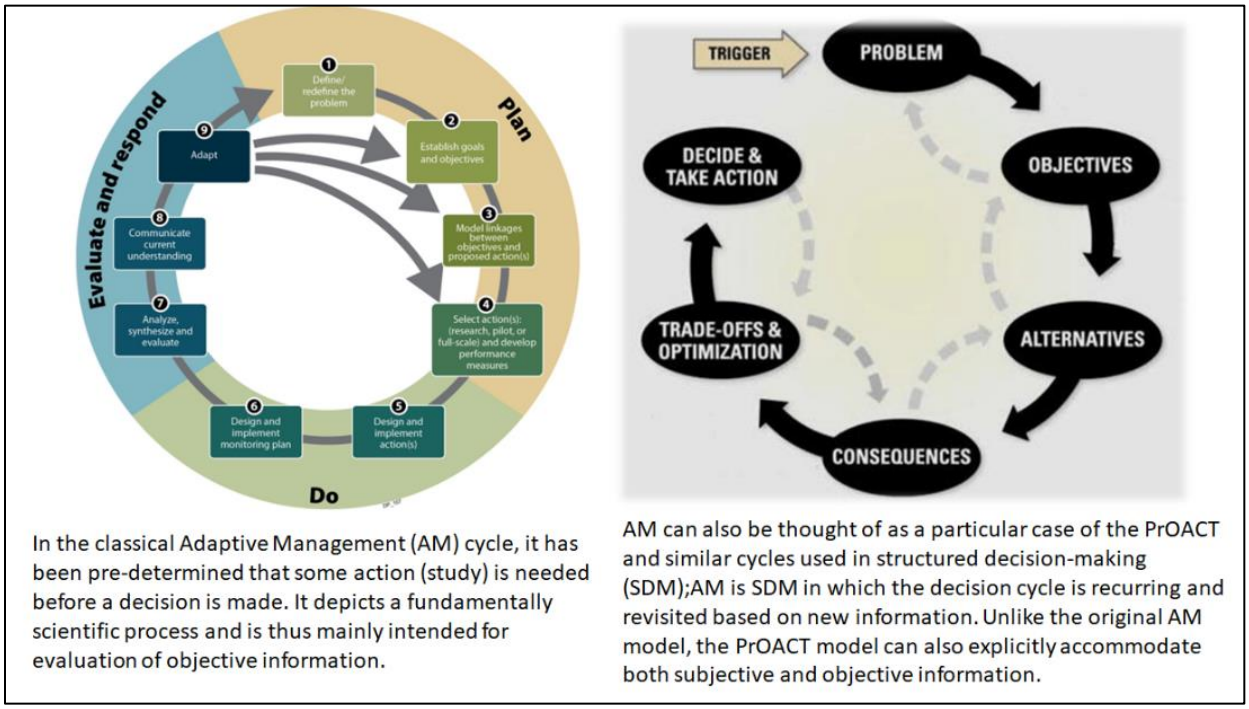

Figure A.2. Comparison of adaptive management as described by DSP (2013; derived from Walters and Hilborn (1978) and the PrOACT cycle, a variant of the general approach to structured decision-making.

The reason that SDM is needed for wicked problems is that they often do not "hold still" long enough to robustly apply scientific methods. Further, wicked problems involve subjective values dimensions that cannot be ignored. The "values" can be things like different agency perspectives on the relative importance of the objectives, or socio-political constraints on decision space (Figure A.1). SDM is a set of tools that has been developed to transparently combine objective and subjective information to make the best decision that can be made with the information available at the time. The repeated use of SDM applied to a wicked problem does not stop the problem from changing over time, but it can allow necessary adaptation as the problem develops new dimensions.

Endangered species consultations on the operation of the Projects involve navigation of an evolving social-ecological system with multiple, often competing objectives. Consultations under both ESA and CESA have been a facet of Project operations since the 1990s and are one of the drivers increasing decision complexity (Figure A.1). A conceptual model of CVP and SWP ESA/CESA consultations as a recurring decision is shown in Figure A.3. The conceptual model is superimposed on the PrOACT cycle, which is a predominant SDM framework. This is not done to imply that historical consultations have proceeded using decision analysis techniques, but rather to show how the process still has to move through the steps of a decision-analytic cycle. Here we use the word 'cycle' to describe each time a major new consultation has occurred. Several things have acted as drivers of a new consultation cycle; these are shown in yellow. In the broadest sense, the problem and the objectives do not change from cycle to cycle, but they do imply a decision involving multiple competing objectives. The Biological Assessment prepared by the US Bureau of Reclamation (Reclamation) and the incidental take permit (ITP) application prepared by the Department of Water Resources (DWR) constitute a negotiated alternative (collectively, proposed action); these documents and the resulting biological opinions issued

by the US Fish and Wildlife Service and National Marine Fisheries Service (BiOps) and ITP issued by CDFW (LTO ITP) provide the analysis of the alternative; the decision is the new BiOps and LTO ITP.

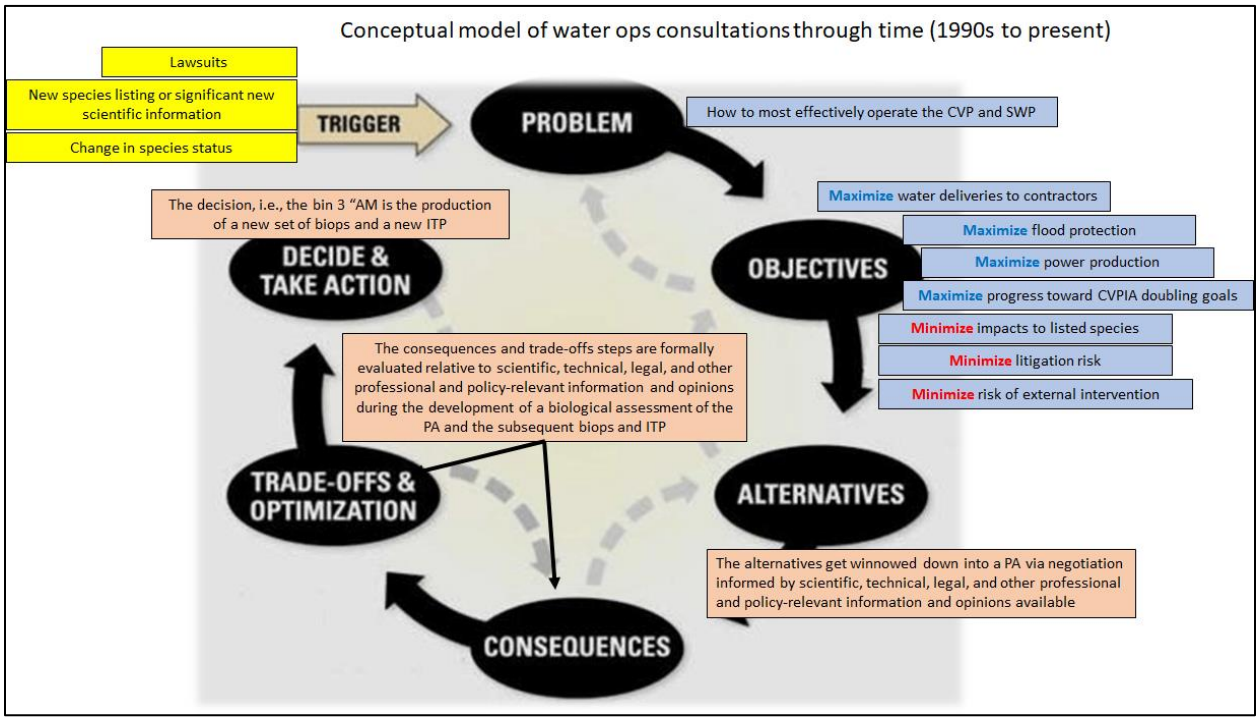

Figure A.3. Conceptual model of ESA/CESA water operations consultations as a recurring decision.

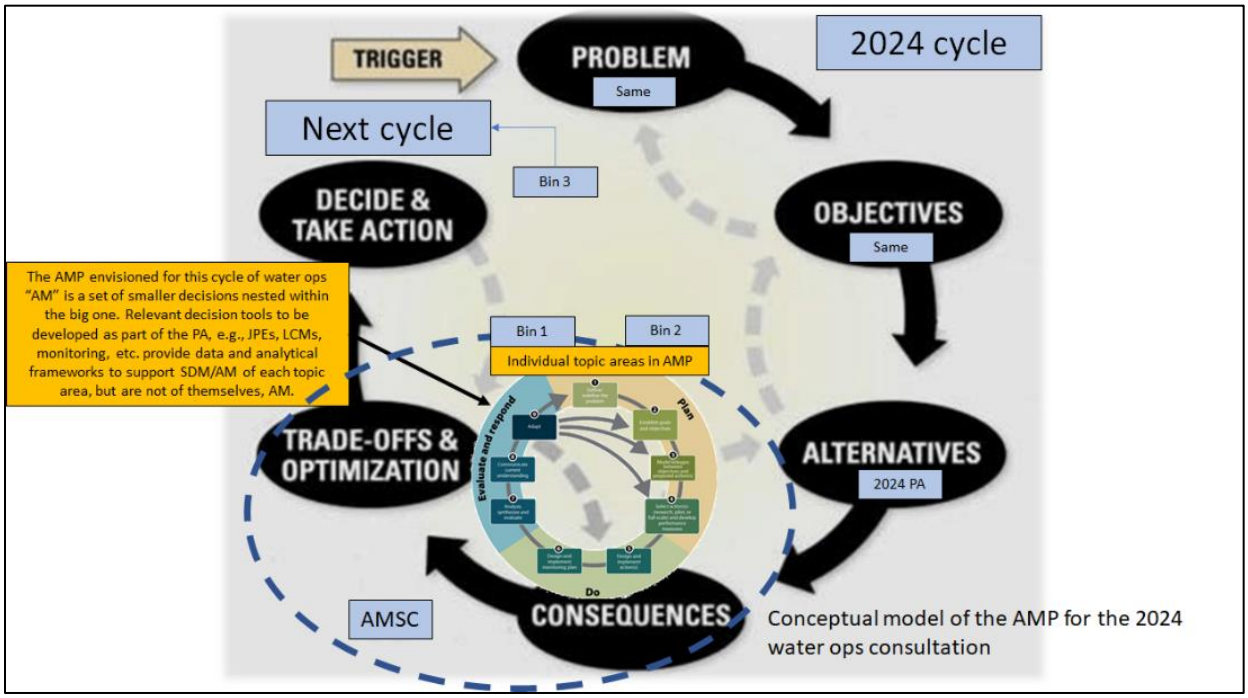

Figure A.4. Conceptual model of the Adaptive Management Program described in this appendix within the current consultation cycle. Refer to Figure A.3 for additional details.

The adaptive management framework envisioned for this cycle of water project consultations involves ongoing scientific re-evaluation of multiple topic areas that sit within the 'consequences' and 'trade-offs/optimization' steps of the current PA decision cycle (Figure A.4). The framework or 'Adaptive Management Program' (AMP) will be used for two major purposes. The first is to provide a potential path to modify water operations rules without a full new cycle (e.g. new full reinitiation of consultation or ITP development) if the existing and proposed studies, tools, and monitoring are developed and their use supports a change. The evaluation of changes that could be conducted within the current cycle are called Bin 1 and Bin 2 pathways and they are differentiated depending on their implementation timeline (see Appendix B). Bin 1 pathways may result in modifications within 3 years of issuance, while Bin 2 pathways may result in modifications but are not expected in fewer than 3 years of issuance. Bin 3 pathways are longer-term, and considerations are not expected to be complete within a single consultation cycle because they involve either or both long data evaluation timelines or substantial changes to authorized levels of listed species take. Topics in the Bin 3 category are included because they require continued data collection and analysis to inform their evaluation in the next consultation cycle.

2 AMP Framework and Implementation

The AMP will be used to evaluate and adapt the operations, actions, and related activities identified in Section 3a of the AMP and Appendix B. This evaluation will include addressing areas of known uncertainty, improving scientific understanding by filling data gaps, and weighing whether new information should be incorporated into the relevant ESA and CESA authorizations. To do so, an Adaptive Management Steering Committee (AMSC) will oversee efforts to monitor and evaluate existing operations and related activities through existing technical teams (to the maximum extent practicable), make decisions at that level, and suggest to the Directors whether modifications or alternative actions

may be warranted. The AMSC will utilize a structured decision-making process to assess the relative benefits or impacts of proposed operational changes and activities for listed species compared to what is being implemented at the time. Any proposed changes to project operations or related activities through adaptive management should provide equivalent or increased conservation benefits to the listed species.

Adaptive management typically utilizes a multi-step process. The following adaptive management framework includes elements from the Delta Plan (DSP 2013) and recommendations from the Delta Independent Science Board (2016). This framework is made up of three broad phases that are part of any scientific endeavor: (1) Plan; (2) Do; (3) Evaluate and respond. Within the phases are nine steps as represented in Figure A.2.

2.1 Phase 1: Plan

The first phase of an adaptive management process is to plan. The suite of tools to be developed and general adaptive management topics are described in Appendix B. As approved by the AMSC, Adaptive Management Teams (AMTs) will develop their own plan for each activity identified in Appendix B. Annual Presentations prepared by each AMT, as described in Section 2.3.1, will include the compilation of the individual actions covered under that AMT.

The planning process begins by clearly defining the problem or question to be addressed (*Step 1*), identifying goals and objectives (*Step 2*), and identifying the model linkages between the goals, objectives, and proposed actions (*Step 3)*. Models can be conceptual, statistical, physical, decision support, or simulation. The AMSC and its facilitator(s) will oversee steps 1 and 2, then the AMTs will take a lead role in step 3.

The proposed action, LTO ITP, and BiOps outline the problems to be addressed, the goals and objectives, and in some cases describe the conceptual linkage between the actions and the objectives. However, these steps should be formally evaluated by the AMSC and its facilitator(s) once the group is established. A list of the proposed tools to be developed as part of the AMP and the general topic areas addressed by this AMP are the subject of Appendix B; more detail about the goals, objectives, and rationale is in the text below and in the associated effects analyses of the proposed action, BiOps, and LTO ITP.

The first part of *Step 4* in the Adaptive Management cycle is to decide whether a change in an existing action(s) will be recommended based on the modeling results. The proposed action, BiOps, and LTO ITP are the starting point for AM actions. Future assessments may support keeping an action as is, or modifying it in some way. A key part of the AMP (coordinated through the AMSC) will be the development of performance metrics (response variables for each tool, study, monitoring program etc. associated with each adaptive management action) to guide the program (*Step 4*). Performance metrics would be measured utilizing a suite of activities including monitoring (long-term surveys; new measurements), experimental methods (e.g. fish enclosures), and modeling (e.g. 3-D modeling, life cycle modeling). Each operation and activity, and each adaptive management change must be accompanied by a set of criteria that the implementing entities can use to determine whether the action is having the anticipated effects.

2.1.1 Structured Decision Making

The AMSC, and associated AMTs, will utilize decision-analytic tools or a structured decision-making process to define relevant uncertainty, develop action alternatives, estimate consequences and evaluate trade-offs and preferences when making choices between alternative courses of action (e.g., *Steps 1- 4* above*)*. Structured decision-making processes can include consideration of value-based objectives and priorities as well as science-based objectives. These processes also document the basis for decisions in a transparent, organized and repeatable framework. Below provides more detailed information on examples of structured decision-making processes currently being used by technical teams and CSAMP.

Structured decision making (SDM) is a collection of practices rooted in decision theory that provides a rational, organized framework for evaluating alternatives against consistent and explicit quantifiable objectives, encourages clear articulation of anticipated effects, and transparent consideration of trade-offs and uncertainty (Figure A.5). SDM can take many forms, depending on which of the six typical steps receive greater relative emphasis. SDM can be used to help build consensus if the SDM process includes deliberation about trade-offs and this deliberation informs the development of new alternatives that better address the range of interests represented.

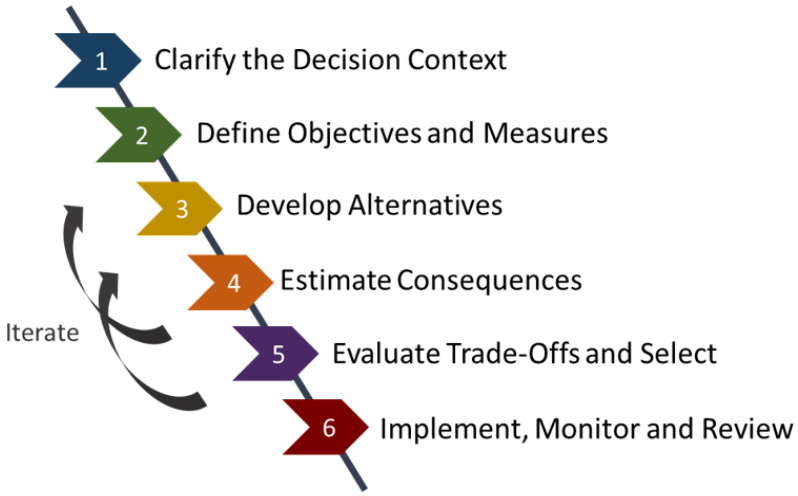

Figure A.5. Six steps of a typical SDM process (Gregory et. al. 2012).

1. Clarify the Context – The first step is to clearly establish the planning and decision-making context through answering questions such as: What decision needs to be made and who will make it? Who else needs to be involved or consulted? What is the scope and bounds of the process and the decision (e.g., what's in and what's out)? The initial structuring step lays out a road map for both the deliberations and the analysis that will follow.

2. Define Objectives and Measures – Objectives define the interests and values about the decision at hand. Measures define exactly what is meant by an objective and are used to estimate and report the predicted consequences of different alternatives for making a choice.

3. Develop Alternatives – Alternatives are the various actions or strategies that are under consideration. This step involves iteratively developing, comparing, and refining alternatives in the search for one(s) that offers the best balance across objectives.

4. Estimate Consequences – Consequences of the alternatives against each objective are estimated or characterized, including identifying uncertainties. Results are typically presented in a consequence table, which is a concise summary matrix illustrating the performance of each alternative with respect to each objective, as reported by the measures.

5. Evaluate Trade-offs and Preferences – Explicit choices must be made for preferred alternatives, based gains and losses for each objective. Each decision-maker is asked to make choices based on their own values and their understanding about the values of others. A variety of methods from the decision sciences are used to facilitate constructive deliberations about values and trade-offs and to ensure that tradeoff judgments are informed, thoughtful and transparent.

6. Decide, Monitor, and Learn – The focus at this stage of the process is on how to implement the decision in a way that reduces uncertainty, improves the quality of information for future decisions, and provides opportunities to revise and adapt based on what is learned. The SDM process should end with a formal transition into adaptive management and monitoring, and produce recommendations for the governance and oversight of monitoring programs, as well as triggers and mechanisms for review and amendment.

Example Applications of SDM

SDM is being utilized by the Delta Coordination Group (DCG) for the Summer-Fall Action. During 2022, Reclamation and DWR developed an SDM approach for informing decisions regarding the Delta Smelt summer-fall habitat actions. This modeling approach utilized existing and new modeling, data, and expert opinion on the impacts of the summer-fall habitat actions to provide information on the physical and biological consequences associated with implementing the various actions compared to a baseline of these outcomes without the summer-fall habitat actions. Through this SDM process, Reclamation and DWR also developed a multiyear monitoring and science plan that includes additional science that might be helpful to further investigate the spatial and temporal distribution of abiotic and biotic factors known to influence Delta Smelt habitat, including its food supply and access to those prey, Delta Smelt abundance, survival, and viability during the summer-fall time period.

2.2 Phase 2: Do

The ‘Do’ phase of adaptive management includes two steps that occur in parallel. The design and implementation of studies, monitoring, or modeling of actions as they are implemented with the explicit goal of improving the understanding of how strongly the action is affecting the vital rate or performance metric (*Step 5 and 6*).

Monitoring plans associated with each relevant operational or management action will include data management plans that describe the process for organizing and clearly documenting observations, including how data are collected; the methods, quality assurance, and calculations used; the temporal and spatial scales of the variables; and accurate site locations and characteristics. Monitoring must provide the data necessary to determine whether the performance metrics are responding to the management action(s). Monitoring plans may also include targeted research to better understand observed results and further resolve key uncertainties. Results of monitoring and research must be clearly communicated so that the information gathered, and current understanding, is broadly understood.

2.2.1 Work Plan and Budget

2.2.1.1 AMSC Annual Work Plan and Budget

The planning and doing outlined in phases 1 and 2 will be described in an Annual Work Plan and Annual Budget prepared by the AMSC for the upcoming year. The Annual Work Plan will describe the proposed activities of the AMP. This plan will include 1) monitoring and research that are part of the proposed action or are otherwise required by the SWP ITP, BiOps, 2) needed facilitation services to coordinate and support implementation of the AMP, and 3) any additional monitoring and research that is planned, including any relevant monitoring and research that is part of the IEP annual work plan, as approved by the AMSC. The Annual Budget will set out projected expenditures and identify the sources of funding for those expenditures. If the Annual Work Plan describes activities that span multiple years, the budget for those activities will cover the entire period they will be implemented. The AMSC will ensure the Annual Budget accurately sets forth and makes adequate provision for the implementation of the BiOps and LTO ITP terms under which the CVP and SWP operate.

At a minimum, the Annual Work Plan and Annual Budget will contain the following information:

A. A description of the planned actions under the AMP including their goals, objectives, and performance metrics.

B. A description of the planned monitoring activities and the entities that will implement those activities.

C. A description of the anticipated research to be undertaken and the entities that will conduct the studies.

D. A budget reflecting the costs of implementing the planned actions.

E. A description of the sources of funds that will be used to support the budget.

The AMSC will develop and approve the Annual Work Plan and Annual Budget with support from independent facilitators. The first Annual Work Plan and Annual Budget will be completed within the first year the AMSC begins convening, and annually thereafter. Upon approval, the Annual Work Plan will be posted on a public website.

2.2.1.2 Individual AMT Work Plans

Within twelve months of their initial meeting, each AMT will develop a work plan that describes the timeline needed to gather and/or synthesize the needed information for its purpose, all reasonable hypotheses addressed for that action, and the timeline for incorporating information into individual SDM processes. The AMSC will review the work plans for each AMT, provide direction or edits as needed, and approve the final plan when they are satisfied with it. Thereafter, each AMT will provide a presentation to the AMSC at least annually to document progress toward addressing the relevant hypotheses (see Section 2.3.1 below). The work of individual AMTs and associated annual presentations can cease if a team has achieved what it was tasked to do.

2.3 Phase 3: Evaluate and Respond

The 'evaluate and respond' phase of adaptive management includes three key steps. Analysis, synthesis, and evaluation of the action(s) (*Step 7*) are critical for improving current understanding. Analysis and synthesis will incorporate information on how conditions have changed, expectedly and unexpectedly, as a result of implementing the action(s). Because measurable improvement in conditions for covered species might not occur on short timescales, evaluations will also examine whether actions taken prevented deterioration of conditions that may have occurred if no actions were taken or if the action is resulting in species responses trending in the desired direction. The evaluation will examine whether performance metrics indicate that one or more of the objectives have been met as a result of the implemented action(s). If an objective is not met, the potential reasons why it was not met will be identified. As each year's data become available, recognizing that specific actions may not be required in that particular year or sequence of years, analyses should assess whether the probability of the desired outcome has changed and, if so, how this affects decisions about the action. Within the AMP it is anticipated that the AMTs will be primarily responsible for the "evaluation" step, while the AMSC will be primarily responsible for the "response" step.

Communication (*Step 8*) of current understanding gained through analysis, synthesis, and evaluation of implemented actions and monitoring will occur through a variety of channels including: 1) regular back and forth communication between the AMSC and AMTs via the floating facilitators, and when relevant, between the AMSC and the Directors, 2) annual presentations from each AMT to the AMSC, and 3) with interested parties external to the AMP by posting meeting notes on websites, giving presentations, preparing white paper reports, ensuring transparency of independent peer review materials and recommendations, and publication in peer reviewed scientific journals.

2.3.1 Annual Presentations by AMTs

During each implementation year, each AMT will provide at least one presentation (Annual Presentation) to the AMSC. The Annual Presentation will provide an overview of the AMT activities carried out during the previous implementation year.

Each AMT Annual Presentation will include, among other things, the following types of information:

1. An assessment of the implementation and efficacy of studies, monitoring, and modeling of actions during the prior reporting period, including new information gained.

2. Identification of tasks that have not been implemented on schedule and an explanation for the deviation from schedule. For actions that are behind schedule, a suggested schedule or process for completing them will also be included.

3. Adaptive management changes to actions resulting from the SDM process and proposed by an AMT for consideration by the AMSC, including the scientific rationale for the action.

2.3.2 Adapt

When it is informed and equipped with new results and better understanding, the AMSC will re-examine the actions it has been evaluating (e.g., see Appendix B). It is possible that revisions may be suggested when current information suggests doing so (*Step 9*). Possible adaptations could include anything from staying the course, to making a minor modification that can be made without formal changes to the

existing LTO ITP and BiOps, to considering reinitiation or an LTO ITP amendment as mechanisms to enable a new management action or paradigm to be implemented.

Decisions to adapt are anticipated to be needed at various time intervals depending on the action or environmental conditions which may delay implementation of certain actions in any particular year or series of years. Appendix B contains a description of the planned timeframe for each action that estimates when decisions regarding AMP actions may be ready to evaluate for potential changes. In general, one year's results, however anomalous, are seldom enough to demonstrate that an action should be subject to change as a part of the adaptive management process. Furthermore, when the analysis, synthesis, and evaluation of information learned from implementing an action over time indicates that no benefit accrues, resources should no longer be spent on that action no matter how popular the action might be.

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Appendix B: Adaptive Management Actions and Programs

A. Timeframe of implementation and evaluation of individual Adaptive Management Actions

Bin 1: Evaluation occurs annually - biannually by technical teams.
Actions for which agencies evaluate recent data to determine how to proceed before the action is conducted again. Refinement of the approach is expected to occur regularly based on prior data and targeted research. There is an expectation that Bin 1 Adaptive Management Actions or Programs (collectively AMAs) have defined objectives and performance metrics with associated monitoring occurring during the implementation of the action. Incidental take permit (ITP) amendment inquiries will be conducted, but an ITP amendment is not expected to be required to refine the approach to implementation after each evaluation.

Bin 1 AMAs will require components of a Structured Decision Making (SDM) process to maintain an organized approach for agency collaboration and to ensure transparency in determinations. However, Bin 1 AMAs will be managed adaptively based on present conditions, such as hydrology or annual species status, and will require quick decision-making relative to full SDM. It is not anticipated that Bin 1 AMAs will require long-term action objectives or performance measures to be determined prior to implementation nor will they require identification or evaluation of long-term alternatives. Decision support tools such as utilization of an independent facilitator and Adaptive Management Technical Team (AMT) evaluation of near-term implementation alternatives and tradeoffs will guide the Adaptive Management Steering Committee (AMSC) annual or biannual implementation action decision.

Bin 2: Evaluation and potential refinement occurs within the timeframe of the ITP.
Actions for which agencies evaluate data from multiple years of implementation. There is an expectation that coordinated science and monitoring is occurring during implementation of these actions. The evaluation may trigger an ITP amendment for the actions, or not, depending on scope and scale of recommended change.

Bin 2 will apply to those AMAs that are iterated or linked over time whereby actions taken early on may result in learning that improves management within the next 3-8 years. It is anticipated that Bin 2 AMAs have existing AMTs and/or have some understanding of action objectives and performance measures and have already undergone some evaluation of alternatives and trade-offs. However, it is acknowledged that Bin 2 AMAs may need refinement once implementation has occurred to minimize uncertainties associated with known data gaps. Independent facilitators and AMTs will utilize decision support tools to assess monitoring data obtained, evaluate updated knowledge base against action objectives and performance measures, develop and evaluate new alternatives if warranted, and present action implementation trade-offs to the AMSC for consideration.

Bin 3: Evaluation and potential refinement occurs in a longer timeframe on the order of 10 – 15 years and may inform the development of the next ITP for long-term SWP operations.
Actions for which agencies evaluate data over longer periods of implementation, on the order of 10-15 years. There is no expectation of an ongoing evaluation to occur during the time period of the ITP for long-term operations of the State Water Project (SWP). However, there is an expectation that science and monitoring is occurring during the timeframe of the ITP to support evaluation and refinement during the development of the next ITP.

Bin 3 AMAs may have complex objectives, unknown alternatives, significant uncertainty in outcomes, and/or large data gaps. These AMAs require a full SDM process whereby qualified and independent facilitators will guide the AMSC and associated AMTs and utilize decision-analytic tools or a structured decision-making process to define relevant uncertainty, develop action alternatives, estimate expected consequences of the alternatives, and evaluate trade-offs and preferences when making choices between alternative courses of action. It is anticipated that Bin 3 AMAs will require substantial time to plan, evaluate, and implement to facilitate learning opportunities for future action management.

Some AMAs may have components that fall in different Bins. For example, some AMAs in Bins 1 and 2 may yield the development of a decision support tool for use in an AMA in Bin 3 during future consultation. Therefore, it is important all AMAs use components of structured decision-making and apply a consistent and coordinated approach to monitoring performance metrics identified so that results from various AMAs can be comprehensively evaluated when related.

B. Adaptive Management Actions

1) Winter-run Old and Middle River Flows Management
   a) *Brief Description:* Onramping and offramping Old and Middle River Flows (OMR) management for winter-run Chinook Salmon is currently informed by the Salmon Monitoring Team (SaMT). The SaMT is a technical advisory team made up of technical staff from the US Bureau of Reclamation (Reclamation), the Department of Water Resources (DWR), the National Marine Fisheries Service (NMFS), the California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (SWRCB) that synthesizes recent field monitoring data and historical long-term monitoring data, along with expert opinion to inform the Water Operation Management Team (WOMT). Specifically, the SaMT will evaluate real-time data, including the Salmonid Distribution Table, and the weekly loss threshold table, which classifies the winter-run Chinook salmon population as the percent in the Delta. This information is used to implement the winter-run weekly loss thresholds and to minimize the effects of water operations on winter-run Chinook Salmon.

      ITP Conditions of Approval 8.4.3 and 8.4.4 (Proposed Action (PA) Sections 3.7.4.1 and 3.7.4.5.3) describe the use of winter-run Chinook Salmon weekly and annual loss thresholds to trigger actions aimed to minimize entrainment and loss of juvenile out-migrants. However, it is anticipated that the criteria associated with the Winter-Run Chinook Salmon Machine Learning Model will need to be reassessed using the genetics-based run-identification loss dataset currently available as described in ITP Conditions of Approval 7.9.2 (PA Section 3.7.4.1) and a larger effort to develop a real-time assessment tool for the SaMT to recommend OMR management actions to minimize entrainment into the south Delta well before salvage events occur.

   b) *Assigned AM Bin:* **Bin 2**
      i. The development of a model explicitly predicting daily winter-run Chinook Salmon migration timing using historical long-term monitoring data and environmental variables is necessary to reduce uncertainty in the weekly Salmonid Distribution Table and the estimated percent of winter-run present in the Delta. This model needs to be made readily available as a transparent prediction tool that leverages recent biotic and abiotic data to predict current and near-future migration timing and provided to the SaMT to

inform their discussions prior to WOMT. This effort should be completed and implemented no later than 2026.

ii. The previous winter-run Chinook salmon machine learning (WRCML) effort was developed using length-at-date classified winter-run Chinook salmon (WRC). However, a >10-year dataset of genetically classified WRC has been compiled since the onset of the original WRCML effort. A revised WRCML model incorporating these genetic data is to be developed based on the framework used during the development the existing WRCML model. Specifically, a new WRCML model will be developed using biotic and abiotic variables upstream of the south Delta to predict salvage one or more weeks prior to salvage occurring. This new model shall be used as a real-time assessment tool to recommend OMR/export management actions to minimize entrainment into the south Delta well before salvage events occur to prevent surpassing critical WRC salvage thresholds.

c) *Adaptive Management Technical Team:* The existing Winter-run Chinook Machine Learning Interagency Team will lead analysis and development of all winter-run Chinook salmon OMR management sub-actions in coordination with other interested agencies and stakeholders. Specific work pertaining to this action should be conducted by the current Winter-run Chinook Machine Learning Interagency Team. The team has welcomed input from a diverse array of agency and stakeholder representatives since its inception to provide critical guidance throughout model development and interpretation. This role would continue with the addition of SDM processes as needed.

d) *Tools:* Winter-Run Chinook Salmon Machine Learning Model

2) Spring-run OMR Management

1) *Brief description*: Spring-run OMR Management, Science, and Monitoring: ITP Conditions of Approval 7.9.3, 7.9.4, 8.4.5 and 8.4.6 and Section 3.9.2 of the Proposed Action describes an approach to minimize impacts of SWP and CVP operations in the South Delta on Sacramento River origin spring-run Chinook Salmon that relies on detection of hatchery-origin Chinook Salmon (spring-, fall-, and late fall-run) in salvage at the SWP and CVP facilities as surrogates for entrainment of natural-origin spring-run in the Central and South Delta. While implementing the Spring-run Hatchery Surrogate measure a parallel effort is ongoing to develop an annual Spring-run Juvenile Production Estimate (JPE) (ITP Condition of Approval 7.9.3 and PA Section 3.9.2). ITP Condition of Approval 7.9.3 and PA Section 3.9.2 describe the timeline for initial program development (interim monitoring, special studies, and development of the JPE database and model) and the intention to utilize independent peer reviews. The Spring-run JPE Core Team is also responsible for evaluating the existing Spring-run Hatchery Surrogate measure (ITP Condition of Approval 7.9.3). Recommendations from these reviews will inform considerations for future reinitiation of consultation and ITP amendments with NMFS and CDFW. A subsequent independent peer review will be considered to continue to evaluate monitoring and special study data available through implementation of the Spring-run JPE as well as the initial Spring-run Lifecycle Model.

2) *Assigned AM Bin*: **Bin 2**
Development of an interim Spring-run JPE is ongoing and independent peer reviews of the Spring-run JPE program will be considered in the near-term. Additionally, the Spring-run JPE Core Team is tasked with reviewing the Spring-run Hatchery Surrogate measure (ITP Condition of Approval 7.9.3 and PA Special Studies Section) in early 2025.

3) *Adaptive Management Technical Team*: The Spring-run JPE Core Team is responsible for implementing the Spring-run JPE program, and collaborating with the AMSC to charter independent peer review panels when initiated, and evaluating the Spring-run Hatchery Surrogate measure. After these reviews DWR and Reclamation will continue to convene the Spring-run JPE Core Team and subteams in coordination with CDFW, NMFS, and the US Fish and Wildlife Service (USFWS), and support implementation of the Spring-run JPE Science Plan, the Spring-run JPE Monitoring Plan, the Spring-run JPE Race ID Program Development Plan, the Spring-run JPE Data Management Strategy, and updates to those plans.

4) *Tools:* The Spring-run JPE and the Spring-run Lifecycle Model are key tools needed to reduce uncertainty regarding the timing and abundance of young-of-year and yearling life stages entering the Delta from the Sacramento River and assess impacts of a variety of stressors on spring-run Chinook Salmon.

3) Larval and Juvenile Delta Smelt OMR Management

a. *Brief Description:* The Larval and Juvenile Delta Smelt Protection Action in Chapter 3 of the ITP Application describes an approach to minimize the impacts of the SWP and CVP operations in the south Delta on larval and juvenile Delta Smelt that relies on the collection of Secchi depth data by field surveys. While this metric of water clarity is based upon the best available science, it is anticipated that an evaluation of turbidity data from telemetered water quality stations across the south and central Delta could yield a trigger that would be more responsive to real-time conditions and would eliminate the need for field crews to conduct additional Secchi depth surveys when data is needed more frequently than biweekly. The turbidity-based trigger level will be as close as is feasible to matching the existing Secchi depth trigger of 1 meter, including using multiple turbidity stations to match the geographic scope of the 12 stations used for the Secchi depth trigger.

b. *Assigned Adaptive Management Bin:* **Bin 2**

Development of a turbidity-based trigger to replace the Secchi depth trigger will be considered in the near term.

c. *Adaptive Management Technical Team:* A team of technical staff from CDFW, USFWS, DWR, and Reclamation will convene to discuss analytical approaches to developing a turbidity-based trigger that provides the same level of minimization as the Secchi depth trigger.

d. *Tools:* The Delta Smelt Life Cycle Model informed the development of the Secchi depth trigger and may be used to evaluate a turbidity-based trigger.

4) Larval and Juvenile Longfin Smelt OMR Management

    a. *Brief Description:* The Larval and Juvenile Longfin Smelt Protection Action in Chapter 3 of the ITP Application describes an approach to minimize the impacts of the SWP and CVP operations in the south Delta on larval and juvenile Longfin Smelt that relies on paired real-time hydrologic and monitoring triggers. While these OMR management triggers are designed to provide entrainment minimization for larval and juvenile Longfin Smelt, the inclusion of new monitoring data and quantitative tools could provide further evaluation of environmental and monitoring data that could potentially yield an action that would be more responsive to real-time conditions and be more effective at minimizing entrainment.

    b. *Assigned Adaptive Management Bin:* **Bin 2**

    Development of a new OMR management trigger will be considered in the near term.

    c. *Adaptive Management Technical Team:* A team of technical staff from CDFW, USFWS, DWR, and Reclamation will convene to discuss analytical approaches to analyzing water quality, hydrologic, and distribution data to inform the creation of a new trigger framework initiating OMR management.

    d. *Tools:* Available water quality, hydrologic, and fish monitoring datasets will be analyzed, as well as relevant flow and particle tracking models, as appropriate. New Longfin Smelt life cycle model tools will be utilized, as available.

5) Summer-Fall Habitat Action for Delta Smelt

To study habitat effects on Delta Smelt survival and evaluate effectiveness of mitigation actions in improving habitat and food availability, DWR and Reclamation have proposed the Summer Fall-Habitat Action (SFHA). The SFHA includes, but is not limited to, the actions described below. The Summer Fall Planning Group (SFPG) will a) develop a research plan for testing key mechanisms underlying the findings of the USFWS Delta Smelt Life Cycle Model and b) conduct reviews of findings resulting from prior Summer-Fall Habitat Action reports specific to Fall X2. The Delta Coordination Group (DCG) will a) develop a multi-year science and monitoring plan for the Summer-Fall Habitat Action including focused studies and b) conduct reviews of action plans and seasonal action results to inform future Suisun Marsh Salinity Control Gate operations or improvements to science and monitoring to inform uncertainties in evaluation specific to Suisun Marsh Salinity Control Gate. The DCG will utilize project-specific and technical teams for coordination on the adaptive management framework as described in the AMP. Specific adaptive management plans for the Summer-Fall Habitat Actions will be reviewed by the AMT (where applicable), and coordination with the AMT may differ for actions based on assignment of AM bins.

Fall X2

a) *Brief Description:* To increase the amount of low-salinity zone habitat for Delta Smelt in wet and above normal hydrologic year types, DWR will maintain a 30-day average X2 ≤ 80 km from September 1 through October 31.

    In 2012, USFWS initiated the development of several life cycle modeling efforts to better understand the factors that affect Delta Smelt population growth rates. These efforts led to two published life cycle models. The results of these life cycle model variations support the hypothesis that Delta outflow in the summer has a stronger effect on Delta Smelt survival than

Delta outflow in the fall. The best information currently available suggests that high summer flows help align habitat needs of Delta Smelt in the Suisun Marsh and Suisun Bay region, including turbidity and water temperature, while also increasing food subsidies, supporting Delta Smelt growth and survival. The same outcome is expected if flows are high enough in the fall, but the response of Delta Smelt is expected to be less, because ambient air temperatures cool into more appropriate ranges and the prey subsidy is reduced as prey populations seasonally senesce. These changes in fall habitat conditions are expected to occur part way through the September – November time period considered in the Delta Smelt lifecycle models. This newer information merits a robust synthesis effort to bring together available modeling tools, including the Delta Smelt lifecycle model, and monitoring data.

b) *Assigned AM Bin:* **Bin 1**
While science and monitoring in the summer and fall will occur each year (during implementation and non-implementation years), evaluation of the Fall X2 action will occur on a shorter timeframe, after multiple years of implementation since its inception in 2008. No later than January 2026 DWR and CDFW will initiate a structured decision making (SDM) planning process in the SFPG to develop a research plan for testing key mechanisms underlying the findings of the USFWS Delta Smelt Life Cycle Model and findings resulting from prior Summer-Fall Habitat Action reports. The goal of this SDM effort will be to identify key research questions that will be prioritized and implemented starting in water year 2026. Results of this research will be used to support the development of the Summer-Fall Habitat Action Plan each year, starting in water year 2026.

c) *Adaptive Management Technical Team:* The Summer Fall Planning Group (SFPG), in collaboration with SFPG technical teams, will be responsible for developing a research plan for testing key mechanisms underlying the findings of the USFWS Delta Smelt Life Cycle Model and findings resulting from prior Summer-Fall Habitat Action reports including describing AM objectives, hypotheses, and performance metrics for evaluation.

Suisun Marsh Salinity Control Gate

a) *Brief Description:* To improve Delta Smelt habitat in Suisun Marsh and Grizzly Bay during summer-fall, Suisun Marsh Salinity Control Gates (SMSCG) will be operated as described in ITP Condition of Approval 9.1.3 and the PA to maximize the number of days at Belden's Landing where the 3-day average of salinity is equal or less than 4 psu during Above Normal and Below Normal years and 6 psu in Dry years with the goal of maximizing the amount of suitable habitat available to Delta Smelt in Suisun Marsh and Grizzly Bay.

b) *Assigned AM Bin:* **Bin 3**
While science and monitoring will occur each year (during implementation and non-implementation years), evaluation of SMSCG operation efficacy will occur on a longer timeframe after multiple years of implementation across a range of hydrologic conditions, within 10-15 years. The AMT will work with described technical teams to review monitoring plans and focused research as needed within the larger SDM process. They may recommend an independent workshop or review of the action following sufficient implementation and monitoring for a robust evaluation.

c) *Adaptive Management Technical Team:* The Delta Coordination Group (DCG), in collaboration with DCG technical teams (Science and Monitoring Workgroup and Hydrology and Operations

Workgroup) will be responsible for developing adaptive management plans specific to the SMSCG action including describing AM objectives, hypotheses, and performance metrics for evaluation.

Experimental Food Enhancement Actions

a) *Brief Description:* Each year food subsidy measures to augment the SFHA will be considered. Food actions may include a number of implementation alternatives (e.g., water source, timing, intensity, etc.) which have been evaluated by the Delta Coordination Group (DCG) to inform future implementation plans. Food subsidy actions are hypothesized to increase localized prey availability for Delta Smelt in the North Delta and Suisun Marsh, resulting in opportunities for higher growth and survival of juvenile and sub-adult life stages. Food actions include North Delta Food Subsidy Action, Managed Wetland reoperation in Suisun Marsh, and Sacramento Deepwater Ship Channel Food Subsidy Action.

b) *Assigned AM Bin:* **Bin 2**
Following multiple years of implementation, data collection, and results, the DCG may suggest convening an independent workshop or review panel within the timeframe of the consultation and ITP. Results will be included in seasonal reporting and adaptive management reviews to evaluate the science and monitoring, efficacy of actions, hypothetical alternative strategies and/or actions, and potential inclusion of food subsidy actions as potential permanent action elements of the SFHA, or if appropriate, termination of actions deemed ineffective by the AMSC.

c) *Adaptive Management Technical Team:* Food subsidy action plans, monitoring plans, focused research and reports will be developed by the DCG, in collaboration with DCG technical teams (Science and Monitoring Workgroup and Hydrology and Operations Workgroup). Together, teams will be responsible for developing adaptive management plans specific to food actions including describing objectives, hypotheses, performance metrics for evaluation, and timeline.

6) Tidal Habitat Restoration Effectiveness for Smelt Fishes

a) *Brief Description:* DWR and Reclamation propose to carry forward habitat restoration acre targets identified from the 2008 and 2019 FWS Biological Opinions (8,000 acres) and the 2020 ITP (396.3 acres) to complete mitigation requirements for Delta Smelt and Longfin Smelt (per the 2020 ITP). DWR and Reclamation propose to meet the total acreage requirement (8,396.3 acres) through completion of habitat restoration projects. The projects identified in the PA are in different phases of completion: 1) constructed (3,584 acres), 2), in construction (3,490 acres) or 3) planned (1,662 acres). All identified restoration projects are located in the northern arc of the upper estuary and are designed to enhance food production and rearing habitat for Delta Smelt and Longfin Smelt (per the 2020 ITP). DWR and Reclamation will complete its 8,396.3 acre restoration requirements by 2026.

b) *Assigned AM Bin:* **Bins 1 and 3**
Bin 1*:* Some actions involving treatment or clearing of invasive vegetation, use or presence of livestock, or other land management actions will be evaluated on an annual or biannual basis. These evaluations may inform revisions to site-specific Long-term Management Plans, which are required of DWR and Reclamation as part of the mitigation.

Bin *3:* To understand the effectiveness of tidal wetland restoration for providing a food subsidy for pelagic areas to benefit Delta Smelt as well as juvenile rearing habitat for Chinook Salmon, monitoring occurring as part of the DWR-CDFW Fish Restoration Program will continue throughout the permitted period. Monitoring will allow assessment of the biotic and abiotic capacity of restored tidal wetlands to support listed fish species, the opportunity for fish to access wetland-derived resources, and actual use of those resources. Reference wetlands will continue to be monitored concurrently to account for dynamic regional conditions that also impact restored habitats. Following multiple years of monitoring and targeted studies to address specific uncertainties regarding effectiveness of tidal wetland restoration, such as the ability of restoration locations to provide food resources to Delta Smelt at critical times of the year, observations of Delta Smelt or juvenile Chinook Salmon occupying restoration sites or utilizing restored resources, and retrospective evaluation of the tidal marsh restoration site quality and or effectiveness relative to targets identified, the AMSC will provide guidance to the AMT in prioritizing data and information for synthesis work. Syntheses for understanding efficacy of tidal wetland restoration may regard food subsidy, effects of restoration on water quality, prevalence of invasive aquatic vegetation, utilization of restored habitat by Delta Smelt and listed salmonids, as well as evaluations of site design and local geomorphology on tidal wetland function as a food web subsidy. Based on the data resources and information available, the AMT may recommend that an independent workshop or peer review panel be convened to assist with evaluation and collecting lessons learned. Information gathered through syntheses, workshops, and/or independent review panels will be used to inform future tidal wetland restoration designs and future reinitiation of consultation for the SWP and CVP with USFWS and NMFS and ITP amendments for the SWP with CDFW.

c) *Adaptive Management Technical Teams:*

i. DWR and CDFW will lead evaluations of land management actions to inform and develop changes to site specific Long-term Management Plans based on information gained through evaluation of specific management practices and will coordinate accordingly with Reclamation, USFWS and NMFS on plan revisions.

ii. An inter-agency technical team composed of scientists from DWR, Reclamation, CDFW, USFWS, and state and federal water contracting entities, as well as any consultants contracted for focused research on specific uncertainties regarding tidal wetland restoration will be responsible for data analyses and synthesis work. This team will work with the AMSC to prioritize data analyses that are responsive to specific hypotheses regarding tidal wetland restoration effectiveness as a food subsidy and juvenile salmon rearing habitat. At milestones for analysis and reporting of special studies or multi-year syntheses, the inter-agency technical team will present its findings to the Interagency Ecological Program's Tidal Wetland Project Work Team, which is an open and collaborative venue for exchange of scientific ideas and information.

7) Tributary Habitat Restoration Effectiveness for Salmonid Fishes

a) *Brief Description:* The Upper Sacramento River Anadromous Fish Habitat Restoration Project Monitoring Plan and Protocols (2017) are designed to determine the effectiveness of the Upper Sacramento River Anadromous Fish Habitat Restoration Project (referred to Project henceforth) in meeting identified objectives and to validate the linkage between restoration actions and the biologic response to those actions. This monitoring plan follows the framework for detecting biological responses to flow management described by Souchon et al. (2008). Monitoring

methods structured as field protocols are described in the Plan and Protocols including control site selection, longitudinal profile and cross sections, juvenile habitat mapping protocols, snorkel survey protocols, seining, enclosure studies, invertebrate drift sampling, redd surveys, and stream temperatures.

b) *Assigned AM Bins:* ***Bin 1 and 3***
Bin 1: Some actions involving annual land management practices will be evaluated on an annual or biannual basis. These evaluations may inform revisions to site-specific Long-term Management Plans, which are required of DWR and Reclamation as part of the mitigation.

Bin 3: Monitoring and targeted studies to address specific uncertainties regarding effectiveness of tributary habitat restoration inform the Science Integration Team's decision support models. The AMT will review recommendations from decision support models to assess critical uncertainties to understand the effectiveness of tributary habitat restoration in providing spawning and refuge habitat to benefit Chinook Salmon, monitoring occurring as part of the Anadromous Fish Habitat Restoration Program throughout the permitted period.

c) *Adaptive Management Technical Team:* The existing CVPIA Upper Sacramento River Habitat Restoration Technical Team includes Reclamation, USFWS, NMFS, CDFW, consultants (e.g., Chico State University, PSMFC), and recipients of competitive funding for habitat restoration will be utilized as the AMT for this action.

8) Shasta Spring Pulse Studies

a) Brief Description: Reclamation will release up to 150 thousand acre feet (TAF) in pulse flow(s) each water year to benefit Chinook Salmon in the Sacramento River watershed. In 2021, a multi-year Upper Sacramento River Spring Pulse Flow Study Plan was developed by Reclamation in coordination with CDFW, USFWS, NMFS, SWRCB, UCSC, and SRSC. The timing, magnitude, duration, and frequency of the pulse flows will be evaluated and refined by the Sacramento River Group (SRG) on an annual basis and with the intent of maximizing multi-species benefits, which may include coordinating timing of pulse flows with natural flow events and/or pulse flows in tributaries. The pulse flow schedule will be planned by the agencies and stakeholders in the SRG and implemented annually by Reclamation. Reclamation will reduce the volume of a pulse flow, not release a pulse flow, or apply the water to another purpose only if CDFW, NMFS, or USFWS determines that these alternatives will be more beneficial to fish species. CDFW or NMFS would consider reducing the volume of a pulse flow or not releasing a pulse flow if, for example:

i. the releases would increase the forecasted winter-run Chinook Salmon mean annual temperature dependent mortality (TDM) by 10% or more, or

ii. the 150 TAF pulse flow volume (regardless of when it is released) would decrease the forecasted end of April Shasta storage to below 2.2 MAF using the February 90% exceedance forecast.

b) Assigned AM Bin: **Bins 2 and 3**

Bin 2: Hindcast evaluation of action effectiveness that includes technical review of the functional elements of the pulse flow (i.e., timing, magnitude, duration, and frequency) as well as an evaluation of criteria used to support beneficial use decisions.

Bin 3: If Bin 2 evaluations indicate a set of triggers and or the timing and magnitude of spring pulse flows are beyond what was considered in the Proposed Action or review of conditions, triggers, and effects after multiple years of implementation across a range of hydrologic conditions determines there is new understanding and/or information that is significantly different from what was applied to the effects analysis at the time of ESA consultation initiation. Reviews will also provide an opportunity to consider refined understanding and potential applications to other tributaries, divisions, or systems.

c) *Adaptive Management Technical Team:*

Bin 2 responsibilities would be assigned to the SRG.

Bin 3 responsibilities would be assigned to the SRG, SHOT, and the AMSC.

9) Winter-run Chinook Salmon Through-Delta Survival and Salvage Thresholds

a) *Brief Description:* There is considerable uncertainty surrounding the implications of facility loss of juvenile Sacramento River winter-run Chinook Salmon at CVP and SWP facilities for through-Delta survival in the Central Valley Bay-Delta. Juvenile salmon through-Delta survival, as measured at Chipps Island (Delta exit), accounts for route-specific survival and migration routing through different migratory pathways. Field and modeling studies will address these uncertainties by conducting the following analyses: 1) an acoustic receiver network and associated real-time modeling of the data, 2) targeted acoustic telemetry studies (i.e., tag fish and release them in the Delta, 3) retrospective analyses of data to evaluate through-Delta survival due to LTO operations, 4) incorporation and consideration of any additional routing and survival data obtained, 5) evaluation of the sensitivity of winter-run Chinook Salmon population dynamics, relative to recovery and viability criteria, to through-Delta survival using lifecycle modeling, and 6) analyses of the relationship between loss at facilities and broader Delta conditions using a combination of particle tracking models. Several lifecycle models, including simplified simulation-based approaches, the CVPIA SIT DSM, and the SWFSC Winter-run Chinook Salmon Lifecycle Model, may be considered to evaluate winter-run Chinook Salmon population responses to varying Delta conditions and identify a target Delta survival. We propose using multiple particle tracking models (e.g., PTM, ecoPTM, ePTM), with competing tradeoffs related to ease of implementation and assumptions about particle movement and mortality, to assess relationships between loss at facilities and Delta survival.

b) *Assigned AM Bin:* **Bin 2**
Studies will be completed to address uncertainties in the estimation of through-Delta survival. These newly generated modeling results will be used to propose and update decision support tools for juvenile Chinook Salmon related to outmigration survival and entrainment risk and may change the triggers for export reductions. This work may be of interest to independent review panels. New information and its application may inform future reinitiation of consultation and ITP amendments.

c) *Adaptive Management Technical Team:* This work has been of interest to the Science Integration Team (SIT), which has identified these studies as critical for reducing uncertainty in entrainment risk management. Field coordination and implementation of these studies has

occurred through the Interagency Telemetry Advisory Group (ITAG) since 2018. Technical review may occur through the SIT and/or ITAG.

10) Longfin Smelt Science Plan Actions
    a) *Brief Description:* ITP Condition of Approval 7.8.1 and the Special Studies Section of the Proposed Action describes the continued implementation of the Longfin Smelt Science Program and updating its science plan. The science plan is a roadmap for addressing substantial gaps in our understanding of the biology and ecology of Longfin Smelt, which include management activities needed to prevent further decline of the species within the San Francisco Estuary. To accomplish this, the Longfin Smelt Technical Team (LFSTT) will continue to develop and support the ongoing activities of the Longfin Smelt Science Program. These activities will address one or more of the seven Priority Areas of the science plan and are expected to produce valuable information for resource managers. These Priority Areas are: 1) continued development of the Longfin Smelt lifecycle model, 2) providing input and guidance for the Longfin Smelt culture program, 3) improved distribution monitoring, 4) improved larval entrainment monitoring, 5) improved understanding of spawning and rearing habitat, 6) understanding migration and movement behaviors, and 7) factors which affect abundance, growth, and survival. Findings from the scientific activities conducted within the program will inform considerations for future consultations and ITPs. However, if new information pertinent to real-time operations for Longfin Smelt entrainment or if LFSTT provides other information relevant to management actions for Longfin Smelt during the term of the BiOp or ITP, trigger re-initiation of consultation or an ITP amendment for the actions.

    b) *Assigned AM Bin:* **Bin 2**
    A Longfin Smelt Science Plan has been developed and implementation of high priority individual science actions has begun. Actions already underway include development of a Longfin Smelt lifecycle model, establishing Longfin Smelt in culture, and improved distribution monitoring. The LFSTT has prioritized science actions to allow for sequenced implementation and completion over the course of the next eight years. As a result, actions will be ready for evaluation and be available to inform development of a subsequent permit/consultation.

    c) *Adaptive Management Technical Team:* The Longfin Smelt Technical Team (LFSTT) would be assigned all responsibilities for guiding implementation of each Longfin Smelt Science Action identified in the Longfin Smelt Science Plan. The LFSTT is co-lead by DWR and CDFW and includes representatives from USFWS, Reclamation, and the State/Federal Water Contractors.

11) Delta Smelt Supplementation
    a) Brief Description: DWR and Reclamation propose to support continued experimental releases and the development of a program to conduct supplementation of the wild Delta Smelt population with propagated fish consistent with USFWS' Supplementation Strategy (USFWS 2020). Reclamation and DWR will ensure production ramps up to a minimum of 125,000 fish by water year 2024, a minimum of 150,000 fish by water year 2025, a minimum of 250,000 fish by water year 2029 and a minimum of 500,000 fish by water year 2034 that are at least 200 days post-hatch (dph) or equivalent as informed by CDFW and USFWS. USFWS and CDFW, in coordination with Reclamation and DWR, will update the Supplementation Strategy to incorporate new findings from the program and update performance metrics used to guide production targets and methods development.

b) *Assigned AM Bin:* **Bins 1 and 2**

Bin 1: A process to evaluate production targets to support supplementation will be developed and implemented no less than annually via the existing Culture and Supplementation of Smelt (CASS) Steering Committee. Outcomes of the review may include but are not limited to revisions of production numbers, timeline, release methods, monitoring, and genetic management strategies. These findings will be incorporated into the Supplementation Strategy and will serve as guidance for the program.

Bin 2: Additionally, an independent peer review of the program may be conducted on a 5-year basis at the discretion of the AMSC.

c) *Adaptive Management Technical Team:* The CASS group was created in 2019 and is comprised of participants from Reclamation, DWR, CDFW, and USFWS. This body provides oversight in advancing science-based management activities to secure and stabilize the Delta Smelt population through a coordinated propagation and supplementation program. The CASS Steering Committee shall continue to provide guidance to its three working groups: 1) Captive Propagation Working Group, 2) Research Working Group, and 3) Regulatory Working Group. The CASS Steering Committee may be integrated into the AMSC following formation of the AMSC.

12) Steelhead JPE

a) *Brief description*: Reclamation proposes to develop a steelhead JPE for tributaries with CVP facilities that will focus on the annual production of outmigrating juvenile steelhead. Data used in the JPE will inform the status and trends of Sacramento and San Joaquin basin steelhead and may also help inform actions that will increase steelhead abundance and improve steelhead survival through the Delta.

b) *Assigned AM Bin*: **Bin 2**
Reclamation and DWR propose to conduct the first four-year independent panel review (2024) from data generated from the Stanislaus River steelhead life-cycle monitoring program. Beginning Fall 2025 and based upon incorporated 2024 review panel feedback and recommendations, Reclamation and DWR will work with the technical team to consider implementing an expanded JPE framework to the San Joaquin and Sacramento basins. By Summer 2026, Reclamation and DWR will decide to address deficiencies in the JPE framework and/or expand the JPE framework to remaining CVP or SWP tributaries. Reclamation and DWR propose to conduct the second four-year independent panel review (2028) from data generated from the San Joaquin and Sacramento basins JPE.

c) *Adaptive Management Technical Team*: Reclamation and DWR, in coordination with USFWS, NMFS, CDFW, and interested stakeholders will create or use an existing technical team should one be later identified to develop the steelhead JPE framework and incorporate feedback from the 2024 and 2028 panel reviews.

13) Alternative Salmonid Loss Estimation Pilot Study

a) *Brief description*: DWR, in coordination with Reclamation, has completed a draft updated Alternative Loss Equation (ALE-22) software tool for estimating winter-run and spring-run

Chinook Salmon and Central Valley steelhead losses at the SWP and CVP export facilities. DWR, in coordination with Reclamation and the Alternative Loss Equation Technical Team (ALE-TT), a proposed new sub-team of the Central Valley Fish Facilities Review Team (CVFFRT), will further refine the parameters of this tool by developing an Alternative Loss Pilot Study Implementation Plan (ALPS-IP) to implement this tool in parallel with current loss estimation methods and incorporate SDM to prioritize the implementation of loss component studies and performance evaluation studies. The goal of this pilot study is to provide a more accurate estimates of salmonid loss, and loss parameters, at the SWP and CVP export facilities while understanding the utility of the new alternative method relative to the existing method.

b) Assigned AM Bin: **Bin 2**

Within the first year of the effective date of the ROD or ITP, DWR, in collaboration with Reclamation, will convene the ALE-TT and conduct a knowledge transfer and methods workshop for the ALE-22 tool and prepare a draft ALPS-IP for ALE-TT review. Within the second year of the effective date of the ROD or ITP, DWR will submit the final draft ALPS-IP for both the ALE-TT and AMSC review. DWR will finalize the ALPS-IP once approved by the AMSC and establish priorities for implementation (e.g., loss parameter studies) using SDM within the ALE-TT. The ALE-TT may utilize an independent science panel review to further enhance the SDM prioritization process. In the third year of the effective date of the ROD or ITP, DWR will submit prioritized ALPS-IP recommendations, informed by the ALE-TT SDM process, to the AMSC for approval. The permittee shall then update the loss equation with refinement to the loss equation components as approved by CDFW.

c) Adaptive Management Technical Team:

i. Knowledge transfer and methods workshop: DWR and Reclamation will convene the ALE-TT, with membership comprised of DWR, Reclamation, CDFW, USFWS, NMFS, and State/Federal Water Contractors representatives, as well as other interested stakeholders.

ii. Review of the initial draft ALPS-IP: ALE-TT

iii. Review of the final draft ALPS-IP: ALE-TT, AMSC, as well as input from the CVFFRT and Salmonid Monitoring Team (SaMT)

iv. SDM Prioritization of ALPS-IP: ALE-TT, with support from an independent review panel if requested.

14) Shasta Cold Water Pool Management

a) Brief Description: Reclamation will operate Shasta Reservoir to build a cold-water pool and use the Temperature Control Device (TCD) on Shasta Dam to blend water from different reservoir strata to protect downstream winter-run Chinook Salmon returning adults and incubating eggs from temperature stressors. An annual operation of the Shasta TCD and the development of the temperature management plan will be developed as part of real-time operations. Shasta Reservoir cold water pool management will rely on an objectives-based management framework adapted from the multi-year drought sequence experienced in Victoria, Australia (Mount et al. 2016) that considers the available hydrology to “Protect,” “Maintain,” “Recover,” and “Enhance,” protected species, habitats, and water deliveries. An initial set of objectives and

metrics will be further refined according to increased understanding of species needs, interannual hydrologic conditions (e.g., drought) and operational limitations.

b) Assigned AM Bin: **Bin 2**
Hindcast evaluation of action effectiveness that includes a review of the objectives and metrics used to guide annual temperature planning. Objective-based storage targets and temperature dependent mortality will be considered with regards to their ability to support species viability and water delivery performance.

c) *Adaptive Management Technical Team:* Evaluation of action effectiveness and objective-based criteria would be assigned to the SRG.

15) Georgiana Slough Salmonid Migratory Barrier Effectiveness for salmonid fishes

a) Brief Description: DWR in coordination with Reclamation will continue to seasonally install and operate a salmonid migratory barrier at Georgiana Slough each year to reduce entrainment into the Central and South Delta of emigrating juvenile salmonids. Operation of the salmonid migratory barrier should improve the seasonally averaged through-Delta survival probability to Chipps Island compared with survival probability if the salmonid barrier were not in operation. Barrier operations and monitoring details are defined in the Georgiana Slough Salmonid Migratory Barrier (GSSMB) Operations and Monitoring Plans developed by the GSSMB Coordination Group. To further maximize seasonal survival benefits to migrating salmonids, DWR and Reclamation will continue leading the GSSMB Coordination Group, with membership comprised of DWR, Reclamation, CDFW, USFWS, NMFS, and State/Federal Water Contractors representatives. DWR and Reclamation, working with the GSSMB Coordination Group, will provide at least a triennial report and review and update, as necessary, the GSSMB Operations and Monitoring Plans.

b) Assigned AM Bin: **Bin 2**
Triennial report of GSSMB operations and monitoring that can be used to inform necessary changes/updates to the Operations and Monitoring Plans.

c) Adaptive Management Technical Team: Triennial report and updating the GSSMB Operations and Management Plan would be assigned to the GSSMB Coordination Group.

16) Spring Outflow

a) *Brief Description:* Reclamation and DWR will supplement Delta outflow during spring months per the terms of the Voluntary Agreements (VAs) as described in the March 2022 Voluntary Agreement Term Sheet, revised in November 2022. Actions that will support the additional Delta outflow include Reclamation and DWR south of Delta export modifications, Reclamation reoperating upstream reservoirs to advance and allow for scheduling of water made available by contractors in CVP watersheds and passing Delta inflow from water made available by VA Parties. In the latter case, spring flow pulses on VA tributary systems (Sacramento, American, Feather, Mokelumne, Yuba, and Tuolumne rivers and Putah Creek) are intended to benefit juvenile Chinook Salmon growth and survival in the tributaries while also contributing to increased Delta outflows. The increased Delta outflows are intended to benefit Chinook Salmon outmigration survival in the Delta and enhance habitat for native estuarine fishes, including Delta Smelt and Longfin Smelt. The amount of supplemental Delta outflows will vary by water

year type, with 750 – 825 TAF provided in Dry, Below Normal, and Above Normal years, and approximately 150 TAF provided in Critical and Wet years. The supplemental flows will occur during the months of March through May and prioritized during the period of April 1 – May 31. The details of flow amounts by source and water year type are provided in ITP Condition of Approval 8.12.2 and the PA and in the November 2022 revision of the March 2022 Voluntary Agreement Term Sheet. Supplemental spring Delta outflows are proposed as part of a path of implementation for an updated SWRCB Bay-Delta Water Quality Control Plan. In advance of the SWRCB's decision regarding the VA proposal, the supplemental Delta outflows will occur as an early implementation action and continue if and when the SWRCB incorporates the VA actions into an updated Water Quality Control Plan. During implementation, supplemental spring flows will be managed by real-time operation groups to determine the source, schedule, and amount of water to ensure consistency with proposed flow levels as described in the Voluntary Agreement Term Sheet.

b) *Assigned AM Bin:* **Bin 3**
For a synthetic, multi-year evaluation of the performance of increased spring Delta outflows to inform the next reinitiation of consultation for long-term operations of the SWP and CVP and development of a California Endangered Species Act ITP.

c) *Adaptive Management Technical Team:* The Voluntary Agreement Science Committee (VASC) is facilitated by an independent third party and is comprised of scientists and science managers from DWR, Reclamation, CDFW, NMFS, USFWS, and the Public Water Agency organizations of the VA Parties, with staff from the SWRCB participating in an advisory capacity. The Voluntary Agreement Term Sheet includes provisions for a VA Science Program to support adaptive management of VA actions, including increased spring flows on tributaries and Delta outflow. The VASC intends to use quantitative decision-support tools (e.g., lifecycle models for Chinook Salmon) and SDM processes to provide recommendations to the VA Program's decision-making body, the Systemwide Governance Committee. To support the VA program's adaptive management process, the VASC has developed a draft VA Science Plan, which contains hypotheses, metrics, and baselines for evaluating increased spring Delta outflows and pulse flows on tributaries. The draft VA Science Plan thus provides a framework for a multi-year evaluation of whether supplemental spring flows are performing according to expectations and will inform the SWRCB evaluation of the VA Program in Years 6 – 8 of the program, including how and whether the VA Program should continue after Year 8. The VASC will support adaptive management of spring outflows for the Biological Opinion by providing the multi-year, synthetic evaluation developed for the VA Program to the AMSC to inform future major reinitiation of consultation and ITP amendments.

17) Clear Creek

a) Brief Description: A draft proposal from Reclamation for long term Clear Creek/Whiskeytown Reservoir operations includes a novel approach to exerting desirable intra-annual flow variability. A draft new flow regime would implement variable flows over the course of a year that would range from flow releases as low as 100 cfs in late summer, adapting flow needs during spring-run Chinook Salmon spawning/the onset of fall-run spawning in September/October, and (ultimately) slowly ramping up to 300 cfs in the winter when fry could benefit from seasonally inundated surfaces, then ramping back down to 100 cfs the following summer to start again. This flow variability will create a more natural seasonally variable hydrograph and is expected to provide opportunity for gravel augmentation or other restoration

to target surface elevations and channel form for seasonal inundation to benefit salmon rearing. There are expected benefits and potential consequences from these changes. Continuation of existing, and some proposed, monitoring efforts including but not limited to RBFWO maintained temperature loggers, Potential Spawning Area Mapping (PSAM), Spawn Area Mapping (SAM), rotary screw trapping, spawning surveys, snorkel surveys, video weir, redd mapping, and proposed habitat monitoring will be important for evaluation of these management actions.

b) Assigned AM Bin: **Bin 2**

An adaptive management and monitoring approach to the new flow regime and/or temperature criteria will be useful for determining if the flow variability indeed provides viable opportunity to contribute to restoring channel form and floodplain elevations to targeting rearing habitat and improved growth and survival for juvenile salmon, and for guiding adjustments to flow and temperature criteria if necessary. It is anticipated that adaptive management refinements would occur at approximately three-year intervals, although more frequent refinements may be necessary in the first few years of implementing the new flow regime.

c) Adaptive Management Technical Team: Field coordination and implementation of monitoring studies would occur though the existing Clear Creek Technical Team (CCTT) work team. The CCTT, with representatives from Reclamation, USFWS, NMFS, DWR, CDFW and others, provides Central Valley Operations with an annual pulse flow and temperature management proposal. This proposal details the CCTT's request for pulse flow releases from Whiskeytown Dam (e.g., flow schedule, ramping rates, peak flow) and water temperature management, as well as background information on fish monitoring and proposal rationale. It is anticipated that the CCTT will continue to provide annual proposals and that they will include details on how best to implement the variable flow regime and meet water temperature criteria. Additionally, the CCTT is anticipated to review outcomes of the flow regime and make suggestions to improve future management actions for the benefit of fish and wildlife on Clear Creek. Additionally, the CCTT provides Reclamation with an annual summary of management activities on Clear Creek. These reports highlight the past water year's conditions, management actions and results, habitat restoration projects, fisheries monitoring data, and the CCTT's meeting discussions. It is anticipated that these annual summaries will continue to provide evaluations and potential refinements for future year's implementation of flow and temperature management.