State and Federal Principals Joint Recommendations Regarding Key Elements of the Bay Delta Conservation Plan

This Working Draft Document describes a set of joint recommendations by State and Federal Principals regarding key elements of the Bay Delta Conservation Plan, as well as other actions needed to achieve the two coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.

State and Federal Bay Delta Conservation Plan Principals providing these recommendations include high ranking officials from the following agencies:

California	Natural Resources Agency; Department of Water Resources; and Department of Fish and Game
Federal	Department of the Interior; Department of Commerce; Bureau of Reclamation; Fish and Wildlife Service; and National Marine Fisheries Service

These recommendations are being provided to Governor Jerry Brown, Interior Secretary Ken Salazar and Under Secretary of Commerce for Oceans and Atmosphere Jane Lubchenco for their consideration in crafting a proposed Bay Delta Conservation Plan project.

During the course of the last six years, much progress has been made in developing the science and the dialogue necessary to make key decisions concerning the Bay Delta Conservation Plan. Despite that progress, it has been clear that previous preliminary proposals were not likely to satisfy the statutory requirements necessary for securing permits. Simply put, a new Bay Delta Conservation Plan framework is needed in order to be successful in this effort.

The recommendations that follow describe key elements of a proposed project that can be successful, and address the urgent change that is needed for the benefit of the Delta and all Californians. Of course, the recommendations and subsequent specific proposal for the Bay Delta Conservation Plan, as well as alternatives, will be subject to further in-depth analysis, public comment, and ongoing review and refinement under applicable State and Federal law. Final decisions will be made only at the end of the review process, anticipated in 2013.

BDCP Program Elements

July 16, 2012

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Governance Structure, Roles & Responsibilities

Background

California law declares that the basic goal of the state for the Delta is the following: achieve the two coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.

To meet the co-equal goals of water supply reliability and ecosystem restoration, the Bay Delta Conservation Plan (BDCP) proposes major physical changes to the Delta, including new diversion and conveyance facilities and their operational criteria, extensive new aquatic habitat, and other measures to help reverse the Delta's ecological decline and secure water supplies for human use. This combination of actions is intended to bring additional flexibility to state and federal water project operators and fish and wildlife agencies in meeting the co-equal goals. Implementation of the Bay Delta Conservation Plan will require significant investments by water users benefiting from improvements to water supply security, as well as public contributions to actions to promote species recovery in the Delta.

While the broad potential benefits of these measures are supported by the best available scientific data and other information, a degree of uncertainty remains about the level and quality of biological response to these actions and the effects of various stressors on covered species over time. To address this uncertainty, the Bay Delta Conservation Plan will include a robust scientific research, monitoring and adaptive management program. This key program feature is widely considered necessary to achieve the State of California's co-equal goals.

Moreover, the Bay Delta Conservation Plan area itself encompasses numerous land uses of statewide and local importance, supporting flood protection, a vital local agricultural economy, recreational opportunities, and rural communities with rich heritage. Many of the actions described in the Bay Delta Conservation Plan, habitat restoration in particular, are defined to meet broad biological goals and objectives over time, but are flexible enough to be able to respond to future conditions and new information and to accommodate future land use changes in the Delta.

Guiding Principles

The implementation structure is designed to ensure that sufficient institutional expertise, capacity, resources, and focus are brought to bear to accomplish the goals and objectives of the Bay Delta Conservation Plan, that the entities receiving regulatory authorizations are accountable to those agencies granting the regulatory authorizations, and that the decision-

making process regarding the implementation of the Bay Delta Conservation Plan is transparent and understandable to the public.

The Bay Delta Conservation Plan implementation structure will help ensure effective and efficient implementation and ongoing compliance with provisions of the Bay Delta Conservation Plan and its associated regulatory authorizations. This implementation approach will also facilitate the clear delineation of roles and responsibilities among the public and private entities participating in the process and help define the nature of their engagement. See Exhibit 1 for additional details regarding roles and responsibilities.

This approach reflects the commitment to maintain and encourage ongoing collaboration among the range of stakeholders with interests in the Delta, and to facilitate adaptive and responsive plan implementation guided by new information and scientific understanding.

Description of Structure, Roles & Responsibilities

There are three main areas of Bay Delta Conservation Plan implementation: program management, science and adaptive management, and water operations. An Implementation Office will be established and administered by a Program Manager who will hire staff, develop proposed budgets and work plans, manage implementation of conservation measures (except for water operations), manage expenditures, and contract for services. For those activities involving non-delegable functions under federal law (such as water operations, water contracting, procurement, and relevant administration), the Program Manager will coordinate with the appropriate designated federal officials for implementation. Four discrete entities that reflect the scope of their authorities, expertise, and interest in the Bay Delta Conservation Plan will provide varying degrees of input and decision-making to the Implementation Office. These entities and their authorities are described below.

Permit Oversight Group (POG) – This group will consist of the Director of the California Department of Fish and Game (DFG) and the Regional Directors of the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) or their designees. The Permit Oversight Group will provide input into multiple program management, science and adaptive management, and water operations decisions. It will have final authority to approve plan amendments submitted by the permit holder(s); approve a change to a biological objective or adaptive management problem statement (see Adaptive Management Process – Step 1 below); approve monitoring and research plans (spanning several adaptive management steps below); and initiate science review and select panel members (both independent and internal). The Permit Oversight Group will also have final authority to determine compliance with permit terms and approve a change to a conservation measure

(both water operations and non-water operations) as determined by the adaptive management process and approve changes to water operations in real-time for covered species consistent with the flexibility provided for in the annual plan for water operations.

Authorized Entity Group (AEG) – This group will consist of the Director of the California Department of Water Resources (DWR), Regional Director of the U.S. Bureau of Reclamation (Reclamation), and, if they are granted permittee status, a representative of the Public Water Agencies. The Authorized Entity Group will be the primary entity responsible for program management and implementation of the Bay Delta Conservation Plan. It will provide input into science, adaptive management, and water operations decisions. It will have final authority, with input from the Permit Oversight Group, to select a Program Manager; oversee and administer funding and resources; oversee and implement conservation measures; implement outreach and compliance monitoring and reporting requirements; and prepare annual reports. For those activities involving non-delegable functions under federal law (such as water operations, water contracting, procurement, and relevant administration), the Program Manager will coordinate with the appropriate designated federal officials for implementation. The Program Manager, with input from the Permit Oversight Group, will have authority to select a Science Manager.

Adaptive Management Team (AMT) — This group will consist of representatives from California Department of Fish and Game, National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Water Resources, U.S. Bureau of Reclamation, Public Water Agencies, Interagency Ecological Program, Delta Science Panel, and up to two scientific experts affiliated with external stakeholder groups such as non-governmental organizations and academic communities. The Adaptive Management Team will be run by the Science Manager as a collaborative, consensus-based process. It will develop, manage, and oversee the monitoring and research program, science review process, and adaptive management program. If consensus is not reached, the Permit Oversight Group will work with the Authorized Entity Group to resolve issues. The Permit Oversight Group retains final authority, subject to a dispute resolution process described below.

Nine Steps of the Adaptive Management Process

1. Define/redefine the problem
2. Establish/recognize biological goals and objectives
3. Model linkages between objectives and proposed actions
4. Select and prioritize conservation measures and develop performance measures
5. Design and implement conservation measures
6. Design and implement monitoring and research plans
7. Analyze, synthesize and evaluate monitoring and research results
8. Communicate current understanding

9. Decide what actions, models, goals objectives, or problems (if any) need to be revised

Stakeholder Council – Convened at least quarterly, this group will consist of approximately 40 stakeholders and will have primary input into program oversight, administration, funding and resources; implementation of conservation measures (except water operations); and implementation of outreach, compliance monitoring and reporting requirements. Together with the Permit Oversight Group and Authorized Entity Group, the Stakeholder Council will provide input into the annual work plan, annual reports, and plan amendments. It will also provide input into all aspects of adaptive management and the annual water operations plan. At a minimum, representatives from the following entities will be invited to be a member of the Stakeholder Council:

- Bay Delta Conservation Plan Program Manager
- Representatives of California Department of Water Resources and the U.S. Bureau of Reclamation
- Representatives of the State and Federal Contractors Water Agency
- Representatives of Other Authorized Entities
- Representatives of U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game
- Representatives of other State and federal regulatory agencies, including the Army Corps of Engineers, the U.S. Environmental Protection Agency, and State Water Resources Control Board
- A representative of the Delta Stewardship Council
- A representative of the Delta Protection Commission
- A representative of the Delta Conservancy
- A representative of the Central Valley Flood Protection Board
- Representatives of the counties of San Joaquin, Sacramento, Solano, Yolo, and Contra Costa

Additional members will be selected from the following categories by the Secretary of the California Natural Resources Agency, in consultation with the directors of the relevant departments comprising the Agency, such as California Department of Water Resources and California Department of Fish and Game. The public may submit nominations to the Secretary for these additional members. Each member will serve a term of four years, and may be reappointed without limit and may serve until such time as they are replaced.

- At least three representatives from conservation groups with expertise in fish and wildlife management and/or the management of aquatic habitats and other natural lands

- At least three representatives of local government agencies within the Delta
- At least one representative of fishing organizations
- At least one representative of hunting organizations
- At least one representative of recreational organizations
- At least two representatives of delta reclamation districts
- At least two representatives of Delta agriculture
- At least three scientists with expertise in the management of natural lands, and native plant and animal species
- At least one representative of water agencies located in the Sacramento valley
- At least one representative of water agencies in the San Joaquin River watershed
- Other stakeholders whose assistance will increase the likelihood of the success of plan implementation, including delta civic organizations and members of the general public

Other Relevant Information

Dispute Resolution Process

The parties to the permit shall establish informal and formal dispute resolution procedures between them. In the event a dispute is not resolved at a working level, the issue would be elevated, in an orderly and timely manner, to the Regional Director of U.S. Fish and Wildlife Service, the Regional Administrator of National Marine Fisheries Service, the Director of California Department of Fish and Game, the Director of California Department of Water Resources, and the Regional Director of the U.S. Bureau of Reclamation.

In the event that the dispute of a continuing significant issue cannot be resolved, the issue in dispute will be elevated to the highest ranking responsible official, be it a federal or State cabinet-level official or their designee (i.e., the Departments of Commerce and/or the Interior), and/or the California governor or his/her designee, for their consideration.

The detailed implementation of the dispute resolution process is a high priority for all parties and will be completed in advance of the draft proposal for public review.

EXHIBIT 1: BDCP GOVERNANCE DECISION-MAKING TABLE

Decision	Who has input	Who makes decision and is there midlevel elevation if no consensus?	Who has final authority
PROGRAM MANAGEMENT			
Selection of Program Manager	POG consult and participate in interviews	AEG	AEG
Selection of Science Manager	POG consult and participate in interviews	Program Manager	Program Manager
Oversight and administration of program funding and resources	Stakeholder Council	Program Manager and Designated Federal Representative (if involving federal funding/contracting)	AEG; Reclamation Regional Director if involving federal funding/contracting
Oversight and implementation of conservation measures (except water operations)	Stakeholder Council	Program Manager	AEG
Implementation of outreach, compliance monitoring and reporting requirements	Stakeholder Council	Program Manager	AEG
Annual Work Plan (check Chapter 6)	AEG, POG agencies, Stakeholder Council	AEG, with prior POG approval of relevant components (adaptive management, annual operations plan, research and monitoring plan, etc.) Designated Federal Representative	AEG; Reclamation Regional Director for CVP
Annual Reports	POG, AEG, Stakeholder Council input	Program Manager	AEG (POG accepts annual reports)
Input into and approval of BDCP plan amendments	Program Manager, AEG, POG, Stakeholder Council	AEG decision to submit plan amendment for POG approval	POG
SCIENCE AND ADAPTIVE MANAGEMENT			
Adaptive management change to a conservation measure (both water operations and non-water)	Members of Adaptive Management Team (AMT), Independent review panel, Stakeholder Council	Led by Science Manager in a collaborative consensus-based process, AMT makes decisions and/or recommendations based on scientific, budget and schedule factors. If there is consensus by the AMT on the decision or recommendation, it is forwarded by the PM to the AEG/POG for concurrence.	Regional director of relevant federal fish agency and DFG director. (written concurrence needed); If project operations, (Regional) Director of relevant Project agency has final say that operation is within their authority

Decision	Who has input	Who makes decision and is there midlevel elevation if no consensus?	Who has final authority
		If not consensus, it is elevated by the PM to the AEG/POG to decide.	
Change to a biological objective or adaptive management "problem statement" (Adaptive Management step #1)	Members of Adaptive Management Team (AMT), Independent review panel, Stakeholder Council	Same as above	See Note 7
Monitoring and research plans (spans several adaptive management steps)	AEG, POG agencies, DSP, IEP, Stakeholder Council	Same as above	POG
Science Review initiation and panel selection (independent and internal)	Members of AMT, Stakeholder Council	Same as above	POG
WATER OPERATIONS			
Annual Water Operations Plan	DWR/BR with POG, Program Manager and AMT, Stakeholder Council	DWR, Reclamation, DFG, FWS, NMFS	DWR and Reclamation; requires written concurrence of POG
Real time operations for covered species	DWR, BOR, FWS, NMFS, DFG, including real-time technical teams in current BiOps	DWR, Reclamation, DFG, FWS and NMFS	Regional director of relevant fish agency (Regional) Director of relevant Project Agency has final say that operation is in their authority

NOTES:

1. AEG is Authorized Entity Group and consists of Director of DWR, Regional Director of Bureau of Reclamation, and Public Water Agencies representative.
2. POG is Permit Oversight Group and consists of Director of DFG, Regional Administrators of NMFS and FWS.
3. AMT is Chaired by the BDCP Science Manager and includes management representatives of DFG, FWS, NMFS, DWR, Reclamation, IEP Lead Scientist, DSP rep, SFWCA Science Manager, Director NOAA Southwest Science Center, and NGO-designated lead scientist. This is a non-voting group consensus-based group and the Chair will seek the appropriate balance of membership. Most of the work may be done by sub-teams chartered for specific technical issues. These sub-groups could have even broader membership. A FACA charter is probably needed.
4. The Program Manager carries forward decisions made by the AMT, and elevates issues to the POG/AEG as necessary.
5. All decisions are subject to a general dispute resolution procedure which starts with regional director, and goes up the chain as necessary to Secretary and Governor.

6. Chapter 3 breaks the adaptive management process into 9 steps provided for in the draft Delta Plan. Chapter 3 provides who has primary leadership within the AMT for each of the 9 steps. [Chapter 3.6, containing the 9 steps, is currently in revision.]
7. The agencies agree that the Biological Goals and Objectives established for BDCP will be a foundational element for directing program implementation. Because of this significance, it is imperative for both the AEG and POG to be in agreement on any changes to the Biological Goals and Objectives made over the term of the permit. Therefore, as the description of the proposed Governance for BDCP is refined, it will be clarified that the POG will not be authorized to make unilateral decisions regarding changes to the Biological Goals and Objectives.

Bay Delta Collaborative Science Process

The Bay Delta Conservation Plan proposes a collaborative science program that is broadly inclusive, independent, competent, timely and unbiased. Four steps are envisioned: (1) identify the research to be conducted, (2) conduct the research, (3) validate the data and conclusions resulting from research and (4) identify new areas of scientific inquiry.

Identify Research to be Conducted

The Bay Delta Conservation Plan will utilize a Common Framework for Scientific Research to identify the areas of scientific research necessary to meet the co-equal goals of water supply reliability and ecosystem restoration. This broadly inclusive process will solicit input from regulated agencies (California Department of Water Resources and U.S. Bureau of Reclamation), resource agencies (California Department of Fish and Game, National Marine Fisheries Service and U.S. Fish and Wildlife Service, public water agencies, environmental non-government organizations, other water interests (e.g. Delta counties), the Environmental Protection Agency and the State Water Resources Control Board.

This initial step is intended to be a highly collaborative process in which an area of uncertainty or disagreement is identified for which a hypothesis can be tested through scientific research. In order to make such a determination, the following questions will need to be addressed. Can research be designed that will address the question or hypothesis? Is the research logistically and economically feasible? Will the research be timely? What is the likelihood that the research will produce results that can be statistically assessed? What data is to be collected? What conclusions are expected to result from the data that is collected?

Long-term research concerning the environment and the species should provide data to better inform future management and regulatory decisions. However, discussions continue on the scope of what should be included in the Common Framework for Scientific Research. Discussion includes questions such as: Is collaborative agreement needed to set priorities for all future science in the Bay Delta, or just the science that will address controversial issues? Does ongoing long-term monitoring of abundance and distribution of a species need to be part of the agreement process? Is an independent body – perhaps as part of the Interagency Ecological Program process – needed to independently set priorities for needed research?

Only a small percentage of research in the Bay Delta is controversial. The “fall X2” is an often used example. There is considerable difference of opinion on the extent to which a “fall X2” is needed. This is critical research and probably little disagreement exists that this research should be a high priority.

Additionally, a first step that should be undertaken is to review and compile a tally of research and monitoring activities currently being conducted in the Bay Delta and the status of that research to ensure research is not duplicated.

Conduct the Research

Independent, competent scientific panels could be used within the existing Interagency Environmental Program process to assess the following: (1) identify the most qualified researchers or integrated research team; and (2) identify the research methods, to include data collection and statistical methods, to be used in analysis. An independent party may be needed to monitor research to ensure the timely reporting of results. Final funding could be contingent on publication of results.

Validate the Research

An independent body, such as the Delta Science Program or the National Research Council would evaluate the research results to check for the following: Did the research address the research question or hypothesis? Were data collected in a valid manner? Were data correctly analyzed? Were the data interpreted in an unbiased fashion?

Utilizing research results is often a major area of controversy among the parties being regulated and the agencies doing the regulating. An independent body such as the Delta Independent Science Board would advise to ensure that application of the research results is within appropriate bounds, that results are being correctly interpreted and application of the conclusions is reasonable. Research does not answer management questions; it only informs management decisions.

Identify New Areas of Research

Good science always uncovers new questions to be addressed, initiating a new round of scientific inquiry.

Collaborative Science Process and Adaptive Management

The Bay Delta Conservation Plan adaptive management program will be the mechanism for achieving the collaborative Bay Delta science process. The Bay Delta Conservation Plan Adaptive Management Team will consist of representatives from California Department of Fish and Game, National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Water Resources, U.S. Bureau of Reclamation, Public Water Agencies, Interagency Environmental Program, Delta Science Panel, and up to two scientific experts affiliated with external stakeholder groups such as the NGO and academic communities.

The Adaptive Management Team will be chaired by the Science Manager as a collaborative, consensus-based process. The Adaptive Management Team will develop, manage, and oversee the monitoring and research program, science review process, and adaptive management program for Bay Delta Conservation Plan. It will make recommendations for adaptive management changes to Bay Delta Conservation Plan conservation measures and biological objectives as appropriate.

Biological Goals and Objectives

Background

Science-based, clearly articulated biological goals and objectives are the fundamental expression of the Bay Delta Conservation Plan's ecosystem restoration goal, one of California's co-equal goals for the managing the Delta mandated by the Delta Reform Act of 2009. As a Habitat Conservation Plan under the federal Endangered Species Act and Natural Communities Conservation Plan Act under California law, the Bay Delta Conservation Plan includes biological goals and objectives for the ecosystem as a whole, natural communities, and individual species. At each of these levels, biological goals articulate the broad, intended outcomes of the Bay Delta Conservation Plan. Biological objectives are more specific, measurable outcomes that are expected to be achieved by the Bay Delta Conservation Plan. Conservation measures are designed to achieve the biological objectives and will directly or indirectly contribute to achieving one or more of the broader biological goals. The Bay Delta Conservation Plan includes a total of 214 biological goals and objectives for the Bay Delta Conservation Plan's 59 covered fish and terrestrial species, their habitats, and the Delta ecosystem.

In April 2011, the Delta Science Program convened a group of independent science advisors on behalf of Bay Delta Conservation Plan to assess the availability of scientific data for, and help complete, goals and objectives for covered fish species. The independent science advisors presented their findings and recommendations in June of 2011. Based on these recommendations and ongoing discussions with agency and external technical experts, Bay Delta Conservation Plan biological goals and objectives are being developed for the Bay Delta Conservation Plan's 11 covered fish species. Some of the targets in the biological objectives are expressed as a population metric such as species growth or survival. This approach, recommended by the science advisors, addresses important uncertainties related to the efficacy of the conservation measures for the covered fish. Biological objectives with specific population metrics are being developed to ensure that they can be measured accurately and achieved by factors within the control of the Bay Delta Conservation Plan. Factors beyond the control of Bay Delta Conservation Plan will be monitored to determine their effect on the ability of Bay Delta Conservation Plan to reach its goals and objectives. The Bay Delta Conservation Plan's ability to meet each biological objective for covered fish will be evaluated in Chapter 5 of the Bay Delta Conservation Plan, the Effects Analysis.

Guiding Principles

1. The Bay Delta Conservation Plan will establish biological goals and objectives for covered species that are intended to be achieved through Plan implementation.

2. Biological objectives may or may not be permit conditions. Achievement of certain biological objectives may be permit conditions in the context of the adaptive management program for certain conservation measures. Those objectives that may be permit conditions are those that are both achievable by the permittee and essential for agency findings.
3. Biological goals and objectives for covered fish will be stated as desired outcomes such as targeted increases in growth rates, survival, population size, or habitat extent. Biological goals and objectives for other covered species will be stated as desired outcomes for species habitat amount or condition.
4. Biological goals for covered fish will be expressed as broad biological outcomes associated with population viability criteria such as targeted improvements in population size, productivity, spatial distribution or habitat extent.
5. Biological objectives will be expressed as more specific outcomes for species, community, ecosystem, habitat, or stressor attributes that are expected to be achieved.
6. Biological objectives for the Plan will be specific, measurable, achievable, relevant, and time-bound—to the greatest extent practicable. Where a high level of uncertainty is associated with the measurability, achievability, or relevance of an objective, that uncertainty will be explicitly addressed through planned research, monitoring, and the adaptive management program.
7. Success in achieving the biological goals and objectives will be measured during implementation of the Plan and the adaptive management program through monitoring and targeted research.
8. In developing the Bay Delta Conservation Plan conservation strategy, the effects analysis will evaluate whether the conservation measures proposed to be included in the Bay Delta Conservation Plan are reasonably likely to achieve the objectives where there are data and analytical methods to do so. If the evaluation finds that a conservation measure is unlikely to advance an objective, the conservation measure may be modified or alternative measures adopted, or the objective may be reconsidered. Where the data and/or methods do not allow for such an analysis, the Plan will include targeted research to obtain the needed data and develop the needed analytical methods to inform the adaptive management program and address and reduce uncertainty about achieving the objective.
9. During Bay Delta Conservation Plan implementation, conservation measures may be adjusted, as necessary, appropriate, and consistent with Plan commitments, through the adaptive management process, to better achieve the biological goals and objectives. The adaptive management process will be designed to distinguish effective (or better) conservation measures from ineffective (or worse) conservation measures.

10. Objectives may also be modified over time, but only if new information indicates that such changes are warranted. The standard for modifying an objective will generally be higher than the standard for modifying a conservation measure. Goals are unlikely to be modified. The process for modifying objectives will be set out in Chapter 3 of the Bay Delta Conservation Plan in the adaptive management program.
11. Some factors (e.g., other stressors) that are outside the control of the Bay Delta Conservation Plan participants may affect the ability of the Bay Delta Conservation Plan to reach some of its goals and/or objectives. Factors beyond the control of Bay Delta Conservation Plan will be monitored to determine their effect on the ability of Bay Delta Conservation Plan to reach its goals and objectives.

Status and Description of Biological Goals & Objectives for Key Species

A set of draft biological goals and objectives at the ecosystem, natural community, and species levels was completed for 48 terrestrial species and 11 fish species proposed for regulatory coverage under the Plan, and posted in Chapter 3.3.1 on the Bay Delta Conservation Plan website at the end of February. Since that time, the consultant team has been working intensively with the technical staff of the regulatory agencies to develop more specific and quantitative objectives for a number of the fish species. For ease of access, a revised partial set of draft biological goals and objectives for the fish species, reflecting the results of those deliberations is included here as Attachment 1. The revised objectives include a number of more specific, quantitative objectives for each of the fish species, as has been requested by the regulatory agencies and conservation organizations. As noted below and in the text, several specific objectives pertaining to longfin smelt and salmonids are still under discussion. Notwithstanding the several objectives still under discussion, many of the longfin and salmonid objectives are complete along with all of those for the remaining fish species.

Longfin smelt habitat/stock recruitment objective: Unlike Delta smelt and the location of the fall low salinity zone which defines the amount and quality of habitat available to the species, longfin smelt abundance is correlated with the amount of outflow in the spring and is not understood to be associated with an amount of habitat. Therefore, regulatory agency technical experts are developing an objective that can measure the effect of Bay Delta Conservation Plan conservation measure implementation on longfin smelt recruitment to achieve an overall abundance goal.

Salmonid survival: Accurate and precise survival estimates are needed for all Central Valley runs of salmon and steelhead, both for San Joaquin and Sacramento Delta corridors. There are currently limited empirical data to directly estimate Delta survivals and establish Bay

Delta Conservation Plan objectives for these species. The best estimates are from U.S. Geological Survey acoustic tag studies that use late fall and fall-run hatchery Chinook salmon. Other considerations for salmonid survival objectives include worsening baseline conditions due to climate change, potential effects of upstream and ocean conditions on Delta survivals, hydrologic year type, and size of fry versus smolts for different runs. Biological objectives for salmonid survival will be based on this information, and will be interim in nature.

A salmonid life-cycle model, currently under development, will more accurately predict salmonid survival in response to ecological conditions than methods to date. Completion of this model is expected in 2014 and will inform revisions to the salmonid survival objective in an open and transparent process, as described in the proposed Bay Delta Conservation Plan governance and adaptive management structure.

The salmonid life-cycle model will provide the data necessary to:

- Compile life stage-specific survival estimates for each of the Chinook runs and steelhead for Sacramento and San Joaquin rivers;
- Consolidate survival estimates for three periods: pre, through, and post-Delta survivals;
- Calculate cohort replacement rates; and
- Determine required improvement in Delta survival to achieve cohort replacement rates during the 15 year and 50 year time frames analyzed in the Bay Delta Conservation Plan.

Attachment 1: Biological Goals and Objectives

Delta Smelt Biological Goals and Objectives:

BDCP Goal DTSM1: Increased end of year fecundity, and improved survival of adult and juvenile Delta smelt to support increased abundance and long-term population viability
▪ **BDCP Objective DTSM1.1:** Increase fecundity over baseline conditions as measured through field investigations and laboratory studies conducted through year 10, and refined through adaptive management. ▪ **BDCP Objective DTSM1.2:** Limit entrainment mortality associated with project operations in the South Delta to ≤5% of the Delta smelt population, calculated as a 5-year running average of entrainment for subadults and adults in the fall and winter and their progeny in the spring and summer. Assure that the proportional entrainment risk is evenly distributed over the adult migration and larval-juvenile rearing time-periods.[1] ▪ **BDCP Objective DTSM1.3:** Achieve a Recovery Index ≥239 for at least 2 years of any 5 consecutive year period; measured from initial operations through the end of the permit term; the midpoint of any two consecutive Recovery Index values cannot be lower than 84. [2]
Assumed Stressors: Lack of food resources and entrainment (NEED TO REVISIT ONCE WE SETTLE ON OBJECTIVES AND UPDATE AS NECESSARY). **Stressor Reduction Targets:** • **Food.** Increase the density of copepods and other food resources that delta smelt prefer (currently Calanoid copepods) and that co-occur with the delta smelt in suitable habitat. • **Adult entrainment.** Maintain the proportion of the adult delta smelt population that are entrained in the South Delta SWP/CVP facilities during December to March at a level that is below values estimated for years with historically low entrainment and high delta smelt population growth during the late long-term. ▪ **Juvenile entrainment.** Maintain the proportion of the juvenile delta smelt lost to entrainment at the project diversions (during spring and early summer) to a level that is below historical entrainment relative to the Kodiak trawl index during the late long-term.

Rationale:

DTSM1.1

- Increasing the density of copepods and other food resources that delta smelt prefer (currently Calanoid copepods) and that co-occur with the delta smelt in suitable habitat is anticipated to contribute to an increase in the growth of Delta smelt, and thus contribute to an increase in fecundity. Delta smelt fecundity increases as a function of increasing length of the female and therefore increased growth rate would contribute to increased fecundity. Increased food resources and increased growth rate of delta smelt would also result in improved survival and increased adult abundance which would contribute directly to increased fecundity of the population.
- Monitoring will be required to track the trend of fecundity in delta smelt and progress in achieving this objective. An increase in the size of Delta smelt is anticipated to result in an increase in the number of eggs/female. However, an increase in the size could result in

[1] The specific metric is still being discussed. ICF proposed ≤10% FWS proposed ≤5%.

[2] This objective is a Global Goal and Objective, as presented in the February 2012 Draft BDCP. FWS indicates that because Delta smelt live out their entire life-history within the Plan Area it is suitable as a BDCP Objective. Conversation is ongoing regarding this point, and whether the metrics are still reasonable, as this recovery plan objective was crafted in '80's and we have more information today.

larger, healthier eggs, which could affect the achievement of this objective. Thus monitoring of fecundity will include not just the number of eggs/female but also the size and condition of the eggs. Monitoring the density of copepods and other food resources will also be required to ensure an increase is occurring and these are available to delta smelt. The monitoring will also evaluate the stock-recruitment for delta smelt with the goal that the BDCP conservation actions will contribute to increased numbers of juvenile smelt produced.

DTSM 1.2

- Kimmerer (2008) concluded that losses of adult delta smelt due to entrainment were important in certain years, while in other years, the population-level effects were small. The most recent pelagic organism decline synthesis, prepared by the Interagency Ecological Program (2005) continued in this logic of entrainment likely being important under certain conditions but not universally important in all years (typically the risk of delta smelt entrainment is reduced in wetter years when Delta inflow and outflow are greater and a larger proportion of the smelt are transported downstream to Suisun Bay where they have a low risk of entrainment into the south Delta exports). While Maunder and Deriso (2011) concluded that entrainment of delta smelt does not have an overall population level effect, entrainment of delta smelt results in direct mortality, and lower levels of entrainment are desirable for the benefit of the species.

- The current regulatory requirements regarding entrainment established by the BiOp were imposed at a time when the delta smelt population had declined substantially, and are therefore highly restrictive. Based on data from 2002 through 2006, USFWS (2008) estimated that incidental take limits under the BiOp would be approximately 5% of the pre-spawning adult population. Such estimates were not made for the larval and juvenile population. Retrospective calculations were made of the average percentage of the larval and juvenile population lost to entrainment in years when incidental take limits under the OCAP BiOp would have been exceeded (16%, average proportion in years not exceeding incidental take, calculated retrospectively) and years when incidental take would not have been exceeded (4%, average proportion in years not exceeding incidental take, calculated retrospectively). These data suggest the incidental take limits for larvae and juveniles may represent a similar proportion of the population as for adults and that taken together this would be around 10% of the population. However, these data and the calculations do not, and cannot account for real-time operation management decisions that are made to reduce entrainment risk and ensure entrainment is avoided and minimized (e.g., delta smelt working group recommendations, managing exports based on flows and turbidity, etc.). Thus, an objective to limit entrainment to ≤5% of the population is an aggressive objective that will be achieved through modifications in water operations and real-time water operation management decisions. The loss reduction goal may not be met in every year – it is recommended that this apply to a 5-year average or other extended period to accommodate annual variation in entrainment risk.

DTSM 1.3

- The stated abundance objective is based on analyses developed in the mid-1990s using data from the CDFG fall mid water trawl surveys. The rationale was that these objectives had been met in the past when the delta smelt population was thought to be in suitable condition to qualify for species recovery. These criteria have been met in the past decade. The criteria do not reflect results of more recent surveys showing delta smelt inhabiting the Cache Slough complex that are not included in the index. In addition, the historic FMWT indices do not reflect delta smelt that would inhabit expanded tidal habitat (e.g., in Suisun Marsh, Cache Slough, etc.). In addition, the historic FMWT indices do not reflect developing information on the lateral distribution of delta smelt or results of ongoing research and improvements in developing indices of abundance (e.g., size-selective net collection efficiency). Additional work needs to be done to refine and validate the abundance metrics used in the BDCP objectives. It is expected that the abundance objective will be revised and refined.

BDCP Goal DTSM2: Increase quality and availability of habitat for all life stages of delta smelt, and increase availability of good quality food for developing fish.
• **BDCP Objective DTSM2.1:** Increase the extent of suitable habitat, as defined by flow, salinity, temperature, turbidity, food availability and presence of delta smelt, to support contribution to delta smelt recovery by the achieving the following sub-objectives:. a) Provide a monthly average of at least 37,000 acres of open-water habitat in hydrological Wet years*, and at least 20,000 acres of connected open-water habitat in hydrologically Above Normal years*, of 1-6 psu habitat surface area during July-November. This habitat shall meet all of the following criteria: extensive vertical circulation including gravitational circulation, contiguous with other open water habitat, lateral mixing, and other hydrodynamic processes keeping Secchi disk depths less than 0.5-meters, high calanoid copepod densities (over 7,000 per cubic meter), hydrological connected to substantial tidal marsh areas, and maximum water temperatures less than 25 degrees Celsius. [*since July-November crosses a Water Year boundary, the Water Year type criteria apply to the first three months of that period]. b) Increase the extent of tidal wetlands of all types in the Plan Area by 10,000 acres by year 10, 17,000 acres by year 15, and 48,000 acres by year 40. In Suisun Marsh, West Delta and Cache Slough/Sacramento Deep Water Ship Channel complex, individual restoration projects must show a net positive flux of calanoid copepods and mysids off of the restored wetlands into open water occupied by Delta smelt. Food production targets and export distances are to be determined through field investigations and modeling, and refined by adaptive management. c) Increase by 100% the surface area of open-water very low salinity (<1 psu) habitat in the Cache Slough/Sacramento Deep Water Ship Channel complex during July-November by 2060. This habitat shall meet all of the following criteria: extensive lateral mixing, contiguous with other open water habitat, hydrodynamic processes keeping Secchi depth less than 0.5-meters, high calanoid copepod density (over 7,000 per cubic meter), and temperature criteria described in item b, above. [3]
Assumed Stressors: Lack of suitable biotic and abiotic habitat. **Stressor Reduction Targets:** ▪ **Habitat:** Increase the extent of suitable biotic and abiotic habitat (NEED TO WORK ON THESE WITH CHUCK HANSON).

[3] Policy Level discussions are ongoing regarding this habitat objective, but significant progress was made Friday 6/22/2012.

Rationale:

DTSM 2.1

- The Plan is premised on a hypothesis that the delta smelt population will greatly benefit from creation of new shallow water habitat in the Cache Slough complex, Delta and Suisun Marsh. The tidal marsh targets in parts (b) and (c) of the objective allow for investigation of this hypothesis and implementation of large additional investments in shallow water habitat if the benefits are demonstrated. Until this hypothesis is resolved, the primary component (part (a) above) of the objective is intended to provide recovery-oriented habitat benefits in the low salinity zone (1-6 psu).
- If shallow water habitat benefits are demonstrated and substantial progress is made towards achieving recovery goals, this objective may be revised to adjust the mix of habitat targets in parts (a) through (c) through the Adaptive Management Process described in Section 3.6. Such an adjustment would have to be based on new information about species status, trends, and needs, including documented performance of new shallow water marsh areas in producing and exporting food and/or providing other benefits to delta smelt that are of sufficient magnitude that such an adjustment can prudently be made.
- The objective recognizes that tidal wetlands in Suisun Marsh, West Delta, and Cache Slough have the greatest potential to contribute to delta smelt abundance because of their proximity to the channels and embayments hosting most of the population.
- The objective recognizes that the same area can meet more than one of the sub-objectives described. For example, the same area could satisfy items (a) and (b) or (b) and (c) (but not (a) and (c).
- The objective recognizes a continuum of habitat from 6 psu to less than 1 psu that is important to juveniles and subadult delta smelt during the summer and fall months.
- Outflow effects on delta smelt habitat quality and abundance is an active area of research, and we expect our understanding will improve in the coming years. Until then, it is important to note that while this objective is phrased in terms of habitat area at a range of salinities, turbidities, and other features, these benefits are being achieved now by providing flows necessary to position the low salinity habitat in or near Suisun Bay. It is not apparent at present that these benefits can be provided by means other than augmenting flow. However, advances in science, especially including investigation of the value of new shallow water habitat areas adjacent to channels, may expand the available options to accomplish this objective.

Longfin Smelt Biological Goals and Objectives:

BDCP Goal LFSM1: Increase fecundity and improved survival of adult and juvenile longfin smelt to support increased abundance and long-term population viability.
▪ **BDCP Objective LFSM1.1:** Productivity as measured by the Fall Mid Water Trawl must be equal to or greater than predicted for 5 of 10 years based upon a regression of 1987 to 2000 abundance on December through May mean outflow (or X_2). [4] ▪ **BDCP Objective LFSM1.2:** Limit entrainment mortality associated with project operations to ≤5% of the longfin smelt population, calculated as a 5-year running average of entrainment for subadults and adults in the fall and winter and their progeny in the winter and spring. Assure that the proportional entrainment risk is evenly distributed over the adult migration and larval-juvenile rearing periods. [5]
Assumed Stressors: Lack of food resources, entrainment, and spawning habitat conditions. **Stressor Reduction Targets:** • **Entrainment.** From February through June, entrainment of juveniles in combined SWP and CVP facilities shall not exceed ___ ratio of salvage to fall midwater trawl index from the previous September through December matched by water year type. (Additional analysis is needed to develop appropriate target.) Reducing entrainment will contribute to increased longfin smelt juvenile abundance, and over time increased adult abundance. • **Food.** Increase the average late winter and early spring (late February to April) density of zooplankton in the lower Sacramento, western Delta, and Suisun Bay and/or supply adequate transport flows (sustained or pulse flows) to move longfin smelt larvae to adequate food resources within 15 years of BDCP permit authorization. (Additional analysis is needed to develop appropriate prey density target.). Increasing food abundance will contribute to increased longfin smelt juvenile survival immediately following yolk-sac absorption by providing food resources suitable for juvenile longfin smelt within the Plan Area. • **Spawning habitat.** Increase overlap of suitable spawning substrate and suitable flow conditions in lower San Joaquin River such that spawning will be detected in at least three of the following locations in all years (Lower Sacramento, Cache Slough Complex, Lower San Joaquin River, Suisun Bay and Suisun Marsh). Increasing the extent of suitable spawning habitat for longfin smelt will contribute to an increase in spawning success, thereby contributing to an increase in juvenile and, over time, adult longfin smelt abundance.

Rationale:

LFSM1.1

- Results of fall mid water trawl monitoring and statistical analyses have previously shown a relationship between longfin smelt abundance in the fall and Delta outflow (and X2 location) during the previous winter and spring. More recent analyses by FWS indicate that the abundance-outflow relationship for longfin smelt focuses more on flow conditions during the spring (March-May) than during the late winter months. Results of these analyses are continuing to be developed and have not been subject to extensive outside review. In addition, there is considerable uncertainty regarding the mechanism through which Delta outflow may be affecting the production and survival of early lifestages of longfin smelt. It is expected that results of these analyses will continue to be refined and that management decisions regarding the contribution of Delta outflow to meeting the abundance objective outline in LFSM 1.1 will be the subject of a decision tree investigation and analysis. It is

[4] Discussion with FWS regarding whether FMWT or Bay Study is most appropriate to use here for measuring abundance. FWS indicated FMWT is most appropriate at 6/22/2012 meeting.

[5] The specific metric is still being discussed for this objective, as well as for the Stressor Reduction Target. FWS proposed a metric of ≤5% for the objective, same as delta smelt, but indicated there is insufficient data to develop a specific metric. ICF did not have an entrainment objective in the February draft. Discussions are ongoing.

expected that evaluation of the decision tree management decisions will require a 10-15 year period. The specific seasonal time periods, magnitude of Delta outflow and other conservation actions (see food and habitat below), examination of longfin smelt abundance based on the Bay Study otter and mid water trawl results, and the underlying mechanisms and response of longfin smelt will require further discussion prior to establishing this biological objective.

- Food availability is also a limiting factor for longfin smelt, particularly during the initial feeding stage when the larval yolk-sac is absorbed. Researchers have hypothesized that a major factor in the decline of longfin smelt abundance is related to the invasion by the Amur River clam *Corbula amurensis* and its subsequent disruption of the foodweb (Carlton et al. 1990; Alpine and Cloern 1992; Orsi and Mechum 1996; Baxter et al. 2008:36). Rosenfield and Baxter (2007) speculate that the estuary has experienced a fundamental change in its carrying capacity for pelagic fishes. There is evidence that the disruption of the foodweb is the most significant change in the estuary's carrying capacity. Rosenfield and Baxter (2007) concluded that food limitation is consistent with their finding of reduced age-1 productivity and the reduction in age-2 recruitment. Hobbs et al. (2006) further documented poor growth and condition of longfin smelt in the south channel region of Suisun Bay. Densities of *C. amurensis* are high in Suisun Bay (Carlton et al. 1990). Thus increasing food abundance will contribute to increased longfin smelt juvenile survival immediately following yolk-sac absorption by providing food resources suitable for juvenile longfin smelt within the Plan Area. The effects of tidal habitat restoration and increased zooplankton production as a food resource for longfin smelt will be subject to extensive research and monitoring as part of the decision tree framework or assessing management decisions for BDCP.

LFSM1.2

- Nearly all the longfin smelt that are recorded in annual surveys are found downstream of the confluence of the Sacramento and San Joaquin Rivers. The fraction of the longfin population found at or east of the lower San Joaquin River is low—averaging 0.5% for adult longfin smelt from 2002 to 2008 and 6% for larvae and juveniles from 1995 to 2007. Over those same periods, the average percentage of larval, juvenile, and adult longfin smelt found east of Franks Tract, where water export pumps are located, was 0%. These data suggest that the threat of entrainment may be relatively low in years when Delta flow transport the longfin smelt downstream into Suisun Bay where the risk of entrainment is reduced. In years when Delta outflow is low during the winter and early spring months the risk of entrainment is increased in the south Delta export facilities. However, the species has exhibited changes in distribution over time, so it would be prudent to continue to monitor entrainment. Using a 5-year running average of entrainment losses helps address concerns regarding interannual variability in longfin smelt entrainment risk.

- Reducing water diversions in the tidal region of the Delta is expected to reduce the risks of entrainment and impingement. Relocating the primary point of diversion will also result in more natural flow patterns in the Delta, reducing the occurrence of reverse flows which can contribute to entrainment.

BDCP Goal LFSM2: An additional longfin goal and objective is in the process of being finalized.

Winter-run Chinook Salmon Biological Goals and Objectives:

BDCP Goal WRCS1: Improved survival (to contribute to increased abundance) of immigrating and emigrating winter-run Chinook salmon through the Plan Area.
▪ **BDCP Objective WRCS1.1:** Achieve a through-Delta survival rate of juveniles of at least XX% measured as a 4-year running average, which will accommodate an expanding population within 15 years of BDCP permit authorization. [6] ▪ **BDCP Objective WRCS1.2:** Create a viable alternate migratory path through Yolo Bypass in >70% of years for outmigrating juveniles, within 15 years of BDCP permit authorization. ▪ **BDCP Objective WRCS1.3:** Reduce illegal harvest of Winter-run Chinook salmon in the Plan Area within 5 years of BDCP permit authorization.

[6] Dave Swank and Michael Schiewe are reviewing the available data to assess current through-Delta survival and evaluate a reasonable metric for BDCP to achieve in terms of a percent increase. Dave and Michael are preparing a Tech Memo that will outline the data; the assessment/evaluation methods; assumptions and uncertainty, and; the rationale for the percent increase in through-delta survival BDCP should be responsible for. Meetings to discuss scheduled for 7/13 and 7/16.

Assumed Stressors: Entrainment, predation, lack of rearing habitat, spatial structure, illegal harvest and altered migration flows.

Stressor Reduction Targets:

- **Survival Rates at North Delta Pumps:** Maintain survival rates through the reach containing new north Delta diversions (0.25-mile upstream of the upstream most diversion to 0.25-mile downstream of the downstream most diversion) to no more than a 5% cumulative loss across all screens. This loss will be in addition to existing loss resulting from predation and other factors within this reach.[7]
- **Survival Rates at South Delta Pumps:** Three levels of stressor reduction:
  - Reduce fraction of Sacramento River Basin population in the south Delta through improved operations, nonphysical barriers, and other means
  - Reduce salvage loss in the CVP and SWP South Delta Facilities to less than 1% of Sacramento River Basin fish entering the Delta (using tagged late fall-run hatchery release fish as a surrogate for winter-run fish) within 5 years of BDCP permit authorization. This metric may need to be adjusted as part of adaptive management and monitoring if, for example, predation is reduced and an increase in salvage is observed. [acknowledge dynamic situation and improvement over time; select level below current entrainment levels that BDCP can achieve, based on results of effects analysis and assumptions re: adaptive management + be specific about BiOp RPAs that we include in PP].[8]
  - Improve salvage efficiency of entrained fish through predation reduction in CCFB, reduced mortality in CCFB, and improved return to the Delta [incorporate predation target below].
- **Predation:** Reduce predation in CCFB and at the CVP trash-racks to achieve a reduction in mortality rates across CCFB and past CVP trash-racks by 50% from existing baseline as reflected in the NMFS RPA within 5 years of BDCP permit authorization [expand to capture predation reduction through Plan Area from CM].[9]
- **Lack of Rearing Habitat:** Provide access to at least 10,000 acres of inundated floodplain habitat within the Yolo Bypass Inundation will occur for at least 30 days in at least 70% of years. The extent, duration and frequency of inundation will occur within 15 years of BDCP permit authorization.
- **Spatial Structure:** Increase the heterogeneity of habitat along key migration corridors to provide greater spatial structure for juvenile salmonids within 10 years of BDCP permit authorization. Improved habitat conditions are expected to increase fish growth and, in the case of the Yolo Bypass, divert fish away from predators and areas of entrainment thereby contributing to the BDCP through-Delta survival objective.
- **Illegal Harvest:** Increase enforcement efforts to reduce illegal take in the Plan Area within 5 years of BDCP permit authorization.
- **Migration Flows:** Insure that pumping operations do not increase reverse flows in the Sacramento River at the Georgiana Slough junction.[10]

Rationale (Applicable to Spring-run and Fall-run Chinook salmon as well as Steelhead):

WRCS1.1

- Increasing the through-Delta survival of juvenile salmon will be accomplished by maximizing survival rates at the new North Delta Intakes, increasing survival rates at the South Delta Facilities, reducing predation rates within the Plan Area overall, increasing habitat complexity along key migration corridors and ensuring pumping operations do not increase the occurrence of reverse flows in the Sacramento River at the Georgiana Slough junction. BDCPs contribution toward addressing these factors is anticipated to improve survival through the Plan Area and contribute to increased abundance of emigrating juvenile salmonids. *The metric and rationale for through-Delta*

[7] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[8] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[9] More work needed to determine whether/how this metric will be measured and achieved, as well as how to capture predation reduction through Plan Area from CM15.

[10] Discussion is ongoing regarding what an appropriate metric is.

survival for salmonids is currently being drafted by NMFS. Discussions at the technical level to occur on July 16, 2012.

- Juvenile winter-run Chinook salmon migrate downstream into the lower Sacramento River and Delta typically beginning in late December followed by an extended (months) juvenile rearing period prior to migrating into coastal marine waters. Habitat conditions during juvenile rearing, including access to low velocity, shallow water habitat with few predators and abundant food supplies. Access to seasonally inundated floodplain habitat (e.g., Yolo Bypass), tidal wetlands, and channel margin habitat provides improved juvenile rearing conditions expected to directly contribute to increased juvenile growth and survival. Access to the Yolo Bypass also serves as an alternative migration pathway for juvenile salmon movement around those regions of the Sacramento River where the north Delta intake will be sited, avoids exposure to the Delta cross Channel (DCC) and Georgiana Slough, and reduces the risk of exposure to striped bass and other predators inhabiting the Sacramento River between the Freemont Weir and Rio Vista. These BDCP conservation actions are expected to directly improve survival of juvenile winter-run Chinook salmon.

WRCS1.2

- Creating a viable alternate migratory pathway through the Yolo Bypass in >70% of years for emigrating juvenile winter-run Chinook salmon will contribute to increased survival. Increasing the frequency, duration and extent of inundation of the Yolo Bypass will contribute to an increase in the extent of suitable rearing habitat and food resources available to juvenile salmonids, which is expected to contribute to an increase in survival. Restoration of seasonally inundated floodplain habitat (CM5) and enhancement of channel margin habitat (CM6) will further provide important rearing habitat for food resources for juvenile salmonids. Nonphysical barriers will reduce exposure of juvenile salmonids to predator "hot spots," or areas know to have high predator densities such as the interior Delta (e.g., Georgiana Slough) and result in relatively significant loss of juvenile salmonids to predation.

WRCS1.3

- BDCP will address several factors affecting adult survival within the Plan Area, including illegal harvest. BDCPs contribution toward addressing illegal harvest is anticipated to improve survival through the Plan Area and contribute to increased abundance of covered adult salmonids by decreasing the number of potential spawners taken illegally by recreational anglers and poaching rings. The scale of the illegal harvest issue within the Plan Area is unknown, but illegal harvest is known to occur and contributing to decrease in this problem under BDCP is anticipated to increase escapement of spawning adults.

BDCP Goal WRCS2: Substantially reduce passage delays (to contribute to increased migration and spawning success, and thus abundance) at anthropogenic impediments of adult Winter-run Chinook salmon migrating through the Delta.
• **BDCP Objective WRCS2.1:** Limit adult passage delays in the Yolo Bypass to less than 36 hours, within 15 years of BDCP permit authorization.
Assumed Stressors: Adult fish passage barriers. **Stressor Reduction Targets:** ▪ **Adult Passage:** Limit passage delays at anthropogenic barriers and impediments (e.g., Fremont Weir) in the Yolo Bypass to less than 36 hours, within 15 years of BDCP permit authorization.

Rationale (Applicable to Spring-run and Fall-run Chinook salmon as well as Steelhead):

WRCS2.1

- Reducing passage delays in the Yolo Bypass will increase connectivity between the Yolo Bypass and the Sacramento River and provide timely passage for adult salmonids past the Fremont Weir, substantially reducing the risk of stress, which can contribute to weakness, sickness and mortality in individuals. Reducing passage delays will also contribute to a reduction in the risk of adult salmon and other fish being illegally harvested (poached) in areas where adult migration is impeded. Providing greater connectivity between Yolo Bypass and the Sacramento River will increase the number of adult salmonids that may successfully spawn.

- Reducing passage delays will also reduce stress to adult salmonids delayed at the Fremont Weir and other anthropogenic barriers within Yolo Bypass. Stress associated with migration delays can contribute to fatigue, reduced health, and mortality from exposure to elevated water temperatures, low DO conditions, and illegal harvest.

- An inventory of other physical barriers that may contribute to migration delays will provide further opportunities to increase connectivity between the Yolo Bypass and the Sacramento River and further reduce passage delays for migrating salmonids.

BDCP Goal WRCS3: Do not degrade aquatic habitat conditions upstream from BDCP Operations.
▪ **BDCP Objective WRCS3.1:** BDCP covered activities will be implemented in such a way as to not result in a reduction of the Primary Constituent Elements (PCEs) of designated critical habitat for Winter-run Chinook salmon upstream of the Plan Area, within the Study Area. ▪ **BDCP Objective WRCS3.2:** Implement project operations in a way that will support a wide-range of life-history strategies within a species without favoring any one life-history strategy or trait over another (e.g., a project operations through real-time operations will have an implementation window covering at least 95% of the life-stage present in the Plan Area. Implementation through real-time operations would be evaluated).[11]
Assumed Stressors: Habitat conditions, water temperatures **Stressor Reduction Targets:** ▪ **Habitat:** Avoid degradation of fish habitat conditions upstream of the Plan Area as a result of BDCP covered activities ▪ **Water Temperatures:** BDCP covered activities will be implemented in such a way as to not result in an increase in water temperature upstream of the Plan Area, within the Study Area.

Rationale (Applicable to Spring-run and Fall-run Chinook salmon as well as Steelhead):

WRCS3.1

- The Primary Constituent Elements (PCEs) of salmonid Designated Critical Habitat include sites for rearing, spawning and migration, all of which occur upstream of the Plan Area (rearing sites and migration corridors occur within the Plan Area). Implementing BDCP covered activities in a way that will not degrade the condition of rearing sites, spawning sites or migration corridors upstream of the Plan Area will ensure that the effort BDCP contributes toward improving conditions and increasing the abundance of juvenile and adult salmonids within the Plan Area is also contributing toward maintaining, and not degrading conditions upstream of the Plan Area, within the Study Area.

[11] Michael Schiewe (NMFS) discussed requirements for spills at dams on the Columbia River and the requirement that spills cover 95% of the outmigration based on timing. This wording developed and agreed to at the 6/22/2012 meeting.

WRCS3.2

- Implementing BDCP covered activities in a way that will support a wide-range of life-history strategies (i.e., early migration vs. late-migration) without favoring any one particular life-history strategy, will ensure that BDCP contributes to a diversity of conditions that supports a broad range of life-history strategies, with greater genetic diversity. The greater diversity of life-history strategies are expected to contribute to a stronger population capable of adapting to fluctuations in conditions (i.e. timing of peak outflow, shifts in the period of floodplain inundation, shifts in the timing of optimum spawning and rearing conditions) that may occur from year to year.

Spring-run Chinook Salmon Biological Goals and Objectives:

BDCP Goal SRCS1: Increase Spring-run Chinook salmon abundance.
▪ **BDCP Objective SRCS1.1:** Achieve a 4-year running average through-Delta survival rate of XX% in the South Delta (measured between Mossdale and Chipps Island) and XX% in the North Delta (measured between the Fremont Weir and Chipps Island), which will accommodate an expanding population within 15 years of BDCP permit authorization.[12]
▪ **BDCP Objective SRCS1.2:** Create a viable alternate migratory path through Yolo Bypass in >70% of years for outmigrating juveniles, within 15 years of BDCP permit authorization.
▪ **BDCP Objective SRCS1.3:** Reduce illegal harvest of Spring-run Chinook salmon in the Plan Area within 5 years of BDCP permit authorization.

[12] Dave Swank and Michael Schiewe are reviewing the available data to assess current through-Delta survival and evaluate a reasonable metric for BDCP to achieve in terms of a percent increase. Dave and Michael are preparing a Tech Memo that will outline the data; the assessment/evaluation methods; assumptions and uncertainty, and; the rationale for the percent increase in through-delta survival BDCP should be responsible for. Meetings to discuss scheduled for 7/13 and 7/16.

Assumed Stressors: Entrainment, predation, spatial structure, lack of rearing habitat, illegal take, and altered migration flows.

Stressor Reduction Targets:

- **Survival Rates North Delta Pumps:** Maintain survival rates through the reach containing new north Delta diversions to no more than a 5% cumulative loss through the reach relative to conditions prior to construction of new facilities. This loss will be in addition to existing loss resulting from predation and other factors within this reach. [13]
- **Survival Rates South Delta Pumps:** Three levels of stressor reduction:
  - Reduce fraction of Sacramento River Basin population in the south Delta through improved operations, nonphysical barriers, and other means
  - Reduce salvage loss in the CVP and SWP South Delta Facilities to less than 1% of Sacramento River Basin fish entering the Delta (using tagged late fall-run hatchery release fish as a surrogate for spring-run fish) within 5 years of BDCP permit authorization. This metric may need to be adjusted as part of adaptive management and monitoring if for example; predation is reduced and an increase in salvage is observed. [acknowledge dynamic situation and improvement over time; select level below current entrainment levels that BDCP can achieve, based on results of effects analysis and assumptions re: adaptive management + be specific about BiOp RPAs that we include in PP]. [14]
  - Improve salvage efficiency of entrained fish through predation reduction in CCFB, reduced mortality in CCFB, and improved return to the Delta [incorporate predation target below].
- **Predation:** Reduce predation in CCFB and at the CVP trash-racks to achieve a reduction in mortality rates across CCFB and past CVP trash-racks by 50% from existing baseline as reflected in the NMFS RPA within 5 years of BDCP permit authorization [expand to capture predation reduction through Plan Area from CM]. [15]
- **Spatial Structure:** Increase the heterogeneity of habitat along key migration corridors to provide greater spatial structure for juvenile salmonids within 10 years of permit authorization. Improved habitat conditions are expected to increase fish growth and, in the case of the Yolo Bypass, divert fish away from predators and areas of entrainment thereby contributing to the BDCP through-Delta survival objective.
- **Lack of Rearing Habitat North Delta:** Provide access to at least 10,000 acres of inundated floodplain habitat within the Yolo Bypass. Inundation will occur for at least 30 days in at least 70% of years. The extent, duration and frequency of inundation will occur within 15 years of BDCP permit authorization.
- **Lack of Rearing Habitat South Delta:** Provide access to at least 1,000 acres of inundated floodplain habitat, primarily within the South Delta. On average, 50 acres of floodplain will be inundated a minimum of every other year, 500 acres will be inundated a minimum of every 5 years and all 1,000 acres will be inundated a minimum of once every 10 years. Floodplains shall be inundated for a minimum of one week between December and June. The extent, duration and frequency of inundation will occur within 15 years of BDCP permit authorization.
- **Illegal Take:** Increase enforcement efforts to reduce illegal take in the Plan Area within 15 years of BDCP permit authorization.
- **Migration Flows:** Insure that pumping operations do not increase reverse flows in the Sacramento River at the Georgiana Slough junction. [16]

[13] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[14] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[15] More work needed to determine whether/how this metric will be measured and achieved, as well as how to capture predation reduction through Plan Area from CM15.

[16] Discussion is ongoing regarding what an appropriate metric is.

BDCP Goal SRCS2: Substantially reduce passage delays (to contribute to increased migration and spawning success and thus abundance) at anthropogenic impediments of adult Spring-run Chinook salmon migrating through the Delta.
▪ **BDCP Objective SRCS2.1:** Limit adult passage delays in the Yolo Bypass and other anthropogenic barriers and impediments within the Plan Area (i.e., Stockton DWSC) to less than 36 hours, within 15 years of BDCP permit authorization.
Assumed Stressors: Adult fish passage barriers. **Stressor Reduction Targets:** ▪ **Adult Passage:** Limit passage delays at anthropogenic barriers and impediments in the Delta to less than 36 hours, within 15 years of BDCP permit authorization.

BDCP Goal SRCS3: Do not degrade conditions upstream from BDCP Operations.
▪ **BDCP Objective SRCS3.1:** BDCP covered activities will be implemented in such a way as to not result in a reduction to the Primary Constituent Elements (PCEs) of designated critical habitat for Spring-run Chinook salmon upstream of the Plan Area, within the Study Area. ▪ **BDCP Objective SRCS3.2:** Implement project operations in a way that will support a wide-range of life-history strategies within a species without favoring any one life-history strategy or trait over another (e.g., a project operations through real-time operations will have an implementation window covering at least 95% of the life-stage present in the Plan Area. Implementation through real-time operations would be evaluated). [17]
Assumed Stressors: Habitat conditions, water temperatures **Stressor Reduction Targets:** ▪ **Habitat:** Avoid degradation of fish habitat conditions upstream of the Plan Area as a result of BDCP covered activities ▪ **Water Temperatures:** BDCP covered activities will be implemented in such a way as to not result in an increase in water temperature upstream of the Plan Area, within the Study Area.

[17] Michael Schiewe (NMFS) discussed requirements for spills at dams on the Columbia River and the requirement that spills cover 95% of the outmigration based on timing. This wording developed and agreed to at the 6/22/2012 meeting.

Fall-run Chinook Salmon Biological Goals and Objectives:

BDCP Goal FRCS1: Increase Fall-run Chinook Salmon abundance.
▪ **BDCP Objective FRCS1.1:** Achieve a 4-year running average through-Delta survival rate of XX% in the South Delta (measured between Mossdale and Chipps Island) and XX% in the North Delta (measured between the Fremont Weir and Chipps Island), which will accommodate and expanding population within 15 years of BDCP permit authorization. [18]
▪ **BDCP Objective FRCS1.2:** Create a viable alternate migratory path through Yolo Bypass in >70% of years for outmigrating juveniles, within 15 years of BDCP permit authorization.
▪ **BDCP Objective FRCS1.3:** Reduce illegal harvest of Fall-run Chinook salmon in the Plan Area within 5 years of BDCP permit authorization.

[18] Dave Swank and Michael Schiewe are reviewing the available data to assess current through-Delta survival and evaluate a reasonable metric for BDCP to achieve in terms of a percent increase. Dave and Michael are preparing a Tech Memo that will outline the data; the assessment/evaluation methods; assumptions and uncertainty, and; the rationale for the percent increase in through-delta survival BDCP should be responsible for. Meetings to discuss scheduled for 7/13 and 7/16.

Assumed Stressors: Entrainment, predation, spatial structure, lack of rearing habitat, illegal take, and altered migration flows.

Stressor Reduction Targets:

- **Survival Rates at North Delta Pumps:** Maintain survival rates through the reach containing new north Delta diversions to no more than a 5% cumulative loss through the reach relative to conditions prior to construction of new facilities. This loss will be in addition to existing loss resulting from predation and other factors within this reach. [19]
- **Survival Rates at South Delta Pumps:** Three levels of stressor reduction:
  - Reduce fraction of Sacramento River Basin population in the south Delta through improved operations, nonphysical barriers, and other means
  - Reduce salvage loss in the CVP and SWP South Delta Facilities to less than 1% of Sacramento River Basin fish entering the Delta (using tagged late fall-run hatchery release fish as a surrogate for spring-run fish) within 5 years of BDCP permit authorization. This metric may need to be adjusted as part of adaptive management and monitoring if for example; predation is reduced and an increase in salvage is observed. [acknowledge dynamic situation and improvement over time; select level below current entrainment levels that BDCP can achieve, based on results of effects analysis and assumptions re: adaptive management + be specific about BiOp RPAs that we include in PP]. [20]
  - Improve salvage efficiency of entrained fish through predation reduction in CCFB, reduced mortality in CCFB, and improved return to the Delta [incorporate predation target below].
- **Predation:** Reduce predation in CCFB and at the CBP trash-racks to achieve a reduction in mortality rates across CCFB and past CVP trash-racks by 50% from existing baseline as reflected in the NMFS RPA within 5 years of BDCP permit authorization. [expand to capture predation reduction through Plan Area from CM]. [21]
- **Spatial Structure:** Increase the heterogeneity of habitat along key migration corridors to provide greater spatial structure for juvenile salmonids within 10 years of permit authorization. Improved habitat conditions are expected to increase fish growth and, in the case of the Yolo Bypass, divert fish away from predators and areas of entrainment thereby contributing to the BDCP through-Delta survival objective.
- **Lack of Rearing Habitat North Delta:** Provide access to at least 10,000 acres of inundated floodplain habitat within the Yolo Bypass. Inundation will occur for at least 30 days in at least 70% of years. The extent, duration and frequency of inundation will occur within 15 years of BDCP permit authorization.
- **Lack of Rearing Habitat South Delta:** Provide access to at least 1,000 acres of inundated floodplain habitat, primarily within the South Delta. On average, 50 acres of floodplain will be inundated a minimum of every other year, 500 acres will be inundated a minimum of every 5 years and all 1,000 acres will be inundated a minimum of once every 10 years. Floodplains shall be inundated for a minimum of one week between December and June. The extent, duration and frequency of inundation will occur within 15 years of BDCP permit authorization.
- **Illegal Harvest:** Increase enforcement efforts to reduce illegal take in the Plan Area within 5 years of BDCP permit authorization.
- **Migration Flows:** Insure that pumping operations do not increase reverse flows in the Sacramento River at the Georgiana Slough junction. [22]

[19] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[20] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[21] More work needed to determine whether/how this metric will be measured and achieved, as well as how to capture predation reduction through Plan Area from CM15.

[22] Discussion is ongoing regarding what an appropriate metric is.

BDCP Goal FRCS2: Substantially reduce passage delays (to contribute to increased migration and spawning success and thus abundance) at anthropogenic impediments of adult Fall-run Chinook salmon migrating through the Delta.
• **BDCP Objective FRCS2.1:** Limit adult passage delays in the Yolo Bypass and other anthropogenic barriers and impediments within the Plan Area (i.e., Stockton DWSC) to less than 36 hours, within 15 years of BDCP permit authorization.
Assumed Stressors: Adult fish passage barriers. **Stressor Reduction Targets:** ▪ **Adult Passage:** Limit passage delays at anthropogenic barriers and impediments in the Delta to less than 36 hours, within 15 years of BDCP authorization.

BDCP Goal FRCS3: Do not degrade conditions upstream from BDCP Operations.
▪ **BDCP Objective FRCS3.1:** BDCP covered activities will be implemented in such a way as to not result in a degradation of current habitat conditions [e.g., spawning sites, rearing sites, migration corridors] upstream of the Plan Area, within the Study Area. ▪ **BDCP Objective FRCS3.2:** Implement project operations in a way that will support a wide-range of life-history strategies within a species without favoring any one life-history strategy or trait over another (e.g., a project operations through real-time operations will have an implementation window covering at least 95% of the life-stage of the life-stage present in the Plan Area. Implementation through real-time operations would be evaluated). [23]
Assumed Stressors: Habitat conditions, water temperatures **Stressor Reduction Targets:** ▪ **Habitat:** Avoid degradation of fish habitat conditions upstream of the Plan Area as a result of BDCP covered activities ▪ **Water Temperatures:** BDCP covered activities will be implemented in such a way as to not result in an increase in water temperature upstream of the Plan Area, within the Study Area.

[23] Michael Schiewe (NMFS) discussed requirements for spills at dams on the Columbia River and the requirement that spills cover 95% of the outmigration based on timing. This wording developed and agreed to at the 6/22/2012 meeting.

Steelhead Biological Goals and Objectives:

BDCP Goal STHD1: Increase steelhead abundance.
▪ **BDCP Objective STHD1.1:** Achieve a through-Delta survival rate of juveniles of at least XX% measured as a 4-year running average, which will accommodate an expanding population within 15 years of BDCP permit authorization. [24]
▪ **BDCP Objective STHD1.2:** Create a viable alternate migratory path through Yolo Bypass in >70% of years for outmigrating juveniles, within 15 years of BDCP permit authorization.
▪ **BDCP Objective STHD1.3:** Reduce illegal harvest of steelhead in the Plan Area within 5 years of BDCP permit authorization.

[24] Dave Swank and Michael Schiewe are reviewing the available data to assess current through-Delta survival and evaluate a reasonable metric for BDCP to achieve in terms of a percent increase. Dave and Michael are preparing a Tech Memo that will outline the data; the assessment/evaluation methods; assumptions and uncertainty, and; the rationale for the percent increase in through-delta survival BDCP should be responsible for. Meetings to discuss scheduled for 7/13 and 7/16.

Assumed Stressors: Entrainment, predation, spatial structure, lack of rearing habitat, illegal take, and altered migration flows.

Stressor Reduction Targets:

- **Survival Rates at North Delta Pumps:** Maintain survival rates through the reach containing new north Delta diversions to no more than a 5% cumulative loss through the reach relative to conditions prior to construction of new facilities. This loss will be in addition to existing loss resulting from predation and other factors within this reach. [25]
- **Survival Rates at South Delta Pumps:** Three levels of stressor reduction:
  1. Reduce fraction of Sacramento River Basin population in the south Delta through improved operations, nonphysical barriers, and other means
  2. Limit salvage loss to levels at or below the baseline condition in all water type years. Develop method similar to that presented by Nobriga and Cadrett (2001) for calculating the proportion of the population entrained in the SWP/CVP facilities to allow past and future estimates of proportion of population entrained on annual basis.
  3. Improve salvage efficiency of entrained fish through predation reduction in CCFB, reduced mortality in CCFB, and improved return to the Delta [incorporate predation target below]. [26]
- **Predation:** Reduce predation in CCFB and at the CBP trash-racks to achieve a reduction in mortality rates across CCFB and past CVP trash-racks by 50% from existing baseline as reflected in the NMFS RPA within 5 years of BDCP permit authorization. [expand to capture predation reduction through Plan Area from CM]. [27]
- **Spatial Structure:** Increase the heterogeneity of habitat along key migration corridors to provide greater spatial structure for juvenile salmonids within 10 years of permit authorization. Improved habitat conditions are expected to increase fish growth and, in the case of the Yolo Bypass, divert fish away from predators and areas of entrainment thereby contributing to the BDCP through-Delta survival objective.
- **Lack of Rearing Habitat North Delta:** Provide access to at least 10,000 acres of inundated floodplain habitat within the Yolo Bypass. Inundation will occur for at least 30 days in at least 70% of years. The extent, duration and frequency of inundation will occur within 15 years of BDCP permit authorization. [28]
- **Lack of Rearing Habitat South Delta:** Provide access to at least 1,000 acres of inundated floodplain habitat, primarily within the South Delta. On average, 50 acres of floodplain will be inundated a minimum of every other year, 500 acres will be inundated a minimum of every 5 years and all 1,000 acres will be inundated a minimum of once every 10 years. Floodplains shall be inundated for a minimum of one week between December and June. The extent, duration and frequency of inundation will occur within 15 years of BDCP permit authorization.
- **Illegal Take:** Increase enforcement efforts to reduce illegal take in the Plan Area within 15 years of BDCP permit authorization.
- **Migration Flows:** Insure that pumping operations do not increase reverse flows in the Sacramento River at the Georgiana Slough junction. [29]

[25] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[26] Discussions are ongoing regarding whether/how this metric will be measured and achieved.

[27] More work needed to determine whether/how this metric will be measured and achieved, as well as how to capture predation reduction through Plan Area from CM15.

[28] Rationale will indicate that steelhead smolts are not as likely to benefit to the same extent as juvenile Chinook salmon from inundated floodplain habitat. However, there is uncertainty regarding the use of inundated floodplain habitat and the potential benefit to steelhead from an increase in inundated floodplain habitat.

[29] Discussion is ongoing regarding what an appropriate metric is.

BDCP Goal STHD2: Substantially reduce passage delays (to contribute to increased migration and spawning success and thus abundance) at anthropogenic impediments of adult steelhead migrating through the Delta.
• **BDCP Objective SRCS2.1:** Limit adult passage delays in the Yolo Bypass and other anthropogenic barriers and impediments within the Plan Area (i.e., Stockton DWSC) to less than 36 hours, within 15 years of BDCP permit authorization.
Assumed Stressors: Adult fish passage barriers. **Stressor Reduction Targets:** ▪ **Adult Passage:** Limit passage delays at anthropogenic barriers and impediments in the Delta to less than 36 hours, within 15 years of BDCP permit authorization.

BDCP Goal STHD3: Do not degrade conditions upstream from BDCP Operations.
▪ **BDCP Objective STHD3.1:** BDCP covered activities will be implemented in such a way as to not result in a reduction to the Primary Constituent Elements (PCEs) of designated critical habitat for steelhead upstream of the Plan Area, within the Study Area. ▪ **BDCP Objective STHD3.2:** Implement project operations in a way that will support a wide-range of life-history strategies within a species without favoring any one life-history strategy or trait over another (e.g., a project operations through real-time operations will have an implementation window covering at least 95% of the life-stage present in the Plan Area. Implementation through real-time operations would be evaluated). [30]
Assumed Stressors: Habitat conditions, water temperatures **Stressor Reduction Targets:** ▪ **Habitat:** Avoid degradation of fish habitat conditions upstream of the Plan Area as a result of BDCP covered activities ▪ **Water Temperatures:** BDCP covered activities will be implemented in such a way as to not result in an increase in water temperature upstream of the Plan Area, within the Study Area.

[30] Michael Schiewe (NMFS) discussed requirements for spills at dams on the Columbia River and the requirement that spills cover 95% of the outmigration based on timing. This wording developed and agreed to at the 6/22/2012 meeting.

Sacramento Splittail Biological Goals and Objectives:

BDCP Goal SAST1: Improved habitat and restored linkages to enhance survival, reproduction and distribution of Sacramento splittail in the Plan Area.
▪ **BDCP Objective SAST1.1:** Maintain a 5-year running average of splittail index of abundance in the Plan Area of 150% of baseline conditions by providing increased access to suitable spawning and rearing habitat in the Plan Area within 15 years of BDCP permit authorization. [31]
Assumed Stressors: Lack of suitable spawning and rearing habitat. **Stressor Reduction Targets:** • **Spawning Habitat.** Increase the connectivity and availability of floodplain habitat with the following criteria beginning the near-term and continuing through the late long-term: o Floodplain inundation in the Yolo Bypass occurs at least once every five years between March 1 and May 15 (DATES MAY BE REFINED BASED ON CM2) o Area of floodplain habitat in Yolo Bypass is continuous and at least 10,000 acres (ACREAGE MAY BE REFINED BASED ON CM2) o Floodplain inundation in the Yolo Bypass persists for at least 30 days (Sommer pers comm.) o Areas of floodplain habitat with water depths less than two meters (Moyle et al. 2004 and Sommer et al. 2008) o Establish floodplain benches and areas of native riparian and emergent vegetation with large woody debris (habitat complexity). • **Rearing Habitat.** Restore habitat with the following criteria beginning in the near-term and continuing through the late long-term (NEED TO ADD SRTs FOCUSED ON REARING HABITAT). o Manage flood recession in the Yolo Bypass of the inundated floodplain to minimize fish stranding (e.g., flow regulation, altered topography to ensure volitional fish movement and access to escape channels).

Rationale

- Based on the hydrologic record, a five year period is likely to include a broad range of hydrologic conditions that affect splittail abundance. Based on the 1906 to 2010 hydrologic record, any 5-year period has about a 77% chance of including at least one wet or above normal year and one dry or critical year. Therefore, odds are good that a five-year average estimate of abundance would estimate the parametric (i.e., true) mean of abundance with good precision. It will be especially important to include at least one wet or above normal water year type in evaluating the effect of BDCP on splittail because age-0 recruitment is largely driven by production on inundated floodplains. Any 5-year period in the hydrologic record has a 90% chance of including a wet or above normal water year. An additional reason for using a 5-year running average is that the typical lifespan of splittail is about 5 years.

- The index of abundance referred to in Objective SAST1.1 is the USFWS beach seine annual index for age-0 splittail, which is based on the results of a regular sampling survey conducted by the USFWS since 1994 at about 40 stations in the Delta and the lower Sacramento and San Joaquin rivers (Contreras et al. 2011). The FMWT abundance index, which is used to monitor trends in abundance of a number Delta fish species, is less than ideal for monitoring splittail abundance because trawling requires fishing in open, moderately deep water, and young splittail possess a strong affinity for shallow water (Feyrer et al. 2005; Contreras et al. 2011). Furthermore, as their historical prey, mysids, have become less abundant, splittail of all ages are found less frequently in open water. The USFWS beach seine specifically targets age-0 Chinook salmon; other species, including splittail, are collected incidentally (Brown and May 2006).

- Age-0 splittail numbers are expected to be most responsive to the habitat enhancements resulting from BDCP's CM2 (Yolo Bypass Fishery Enhancement Plan). Results of Yolo Bypass inundation modeling (MIKE21) indicate that CM2 would result in a 124% to 142% increase (i.e., 224% to 242% of baseline) in the number of days per year that the Yolo Bypass is inundated during February – June. The effect of such an increase in days of inundation on the abundance of

[31] We have reached agreement with Matt Nobriga (FWS) on the objective and the supporting rationale.

age-0 splittail, as estimated by the beach seine index, was assessed by regressing the 1994 – 2008 annual splittail index on February – June number of days of Yolo Bypass inundation. Splittail are considered to need at least 30 days of inundation to complete egg and larval development, so regressions were computed for the years with more than 30 days of inundation only as well as for all years. Days of Bypass inundation were estimated as days of Fremont Weir overtopping.

- The results of the regression for years with greater than 30 days of Fremont Weir overtopping are more applicable than the results for all years for assessing the potential effect on splittail recruitment of CM2 because the principal benefit to splittail of this measure would be to increase the frequency of years with greater than 30 days of weir overtopping. Therefore, the regression equation obtained from the analysis for greater than 30 days of overtopping was used to compute the increases in the splittail seine index expected from the 124% to 142% increase in days of inundation predicted for implementation of CM2. The results indicate that the increases in seine index would range from about 125% to 354%, depending on the value of the initial days of inundation. For instance, an increase from 10 to 23 days of inundation, a 130% increase, results in a predicted increase in the seine index from 22 to 91, a 324% increase, whereas an increase from 30 to 69 days of inundation, also a 130% increase, results in a predicted increase in the seine index from 129 to 338, a 162% increase. Based on the results of the regression equation, a 50% increase in the total splittail seine index from baseline conditions (i.e., 150% of baseline conditions) was selected as a reasonable target for the objective.

References:

Brown, L.R. and J.T. May. 2006. Variation in spring nearshore resident fish species composition and life histories in the lower San Joaquin Watershed and Delta. San Francisco Estuary and Watershed Science, 4(2).

Contreras, D., V. Afentoulis, K. Hieb, R. Baxter and S. Slater. 2011. Status and trends report for pelagic fishes of the upper San Francisco Estuary. IEP Newsletter 24(2):27-38.

Feryer, R., T. Sommer and R. D. Baxter. 2005. Spatial-temporal distribution and habitat associations of age-0 splittail in the lower San Francisco watershed. Copeia 2005(1):159-168.

Green Sturgeon Biological Goals and Objectives:

BDCP Goal GRST1: Increase abundance of green sturgeon in the Plan Area.
▪ **BDCP Objective GRST1.1:** Increase juvenile survival (as a proxy for juvenile abundance and population productivity) throughout the BDCP period ---and--- Increase adult survival (as a proxy for adult abundance and productivity) within 15 years of BDCP permit authorization.
Assumed Stressors: Incubation and rearing and illegal harvest. **Stressor Reduction Targets:** • **Incubation and Rearing.** Improved incubation and rearing conditions in the Bay-Delta and its tributaries within 15 years of BDCP permit authorization. • **Illegal Harvest.** Reduce illegal harvest of juvenile/sub-adult and adult green sturgeon in the Plan Area based on running average of the previous 5 years observed quantity.

Rationale (for both green and white sturgeon):

GRST1.1 and WTST1.1

- Increasing juvenile and adult green sturgeon survival will also increase juvenile and adult green sturgeon abundance and population productivity;
- Improving incubation and rearing conditions for juvenile green sturgeon is expected to increase juvenile green sturgeon production, survival and abundance consequently resulting in an increase in adult green sturgeon abundance and spawning within the Plan Area;
- Reducing the illegal harvest of reproductive adults will increase abundance of all life stages.

BDCP Goal GRST2: Improved habitat connectivity that facilitates timely passage and reduces stranding of adult green sturgeon.
• **BDCP Objective GRST2.1:** Eliminate stranding of adult green sturgeon at Fremont Weir, the scour pools directly below Fremont Weir, and the Tule Pond within 15 years of BDCP permit authorization, and minimize stranding until this time.
Assumed Stressors: Connectivity. **Stressor Reduction Targets:** • **Connectivity:** Improve connectivity between the Sacramento River and Yolo Bypass for timely passage and decrease stranding of adult green sturgeon between January and May within 15 years of BDCP permit authorization. • **Passage at Fremont Weir before Modification:** Prior to modification of the Fremont Weir, minimize loss from poaching and stranding through increased enforcement and patrols and through fish rescue. • **Passage at Fremont Weir after Modification:** Provide adult passage at anthropogenic barriers and impediments in less than 36 hours, immediately after modification of the Fremont Weir or within 15 years of BDCP permit authorization, whichever comes first, through weir operations, continued fish rescue, and continued enforcement. • **Inventory Passage Barriers and Impediments:** Inventory existing anthropogenic migratory impediments and identify opportunities for BDCP to improve passage/reduce delays. • **Passage at other Barriers and Impediments in the Plan Area:** As feasible as part of BDCP, limit adult passage delays at anthropogenic barriers and impediments in the Plan Area to less than 36 hours, within 15 years of BDCP permit authorization.

Rationale (for both green and white sturgeon):

GRST2.1 and WTST2.1

- Minimizing stranding within the Yolo and Sutter Bypasses initially, and eventually eliminating stranding at known problem areas, will improve successful upstream passage of adult green sturgeon to spawning areas within the Sacramento River system;
- Unobstructed connectivity between the Sacramento River and bypass systems, combined with suitable habitats and safe and timely passage are critical features which will reduce the potential for adult mortality and increase the dispersal of migrating adult green sturgeon to spawning habitat upstream within the Sacramento River system;
- Improvements at the Fremont Weir, focused on adult green sturgeon passage, is expected to have beneficial effects to the species by eliminating migration delays and increasing the number of spawners reaching spawning areas further upstream within the Sacramento River system;
- An inventory of other potential physical migratory obstacles to green sturgeon migration within the Yolo and Sutter Bypasses will identify additional opportunities to improve successful green sturgeon passage, further reducing potential migration delays and increasing the number of spawners reaching spawning areas further upstream within the Sacramento River system ;
- In addition to physical passage obstructions, there may be other anthropogenic influences delaying green sturgeon migration, such as confusing flow patterns and low dissolved oxygen levels within sturgeon migration routes through the Delta. Identifying these other passage obstructions is expected to lead to additional sturgeon habitat improvement opportunities.

BDCP Goal GRST3: Increased spatial distribution of YOY and juvenile green sturgeon in the Delta compared to existing conditions.
▪ **BDCP Objective GRST3.1:** Improve water quality parameters and physical habitat characteristics in the Bay-Delta to increase the spatial distribution of green sturgeon in the Plan Area within 15 years of BDCP permit authorization.
Assumed Stressors: Water quality conditions restrict access to appropriate YOY and juvenile rearing habitat. **Stressor Reduction Targets:** • **Water Quality.** Reduce pollutants and improve water quality, with targets to be set by the adaptive management technical team on the basis of developing understanding of sturgeon sensitivity to water quality impairments. [32]

Rationale (for both green and white sturgeon):

GRST3.1 and WTST3.1

- Water quality is likely a limiting factor during early life-history stages of green sturgeon (Israel and Klimley 2008);
- This objective is intended to increase the spatial distribution and survival of early life stages of green sturgeon by providing water quality conditions that support optimal growth, viability, and behavior;
- Reducing pollutant sources and/or other factors affecting water quality (i.e. invasive SAV, changes in salinity) is expected to improve rearing conditions for juvenile and sub-adult green sturgeon.

[32] Objectives presented here for green sturgeon are based on discussions with Dave Swank, Jason Roberts and Josh Israel. Discussion with Josh on 6/25/2012 indicated he is comfortable with the current objectives for green and white sturgeon.

White Sturgeon Biological Goals and Objectives:

BDCP Goal WTST1: Increase abundance of white sturgeon in the Plan Area.
▪ **BDCP Objective WTST1.1:** Increase juvenile survival (as a proxy for juvenile abundance and population productivity) throughout the BDCP period ---and--- Increase adult survival (as a proxy for adult abundance and productivity) within 15 years of BDCP permit authorization.
Assumed Stressors: Incubation and rearing conditions, food availability, entrainment, and illegal harvest. **Stressor Reduction Targets:** • **Rearing:** Document distribution of incubation and rearing conditions and identify opportunities for improvement. Achieve improved rearing conditions in the Bay-Delta and its tributaries within 15 years of BDCP permit authorization. • **Food Availability:** Identify areas with prey resource enhancement opportunities. Determine appropriate rate and schedule for implementation. Increase the quantity and quality of habitats suitable for prey resources important to white sturgeon (crustaceans, annelids, mollusks, fish, and midges) within 10 years of BDCP permit authorization. • **Entrainment:** Determine impact of entrainment to the white sturgeon population, and manage entrainment levels to support stable and/or increase population trends. • **Illegal Harvest:** Determine an appropriate reduction target, and then reduce illegal habitat of sub-adult and adult white sturgeon in the Plan Area by the target quantity within 15 years of BDCP permit authorization.

Rationale (see Green Sturgeon Above)

BDCP Goal WTST2: Improved habitat connectivity that facilitates timely passage and reduces stranding of adult green sturgeon.
• **BDCP Objective WTST2.1:** Eliminate stranding of adult white sturgeon at Fremont Weir within 15 years of BDCP permit authorization, and minimize stranding until this time.
Assumed Stressors: Connectivity. **Stressor Reduction Targets:** • **Connectivity:** Improve connectivity between the Sacramento River and Yolo Bypass for timely passage and decrease stranding of adult white sturgeon between January and May within 15 years of BDCP permit authorization. • **Passage at Fremont Weir before Modification:** Prior to modification of the Fremont Weir, minimize loss from poaching and stranding through increased enforcement and patrols and through fish rescue. • **Passage at Fremont Weir after Modification:** Provide adult passage at anthropogenic barriers and impediments in less than 36 hours, immediately after modification of the Fremont Weir or within 15 years of BDCP permit authorization, whichever comes first, through weir operations, continued fish rescue, and continued enforcement. • **Inventory Passage Barriers and Impediments:** Inventory existing anthropogenic migratory impediments and identify opportunities for BDCP to improve passage/reduce delays. • **Passage at other Barriers and Impediments in the Plan Area:** As feasible as part of BDCP, limit adult passage delays at anthropogenic barriers and impediments in the Plan Area to less than 36 hours, within 15 years of BDCP permit authorization.

Rationale (see Green Sturgeon Above)

BDCP Goal WTST3: Increased spatial distribution of YOY and juvenile white sturgeon in the Bay-Delta compared to existing condition SWP/CVP regulatory requirements.
▪ **BDCP Objective WTST3.1:** Improve water quality parameters and physical habitat characteristics in the Bay-Delta to increase the spatial distribution of white sturgeon in the Plan Area within 15 years of BDCP permit authorization.
Assumed Stressors: Water quality conditions restrict access to appropriate YOY and juvenile rearing habitat. **Stressor Reduction Targets:** • **Water Quality.** Reduce pollutants and improve water quality, with targets to be set by the adaptive management technical team on the basis of developing understanding of sturgeon sensitivity to water quality impairments. [33]

Rationale (see Green Sturgeon Above)

[33] Objectives presented here for white sturgeon are based on discussions with Dave Swank, Jason Roberts and Josh Israel. Discussion with Josh on 6/25/2012 indicated he is comfortable with the current objectives for green and white sturgeon.

Pacific and River Lamprey Biological Goals and Objectives

BDCP Goal PRL1: Suitable larval rearing habitat for Pacific and River lamprey within the Plan Area.
• **BDCP Objective PRL1.1:** Protect and enhance habitat suitable for larval settlement and development within the Plan Area within 15 years of BDCP permit authorization. [34]
Assumed Stressors: Lack of suitable larval habitat. **Stressor Reduction Targets:** ▪ **Larval Habitat:** Baseline monitoring to determine extent of suitable substrates in Plan Area, extent of use of suitable habitats in the Plan Area and adoption of guidance on tidal habitat restoration to produce these substrate types as practicable. PHABSIM (Physical Habitat Simulation System) analysis on the Columbia River identified commonly preferred habitat characteristics as (Close et al. 2003): o Silt, sand or organic (≥30mm depth) substrates o Water velocity of 0-19 centimeters per second (cm/s) o Avoiding sudden changes in water levels (to reduce stranding).

Rationale

Discussing option of omitting PRL1 BGO, as suitable habitat within the Plan Area is not a limiting factor for Lamprey.

BDCP Goal PRL2: Improved habitat connectivity that facilitates timely passage for Pacific and River lamprey.
• **BDCP Objective PRL2.1:** Reduce passage delays for lamprey adults migrating upstream within the Yolo Bypass within 15 years of BDCP permit authorization. • **BDCP Objective PRL2.2:** Improve downstream passage conditions for lamprey ammocoetes and macropthalmia at the Fremont Weir within 15 years of BDCP permit authorization. [35]
Assumed Stressors: Connectivity and barriers to upstream/downstream migration/passage. **Stressor Reduction Targets:** ▪ **Adult Passage:** Limit passage delays at anthropogenic barriers and impediments in the Yolo Bypass (e.g., Fremont Weir) to less than 36 hours within 15 years of BDCP permit authorization. ▪ **Larval/Juvenile Passage:** Improve connectivity between the Sacramento River and Yolo Bypass for improved passage of ammocoetes and macropthalmia within 15 years of BDCP permit authorization. ▪ **Inventory Passage Barriers and Impediments:** Inventory existing anthropogenic migratory impediments and identify opportunities for BDCP to improve passage and reduce delays. ▪ **Passage at other Barriers and Impediments in the Plan Area:** As feasible as part of BDCP, limit adult passage delays at other anthropogenic barriers and impediments in the Plan Area to less than 36 hours, within 15 years of BDCP permit authorization.

Rationale

To be developed once the objectives for Lamprey have been agreed upon with the Agencies. DFG and FWS are currently reviewing this objective.

[34] PRL2 – The Goal, Objective and Stressor Reduction Target may be omitted. FWS and DFG are considering whether it is suitable to drop this objective. We have not yet received input from the agencies on these.

[35] PRL2 – The Goal, Objectives and Stressor Reduction Targets are new. We have not yet received input from the agencies on these.

Framework for Decision Tree and Operating Criteria

Background

Over the past decades, there has been considerable disagreement over the causes and the relative importance of various factors contributing to the decline of many Delta aquatic species. The state and federal agencies engaged in developing the Bay Delta Conservation Plan acknowledge these differences of opinion, and are united in agreement that much additional insight can be gained through a more significant investment in applied science in the Delta.

It is not possible today to predict with a high degree of certainty the state of scientific information relating to the Bay Delta ecosystem and its species that will be available or the conditions affecting species at the time operation of the proposed dual conveyance system actually begins, which may be 10-15 years from now. Operating criteria (e.g., applicable to Conservation Measure #1), in combination with other conservation measures, must be designed to achieve the biological goals and objectives of the Bay Delta Conservation Plan and contribute to the recovery of covered species based on the best information available.

The establishment and application of biological goals and objectives is fundamental to ensuring the Bay Delta Conservation Plan helps restore species, and the biological goals and objectives will play an important role in helping to prioritize the increased investment in applied science in the Delta. The Bay Delta Conservation Plan will accomplish these biological outcomes in a manner that best achieves the co-equal goals of enhancing ecological functions in the Delta and improving water supply reliability.

Decision Tree, Operating Criteria, and Adaptive Management

The proposed Bay Delta Conservation Plan will at its outset include operating criteria based on the best information available at the time of permit issuance. It will also utilize a "Decision Tree" approach to address the ability of alternative operating criteria, in combination with other conservation measures, to meet the biological goals and objectives and ensure water supply reliability through a structured, scientifically-driven process. This Decision Tree process will produce new scientific information through the testing of specific scientific hypotheses. This information will then be employed to identify refined operating criteria based on the best information available after 10-15 years of applied science prior to actual operation of the dual conveyance system.

The Decision Tree will evaluate a range of alternative criteria that may either go "up" or "down" from the operating criteria initially identified in the permit itself. In other words, the operating criteria identified 10-15 years from now may allow for lesser or greater water exports than operating criteria identified today, depending on new insights gained from the

additional years of applied science. This approach allows the time necessary to take into consideration the performance of the "early implementation habitat program," adaptive management on the full suite of conservation measures other than Conservation Measure #1, and other relevant factors.

The Decision Tree process will involve: (1) clear articulation of a limited set of scientific hypotheses or conceptual models designed to test the ability of differing operating criteria and combinations of operating criteria and conservation actions to meet the goals and objectives of the Bay Delta Conservation Plan; (2) development and implementation of a science plan and data collection program to test the hypotheses and reduce uncertainties; (3) assessment of possible alternative conservation measures to achieve the goals and objectives of the Bay Delta Conservation Plan; and (4) after the 10-15 years of additional information and collaboration during hypothesis testing, identification of operational criteria that meet the biological goals and objectives in a manner that best achieves the co-equal goals of the Bay Delta Conservation Plan.

The Decision Tree process must be specific and precise, and the federal and state agencies acknowledge much detail remains to be worked out regarding the structure, including the hypotheses to be evaluated and the specifics of the evaluation and decision-making process.

Between the time of permitting and operation of the dual conveyance system, the Decision Tree will be the primary process under the Bay Delta Conservation Plan to test specific hypotheses and reduce uncertainties pertaining to the operation of the dual conveyance system, whereas the Bay Delta Conservation Plan adaptive management program will govern adjustments to all other elements from the time the permit is issued throughout the entire permit period. The Decision Tree process will be coordinated with the broader adaptive management program. After the start of operations of the dual conveyance system, the adaptive management program will continue as the primary process for adjusting all the elements of the Bay Delta Conservation Plan, including operations of the dual conveyance system. The Decision Tree will terminate when operations of the new conveyance facility begin.

Therefore, the Decision Tree process must be viewed in combination with the broader adaptive management program, the governance structure, and the science investment (to be described in a revised version of the existing Bay Delta Conservation Plan). These pieces together define the overall approach for gathering more information, refining the specific elements of the operating criteria, adapting the habitat restoration program and other conservation actions as necessary, and making adjustments in the Bay Delta Conservation Plan. The program will ensure the biological goals and objectives specified in regulatory permits are being met.

Guiding Principles

- The Bay Delta Conservation Plan in its totality will be designed to achieve the biological goals and objectives of the Bay Delta Conservation Plan over the term of the permit. More specifically, the operating criteria for the dual conveyance system described in Conservation Measure #1, in combination with the other conservation measures and other elements of the Bay Delta Conservation Plan, will achieve the biological goals and objectives of the Bay Delta Conservation Plan over the term of the permit.

- Conservation Measure #1 will include a complete set of operating criteria for the new dual conveyance system based on the best information available at the time of permit issuance.

- Additional information and insight about specific key operating criteria will be generated through targeted science before operation of the new dual conveyance system begins. The purpose of the Decision Tree process is to generate information for key criteria such as fall and spring outflows, habitat restoration, and the relationships between outflows and habitat restoration and other non-flow conservation measures relative to biological goals and objectives.

- Conservation Measure #1 will also identify ranges for key operating criteria that will be subject to the necessary environmental analyses. These ranges will be included in the final permit authorization as possible outcomes of the Decision Tree process. These ranges, the Decision Tree process, and the applied science conducted over 10-15 years will then be used to identify the specific operating criteria for the dual conveyance system that, in combination with implementation of all Bay Delta Conservation Plan conservation measures, will achieve the biological goals and objectives in a manner that best achieves the co-equal goals.

- The operating criteria identified at the time of permit issuance as well as through the Decision Tree process will meet Endangered Species Act and California Natural Communities Conservation Planning Act permit requirements, determined by the regulatory agencies as informed by current scientific understanding at the relevant moment in time.

Incorporating the Decision Tree into the Bay Delta Conservation Plan Effects Analysis

- The revised Bay Delta Conservation Plan Effects Analysis will include the evaluation of at least one alternative that has been fully modeled and analyzed. It will then expand the analysis to evaluate the effects of the ranges of the criteria included in the Decision Tree.

- The revised Effects Analysis will include alternative versions of analyses to address the scientific hypotheses and take uncertainties into account. These alternative versions of analyses may provide the basis for designing future science investigations to obtain new information.

- For the purposes of complying with Endangered Species Act and California Natural Communities Conservation Planning Act permit requirements, the revised Effects Analysis must identify and demonstrate that at least one of the sets of operating criteria addressed through the Decision Tree process, in combination with implementation of all Bay Delta Conservation Plan conservation measures, meets federal and state permitting standards, within the limits of today's scientific knowledge.

North Delta Facility Sizing and Design

Another notable component of the modification to the Bay Delta Conservation Plan that will be carried forward into the environmental review process is to the design, construction and operation of the proposed new water conveyance facility in the north Delta. Key features of this element of the revised Bay Delta Conservation Plan include the following:

- The proposed project will seek a permit to construct, test and operate north Delta diversion facilities with a total capacity of 9,000 cfs. Additional features will include conveyance facilities to move water from each intake to an intermediate forebay and two tunnels to move water from the intermediate forebay to the south Delta pumping facilities

- The two tunnels will be sized to minimize the energy use and associated greenhouse gas emissions associated with moving water through the water conveyance facilities, including providing gravity flow of water from the intermediate forebay to the south Delta pumping facilities.

- The permit terms governing the operation of these new points of diversions will apply performance standards that reflect generally applicable best management practices for large fish screens. These would consist of the application of the current National Oceanographic and Atmospheric Administration and California Department of Fish and Game fish screening design and operating criteria, which govern such things as approach and sweeping velocities. They will also contain overall performance standards governing juvenile survivals across the screening units, taking into account both direct and indirect effects of the diversions and reflecting best practices.

- These performance standards will govern the operation of the diversion units and will be enforceable terms of the permit.

- All of the parties recognize the importance of meeting these performance standards and share a common interest in the successful design, engineering, testing and operation the new diversion facilities. Federal and state agencies are committed to a collaborative approach to the design and testing effort, striving for a consensus on the design, construction, and operational testing of the new units.

- The agencies acknowledge that, subject to completing more advanced analysis and design, significant uncertainties exist regarding the ability to operate the screens at a scale and in a manner that achieves the applicable performance standards at the outset.

- In light of these uncertainties, the California Department of Water Resources and any other authorized entities will convene a team of fish screening experts to develop a rigorous design and testing program for the new units. The testing and evaluation

program will encompass a variety of strategies to increase the likelihood of success in meeting the performance standards, taking into account engineering, biological, and hydrological factors, and experiences from other similar efforts. California Department of Natural Resources will seek the active participation of National Marine Fisheries Service and other fishery agency experts, as well as non-agency experts with national-caliber expertise on the design and successful operation of large fish screens.

- As more is learned through the collaborate design process, California Department of Water Resources will consider various approaches for managing remaining uncertainties regarding the ability of the screens to meet performance standards, including multi-year staged construction and operation of screens over a test period to ensure performance standards are being achieved with the current designs to avoid major modifications that could entail significant additional costs and delays.

- Within the next year, the permit applicants will design and implement survival studies in the area of the new units to generate information on existing "baseline " survivals across year types which will inform the application of the performance standards once testing and operations commence, working in close coordination with fishery agencies and other fishery experts.

- Final responsibility for the engineering, design and construction of the individual units will lie with California Department of Water Resources, subject to compliance with standard federal, state and local permitting requirements. California Department of Water Resources will seek review and concurrence by National Marine Fisheries Service, U.S. Fish and Wildlife Service and California Department of Fish and Game with final screening design and construction plans, and testing protocols.

- Final responsibility for testing, evaluating, and determining if the diversion structures are achieving the relevant performance standards over the course of operations lies with the relevant permitting agencies.

California Department of Water Resources and the other agencies will convene an independent science review workshop in 2012/2013 of fish screening experts to review and benefit from the range of experience in existing large screen projects in the United States.

Other Elements Contributing to Achieving the Co-Equal Goals and Protecting the Delta

Successful management of water resources to achieve the co-equal goals and overall Delta sustainability will require continued improvement in managing California's finite water resources. The urgent need for a comprehensive strategy to meet California's growing water demand was a fundamental conclusion of the Delta Vision process, and was reiterated in a recent National Research Council Report (Sustainable Water and Environmental Management in the California Bay-Delta, 2012). There is much to gain in both water supply reliability and ecosystem protection and restoration from improved water management throughout California.

The following elements are not part of the Bay Delta Conservation Plan. They are intended to further the co-equal goals and to protect and enhance the Delta as an evolving place. Improvements in the efficiency of water operations in California could result in reduced future reliance on the Delta as a water supply. These actions will be studied and evaluated separately from Bay Delta Conservation Plan and are not part of the associated Bay Delta Conservation Plan regulatory authorizations

To the extent these additional actions are implemented, they will clearly help enhance the Bay Delta Conservation Plan's success by promoting more flexibility and better management of water to satisfy current and future demands. The elements include a strong state and federal commitment to using the Integrated Water Management approach to achieve: (1) Increased Water Efficiency; (2) Increases in Water Supply; and (3) Improvements in Efficiency of Operations.

The state and federal governments recognize the importance of continuing the substantial investments being made in improved water management in California through existing programs (e.g. WaterSMART, EQIP, IRWM). Accordingly, the state and federal governments will consider opportunities to ensure those investments continue, potentially through dedicated revenue sources, although any such proposals would likely require state and/or federal legislation.

Overall, these additional elements are intended to be implemented in the manner they have been historically applied – through voluntary agreements that are cost-shared in recognition of the benefits to both the public at large and the entities involved. These programs represent opportunities, not mandates. Moreover, environmental review, with public input, will be necessary before binding commitments can be made to any of these elements. It is anticipated that they can be implemented by the state and federal governments as part of their broader responsibilities for California water planning, separate from but complementary to the Bay Delta Conservation Plan.

Integrated Water Management

This element embraces an Integrated Water Management approach within the upstream areas to the Delta, within the Delta proper, and within the Central Valley Project and the State Water Project service areas. Within the Integrated Water Management context, all water management programs and projects are integral and interconnected—it is through this interconnectivity that Integrated Water Management programs and projects maximize their value. The value of Integrated Water Management is to integrate water management, flood management, and ecosystem programs to maximize limited resources and yield multiple benefits—life safety and reduction of flood risk, water supply reliability and economic stability, and environmental enhancements. Integrated Water Management also provides value in integrating regional water supply reliability with system wide solutions. Most California water management actions affect the Delta; therefore, sustainable integrated flood and water management should include considerations of the Delta ecosystem, water supply and conveyance roles, and comprehensive flood risk management. The opportunity exists to build upon the numerous state and federal programs and projects currently underway in the Delta and throughout California. They include:

- Delta conveyance
- Delta flood emergency response
- flood management (special projects and subvention programs)
- fish passage improvements
- tributary habitat restoration
- long term management of dredge materials
- Integrated Regional Water Management Plans

An Integrated Water Management approach promotes system flexibility to adapt to changing conditions (such as climate change, policies and regulations, etc.) and enhances the natural environment. This element will enhance solution opportunities by partnering across all levels of government and interest groups to align water planning, policies, and regulations.

Increased Water Efficiency

The state and federal governments will invest in measures that have the potential to help increase water efficiency or increase supply reliability to make more effective use of existing supplies. Water management actions under this element may utilize behavioral and technological improvements to use water more efficiently while still meeting existing and future beneficial needs. These actions may include:

- Water Conservation: The California Department of Water Resources and the U.S. Bureau of Reclamation will partner with districts that have potential for water saving by implementing water conservation practices such as regulation reservoirs, canal lining, system automation, modernization projects and efficient irrigation practices.

- Agricultural Water Use Efficiency: State and federal agencies will partner with water districts to encourage the use of drip and micro irrigation systems, irrigation scheduling, crop shifting, deficit irrigation, and other efficient water management practices. They will also provide assistance to enable implementation of the Water Conservation Act of 2009 which requires certain agricultural water suppliers to measure water delivered to their customers and bill based at least in part on volume delivered.

- Urban Water Use Efficiency: State and federal agencies will assist with implementation of the Water Conservation Act of 2009, which requires California urban water suppliers to reduce urban per capita water use by 20% by the year 2020.

Increase Water Supply

This water management element involves finding or creating additional sources of water as well as improving management of existing water supplies to more efficiently store and provide water for California, even in drought years. The types of water management actions that could be implemented to meet the goals of this element include:

- Conjunctive Management and Groundwater Storage: There is considerable interest and opportunity for additional ground water storage south of the Delta. State and federal partners can assist in permitting and contribute to cost effectiveness for the local partners. This is an area where commitment of funding and support could expand the quantity and efficiency of water supply particularly in the San Joaquin valley.

- Desalination: Potential options regarding desalination should be explored as part of this element.

- Recycled Municipal Water: Both the federal and state governments have made significant investments. For example, to date U.S. Bureau of Reclamation has invested over $500 million in Title XVI recycle and reuse projects in California resulting in about 250,000 acre feet of new water annually. With an increase in the availability of state or federal funding, there is an opportunity to expand the usable water supply south of the Delta in both the State Water Project and Central Valley Project service areas. Accelerated completion of projects underway could yield up to an additional 400,000 acre feet of water annually. This illustrates the significant potential for adding to the available water supply for Central Valley Project and State Water Project contractors. Although this can be expensive water, it is becoming more competitive and has considerable political and public support.

- Surface Storage: Most potentially viable dam and reservoir sites have been identified and assessed as part of previous water resources studies at one time or another. However, the need to determine and pursue the most viable options merits

consideration as part of this element. Also there may be opportunities to modify existing surface storage structures (e.g. modification to spillways and/or spillway gate structures or raising existing dams) in ways that can increase storage capacity or offer operational opportunities that can enhance water supplies without causing undue adverse environmental or other impacts. Hence, an interagency team drawn from state and federal agencies will be established to focus on the storage projects that offer the most potential and will provide information to be considered as part of additional sources of water. Once identified, those with the most potential for completion and the greatest cost effectiveness will be aggressively pursued.

Improve Operational Efficiency and Transfers/Exchanges

Operational improvements of the two major water projects in California could lead to improved efficiencies to water supply, and improvements to the biological resources. The Central Valley Project generally has more storage and less conveyance flexibility than the State Water Project. The opposite is true for the State Water Project. The State Water Project and Central Valley Project are operated by California Department of Water Resources and U.S. Bureau of Reclamation, respectively. The operations of the two projects are coordinated through the 1986 Coordinated Operating Agreement. Even through coordinated operations, the State Water Project and Central Valley Project are not operating as one unit. They each have different contractual obligations and operating constraints. Operational improvements proposed under this element would take advantage of the strengths of both projects. This water management element involves changing the mode of transportation of water and the way water is used and stored to better meet current and future demand. In addition, there is considerable opportunity for increases in water transfers and exchanges throughout the Central Valley including State Water Project, Central Valley Project, and non-project interests. The types of water management actions that could be implemented to meet the goals of this element include:

- Conveyance: The movement of water south of the Delta in order to facilitate efficient use of currently available supplies is significantly limited by the absence of east/west conveyance. There are many proposed projects for improving the movement of water from east to west and west to east that have good general support but lack funding to support local interest. State and federal support in the permitting process can also enhance their success.
- System Reoperation: U.S. Bureau of Reclamation and California Department of Water Resources will establish a joint team to evaluate Central Valley Project/State Water Project system reoperations and identify specific measures with quantifiable efficiencies.

- Transfers/Exchanges: There is considerable opportunity for increases in water transfers and exchanges throughout the Central Valley including State Water Project, Central Valley Project, and non-project interests. There is an opportunity to accelerate or expand on ongoing activities with additional funding from the federal or state agencies to support local interest in these historically private transactions.

Examples include the 25 year Exchange Contractor transfer program and the North/South transfer program currently being evaluated under NEPA. There is also interest from certain San Joaquin River and tributary interests in a "Yuba Accord" type of arrangement. Exchange opportunities also offer flexibility in timing of deliveries so as to better take advantage of existing water supplies to meet demands at certain times of the year.