Appendix X.

(Draft) Identification of Water Conveyance Alternatives for Bay Delta Conservation Plan Environmental Impact Report/Environmental Impact Statement (Conservation Measure No. 1)

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X.1 Introduction and Purpose of this Appendix

The process for developing the Bay Development Conservation Plan (BDCP) was initiated in 2006.Its primary objective was to achieve long-term compliance with the federal Endangered Species Act (ESA) and parallel state species protection laws (e.g., the California Natural Community Conservation Planning Act [NCCPA]) with respect to (i) the operation of existing State Water Project (SWP) facilities in the Sacramento-San Joaquin Delta (Delta) and (ii) the construction and operation of new conveyance facilities for the movement of water entering the Delta from the Sacramento Valley watershed to the existing SWP and federal Central Valley Project (CVP) pumping plants in the southern Delta. The proposed BDCP also provides for the conservation and management of covered species through actions—conservation measures—within the BDCP Plan Area that will contribute to the recovery of the species.

The proposed BDCP as currently contemplated consists of a set of 23 Conservation Measures (CMs). Conservation Measure 1 (CM1) consists of water conveyance facilities components combined with water conveyance operational components. The BDCP also includes conservation measures that address restoration and conservation strategies for aquatic and terrestrial habitat (CM2–CM11), and other stressors reduction measures(CM12–CM23).

The BDCP Environmental Impact Report/Environmental Impact Statement (EIR/EIS) is being prepared to evaluate the potential impacts of implementing a range of reasonable alternatives representing different potential versions of the ultimate BDCP. The purpose of this appendix is to define the range of alternatives for CM1 to be evaluated in detail in the EIR/EIS. This appendix focuses on:

- A range of conveyance alignment concepts to convey water from the Sacramento River watershed to existing SWP and CVP pumping plants located in the South Delta, and
- A range of conveyance water supply operations concepts related to the timing and capacity of water diversions from the Sacramento River watershed and/or from existing SWP and CVP intakes in the South Delta.

Separate analyses have been prepared to describe the development of specific locations and design criteria of intakes along the conveyance alignments and the development of alternative concepts for CM2 - CM23. Separate analyses also will be prepared to evaluate concepts for Water Demand Management, such as water conservation and water recycling.

X.1.1 Organization of this Appendix

This appendix provides the following: a brief description of the background of the development the BDCP and the EIR/EIS; descriptions of the screening criteria to be used to identify potentially feasible and reasonable alternatives to be fully evaluated in the EIR/EIS; and a chronological description of identification of the range of alternative components related to CM1 to be evaluated in the EIR/EIS. The chronological development of the range of water conveyance alternative components related to CM1 occurred in the following manner.

- Initially, State and federal agencies participating in BDCP identified Delta conveyance concepts described in previous reports as potential means for maintaining good water quality in the Delta and water supply availability to users of Delta water..

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- The BDCP Steering Committee conducted a preliminary analysis of broadly defined conveyance alignment concepts to consider benefits and constraints of different conveyance alignment approaches and completed a "Conservation Strategy Options Evaluation Report" in September 2007 (BDCP 2007a) (also known as the "Options Report").
- The EIR/EIS process initiated scoping in early 2008 and re-opened the process in early 2009. The majority of the comments related to BDCP water supply components were related to conveyance alignment approaches.
- An initial screening process was completed for the EIR/EIS process to identify a broad range of conveyance alignment concepts to be used in the development of a range of conveyance operations concepts.
- During 2008 through 2010, the BDCP Steering Committee conducted analyses of preliminary conveyance operations concepts, and in early 2010 developed a set of conveyance operations criteria to be evaluated for the initial BDCP Effects Analysis.
- In 2011, State and federal agencies involved in the BDCP process continued to receive comments related to conveyance concepts.
- In late 2009, the California Legislature enacted a package of related water bills that included the Sacramento–San Joaquin Delta Reform Act of 2009 (Delta Reform Act), which addressed issues that should be considered in the development of the EIR/EIS alternatives if the BDCP were to be included via a new statutory process within the newly required Delta Plan to be prepared by the newly constituted Delta Stewardship Council (DSC).
- The Lead Agency staff and consultants involved in the EIR/EIS process considered (i) the set of conveyance operations criteria developed through the BDCP Steering Committee process, (ii) 2008 and 2009 scoping comments related to conveyance operations, (iii) issues included in the Delta Reform Act to develop a range of conveyance operations concepts, and (iv) comments received in 2011 by other State and federal agencies involved in the BDCP process. All of this information was used to develop a range of conveyance operations concepts to be considered with the previously screened conveyance alignment concepts.
- Lead Agency staff and consultants completed a second screening process for the conveyance concepts to identify the final range of alternatives to be fully considered for CM1 in the EIR/EIS.

This appendix describes both the information used at each point in this overall process and the results of the first and second screening processes to define the final range of alternatives to be considered for CM1 in the EIR/EIS.

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X.2 BDCP Project Background

In August of 2000, a broad array of State and federal agencies, including the Department of Water Resources (DWR), adopted the CALFED Bay-Delta Program (CALFED) as a 30-year planning roadmap for restoring the Delta's ecology and improving water management. Prior to reaching this milestone, the CALFED agencies had conducted a lengthy, public, and multi-phased evaluation of potential alternatives in connection with preparation of a Program EIR/EIS. In a far-reaching attempt to develop possible alternatives to achieve the mission of the participating agencies, CALFED's scoping process had resulted in the identification of nearly 50 categories of potential actions and 100 preliminary solution alternatives. (CALFED Programmatic Record of Decision, Attachment 1, Aug. 28, 2000, pp. 124-125.) In order to ensure maximum sensitivity to the policies and positions of the CALFED agencies and stakeholder groups, the Program involved technical experts, Program staff teams, and the public to refine the initial set of potential alternatives to 31, and then down to 20. (CALFED Bay-Delta Program Phase I Final Report, Sep. 1996, pp. 7-8.) Further consolidation and refinement led to 10 alternatives, with their various components characterized at modest, moderate, and extensive levels of implementation. (*Id.*) The 10 alternatives were as follows:

- Extensive Demand Management, with the focus on diverting less water from the Delta;
- New Storage To Improve Delta flow, with the focus on changing the timing of flows to benefit all uses;
- Dual Delta Conveyance, with the focus on providing diversified storage and conveyance;
- Through-Delta Conveyance, with the focus on modifying the timing of diversions;
- Delta Channel Habitat and Conveyance, with the focus on improving Delta channel habitat and conveyance;
- Extensive Habitat Restoration With Storage, with the focus on concentrating and improving San Joaquin River flows;
- East-Side Foothills Conveyance, with the focus on isolating conveyance and improving San Joaquin River flows;
- Chain of Lakes Conveyance, with the focus on isolating conveyance within the Delta;
- West-Side Conveyance and River Restoration, with the focus on isolating conveyance and removing diversions from the Sacramento River; and
- East-Side Conveyance, with the focus on isolating conveyance around the Delta.

(CALFED Bay-Delta Program Progress Report, April 1996, p. 12.)

After additional technical analysis, and the evaluation of comments received from the public and various agencies, the CALFED collaboration narrowed and reclassified the 10 potential alternatives into three generalized approaches for conveying water across the Delta, which were carried forward into the alternatives that were studied in detail the Program EIR/EIS. (CALFED Programmatic Record of Decision, Attachment 1, Aug. 28, 2000, pp. 124-125; CALFED Final Programmatic EIR/EIS,

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Response to Comments Vol. 1, July 2000, p. CR-25 - 26.).

With respect reducing Delta exports, the CALFED carefully considered and rejected the concept as unreasonable. In responding to comments concerning a potential reduced Delta exports alternative, the Program EIR/EIS stated as follows:

> Among these [potential alternatives developed in Phase I] were alternatives that emphasized water use efficiency and de-emphasized or eliminated actions to improve export water supplies and improve the adequacy of Bay-Delta water to meet Delta outflow needs. Based on input from public workshops, scoping meetings, the BDAC, and the CALFED agencies, CALFED concluded that these actions would not achieve the primary objective for water supply reliability . . . an alternative that would achieve water quality objectives by reducing or capping exports would prevent the CALFED Program from achieving its objectives regarding water supply reliability.

(*Id.*, p. CR-30.)

As reflected in the CALFED EIR/EIS Programmatic Record of Decision (CALFED ROD), the Preferred Program for water deliveries from the Delta was continued use of the existing Through Delta Conveyance with the following improvements (CALFED 2000a). [1]

- New screened intakes at Clifton Court and Tracy (South Delta intakes for SWP and CVP pumping plants).
- Joint point of diversion and construction of an intertie to allow for joint use of both pumping plants by SWP and CVP (estimated completion of construction in 2012). Increase pumping criteria to fully use the capacity of the SWP pumping plant.
- New permanent operable barrier at the Head of Old River on the San Joaquin River.
- New operable barriers and floodway improvements in the South Delta to improve quantities and quality of water available for South Delta agricultural diverters.
- Evaluation of a new screened diversion facility on the Sacramento River near Hood or Georgiana Slough and a channel to convey water between the Sacramento and Mokelumne rivers.
- New setback levees and dredged or improved channels and levees along the lower Mokelumne River between Interstate 5 and San Joaquin River.

The CALFED ROD also recommended continued evaluation of a screened diversion facility on the Sacramento River in coordination with modifications of Delta Cross Channel operations and a channel between the Sacramento and Mokelumne rivers to improve drinking water quality if the CALFED ROD recommendations for water quality programs did not improve drinking water quality.

Since 2000, further studies and information have become available that have caused reconsideration of the Through Delta Conveyance component of the CALFED ROD. Pelagic organisms, including delta smelt, have experienced a precipitous decline in recent years. Revised biological opinions for the coordinated operation of the CVP and SWP issued by U.S. Fish and Wildlife Service (USFWS 2005 and 2008) and National Marine Fisheries Service (NMFS 2005 and 2009) and related judicial decisions arising from federal court litigation have resulted in current and potential future substantial reductions in water supply availability for both the SWP and the CVP. Recent DWR evaluations indicate a higher degree of risk to Delta levees from earthquakes than was previously understood

[1] The California Supreme Court ultimately upheld the adequacy of the EIR component of the EIR/EIS for the CALFED ROD, rejecting an argument, among others, that the document should have included a "Reduced Export Alternative." (*In re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings* (2008) 43 Cal.4th 1143, 1166.)

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during preparation of the CALFED analysis. The higher potential for levee failure could result in substantial sea water intrusion in the Delta channels that would increase the risk of water supply availability for the SWP and CVP, as well as for Delta water users and the Delta ecosystem. There is also growing consensus among scientific experts suggesting that climate change over the next 50 to 100 years will cause considerable sea level rise, which would increase the risk of levee failure and degrade water quality due to salt water intrusion, thereby increasing the risks of a severe reduction or loss of water supply availability in and from the Delta.

Based upon these predictions and other information collected by State and federal agencies, then-Governor Arnold Schwarzenegger issued Executive Order 2-17-06 on September 28, 2006, initiating the Delta Vision process to develop "a durable vision for sustainable management of the Delta," and a letter to State Senators Perata, Machado and Steinberg, stated his intention to direct DWR to proceed with preparation of the BDCP environmental review and permitting activities, as described in Subsection X.4.3.5.

X.2.1 Background of the Bay Delta Conservation Plan Process

The BDCP is being developed through a collaboration of DWR and federal Bureau of Reclamation (Reclamation), and the project proponents including Metropolitan Water District of Southern California, Kern County Water Agency, Santa Clara Valley Water District, Zone 7 Water Agency (Alameda County Flood Control and Water Conservation District, Zone 7), San Luis and Delta-Mendota Water Authority, and Westlands Water District (BDCP 2010a). Although the BDCP process began prior to enactment of the 2009 Delta Reform Act, the BDCP's original objectives anticipated and will help to meet California's statutory coequal goals for Delta management: water supply reliability and ecosystem restoration through the actions listed below.

- New and/or redesigned water conveyance and operation of the State Water Project [SWP] and the federal Central Valley Project [CVP]
- Habitat restoration within the Delta, including restoring native fish, wildlife and plant habitats.
- Addressing other ecological stressors to covered aquatic species in the Delta.

The BDCP will result in the development of a Habitat Conservation Plan (HCP) under the provisions of federal ESA (section 10(a)(1)(B)) and a Natural Community Conservation Plan (NCCP) under the NCCPA (Fish and Game Code sections 2800 et seq.) and/or the California Endangered Species Act (CESA) (sections 2050 et seq.). If the BDCP is to be integrated into the Delta Stewardship Council's Delta Plan via the statutory process laid out in Water Code section 85320 from the 2009 Delta Reform Act, the BDCP must take the form of an NCCP under California law and an HCP under federal law. The HCP and NCCP processes are conducted by the project proponents proposing to undertake "covered activities." For the BDCP, the covered activities include continued operations and maintenance of existing, improved, and future facilities (including emergency preparedness or response actions) for the SWP and CVP, as well as other conservation measures included in the BDCP to improve Delta ecosystem.

The BDCP Steering Committee, established in order to provide a public forum where key policies and strategy issues could be publicly discussed, met over 120 times between 2006 and 2010. The BDCP Steering Committee established several working groups and technical teams to develop and evaluate alternative concepts. The BDCP Steering Committee identified an initial set of conservation measures and conducted a preliminary Effects Analysis in 2010 in accordance with the requirements for a HCP and an NCCP. Following completion of the preliminary Effects Analysis, the

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State and federal agencies and the project proponents have continued to work with stakeholders and the public to prepare the draft HCP and NCCP for publication in 2012.

X.2.2 Background of the BDCP Environmental Impact Report/Environmental Impact Statement Process

An EIR/EIS is being prepared for the BDCP by DWR as the California Environmental Quality Act (CEQA) state lead agency, and Reclamation, USFWS, and NMFS as the National Environmental Policy Act (NEPA) federal co-lead agencies. DWR is participating as the CEQA lead agency to evaluate potential impacts of approval of BDCP with respect to improved SWP water conveyance infrastructure and other habitat conservation measures and to meet its CEQA obligations. This improved infrastructure and these measures are intended to help DWR and its water contractors meet their common goal of restoring and protecting the SWP water supply, water quality, and the health of the Delta ecosystem. USFWS and NMFS are participating as NEPA co-lead agencies to evaluate potential impacts of approval of the HCP, issuance of incidental take permits to DWR, and issuance of incidental take statements and biological opinions to Reclamation. Reclamation is participating as a NEPA co-lead agency to evaluate potential impacts of approval of BDCP with respect to actions to improve CVP water supply reliability while meeting its ESA and NEPA obligations. Although State and Federal water contractors are not among the Lead Agencies, they are "potential authorized entities" with respect to BDCP, and intend to use the certified Final EIR/EIS in making discretionary decisions associated with implementation of BDCP.

The CEQA and NEPA lead agencies initiated the EIR/EIS in 2008 with the publication of notices of the scoping process. More specifically, on January 24, 2008, USFWS and NMFS issued a Notice of Intent (NOI) under NEPA to prepare an EIS. The NOI was re-issued on April 15, 2008 to include Reclamation as a co-lead Federal agency, to update the status of the planning process, and to provide updated information related to scoping meetings (USFWS, NMFS, Reclamation 2008). On March 17, 2008, DWR issued a Notice of Preparation (NOP) under CEQA to prepare an EIR (DWR 2008). At the time of the publication of the NOP and NOI in 2008, the proposed description of the BDCP was in development and information related to the potential EIR/EIS alternatives was preliminary.

Following development of additional information to describe the proposed BDCP, the lead agencies published a revised NOP and a revised NOI on February 13, 2009 (DWR 2009a, and USFWS, NMFS, Reclamation 2009).The two documents described potential alternative concepts that would likely be considered in the EIR/EIS. The potential alternative concepts included potential elements for conservation measures to improve ecological productivity and sustainability in the Delta, including the creation and/or restoration of floodplains, tidal marsh, channel margin, and riparian habitats, and the reduction of threats to listed species by minimization of other stressors. Potential water conveyance concepts identified in the NOP and NOI were described as follows.

- **Dual Conveyance** - may include potential new points of diversion at various locations in the North Delta, facilities to move water from new points of diversion to the existing SWP and CVP pumping facilities in the South Delta, and continued use of the existing diversions [intakes] in the South Delta.
- **Fully Isolated Conveyance** - may include potential new points of diversion at various locations in the North Delta and facilities to move water from new points of diversion to the existing SWP and CVP pumping facilities in the South Delta.
- **Improved Through Delta Conveyance** - may include new temporary or permanent barriers to modify existing hydraulics or fish movement within the Delta, armoring of levees along Delta

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waterways to ensure continued conveyance capacity, and/or actions to improve conveyance capacity in existing Delta waterways.

The 2009 NOP and NOI stated that the new points of diversion could be located along the Sacramento River between south Sacramento and Walnut Grove. The new conveyance facility could extend from the new points of diversion to the existing SWP and CVP pumping facilities in the South Delta and be located either to the west or east of the Sacramento River. The NOP and NOI also stated that the alternatives could include potential changes to SWP and CVP water diversion operations, including seasonal, daily, and real time diversion amounts, rates, and timing of water diverted through and/or around the Delta.

During the EIR/EIS scoping process, 2,950 separate comments were submitted in 305 letters, emails, and comments cards; and verbal comments from 178 individuals were transcribed. There were 1,051 comments related to the development of alternative concepts. Some comments described specific potential alternatives related to conveyance concepts, such as pipelines/tunnels or unlined and lined canals, as described in Section X.7 of this appendix. Many comments about alternative concepts were related to specific measures for protection and restoration of the Delta ecosystem and/or water supplies currently conveyed through the Delta. Some comments described methods to reduce reliance upon Delta water supplies, including water conservation, recycling, and use of other water supplies such as conjunctive use programs to ensure adequate groundwater recharge operations.

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X.3 Development of EIR/EIS Screening and Consistency Criteria

The alternative development process for the EIR/EIS is based upon a number of legal considerations including:

- The legal requirements for adequate discussions of alternatives in an EIR and EIS, as set forth in CEQA and NEPA and the regulations and case law interpreting those statutory schemes; and
- The concepts of "potential feasibility" under CEQA and "reasonableness" under NEPA.

The results of a multi-level screening process reflecting these considerations were then compared to the requirements of the Sacramento-San Joaquin Delta Reform Act, and scoping comments related to the definition of potential EIR/EIS alternatives as identified by responsible and cooperating agencies under CEQA and NEPA, respectively.

Finally, the potential alternatives were evaluated to determine if the potential alternative would require changes in legal rights, including water rights, of entities that are not participants in the BDCP in a way that could not lawfully or practically be accomplished through the mechanism of an HCP/NCCP.

X.3.1 Identification of Potential Alternatives under CEQA and NEPA (First and Second Level Screening)

X.3.1.1 Process for Identification of Potential Alternatives under CEQA

Under CEQA, alternatives to be included in an EIR, in addition to the No Project Alternative, must be: 1) potentially feasible, 2) attain most of the basic objectives of the project,[2] and 3) avoid or substantially lessen any of the significant effects of the project. DWR, as the CEQA lead agency, may structure its alternative analysis around a reasonable definition of a fundamental underlying purpose, and need not study alternatives that cannot achieve that basic goal.

The range of alternatives required in an EIR is governed by a "rule of reason" that requires the EIR to set forth only those alternatives necessary to permit a reasoned choice. An EIR need not consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decision making and public participation. An EIR is not required to consider alternatives that are infeasible.

According to CEQA case law, where the alternatives analyzed in the EIR allow for a wide range of choices with varying degrees of environmental impact, the document may support the ultimate approval not only of the fully developed alternatives, but also what might be called "hybrid" alternatives whose features and impacts occur within the analytical continuum between the "bookends" created by the least-impacting and most-impacting alternatives, respectively. With

[2] According to the California Supreme Court, CEQA lead agencies have the discretion to require that *all* action alternatives (i.e., alternatives other than No Project) carried forward in an EIR be able to satisfy a project's "underlying fundamental purpose." (*In re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings* (2008) 43 Cal.4th 1143, 1165.) The requirement that a CEQA alternative must meet "most" project objectives should be understood with this qualification in mind.

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respect to such hybrid options, agency staff should prepare a written analysis, perhaps for inclusion in the Final EIR, demonstrating the adequacy of the draft document to support approval of the hybrid, citing substantial evidence as appropriate.

For BDCP, the CEQA project objectives, as they were characterized at the time, were identified in the February 13, 2009, NOP to achieve the following purposes:

- To be granted incidental take permits for the covered species that authorize take related to:
  - The operation of existing State Water Project (SWP) Delta facilities and construction and operation of facilities for the movement of water entering the Delta from the Sacramento Valley watershed to the existing SWP and federal Central Valley Project (CVP) pumping plants located in the southern Delta;
  - The implementation of any conservation actions that have the potential to result in take of species that are or may become listed under the federal ESA, pursuant to the ESA at section 10(a)(1)(B) and its implementing regulations and policies; and
  - The diversion and discharge of water by Mirant for power generation in the western Delta.[3]
- To improve the ecosystem of the Delta by:
  - Providing for the conservation and management of covered species through actions within the BDCP Planning Area that will contribute to the recovery of the species;
  - Protecting, restoring, and enhancing certain aquatic, riparian, and associated terrestrial natural communities and ecosystems; and
  - Reducing the adverse effects to certain listed species of diverting water by relocating the intakes of the SWP and CVP.
- Restore and protect the ability of the SWP and CVP to deliver up to full contract amounts, when hydrologic conditions result in the availability of sufficient water, consistent with the requirements of State and Federal law and the terms and conditions of water delivery contracts and other existing applicable agreements.

X.3.1.2 Process for Identification of Alternatives under NEPA

Both the Department of the Interior (DOI) (including Reclamation and USFWS) and the Department of Commerce (including NMFS)obtain NEPA guidance from a document issued by the Council on Environmental Quality (CEQ) entitled, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations. The CEQ guidance indicates that the "range of alternatives" (addressed in Question 1b and referred to in 40 CFR Part 1502.14) includes all *reasonable* alternatives, which must be rigorously explored and objectively evaluated. In addition, there must be a discussion of other alternatives, eliminated from detailed study, with a brief discussion of the reasons for eliminating them. The reasonable range of alternatives can also include alternatives not within the jurisdiction of the lead agencies. The CEQ guidance also states that what constitutes a reasonable range of alternatives may depend on the nature of a proposed federal action and the facts of a particular case.

When there are potentially a very large number of potential alternatives, a reasonable number of alternatives covering the full spectrum of reasonable alternatives can be identified for detailed analyses in the NEPA document. As noted earlier in discussing CEQA requirements, such an approach creates what in common practice are known as analytical “bookends,” referring to a range

[3] Mirant is no longer seeking incidental take authorization for its existing power generation facility in the West Delta. This reference is therefore no longer operative.

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of decision-making options (alternatives) consisting of a continuum of choices. Alternatives with comparatively low levels of environmental impact occupy one end of the continuum or range, while alternatives with comparatively higher levels of impact occupy the other end. Where specific policy options within the continuum consist of reasonable mid-points between the low bookend and the high bookend, agency decision-makers retain discretion to ultimately choose to approve an alternative anywhere within the continuum, provided that the information developed for the various bookends and the mid-points suffices to address the actual projected impacts of the precise option chosen. As with CEQA, the creation of "hybrid" options similar, if not identical, to fully developed alternatives is also permissible. As a practical matter based on experience, policy-making options with lower levels of environmental impact often are less effective than other, more impacting options in fully meeting a project purpose and need reflecting economic, rather than environmental, objectives. The ultimate choice of an alternative thus often reflects the need for agency decision-makers to balance competing environmental and economic objectives.

DOI has adopted additional regulations (43 CFR Section 46.415(b)) that state that alternatives to be included in an EIS, in addition to the No Action Alternative, must be: 1) reasonable, 2) meet the purpose and need of the proposed action, and 3) address one or more significant issues related to the proposed action. The statement of purpose and need, in this context, must be related to the underlying statutes that govern the federal action agencies' activities and duties with respect to the proposed action or project, with application of a "reasonableness" standard to the federal agencies' interpretation and application of the relevant statutes.

The DOI NEPA regulations further provide that "when there are potentially a very large number of alternatives then a reasonable number of *examples* covering the full spectrum of reasonable alternatives" will suffice. This latter principle appears to reflect two important practical points. First, the NEPA requirement to look at all reasonable alternatives should be interpreted in a practical manner so as to avoid the economically wasteful result of examining in detail (and at not inconsiderable expense) a whole series of alternatives that differ from each other in only comparatively minor respects. Second, a series of potential alternatives representing *examples* of potential policy-making options impliedly functions as a continuum of choices, which can be bounded by *bookends* representing comparatively lower and higher levels of environmental impact.

The DOI NEPA regulations also state that the lead agencies should also include any consensus-based alternatives consistent with the purpose and need of the proposed project that are proposed by participating persons, organizations, or communities who may be interested in or affected by the proposed project. Any consensus-based alternative must be consistent with the requirements of NEPA, the Council on Environmental Quality regulations, and all applicable statutory and regulatory provisions, as well as DOI written policies and guidance. Any consensus-based alternative, like any other reasonable alternative, must meet the purpose and need of the proposed project to be properly considered for detailed analysis in the EIR/EIS. The DOI NEPA regulations do not define the term "consensus-based alternative" but do state that consensus-based management incorporates direct community involvement in consideration of DOI activities subject to NEPA analyses, from initial scoping to implementation of the decision.

For BDCP, the NEPA project purpose and need were identified in the February 13, 2009, NOI as seeking to achieve the following purposes:

- Respond to the applications for incidental take permits for the covered species that authorize take related to:

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  - The operation of existing SWP Delta facilities and construction and operation of facilities for the movement of water entering the Delta from the Sacramento Valley watershed to the existing SWP and CVP pumping plants located in the southern Delta;
  - The implementation of any conservation actions that have the potential to result in take of species that are or may become listed under the ESA, pursuant to the ESA at section 10(a)(1)(B) and its implementing regulations and policies; and
  - The diversion and discharge of water by Mirant for power generation in the western Delta.[4]
- Improve the ecosystem of the Delta by:
  - Providing for the conservation and management of covered species through actions within the BDCP Planning Area that will contribute to the recovery of the species;
  - Protecting, restoring, and enhancing certain aquatic, riparian, and associated terrestrial natural communities and ecosystems; and
  - Reducing the adverse effects to certain listed species of diverting water by relocating the intakes of the SWP and CVP.
- Restore and protect the ability of the SWP and CVP to deliver up to full contract amounts, when hydrologic conditions result in the availability of sufficient water, consistent with the requirements of state and federal law and the terms and conditions of water delivery contracts held by SWP contractors and certain members of San Luis Delta Mendota Water Authority.

X.3.1.3 First Level of Screening: Identification of Alternatives under CEQA and NEPA

The legal requirements of CEQA and NEPA were considered with the project objectives and purpose statement included in the February 13, 2009, NOP and NOI to develop the following First Level Screening Criteria.[5]

- Could the potential alternative provide for the conservation and management of covered species through actions within the BDCP Planning Area that will contribute to the recovery of the species?
- Could the potential alternative protect, restore, and enhance certain aquatic, riparian, and associated terrestrial natural communities and ecosystems?
- Could the potential alternative reduce the adverse effects to certain listed species of diverting water by relocating the intakes of the SWP and CVP?
- Could the potential alternative restore and protect the ability of the SWP and CVP to deliver up to full contract amounts, when hydrologic conditions result in the availability of sufficient water, consistent with the requirements of state and federal law and the terms and conditions of water delivery contracts held by SWP contractors and certain members of San Luis Delta Mendota Water Authority, and other existing applicable agreements?

[4] As noted earlier, Mirant is no longer seeking incidental take authorization for its existing power generation facility in the West Delta.

[5] These screening criteria reflect the project objectives and purpose and need as they read at the time the NOP and NOI are issued. Nothing in CEQA or NEPA requires the Lead Agencies to continue to use this precise language throughout the remainder of the environmental review process. In fact, such preliminary language has evolved since 2009, and the project objectives now reflect DWR's view that its "*fundamental purpose* in the proposing the BDCP is to make *physical and operational improvements* to the SWP system in the Delta necessary both to minimize adverse effects on listed species due to operations of existing SWP plants in the southern Delta and, consistent with its statutory and contractual obligations, to facilitate the delivery, at reasonable costs, of reliable water supplies to SWP contractors."

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Under CEQA, the answers to *most* of these questions should be "Possibly" or "Unknown" for an alternative concept to continue to be considered in the Second Level Screening. (See the earlier reference to the CEQA requirement that a potentially feasible alternative must "feasibly attain *most* of the basic objectives of the project".) If, however, the answers to most of these questions are "No" or "Not Likely," the alternative concept may need not be considered in the Second Level Screening.

Under general NEPA principles, the answers to *all* of these questions should be "Possibly" or "Unknown" if an alternative is to continue to be considered in the Second Level Screening. (See the earlier reference to the DOI NEPA requirement that an alternative must meet a federal agency's stated purpose and need, not just "most" aspects of them.) However, because the EIR/EIS is a joint document and the project/action will be a joint state/federal undertaking, alternative concepts with "Possibly" or "Unknown" answers to *most* of these questions (the CEQA standard) is adequate to continue consideration in the Second Level Screening. If the answers to most of the questions are "Not Likely," the alternative concept would not be considered under subsequent levels of screening under either NEPA or CEQA.

X.3.1.4 Second Level of Screening: Identification of Alternatives under CEQA and NEPA

Under CEQA, alternative concepts that continued to the Second Level Screening would be evaluated with the following Second Level Screening Criterion.

- Would the potential alternative avoid or substantially lessen any of the expected significant environmental effects of the "proposed project"?

If the answer to the CEQA criterion question is "Possibly" or "Unknown," the alternative concept would be considered for the Third Level Screening.

Under NEPA, alternative concepts that continued to the Second Level Screening would be evaluated with the following Second Level Screening Criterion.

- Would the potential alternative "address one or more significant issues" related to the proposed action?

If the answer to the NEPA criterion question is "Possibly" or "Unknown," the alternative concept would be considered for the Third Level Screening. If the answers to both questions are "No" or "Not Likely," the alternative concept would not be considered under subsequent levels of screening.

As described for the First Level Screening, the alternative concept does not need to comply with both CEQA and NEPA requirements to be considered in the next step of screening. Meeting the requirements under one of the statutory schemes is enough for purposes of these initial levels of screening. If any NEPA-only alternatives and/or CEQA only-alternatives are found to exist at this stage, however, those alternatives must also meet their respective legal requirements in the subsequent analytical stages as well, because the final range of alternatives will be analyzed in full compliance with both CEQA and NEPA requirements.

X.3.2 Third Level Screening: Defining Potentially Feasible Alternatives under CEQA and Reasonable Alternatives under NEPA

Under CEQA, alternative concepts should be evaluated with a focus on issues of potential feasibility.

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CEQA defines feasible as capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Under NEPA, an EIS must rigorously explore and objectively evaluate all reasonable alternatives. Reasonable alternatives include those that are practical or feasible from the technical or economic standpoint and using common sense, rather than just desirability from the standpoint of the applicant.

Under both CEQA and NEPA, alternative concepts can be developed using economic considerations, social factors, legal infeasibility under species protection laws, and other laws and technical factors to inform the general concepts of feasibility under CEQA and reasonableness under NEPA.

Under CEQA, excessive cost as compared to other alternative concepts can be a basis for rejecting an alternative concept as being infeasible or impracticable. However, an alternative concept cannot be rejected simply because it would impede to some degree the attainment of project objectives, or would be more costly. In this context, the relevant question related is whether the additional costs are sufficiently severe to render it impractical to proceed with the project. Put another way, the question is whether the marginal costs of the alternative as compared to the cost of the proposed project are so great that a reasonably prudent project proponent would not proceed with the alternative. Under CEQA, an alternative concept also can be rejected due to excessive time needed for implementation.

Furthermore, "feasibility" under CEQA encompasses "desirability" from a policy standpoint, or in terms of the effectiveness in meeting project objectives, to the extent that desirability is based on a reasonable balancing of the relevant economic, environmental, social, and technological factors supported by substantial evidence.

It is also possible for CEQA determinations regarding the potential feasibility of alternative concepts to be considered under NEPA to determine if an alternative would be practical or feasible from the technical or economic standpoint and using common sense. Although, in most instances, federal agencies do not reject alternatives under NEPA solely because they do not qualify as valid CEQA alternatives, such rejection may be appropriate for the BDCP, which, by its very nature, is a joint state-federal undertaking that cannot succeed unless state agencies can make alternatives work under state law and federal agencies can make the same alternatives work under federal law. Here, then, alternative concepts that, even with reasonable modifications and feasible mitigation, could not be approved under either state or federal laws may be rejected under both CEQA and NEPA. Notably, since DWR is the primary advocate of, and applicant for, the BDCP, an alternative that would not satisfy DWR's fundamental purpose (see footnote 5 above) or that would not be consistent with the California Legislature's co-equal goals for the Delta, as set forth in the Delta Reform Act, could not be a potentially feasible alternative under either CEQA or NEPA.

These considerations are reflected in the following Third Level Screening Criteria.

- Are the marginal costs of the potential alternative, as compared to the cost of the proposed project or action, so substantial that a reasonably prudent public agency would not proceed with the alternative?
- Are the marginal costs of the potential alternative, as compared to the cost of the proposed project or action, so substantial that it would be impractical to proceed with the alternative?
- Would the potential alternative take so long to implement, as compared with the proposed project or action, that it would not meet the project objectives or purpose within an acceptable time frame?

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- Would the potential alternative require technology or physical components that are clearly technically infeasible based on currently available science and engineering criteria for the scope of the potential alternative?
- Would construction, operation, and/or maintenance of the potential alternative violate any federal or state statutes or regulations (other than sources of law that would be amended or eliminated as part of the alternative)?
- Would the potential alternative involve an outcome that is clearly undesirable from a policy standpoint in that the outcome could not reflect a reasonable balancing of relevant economic, environmental, social, and technological factors?

If the answers to all of these questions are "Not Likely" or "Unknown," the alternative concept would be considered in the EIR/EIS. If the answers to any of these questions are "LIKELY" or "Yes," the alternative concept would not be considered for detailed analysis in the EIR/EIS, unless its inclusion is contemplated by the Delta Reform Act (discussed below), or is necessary in light of reasonable requests by a public agency that has approval authority over some aspect of the project (e.g., a CEQA responsible agency or federal agency with permitting authority, such as the United States Army Corps of Engineers (USACE)) (also discussed below).

X.3.3 Finding of Consistency with Sacramento-San Joaquin Delta Reform Act

On November 12, 2009, Governor Schwarzenegger signed into law Senate Bill 7X 1 (SB7X 1),which included the Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act) (Division 35 of Water Code, Commencing from section 85000).

The Delta Reform Act created a new agency, the Delta Stewardship Council (DSC), to develop and implement a long-term management plan for the Delta, known as the Delta Plan. The Delta Plan must further the coequal goals for the Delta as set forth in the 2009 legislation. These co-equal goals are "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta Ecosystem." The Delta Reform Act provides that following completion of the BDCP, the BDCP shall be incorporated into the Delta Plan by operation of law if the DFG determines that the BDCP meets the requirements of Water Code sections 85320 and 85321, including that the BDCP:

- Complies with the requirements for preparation of an NCCP (Chapter 10 (commencing with section 2800) of Division 3 of the Fish and Game Code).
- Complies with CEQA (Division 13 [commencing with section 21000] of the Public Resources Code),[6] including a comprehensive review and analysis of all of the following:
    - A reasonable range of flow criteria, rates of diversion, and other operational criteria required to satisfy the criteria for approval of an NCCP (as provided in subdivision (a) of Section 2820 of the Fish and Game Code), and other operational requirements and flows necessary for recovering the Delta ecosystem and restoring fisheries under a reasonable range of hydrologic conditions, which will identify the remaining water available for export and other beneficial uses.
    - A reasonable range of Delta conveyance alternatives, including through-Delta, dual conveyance, and isolated conveyance alternatives and including further capacity and design options of a lined canal, an unlined canal, and pipelines.
    - The potential effects of climate change, possible sea level rise up to 55 inches, and possible

[6] Notably, in enacting the Delta Reform Act, the Legislature stated that its legislation "does not amend, or create any additional legal obligation or cause of action under" CEQA. (Water Code section 85322.)

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changes in total precipitation and runoff patterns on the conveyance alternatives and habitat restoration activities considered in the EIR.

  - The potential effects on migratory fish and aquatic resources.
  - The potential effects on Sacramento River and San Joaquin River flood management.
  - The resilience and recovery of Delta conveyance alternatives in the event of catastrophic loss caused by earthquake or flood or other natural disaster.
  - The potential effects of each Delta conveyance alternative on Delta water quality.
- Has been approved as a HCP pursuant to the federal Endangered Species Act (16 U.S.C. Section 1531 et seq.).

These criteria must be addressed, and other factors must be present, if the BDCP is to be automatically incorporated into the Delta Plan by the DSC as contemplated by the Delta Reform Act. Although, as noted above, DFG is charged by statute with the responsibility for making initial determinations as to whether the BDCP meets these requirements, its decisions can be appealed to the DSC. Notably, the above-quoted statutory language, with its repeated references to the need for a "reasonable range" of such things as "flow criteria," "rates of diversion," "other operational criteria," and "conveyance alternatives" seems to anticipate the kind of "bookend" approach to formulating alternatives described earlier. The Legislature's apparent intention in providing a detailed roadmap for an alternatives analysis in the BDCP EIR was to ensure that State agency decision-makers ultimately had the benefit of a wide range of choices with varying levels of environmental impacts and tradeoffs. New conveyance options figure prominently among the alternatives to be considered. Nothing in the legislation, however, suggests any intention to modify or repudiate general CEQA case law principles governing the formulation of a range of alternatives or to impair State agencies' ultimate discretion to take final actions consistent with their underlying statutory functions and other legal commitments, except to the extent that the policy prescriptions in the Delta Reform Act (e.g., the need to pursue the State's "coequal goals") must be honored for incorporation into the Delta Plan.

Although the roadmap for CEQA alternatives laid out in the Delta Reform Act do not qualify as project objectives, these statutory considerations are nevertheless relevant to the choice of alternatives, in that DWR would like to avail itself of the statutory process for automatic inclusion of the BDCP in the Delta Plan. These considerations are therefore reflected in the following questions, which are to be applied to the range of alternative concepts that remain following the Third Screening Level.

- Does the range of alternatives provide a reasonable range of flow criteria?
- Does the range of alternatives provide a reasonable range of diversion rates?
- Does the range of alternatives provide a reasonable range of other operational criteria to satisfy the criteria of approval as a Natural Community Conservation Plan?
- Does the range of alternatives provide a reasonable range of hydrologic conditions?
- Does the range of alternatives include a Through Delta Conveyance alternative?
- Does the range of alternatives include a Dual Conveyance alternative?
- Does the range of alternatives include an Isolated Conveyance alternative?
- Does the range of alternatives include a Dual or Isolated Conveyance - Lined Canal alternative?
- Does the range of alternatives include a Dual or Isolated Conveyance - Unlined Canal alternative?

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- Does the range of alternatives include a Pipeline/Tunnel Conveyance alternative?

If the answers to any of these questions are "No," then an additional alternative should be included or an alternative concept should be modified to support a "Yes" answer. A single alternative could meet several requirements. For example, a dual conveyance unlined canal alternative would be considered for a "Yes" answer for questions related to both Dual Conveyance and an unlined canal.

X.3.4 Finding of Consistency with Scoping Comments from Responsible and Cooperating Agencies Related to Range of Alternatives

The EIR/EIS will be used by "responsible agencies" under CEQA to provide environmental clearance for their discretionary approvals related to the BDCP and CEQA "trustee agencies" to assist with their commenting function. Responsible agencies are those that have a legal responsibility to approve some aspect or portion of the project, and will have to rely upon the EIR as a basis for preparation and issuance of findings (CEQA Guidelines section 15096). Trustee agencies are those that have jurisdiction over certain resources held in trust for the people of California but do not have legal authority over approving or implementation of the proposed project. The California Department of Fish and Game (DFG), California Department of Parks and Recreation, California State Water Resources Control Board, California Air Resources Control Board, California Department of Boating and Waterways, California Department of Transportation, California State Lands Commission, and San Francisco Bay Conservation and Development Commission are responsible or trustee agencies.

Under NEPA, the CEQ guidance defines a "cooperating agency" as any other agency than the lead agencies with discretionary authority over the proposed project or action, jurisdiction by law, or special expertise with respect to the environmental impacts expected from the proposed project or action (40 CFR Section 1508.5). In general, a federal lead agency shall "[u]se the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise to the maximum extent possible consistent with its responsibility as lead agency" (40CFR Section 1501.6). The U.S. Environmental Protection Agency (USEPA) and USACE are cooperating agencies with jurisdiction by law or special expertise.

The only scoping comments by CEQA responsible and trustee agencies that specifically addressed the range of alternatives were submitted by the State Water Resources Control Board and the Delta Stewardship Council. The following scoping comments were submitted by the State Water Resources Control Board in a May 30, 2008 scoping letter.

> *"...to achieve BDCP's project objectives to assure protection and restoration of fish and wildlife resources, the EIR/EIS should analyze a broad range of alternate water quality objectives and operational strategies, including reductions in exports, that may be more protective of fish and wildlife beneficial uses...the State Water Board requests analyses of a broad range of alternatives under the following scenarios: (1) potential interim changes to the Bay-Delta Plan; (2) long-term changes to the Bay-Delta Plan with new conveyance facilities; and (3) long-term changes to the Bay-Delta Plan without new conveyance facilities."*
>
> *"Specifically, the State Water Board requests analysis of a broad range of conveyance alternatives, flows (including changes to Delta outflow objectives), and diversions by the SWP and CVP (including reduced diversions or a cap on diversions) for providing open water habitat under the above scenarios."*

The State Water Resources Control Board addressed the range of alternatives in a May 15, 2009

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scoping letter with the following scoping comments.

> *"A reduced diversion alternative should be lower than diversions allowed for in the current delta smelt biological opinion and soon-to-be released salmonid and green sturgeon biological opinions for the Long-Term CVP and SWP Operations, Criteria, and Plan. This reduced diversion alternative should be low enough to assure not only continued existence of the species, but also some level of rehabilitation for the estuary. To determine what this level should be, State Water Board staff suggests reviewing historic fisheries data and water export data to arrive at a low export level that is reflective of the quantity of water that could be diverted from the Delta with reasonable confidence of not causing significant or long term impacts to the estuary. Through environmental analysis of such an alternative and higher export alternatives, the State Water Board and other responsible agencies will have information on which to consider the various environmental tradeoffs related to export restrictions."*

> *"Combined with analyzing potential reductions in exports, an alternative for changes to Delta outflows (and potentially inflow requirements) should also be analyzed that reflects a more natural hydrograph. Current outflows and operations have tended to flatten the natural hydrograph and produce more static flow conditions in the Delta. Outflows and export regimes that support a more natural variable hydrograph should be analyzed, including both the naturally high outflow and naturally low outflow ends of the hydrograph for both the interim and long-term. One way to conduct this analysis would be to analyze the effects of providing various percentages of the unimpaired Delta inflow and outflow, and managing storage releases and exports to attempt to parallel this pattern."*

Under the Delta Reform Act, the Delta Stewardship Council (DSC) is characterized as a "responsible agency" for purposes of working with DWR in the development of the BDCP EIR/EIS. (California Water Code section 85320, subdivision (c).) In that capacity, the DSC sent two scoping letters to DWR, dated June 28, 2010, and November 15, 2010, respectively. These letters came long after the end of the formal scoping process, reflecting the fact that the DSC did not exist as a legal entity during the formal scoping period. In both letters, the DSC stated its view that the EIR/EIS alternatives should reflect the "co-equal goals" of the Delta Reform Act, as well as the policy of "[r]educing reliance on the Delta in meeting California's future water needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency." In the first of its two letters, the DSC also stated its view that the EIR "must include 'a comprehensive review and analysis of' seven specifically described items concerning flow and other operational criteria, *conveyance alternatives*, climate change, fish and aquatic resources, flood management, natural disasters, and Delta water quality." (Emphasis added.)

Scoping comments by cooperating agencies with jurisdiction by law or special expertise that specifically addressed the range of alternatives only were submitted by the USEPA. The following scoping comments were submitted by the USEPA in a May 14, 2008 scoping letter.

> *"... EPA believes that reduced inflow and reduced export scenarios are not just reasonable alternatives to evaluate, but represent a likely future for the Bay Delta basin that needs to be reflected in the EIS/EIR."*

In preparing the EIR/EIS range of alternatives, DWR as CEQA lead agency must carefully consider comments from CEQA responsible agencies as long as such comments are within the area of expertise of such agencies (California Public Resources Code, section 21104(c)), and the federal NEPA lead agencies, as noted earlier, must "[u]se the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise to the maximum extent possible consistent with its responsibility as lead agency" (40 CFR Section 1501.6). Although input from responsible, trustee, and cooperating agencies does not alter lead agencies' project objectives, fundamental purposes, or policy reasons for pursuing a proposed project or action, the input from these agencies are nevertheless are reflected in the following questions to be applied to the range of concepts that remain following the Third Screening Level and finding of consistency with the Delta

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Reform Act.

- Does the range of alternatives include alternatives with a broad range of water quality objectives and operational strategies?
- Does the range of alternatives include an alternative with potential interim changes to the State Water Resources Control Board Bay-Delta Plan?
- Does the range of alternatives include an alternative with long-term changes to the State Water Resources Control Board Bay-Delta Plan with new conveyance facilities?
- Does the range of alternatives include an alternative with long-term changes to the State Water Resources Control Board Bay-Delta Plan without new conveyance facilities?
- Does the range of alternatives include an alternative with reduced diversions lower than diversions allowed for in the USFWS and NMFS biological opinions to assure continued existence of the species and some level of rehabilitation for the estuary?
- Does the range of alternatives include an alternative with Delta outflows, and potentially Delta inflows, that reflect a more natural hydrograph then current State Water Resources Control Board Bay-Delta Plan?
- Does the range of alternatives reflect the co-equal goals of the Delta Reform Act of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem?
- Does the range of alternatives include an alternative that would contribute to reducing reliance on the Delta in meeting California's future water needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency?

Out of deference to the State Water Resources Control Board (State Water Board), the DSC, and EPA, the Lead Agencies have determined that, if the answers to any of these questions are "No," an additional alternative should be included or an alternative concept should be modified to support a "Yes" answer. A single alternative could meet several requirements. For example, a dual conveyance alternative with operational criteria for Delta outflow and inflow patterns similar to a natural hydrograph would be considered for a "Yes" answer for questions related to new conveyance and operations that reflect a more natural hydrograph.

As a practical matter, alternatives responding to the requests from State Water Board, the DSC, and EPA will likely form low-impact "bookends," given the relatively greater weight given by those agencies to in-Delta environmental considerations than to the "coequal" California statutory objective of "providing a more reliable water supply for California." State Water Board specifically asked for an alternative involving "*reductions* in exports," with diversions "*lower* than . . . allowed for in the current delta smelt biological opinion and soon-to-be released salmonid and green sturgeon biological opinions for the Long-Term CVP and SWP Operations, Criteria, and Plan." EPA similarly asked for "reduced export scenarios." The DSC asked for an alternative that reflected the policy of reducing California's reliance on the Delta in connection with future water needs. At least arguably, the alternatives envisioned by the three agencies seemed unlikely to fully meet the purpose and need of the BDCP, and thus could be eliminated from further formal environmental analysis. Even so, Lead Agency staff opted to proceed with the three agencies' requests. Notably, in making its request, State Water Board specifically (though impliedly) invoked the "bookend" concept. According to that agency, "[t]hrough environmental analysis of such an alternative and higher export alternatives, the State Water Board and other responsible agencies will have information on which to consider the various environmental tradeoffs related to export restrictions." The Lead Agencies found this logic to be persuasive.

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X.3.5 Consideration of Legal Rights of Entities that are not BDCP Participants

Some of the suggested BDCP alternative concepts that emerged through scoping and otherwise could affect or require changes to legal rights, including long-standing water rights, of entities that are not participants in the BDCP and whose legal rights and entitlements are beyond the regulatory authority and reach of DFG, which approves NCCPs under California law, and of both USFWS and NMFS, which approve HCPs under federal law. For example, several scoping comments suggested that the BDCP EIR/EIS should include alternatives that would achieve increased Delta inflow or outflow through mandatory reductions in existing water diversions occurring upstream in the Delta watershed from parties other than DWR and Reclamation. These proposed reductions would come from entities that are *not* seeking incidental take authorization as part of the BDCP process and that possess long-standing water rights or other entitlements that, as a legal matter, could not be infringed by DFG, USFWS, or NFMS through those agencies' actions in response either to an HCP/NCCP application filed by DWR or through "ESA section 7 consultation" with Reclamation. Since the potentially affected upstream parties other than DWR and Reclamation are not parties to the BDCP process, the approved BDCP cannot dictate terms to those agencies. Regardless of one's views about the potential wisdom of possible future efforts by the State Water Board, separate and apart from the BDCP process, to adjust the existing water rights of upstream interests, the BDCP process operates within a legal framework that does not give DFG, USWFS, or NMFS the authority to make such adjustments through the BDCP.

These considerations are reflected in the following question to be applied to the range of concepts that remain following the Third Screening Level and findings of consistency with the Delta Reform Act and scoping comments from responsible and cooperating agencies.

- Would the potential alternative result in the impairment of existing water rights in the Sacramento-San Joaquin Rivers watershed who are not applicants for incidental take authorization through the proposed Bay Delta Conservation Plan?

If the answers to this question are "Not Likely" or "Unknown," the alternative concept would be considered in the EIR/EIS. If the answers to this question are "LIKELY" or "Yes," the alternative concept would not be considered for detailed analysis in the EIR/EIS, unless its inclusion is required by the Delta Reform Act process for incorporation of the BDCP into the Delta Plan, or is necessary in light of reasonable requests by a public agency that has approval authority over some aspect of the project (e.g., a CEQA responsible agency or federal agency with permitting authority).

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X.4 Alternative Conveyance Concepts Identified in Programs Prior to the BDCP Process

This section includes a brief history of water supply concepts that have been considered to convey water from the Sacramento River watershed to San Joaquin Valley (including Tulare Lake basin in southern San Joaquin Valley), San Francisco Bay area, central coastal areas (San Luis Obispo and Ventura counties), and southern California.

X.4.1 Historical Development of Existing CVP and SWP Conveyance Concepts

California water resources changed substantially during the first 100 years following the granting of statehood in 1850. The demand for irrigated crops increased in the late 1860s and 1870s following completion of the transcontinental railroad that enabled fruits and vegetables from California to be delivered to markets throughout the nation. In 1873, following a severe drought in the 1870s, Congress authorized the Alexander Commission to develop solutions for water supplies of the Sacramento and San Joaquin valleys. The report outlined a system of large-scale irrigation-water supply facilities and suggested that federal assistance would be required to accomplish these recommendations (DPW 1930).

In 1919, the U.S. Geological Survey completed the Marshall Plan, which recommended the transfer of water from northern California to meet urban and agricultural needs of central and southern California (CSIA 1919). The Marshall Plan recommended a series of storage reservoirs on the Sacramento River near the confluence with the McCloud and Pit rivers, with large canals along the west and east sides of the Sacramento and San Joaquin valleys; a storage reservoir on the San Joaquin River near Friant,with canals to along the east side of the San Joaquin Valley to deliver water to areas north and south of the San Joaquin River; and diversion of the Kern River to Los Angeles. A portion of the water from the Sacramento River would be conveyed through the Delta to lower San Joaquin River water rights holders in exchange for water diverted at Friant Dam to the eastern San Joaquin Valley, including the Kern River area.

During the 1920s, the State continued investigation of the Marshall Plan and other concepts to reduce salinity intrusion in the Delta and provide water to the San Joaquin Valley. Most of the alternatives included construction of reservoirs in northern California and conveyance through the Delta to San Francisco Bay area and San Joaquin Valley water users. Delta conveyance concepts included isolated canals or use of Delta channels with a Cross Delta Channel that would convey water from the Sacramento River near Walnut Grove to the San Joaquin River (DPW 1930). In 1930, the Division of Water Resources Bulletin No. 25outlined a statewide water plan, which was approved by the State legislature in 1941 as the State Water Plan.

Construction of the recommended facilities began in 1937 by the federal government as part of the CVP with the completion of Shasta Dam in 1944, followed by the completion of Friant Dam, and the Madera, Friant-Kern and Contra Costa canals between 1945 and 1949. In 1951, the Delta Cross Channel, Tracy Pumping Plant (now known as the Jones Pumping Plant), and Delta-Mendota Canal were completed to convey water through the Delta to users in the San Joaquin Valley. As these facilities were completed, however, it became apparent that California's rapid urban, agricultural,

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and industrial growth would quickly increase demands for water and power to levels that exceeded the initial CVP system capacity. In response to this increase in projected demand, Reclamation expanded the CVP upstream storage facilities, as well as conveyance facilities, to serve users in the Sacramento Valley, San Francisco Bay area, and San Joaquin Valley. By the late 1980s, the CVP was the largest surface water storage and delivery system in California, with a geographic scope covering 35 of the state's 58 counties.

In 1947, the State began an investigation to meet additional water needs through development of the SWP. In 1957, DWR Bulletin No. 3 defined the need for new SWP facilities for flood control in northern California and for conveying water from the Sacramento Valley to water-short areas of California in the San Francisco Bay area, San Joaquin Valley, and central coast and southern California areas due to projected population and industrial growth and irrigation needs for approximately 25 percent of irrigated agricultural acreage in the United States in 1950 (DWR 1957a). The study identified a seasonal deficiency of 2,675,000 acre-feet of water in 1950 that had been met with groundwater pumping primarily from over-drafted aquifers. In 1960, California voters authorized the Burns-Porter Act to construct the initial SWP facilities, including Oroville Dam on the Feather River, San Luis Dam (to be jointly constructed and operated with the CVP), North and South Bay aqueducts, and the California Aqueduct. Most of these facilities were constructed before 1970.

Both the SWP and CVP facilities relied upon a Through Delta Conveyance strategy using Delta channels and the Delta Cross Channel facility to convey water from the Sacramento River to South Delta intakes that diverted water to the SWP and CVP pumping plants. Even before construction of the SWP and CVP pumping plants, however, the Delta was already characterized by high salinity, especially in late summer and fall months or during drought periods. Use of the Delta Cross Channel improved water quality in the central and South Delta during some periods by diverting Sacramento River water from its natural path towards San Francisco Bay into artificial paths that direct this fresh water into the lower quality flows of the Mokelumne and San Joaquin Rivers. Although both the State and federal agencies have continued to evaluate Delta conveyance concepts to improve Delta water quality for water users located in the Delta as well in areas of the San Francisco Bay area, in the meantime Delta water has been used continuously in export areas in the San Joaquin Valley, the central coast, and southern California.

X.4.2 Existing Delta Conveyance Concept

The current method for conveying water from the Sacramento River to the South Delta intakes of the SWP and CVP pumping plants is based solely upon through-delta conveyance. The Sacramento and San Joaquin rivers and Delta sloughs are effectively used as conveyance channels to convey water to the South Delta. Water from the Sacramento River flows along one of two paths to the SWP and CVP South Delta intakes. One method is based on Sacramento River water flowing towards the western Delta near the confluence with the San Joaquin River, and then being pulled in a reverse-flow manner along Old and Middle Rivers by the momentum created by the SWP and CVP pumping plants. Under this method, the reverse flows also convey saline water from Suisun Bay into the Delta towards the SWP and CVP South Delta intakes and decrease the ability for fish passage through the Delta. During periods of low-flow conditions along the Sacramento and San Joaquin rivers, Delta salinity increases and the ability to divert water by the SWP and CVP is restricted in order to protect Delta water quality.

The second Through Delta Conveyance method is based upon flows diverted through the Delta Cross

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Channel located along the Sacramento River near Walnut Grove. Flows through the Delta Cross Channel are controlled with operable gates. When the gates are open, freshwater from the Sacramento River flows through the southern Mokelumne River system to the San Joaquin River and then is pulled in a reverse-flow manner along Middle River towards the SWP and CVP South Delta intakes. Although this method also results in a reverse flow along Middle River, the potential for drawing salt water in from Suisun Bay is less likely than under the first method. The Delta Cross Channel gates are closed during flood events to protect the interior Delta and during periods when juvenile salmon are migrating in the Mokelumne and Sacramento rivers corridors.

In December 1999, low flow conditions on the Sacramento River occurred at the same time as the emigration of juvenile Sacramento Basin salmon. The Delta Cross Channel gates were closed to protect the salmon and Delta salinity increased substantially (DWR 2007).

X.4.3 Delta Conveyance Concepts Considered Prior to the BDCP Process

Many of the studies that proposed the CVP and SWP facilities also identified the need for facilities to control Delta salinity to protect water quality of agricultural and municipal/industrial water supplies. This subsection describes the following concepts.

- Western Delta Salinity Control Barrier.
- Improved Through Delta Conveyance.
- Isolated Eastern Conveyance.
- Isolated Western Conveyance Using the Sacramento Deep Water Ship Channel.

This subsection also describes Governor Schwarzenegger's direction for sustainable management of the Delta and initiation of the BDCP process.

X.4.3.1 Western Delta Salinity Control Barrier

Western Delta salinity control facilities have been evaluated since the late 1940s, including:

- 1957 DWR Evaluation of Salinity Control Barriers
- 1960 DWR Evaluation of Salinity Control Facilities

1957 DWR Evaluation of Salinity Control Barriers

In 1957, DWR prepared Bulletin No. 60 in accordance with the Abshire-Kelly Salinity Control Barrier Act (DWR 1957b). This study investigated methods (i) to convey large quantities of water across the Delta without major losses to Suisun Bay and property damage to Delta property owners;(ii) to reduce salinity in the Delta; and (iii) to deliver water to the San Francisco Bay area. The study results indicated that freshwater could be maintained in the Delta by either of the following methods.

- Maintaining Delta outflows to dilute poor quality water from Suisun Bay. However, this method would require additional releases of water from upstream reservoirs and would reduce the amount of water available for water supplies to be used in other parts of California.
- Isolate poor quality water from Suisun Bay from high quality Delta water with a physical barrier.

The study evaluated three salinity barrier concepts: the Junction Point Barrier Plan, Biemond Plan, and Chipps Island Barrier Plan. The Junction Point Barrier Plan and the Biemond Plan were similar,

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with barriers and fish passage facilities located in slightly different positions along the Sacramento River as described below.

- Operable barriers would be constructed across the Sacramento River and Steamboat Slough to prevent salinity intrusion into the Sacramento River and to increase the elevation of the Sacramento River so that the flow would be directed through a new Cross Delta Channel with a diversion structure near Isleton or through the existing CVP Delta Cross Channel with continued flow into the southern Mokelumne River system.
- Channels along the southern Mokelumne River system would be expanded to increase conveyance of freshwater from the Sacramento River to the San Joaquin River.
- A siphon would be constructed under the San Joaquin River to convey water from the Mokelumne River to Middle River for continued conveyance to the South Delta intakes of the SWP and CVP pumping plants.
- Major flood control levees would be constructed throughout the central Delta to maintain flood waters within the Delta, including a flood control structure on the San Joaquin River at Paradise Cut with a possible channel to divert flood waters to the South Delta intakes of the SWP and CVP pumping plants.
- The North Bay Aqueduct pumping plant and canal would be constructed to deliver water to the northern San Francisco Bay counties.
- The South Bay Aqueduct pumping plant and canal would be constructed to deliver water to the southern San Francisco Bay counties.

The Chipps Island Barrier Plan would include the following facilities to form a freshwater Delta.

- A 22,000-foot long barrier with ship locks would be constructed across the Sacramento River from a location near the City of Pittsburg to a location near Collinsville. The barrier would be designed to pass flood waters from the Delta and to withstand high tide and wave events from San Francisco Bay.
- Major flood control levees would be constructed throughout the Delta and Yolo Bypass to maintain flood waters within the Delta.
- Major flood control levees would be constructed along Suisun Bay due to increased tidal amplitude that would occur along the Contra Costa and Solano counties shorelines on the west side ofthe barrier.
- Methods would be developed to provide mixing within the Delta to dilute waste products from municipal and industrial wastewater treatment plants, high temperature flows from industrial plants in the Delta, accumulated salts from discharges in the Delta watershed, and salt water that would enter the Delta through the ship locks on the barrier.

The study indicated that there would be adverse impacts of these plans on anadromous fish; however, there could be benefits to other fish that could accommodate warmer waters. The study recommended continued evaluation of the Biemond Plan, including levee improvements to reduce flood risks in the Delta, and implementation of the North Bay Aqueduct.

1960 DWR Evaluation of Salinity Control Facilities

In 1960, DWR prepared the Preliminary Edition of Bulletin 76(DWR 1960), which evaluated the following plans.

- Chipps Island Barrier Project, as described above.
- Single Purpose Delta Water Project, similar to the Biemond Plan, with barriers on the Sacramento River near Walnut Grove, Steamboat Slough, San Joaquin River, Piper Slough,

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Holland Cut, Old River at Connection Slough, and Head of Old River to maintain the freshwater within the central and South Delta. The Contra Costa Canal would be expanded to provide freshwater to the western Delta communities and industries.

- Typical Alternative Delta Water Project, same as Single Purpose Delta Water Project with additional levee improvements along Mokelumne and San Joaquin rivers to improve flood protection.
- Comprehensive Delta Water Project, same as Typical Alternative Delta Water Project with additional barriers along Middle River to improve freshwater flows in the central and western Delta).

The results of the study stated that:

> "The Chipps Island Barrier would be functionally feasible… However, the net benefits would be less than the project costs...Therefore, the project would not be economically justified...would probably cause disastrous reductions in the fisheries resources of the Delta...
>
> The Single Purpose Delta Water Project would be the least detrimental of all projects...
>
> Losses resulting from the Typical Alternative Delta Water Project and Comprehensive Delta Water Project would be slightly greater than with the Single Purpose Delta Water Project...
>
> The Single Purpose Delta Water Project and Typical Alternative Delta Water Project would be financially feasible.
>
> The Comprehensive Delta Water Project would not be completely feasible unless local tax revenues could be obtained to recover additional costs allocated to flood and seepage control.
>
> Recommendations...that the Single Purpose Delta Water Project be adopted as an integral feature of the State Water Resources Development System...the United States Corps of Engineers and Bureau of Reclamation be requested to investigate the extent of federal interest...that further planning for the Delta Water Project include consideration of joint financing and construction by federal, state, and local agencies to the extent that respective interests are involved."

These concepts were further evaluated in 1963 (IDC 1963) by the Coordination of Delta Planning Subcommittee of the Interagency Delta Committee in coordination with analysis of a "peripheral canal," as described in Subsection X.4.3.2. The results of this report stated:

> "The construction of a physical barrier [as described for Chipps Island Barrier in this and Preliminary Edition of Bulletin 76] and the creation of a fresh-water pool operated for water supply could effectively conserve water and provide local water supply. This approach, however, would limit future development of navigation in the two Central Valley deep water ports. In addition, the fisheries resources of the Delta area would be jeopardized. Water quality problems related to necessary waste discharge of industry and agriculture within the Delta area are not, as yet, entirely defined but in general would tend to the disadvantage of this plan...
>
> Control structure, channel enlargements and overland canals [as described in Single Purpose Delta Water Project, Typical Alternative Delta Water Project, and Comprehensive Delta Water Project] could provide water transfers across the Delta and meet the quantity and quality requirements of the local water user. While this plan would not interfere with deep draft navigation, there would be restrictions of recreational navigation movements. The influence of the export pumps presents a serious problem to young fish, eggs, and fry. Additional channel closures would be required to solve the San Joaquin flow reversal problem. This alternative would be the least expensive solution."

The analysis recommended additional study of a peripheral canal.

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X.4.3.2 Improved Through Delta Conveyance

DWR and other agencies also evaluated methods to improve Delta water quality and to maintain Delta water supply availability with the continued use of a Through-Delta Conveyance, including:

- 1995 - 2000 and 2000 – 2008: CALFED Evaluations of Through Delta Conveyance Improvements
- 1960 - Present : Various DWR Evaluations of South Delta and Western Delta Salinity Control Barriers
- 1960 DWR Evaluation of Separate Corridors Conveyance
- 2007 Metropolitan Water District of Southern California Eco-Crescent/Middle River Corridor Conveyance
- 2007 - 2009 Delta Corridors Conveyance and Fish Passage
- 1960 Through Delta Conveyance improvements that included separated South Delta water supply corridors, as suggested in the Preliminary Edition of Bulletin 76 in the Typical Alternative Delta Water Project.

1995 - 2000/2000 - 2008 CALFED Evaluations of Through Delta Conveyance Improvements

Between 1995 and 2000, CALFED considered methods to preserve both the fish benefits of closing the Delta Cross Channel gates and the water quality benefits of diverting Sacramento River water into the northern interior Delta, particularly during low-flow periods. One of the options considered the possibility of a single channel, originating at a variety of locations, or the possibility of using several smaller channels. Various combinations of fish screens at the Delta Cross Channel and the new channel(s) were evaluated by CALFED. As described in Subsection X.2, the CALFED ROD recommended continued use of the Through Delta Conveyance with improved fish screens at the SWP and CVP South Delta intakes, changes in operations of the SWP and CVP pumping plants and construction of an intertie between the facilities, and operable barriers along the San Joaquin River system to improve quantity and quality of Delta water.

Since 2000, numerous studies have investigated various approaches to improve the existingsystem for conveying water through the Delta. DWR has evaluated numerous concepts, including (i) the Franks Tract Project (described below),which would reduce tidal mixing of waters from the western Delta into the central Delta and the water supply corridor, (ii) improvements to the Through Delta Facility recommended by CALFED ROD to increase transfer of water from the Sacramento River to the central Delta,(iii) increasing the western outflow of the San Joaquin River, (iv) reoperating the Delta Cross Channel gates, and (v) isolating a freshwater water supply corridor (described below) along Old and Middle rivers. These concepts were evaluated to be independently implemented. Several of the concepts, such as reoperating the Delta Cross Channel, also have been evaluated in coordination with several other concepts listed above.

1960 to Present DWR/CALFED Evaluations of South Delta and Western Delta Salinity Control Barriers

Between 1960 and 2000, DWR focused on evaluation of South Delta barriers to improve water supply and flood management programs. In the 1990s and 2000s, DWR installed temporary barriers at the Head of Old River on the San Joaquin River, Middle River near Victoria Canal, Grant Line Canal near Old River, and Old River near the Delta Mendota Canal Barrier. These barriers were installed to improve water elevations, water circulation, and fisheries habitat. The use of permanent gates was

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recommended in the DWR South Delta Improvements Program. However, installation of permanent barriers in the South Delta was suspended following publication of the NMFS 2009 Biological Opinion (NMFS 2009).

The CALFED Bay-Delta Authorization Act of 2004 (Public Law 108-361, Section 103) authorized the Secretary of the Interior to prepare a feasibility study of actions at Franks Tract to improve water quality in the Delta. Reclamation and DWR are conducting feasibility studies and participating in the preparation of an EIR/EIS. Under the Franks Tract Project, Reclamation and DWR are evaluating construction of operable gates to control the flow of water in the western Delta at Threemile Slough and/or West False River to limit the entry of certain fish species of concern and higher salinity water into Franks Tract. In addition to improving water quality, the gates would limit migration of fish species of concern into the central and South Delta. By protecting fish resources, this project also would improve operational reliability of the SWP and CVP because South Delta diversion restrictions could be less frequent.

The Franks Tract project is currently delayed for reasons described in DWR's website on the project. (See water.ca.gov/frankstract; accessed 021312). The "Separate Corridors" concept identified through the BDCP process, however, also would include an operable barrier at Threemile Slough, as would the Franks Tract Project. The Separate Corridors concept would include Franks Tract as part of the fish passage corridor to allow fish to move from Old River through Franks Tract to the San Joaquin River near Jersey Island. The Separate Corridors concept would isolate Franks Tract for fish passage, with operable barriers along the San Joaquin River at Franks Tract and Fisherman's Cut to prevent fish from moving towards Middle River and the water supply corridor

2007 Metropolitan Water District of Southern California Concept for Separated Delta Corridor for Water Supply Conveyance

In 2007, a concept named "Eco-Crescent/Middle River Corridor Conveyance" was developed (MWD 2007). The concept was to develop an area within the central and South Delta that would improve habitat for delta smelt and other native fishes with variable salinity and turbidity to mimic historic estuarine conditions. A separate water supply corridor would convey water from the Delta Cross Channel through the lower Mokelumne River system to a siphon under the San Joaquin River for continued conveyance in an isolated Middle River corridor. The Middle River corridor would be isolated from Old and San Joaquin rivers by barriers along Middle River at Connection Slough, Railroad Cut, and Woodward Canal.

The separated Delta corridors were similar to those recommended in Preliminary Edition of Bulletin 76 Comprehensive Delta Water Project (DWR 1960), as described above in Subsection X.4.3.1.

2007 - 2009 South Delta Water Agency Evaluation of Separated Delta Corridors for Water Supply Conveyance and Fish Passage

In 2007, the South Delta Water Agency developed the Delta Corridors Plan (SDWA 2007). The Delta Corridors Plan provided an estuarine fish passage corridor along Old River from the Head of Old River into the Delta, and a water supply corridor that extended from the Delta Cross Channel and Georgiana Slough confluences along the Sacramento River through the lower Mokelumne River and along Middle River and Victoria Canal to the SWP and CVP South Delta intakes. Fish screens would be installed at Delta Cross Channel and Georgiana Slough along the Sacramento River. Fish-handling facilities would be improved at the SWP and CVP intakes. Portions of Middle River would be dredged

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to improve capacity. Portions of Old River near the Delta Mendota Canal intake and along Victoria Canal would be divided to separate the fish passage and water supply corridors. Barriers would be constructed at the Head of Old River near the San Joaquin River, Old River near the Delta Mendota Canal approach channel, Old River at Grant Line Canal, Old River at Victoria Canal, Old River at West Canal, Woodward Canal at Middle River, Railroad Cut at Middle River, Connection Slough at Middle River, Middle River at Victoria Canal, and Franks Tract at San Joaquin River. Water would be siphoned from Victoria Canal under Old River and Coney Island into West Canal. Water would be pumped from north to south at the Head of Old River Barrier and at the barrier on Middle River at Victoria Canal. This concept was presented to the Delta Vision Blue Ribbon Task Force and the BDCP Steering Committee.

The Delta Corridors Plan was revised in 2009 to provide fisheries protection in the Mokelumne River system upstream of Delta Cross Channel (SDWA 2009). Under existing conditions, fish passage in the Mokelumne River is from the upper Mokelumne River through Snodgrass Slough into the lower Mokelumne River and into the San Joaquin River. However, use of the lower Mokelumne River for a water supply corridor could increase entrapment of fish in the SWP and CVP intakes. Therefore, under the 2009 version of the Delta Corridors Plan, Meadows Slough would be connected through a new channel to the Sacramento River and operable barriers would be constructed to provide a fish passage corridor from the upper Mokelumne River into the Sacramento River via Lost and Meadows sloughs.

X.4.3.3 Isolated Eastern Conveyance

DWR and other agencies also evaluated Isolated Eastern Conveyance concepts for many years, including:

- 1963 Interagency Delta Committee Evaluation of a Peripheral Canal
- 1965 - 1974 DWR Evaluations of a Peripheral Canal
- 1995 - 2000 CALFED Evaluations of an Isolated Eastern Facility

1963 Interagency Delta Committee Evaluation of a Peripheral Canal

In the early 1960s, an Interagency Delta Committee was convened to coordinate water resources planning for the SWP, CVP, and local agencies. In a 1963 report, the Interagency Delta Committee evaluated alternatives to protect Delta water quality and water supplies, maintain flood protection, control drainage and seepage in the Delta, maintain Delta navigation, maintain Delta recreation, protect fish and wildlife, and maintain vehicular transportation (IDC 1963). The study considered hydraulic and physical barriers and Delta waterway control and a peripheral canal. The peripheral canal would be constructed along the eastern edge of the Delta from Walnut Grove on the Sacramento River to Stockton and continue to Italian Slough near the Clifton Court Tract. The report concluded that the peripheral canal allowed for balanced growth of Delta-oriented activities and recommended that further study be completed.

1965 - 1974 DWR Evaluations of a Peripheral Canal

A DWR study in 1965 defined the peripheral canal alignment along the eastern edge of the Delta as starting from Hood on the Sacramento River with siphons beneath the Mokelumne, San Joaquin, and Old Rivers and connecting canals to the SWP and CVP pumping plants (DWR 1965). In the 1970s, construction of Interstate 5 involved some initial excavation ofborrow pits along the potential

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Peripheral Canal alignment (DWR 1970).

The 1974 Draft EIR for the Peripheral Canal Project described an isolated facility to convey freshwater from the Sacramento River to the SWP and CVP pumping plants with up to 12 release facilities to distribute water from the canal into Delta channels (DWR 1974). The canal was planned to initially operate by gravity with the addition of a pumping plant within 10 years following construction. Other purposes of the project were to convey floodflows from Morrison Creek in Sacramento County and Middle River in San Joaquin County into the Peripheral Canal and to incorporate recreational facilities into the project. A 1982 statewide ballot referendum on construction of the Peripheral Canal was defeated.

1995 - 2000 CALFED Evaluations of an Isolated Facility

The CALFED Phase II Alternative Descriptions included an Isolated Facility with a canal that extended from Hood or Freeport to Clifton Court Forebay in conjunction with Through Delta improvements (CALFED 1997a). The study described an isolated facility that ranged in size from 5,000 to 15,000 cubic feet per second (cfs). The CALFED Phase II Alternative Descriptions also included Isolated Facility alignments between a storage facility on Holland Tract and Clifton Court Forebay along Old River, and between Lower Roberts Island and Upper Roberts Island on the San Joaquin River and Clifton Court Forebay. The isolated conveyance facility was to be operated in coordination with a Through Delta Facility.

The 2000 CALFED Record of Decision (CALFED 2000) recommended a Through Delta approach with new screened intakes as the SWP and CVP South Delta intakes; new conveyance to intertie the SWP and CVP pumping plants and allow for joint operations; new operable barrier at the Head of Old River and other locations in the South Delta to improve water quality, protect fish, and protect water elevations for Delta water diverters; and changes in SWP pumping plant operations to fully use the existing capacity of the facilities. The Preferred Program also included recommendations for further evaluation of new screens on facilities in the Sacramento River, levee improvements on the Mokelumne and San Joaquin rivers, and methods to provide public health protection for drinking water. The Record of Decision stated that:

> "Although the CALFED Agencies did not rule out the possibility of constructing an isolated conveyance facility in the future, they were mindful that, even if approved immediately following the ROD, such a facility could not be studied, approved, funded, and constructed within Stage 1of implementation.
>
> In light of the technical and feasibility issues discussed above, the CALFED Agencies propose to begin with through-Delta modifications. As part of the Preferred Program Alternative, the Program also would :
>
> • Continue to investigate storage opportunities in the context of the broader water management strategy.
>
> • Evaluate and implement storage projects, predicated on complying with all environmental review and permitting requirements. These efforts will be coordinated under CALFED's Integrated Storage Investigation.
>
> • Implement the Stage 1 of the Ecosystem Restoration, Water Quality, Water Use Efficiency, Water Transfers, Watershed, and Levee System Integrity Program Plans.
>
> • Monitor the results of these actions to determine whether an isolated conveyance facility as part of a dual-Delta conveyance configuration is necessary to meet the Program objectives.
>
> If the Program purposes cannot be fully achieved with the actions proposed in the Preferred

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Program Alternative, additional actions including an isolated conveyance facility will need to be considered in the future. Until additional information is available to determine whether water quality objectives and fish recovery goals can be met and which, if any, additional actions will be necessary to achieve the Program goals and objectives, the Preferred Program Alternative is the best alternative to achieve overall project purposes and provide significant beneficial improvements over the conditions anticipated under the No Action Alternative, while establishing a process for obtaining this additional information. Moreover, the way the alternatives are structured, going forward with the Preferred Program Alternative does not preclude the Program's ability to undertake additional conveyance actions in the future, subject to appropriate environmental review."

X.4.3.4 Isolated Western Conveyance Using the Sacramento Deep Water Ship Channel

State agencies evaluated Isolated Western Conveyance in several evaluations, including:

- 1977 Association of State Water Project Agencies Evaluation Montezuma Hills Canal
- 1995 - 2000 CALFED Evaluation of an Isolated Western Facility Using the Sacramento Deep Water Ship Channel
- 2001 DWR Evaluation of Using the Sacramento Deep Water Ship Channel for Fish Passage
- 2009 DWR/DFG evaluation in response to Pubic Scoping comments

1977 Association of State Water Project Agencies Evaluation Montezuma Hills Canal

Isolated Western Conveyance concepts have been considered since the 1970s. A February 1977 report prepared by the Association of State Water Project Agencies describes a potential Montezuma Hills Canal that could be constructed with an intake along the Sacramento River near Rio Vista and siphons under Sacramento River, Sherman Island, and the San Joaquin River to a canal that extends to Clifton Court Forebay (ASWPA 1976). The canal and siphon would cross islands with peat soils that had been previously inundated, including Brannon and Andrus islands and Webb, Frank, and Bethel tracts. The report stated that, because the islands were located below sea level and the soils were not ideal to support a canal structure, the canal embankments would need to be both very high to protect the canal if the island became inundated and very wide to provide foundational support to the canal levees. In addition, the report stated that, although this concept would eliminate reverse-flow impacts in the central and south Delta, it would not be possible to supply freshwater into the extreme eastern Delta to maintain water quality for beneficial uses.

1995 - 2000 CALFED Evaluation of an Isolated Western Facility Using the Sacramento Deep Water Ship Channel

In 1997, CALFED identified an isolated conveyance alternative ("Alternative 3G") with an intake along the Sacramento River near West Sacramento to divert water into the Sacramento Deep Water Ship Channel(CALFED 1997a). A ship lock would be constructed near the western boundary of the Sacramento Deep Water Ship Channel. An intake would be located along the Sacramento Deep Water Ship Channel levee upstream of the ship lock to divert water into a conveyance facility that includes siphons under Sacramento River, Sherman Island, and the San Joaquin River to a canal that extends to Clifton Court Forebay. The isolated conveyance facility was to be operated in coordination with the Through Delta Facility (or Dual Conveyance). This report also identified seven other conveyance alternatives that included isolated facilities, as well as eight conveyance alternatives that relied upon

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Through Delta concepts. The alternative concepts were evaluated in an "alternative narrowing process" in July 1997 (CALFED 1997b). The results of this narrowing process stated that Alternative 3G had "no major technical problems" and only "slight differences" in environmental impacts as compared to other isolated conveyance concepts evaluated. However, because the preliminary cost estimates were two to three times greater than an isolated eastern canal, the recommendation was to eliminate Alternative 3G from further consideration. The results were reviewed with the CALFED Policy Group and the Bay Delta Advisory Committee. In October 1997, a summary of that review process stated:

> "Alternative 3G - Ship Channel. More detailed study indicated that the diversion point near Sacramento did not provide the fishery benefits originally anticipated when the alternative was formulated. Alternative 3B [Isolated Canal with Through Delta conveyance] was judged to provide the same conveyance function at substantially lower cost."

2001 DWR Evaluation Using the Sacramento Deep Water Ship Channel for Fish Passage

In 2001, CALFED and DWR initiated a study of the use of the Sacramento Deep Water Ship Channel to provide an alternative for fish passage as compared to the mainstem of the Sacramento River (DWR 2001). The study was to evaluate conditions needed to move upstream migrating fish of concern into and through the existing boat locks near the Port of West Sacramento. The species of concern included delta smelt, Sacramento splittail, Chinook salmon, steelhead, American shad, striped bass, and white sturgeon. Data was collected through 2005.

X.4.3.5 2007 Governor Schwarzenegger's Direction for Sustainable Management of the Delta

As described in Subsection X.2, then-Governor Arnold Schwarzenegger issued Executive Order 2-17-06 on September 28, 2006, initiating the Delta Vision process to develop “a durable vision for sustainable management of the Delta.” In December 2007, the Delta Vision process resulted in a Blue Ribbon Task Force of experts issuing to a committee of State agency directors a final set of recommendations to chart a new course for the Delta.

One of the recommendations of the Delta Vision process is that the State should consider a different approach to water conveyance from the Sacramento River to areas south of the Delta than the Through Delta Conveyance that the State had approved as part of the CALFED ROD but not fully implemented. On February 28, 2008, Governor Schwarzenegger, in a letter to State Senators Perata, Machado and Steinberg, stated his intention to direct DWR to proceed with preparation of the BDCP environmental review and permitting activities, including the evaluation of at least four alternative Delta conveyance strategies developed in coordination with the BDCP efforts to better protect at-risk fish species. Alternatives were to be developed in light of broad habitat conservation principles, recognizing at the same time, as suggested by the Delta Vision Task Force, the importance of water supply reliability and other issues such as seismic safety, flood durability, ecosystem health and resilience, water quality, schedule considerations, and the costsof various options. The four conveyance strategies included (i) continued use of existing Through Delta Conveyance, (ii) Dual Conveyance (including an Isolated Conveyance facility to convey water from the Sacramento River to the South Delta in conjunction with continued use of existing Through Delta Conveyance), (iii) Isolated Conveyance (to convey water from the Sacramento River to the South Delta without continued use of the Through Delta Conveyance), and (iv) use of an improved Through Delta Conveyance (new or enhanced facilities would include improvements to reduce risk to water

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supplies of future levee failures).

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X.5 Delta Conveyance Concepts Identified in BDCP Steering Committee Process: 2007 - 2010

Starting in 2007, the BDCP Steering Committee developed and evaluated a wide range of concepts related to conveyance and other conservation measures. In 2007, Conservation Strategy Options were identified and evaluated in a preliminary manner. Based upon the results of this preliminary analysis, the BDCP Steering Committee process focused on development of a range of long-term operational criteria for a Dual Conveyance option between 2008 and 2010.

X.5.3.1 Development of Conveyance Concepts by the Conservation Strategy Workgroup

In 2007, the BDCP Steering Committee formed the Conservation Strategy Workgroup, which identified potential Conservation Strategy Alternatives that included conveyance concepts (BDCP 2007b, BDCP 2007c, BDCP 2007d, BDCP 2007e). The following conveyance concepts were identified through this process.

- Existing Through Delta Conveyance (with modified operations) (*Conservation Strategy Alternatives 1, 2, 3, 6, and 7*)
- Isolated Conveyance to convey water from the Sacramento River to the Lower San Joaquin River and continued use of existing South Delta intakes for the SWP and CVP pumping plants (*Conservation Strategy Alternative 4*)
- Isolated Conveyance to convey water from the Sacramento River to the existing SWP and CVP pumping plants (*Conservation Strategy Alternatives 5 and 9*)
- Isolated Conveyance to convey water from the Sacramento River to the existing SWP and CVP pumping plants and to the Lower San Joaquin River with continued use of existing South Delta intakes (*Conservation Strategy Alternative 8*)
- Through Delta Conveyance with separate a water supply corridor along Middle River and a fish passage corridor along Old River (*Conservation Strategy Alternative 10*)

Following several months of evaluation, the BDCP Steering Committee reduced the number of potential Conservation Strategy Alternatives to the following four Conservation Strategy Options (BDCP 2007a).

- Option 1 - Existing Through Delta Conveyance with Opportunistic Delta Operations and Potential New Storage
- Option 2 - Through Delta Conveyance with San Joaquin River Isolation (Separate Corridors for Water Supply and Fish Passage)
- Option 3 - Dual Conveyance: Isolated Conveyance between Sacramento River and SWP and CVP Pumping Plants and Through Delta Conveyance with San Joaquin River Isolation (as in Option 2)
- Option 4 - Isolated Conveyance between Sacramento River and SWP and CVP Pumping Plants

The options were evaluated to determine how well they fared with respect to the following: overall biological benefits primarily for estuarine species dependent on the Delta; ability to meet BDCP water supply goals with practicable implementation methods; comparative costs for initial and long-term costs; ability to be flexible, durable, and sustainable; and ability to minimize unintended

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adverse effects on the human environment and other biological resources. The results of the report are summarized below.

- **Biological Criteria:** Option 4 was determined to provide the greatest benefits among all options to estuarine species, with the most benefits for delta smelt, longfin smelt, and splittail; and benefits for salmonids. Option 3 was determined to provide the next greatest benefits to the estuarine fish and salmonids. Option 2 had fewer benefits for estuarine species than Option 3. Option 1 was determined to provide the lowest benefits of all options for delta smelt, longfin smelt, San Joaquin River salmonids and white sturgeon, but was similar to all other options for Sacramento River salmonids, green sturgeon, and splittail.
- **Planning Criteria:** Option 4 was determined to be slightly more cost effective and practicable than Option 3, although Option 3 provided greater flexibility to meet water supply goals. Option 1was determined to be limited in the ability to meet habitat conservation and water supply goals and could result in poorDelta water quality.
- **Flexibility/Durability/Sustainability Criteria:** Option 4 was determined to have the most flexibility and adaptability to adjust conservation approaches both for habitat restoration and flow management with the least input of future resources. Option 3 was determined to have more limited adaptability for restoration of natural hydrology and physical habitat restoration. Option 2 was determined to be less durable and less flexible related to adaptive management than Options 3 and 4 and more durable than Option 1. Option 1 was determined to be the most reversible but was ranked the lowest for this criterion because of a high risk of loss of habitat and water supply from catastrophic events and sea level rise, and low flexibility for adaptive management.
- **Other Resource Impacts Criteria:** Option 1 was determined to be the most favorable for avoiding direct impacts on other biological and human resources because of the minimal amount of new infrastructure. Option 3 was determined to have the highest impact than other options on the human and biological environment due to the more extensive new infrastructure.

X.5.3.2 Identification of Conveyance Concept for Further Analysis by BDCP Steering Committee

In September and October 2007, the BDCP Steering Committee considered the results of the "Conservation Strategy Options Evaluation Report" during the development of the Points of Agreement to define the subsequent methods for completion of the BDCP (BDCP 2007f). The "Draft Bay Delta Conservation Plan Framework (October 29, 2007)" (BDCP 2007g) stated that, in order to improve biological productivity, improve water quality, and reduce entrainment, the most promising long-term solution would involve an isolated conveyance facility. The draft framework documentation stated that the long-term approach to water conveyance would include (i) intake facilities with positive barrier fish screens on the Sacramento River near Hood or Clarksburg; (ii) a peripheral aqueduct and associated appurtenant facilities (e.g., pumping plant and siphons) that would (a) traverse from the new intake facilities on the Sacramento River southerly along an alignment in the east Delta parallel to, and west of, Interstate 5,(b) terminate south of Clifton Court Forebay, and (c) tie into the existing SWP and CVP pumping and conveyance facilities; (iii) improved through-Delta conveyance, potentially using channel improvements, operable barriers, and levee improvements in the areas around Old and Middle Rivers to reduce entrainment and improve habitat functions; and (iv) continued use of the existing CVP Jones Pumping Plant and SWP Banks Pumping Plant and associated project facilities in the South Delta.

The final Points of Agreement (BDCP 2007f) stated that the Steering Committee agrees that the most promising approach involves a conveyance system with new points of diversion: "The main new

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physical feature of this conveyance system includes the construction and operation of a new point (or points) of diversion in the North Delta on the Sacramento River and an isolated conveyance facility around the Delta. Modifications to existing South Delta facilities to reduce entrainment and otherwise improve the State Water Project's (SWP) and Central Valley Project's (CVP) ability to convey water through the Delta while contributing to near and long-term conservation and water supply goals will also be evaluated. This approach may provide enhanced operational flexibility and greater opportunities for habitat improvements and fishery protection."

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X.6 Alternative Conveyance Concepts Identified in EIR/EIS Scoping Comments

As described in previous sections, the EIR/EIS scoping process occurred in 2008 and 2009 and resulted in 1,051 comments related to the development of alternative concepts. As also noted above, the DSC submitted two scoping letters in June and November 2010. All of this input, along with the conveyance alignment concepts identified in the BDCP Steering Committee Process between 2006 and 2010, were compiled in putting together the following initial list of conveyance concepts.

- **Conveyance Concept Al -** Dual Conveyance with a Tunnel between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes - Tunnel could be up to 50 miles in length with North Delta intake pumping plant capacity from 3,000 cfs to 15,000 cfs (assuming capacity of each pumping plant of 3,000 cfs). Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise.
- **Conveyance Concept A2 -** Dual Conveyance with a Lined or Unlined East Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes - East Canal could be up to 45 miles in length with North Delta intake pumping plant capacity from 3,000 cfs to 15,000 cfs (assuming capacity of each pumping plant of 3,000 cfs). Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise. It is anticipated that the amount of materials required for construction of the canal levees will be similar to the amount of material excavated along the canal alignment.
- **Conveyance Concept A3 -** Dual Conveyance with a Lined or Unlined West Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes - West Canal could be up to 55 miles in length with North Delta intake pumping plant capacity from 3,000 cfs to 15,000 cfs (assuming capacity of each pumping plant of 3,000 cfs). Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise. It is anticipated that the amount of materials required for construction of the canal levees will be similar to the amount of material excavated along the canal alignment.
- **Conveyance Concept A4 -** Dual Conveyance with a Lined or Unlined East Canal between North Delta Intakes and the Lower San Joaquin River, and Continued Use of Existing South Delta Intakes - East Canal could be up to 30 miles in length with North Delta intake pumping plant capacity from 3,000 cfs to 15,000 cfs (assuming capacity of each pumping plant of 3,000 cfs). Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise. It is anticipated that the amount of materials required for construction of the canal levees will be similar to the amount of material excavated along the canal alignment.
- **Conveyance Concept Bl -** Isolated Conveyance with a Tunnel between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes - Tunnel could be up to 50 miles in length with North Delta intake pumping plant capacity of 15,000 cfs (assuming capacity of each pumping plant of 3,000 cfs). Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise.
- **Conveyance Concept B2 -** Isolated Conveyance with a Lined or Unlined East Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes - East Canal could be up to 45 miles in length with North Delta intake pumping plant capacity of 15,000 cfs (assuming capacity of each pumping plant of 3,000 cfs). Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise. It is anticipated that the amount of materials required for construction of the canal levees will be similar to the amount of material excavated along the canal alignment.
- **Conveyance Concept B3 -** Isolated Conveyance with a Lined or Unlined West Canal between

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North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes - West Canal could be up to 55 miles in length with North Delta intake pumping plant capacity of 15,000 cfs (assuming capacity of each pumping plant of 3,000 cfs). The facilities could include over 36 miles of canals located between the Sacramento River and the eastern boundary of the Sacramento Deep Water Ship Channel and between Hotchkiss Tract and a new forebay on Byron Tract; 17 miles of tunnels under the western Delta islands and the Sacramento and San Joaquin rivers; and connecting pipelines between the intakes and western canal alignment. Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise. It is anticipated that the amount of materials required for construction of the canal levees will be similar to the amount of material excavated along the canal alignment.

- **Conveyance Concept B4 -** Isolated Conveyance with a Lined or Unlined East Canal between the Sacramento River near the Confluence with the Feather River and the and Lower San Joaquin River, and Abandonment of Existing South Delta Intakes - East Canal could be up to 150 miles in length with ability to discharge water into American River and Stanislaus River. The intake and pumping plant near the Feather River would be at least 15,000 cfs in capacity (approximately 2 to 3 miles in length) unless a smaller size pumping plant would be required because less water flows in the Sacramento River upstream of the American River. Above ground facilities would be designed to withstand the 200-year return flood and 55-inches of sea level rise. It is anticipated that the amount of materials required for construction of the canal levees will be similar to the amount of material excavated along the canal alignment.
- **Conveyance Concept B5 -** Isolated Conveyance with Diversion from the Sacramento River near West Sacramento into the Sacramento Deep Water Ship Channel and a Tunnel between the Deep Water Ship Channel and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes - New diversion would be constructed near West Sacramento with a pumping capacity of 15,000 cfs (approximately 2 to 3 miles in length), as previously described in SubsectionX.4.3.4. Sacramento Deep Water Ship Channel would be modified through rebuilding of levees, locks, and spillways to withstand the 200-year return flood and 55-inches of sea level rise. A new barrier would be constructed near the southern boundary of the Deep Water Ship Channel with a ship lock to prevent freshwater from flowing from the Deep Water Ship Channel into the Sacramento River. A 15,000 cfs new intake and pumping plant would be constructed along the southeastern levee near Prospect Island. A 40-mile conveyance that would include both a tunnel and canal would be constructed between the Sacramento Deep Water Ship Channel and the existing SWP and CVP pumping plants.
- **Conveyance Concept B6 -** Isolated Conveyance with Diversion from the San Joaquin River near Antioch and Desalination Facilities, a Tunnel between the Desalination Facilities and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes - An intake and pumping plant would be located along the San Joaquin River near Antioch. It is unclear the capacity of the proposed intake, pumping plant, and desalination facility, and therefore, the size of the facility is unclear. A recent study of potential desalination facilities in eastern Contra Costa County indicated that a 25 mgd desalination facility would require approximately 10 acres of land (EBMUD 2010). That facility probably would require an intake of less than 100 cfs capacity. A tunnel would be constructed to convey treated water from the desalination facility approximately 18 miles to the existing SWP and CVP pumping plants.
- **Conveyance Concept C1 -** Separate Corridors - New fish screens with operable gates and boat locks along the Sacramento River at the Delta Cross Channel and Georgiana Slough to allow increased use of the Delta transfer of water, as previously described in Subsection X.4.3.2. Water would be conveyed through the lower Mokelumne River system and across the San Joaquin River (within the surface water, not a tunnel) to Middle River and eventually to Victoria Canal in existing channels. A barrier would be constructed at the western boundary of Victoria Canal and water would be conveyed into Clifton Court through a siphon under Old River for continued conveyance to the existing SWP and CVP pumping plants. Operable barriers would be constructed on Snodgrass Slough to reduce risk to salmon migration in the upper Mokelumne

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River. Operable barriers would be constructed along cross channels between Old River and Middle River (at Woodward Canal, Railroad Cut, and Connection Slough) to isolate Middle River for water supply flows and Old River for fish passage. Operable barriers would be constructed at the Head of Old River and San Joaquin River with a small pumping plant to transfer water into the existing lower San Joaquin River channel to maintain water quality and facilitate downstream flows in the existing San Joaquin River channel. Operable barriers would be constructed along Three Mile Slough or Seven Mile Slough to improve fish passage and water quality in the central and South Delta. Dredging would occur and setback levees would be constructed along portions of Middle River. Continued use of the existing SWP and CVP South Delta intakes would occur during flood periods. This concept would require over 10 million cubic yards of materials to be dredged along the water supply corridor and placed in areas within the Delta.

- **Conveyance Concept C2 -** Through Delta Conveyance with Armored Corridors - Approximately 78 miles of setback levees or traditional levees would be modified or constructed along the Mokelumne and Middle rivers and Victoria Canal to convey water from the Sacramento River to existing SWP and CVP South Delta intakes. Over 10 operable barriers would be constructed to isolate the water supply corridor along the Mokelumne and Middle rivers in case of levee failure in other locations throughout the Delta. This concept also could include two intakes along the Sacramento River near Hood, 12 miles of canals, and approximately 2 miles of tunnel to convey water from the Sacramento River into the armored corridor. The capacity of the facilities would be 15,000 cfs. This concept would require over 150 million cubic yards of materials to be transported to eastern Delta to strengthen the levees along the water supply corridor.
- **Conveyance Concept C3 -** Through Delta Conveyance with West Delta Salinity Barrier - This concept includes construction of an operable barrier near Chipps Island with boat locks and fish passage facilities to maintain a fresh water lake in the Delta, as previously described in Subsection X.4.3.1. Water would continue to flow through existing channels to existing SWP and CVP South Delta intakes.

At the time of the EIR/EIS scoping process, operational scenarios had not been considered or developed. Therefore, these concepts were focused on conveyance alignments.

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X.7 Results of Initial Screening of Conveyance Concepts

The conveyance concepts identified in Subsection X.6 were compared to the First, Second, and Third Level Screening Criteria based upon legal considerations under CEQA and NEPA, as described in Subsection X.3. The results of that comparison are summarized in Tables X.1 through X.3 (located at the end of this appendix).

This initial screening was completed prior to consideration of a range of operations for each of the conveyance alignment concepts. The initial screening was focused upon the legal considerations under CEQA and NEPA because the consistency criteria related to the Delta Reform Act, comments received from Responsible and Cooperating Agencies, and legal rights of entities that are not BDCP participants had a greater emphasis on factors related to water conveyance operations, such as timing of diversions or capacity of facilities. Therefore, the consistency criteria will be used for the secondary screening process presented in Subsection X.10.

The results of the initial screening resulted in elimination of the following conveyance concepts.

- **Conveyance Concept A4** - Dual Conveyance with a Lined or Unlined East Canal between North Delta Intakes and the Lower San Joaquin River, and Continued Use of Existing South Delta Intakes - this concept was eliminated from further evaluation because this concept would result in discharge of Sacramento River water directly into the San Joaquin River, which could cause false attraction flows for sturgeon and salmonids upstream of the area currently affected by reverse flows from the Delta and Sacramento River. ("Attraction flows" are flows that historically have occurred due to rainfall in a watershed that trigger the migration of anadromous fish from the ocean or an estuary into the upper watershed for subsequent spawning. "Attraction flows" from each watershed have unique water quality characteristics that appear to trigger the return of fish that were spawned in that watershed. "False attraction flows" can occur due to discharges that can trigger seasonal migration at times or locations that are not appropriate for spawning for the fish that are lured into the watershed. Therefore, if water from the Sacramento River is discharged to the San Joaquin River, this discharge could falsely attract fish that spawned in the Sacramento River watershed into the San Joaquin River watershed.)
- **Conveyance Concept B4** - Isolated Conveyance with a Lined or Unlined East Canal between the Sacramento River near the Confluence with the Feather River and the and Lower San Joaquin River, and Abandonment of Existing South Delta Intakes - this concept was eliminated from further evaluation because this concept would be at least three times longer than other isolated conveyance alignments considered and would therefore increase the extent of disturbance to communities and habitat along this conveyance alignment and be drastically more expensive to construct than substantially shorter alignments.
- **Conveyance Concept B5** - Isolated Conveyance with Diversions from the Sacramento River near West Sacramento into the Sacramento Deep Water Ship Channel, a 15,000 cfs intake along the eastern levee of the Deep Water Ship Channel upstream of Prospect Island, Pumping Plant near the intake, a Tunnel between the Deep Water Ship Channel and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes. A ship lock would be constructed immediately downstream of the intake to prevent the conveyed water from flowing into the Sacramento River and to prevent fish from swimming from the Delta into the conveyance facility.

  DWR and DFG evaluated the use of the Sacramento Deep Water Ship Channel for Conveyance in 2008 in response to Public Scoping comments and presented the results at two meetings of the BDCP Steering Committee in 2009 (BDCP 2009a and BDCP 2009b). The analysis considered use

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of the five North Delta intakes located along the Sacramento River to avoid disruption of operations of the Port of West Sacramento and provide multiple intake locations as compared to only one intake location near the port.

The January 14, 2009 presentation stated that use of the Deep Water Ship Channel would avoid impacts to about 2,200 acres due to construction and operations of a portion of western isolated canal that would be parallel to the eastern levee of the Deep Water Ship Channel. However, the presentation stated that this concept would cause delays to ship transit times in the Deep Water Ship Channel due to ship handling/piloting through the new lock. The presentation also stated that there was a potential for delta smelt to enter the conveyance facility by passing through the lock. Considerations of potential adverse impacts to delta smelt included the following:

1. It is one of the last remaining concentrations of delta smelt.

a. Sampling of adults (Spring Kodiak Trawl) shows that it is one of the major areas for this species (Source : www.dfg.ca.gov).

b. Collections of fish in the 20 mm survey show that the DWSC is one of the primary spawning areas for delta smelt (Source : www.dfg .ca .gov)

c. It appears that at least some delta smelt use this region on a year-round basis (Source : www.dfg.ca.gov. Sommer, unpublished data).

2. It has important habitat features that attract delta smelt.

a. Delta smelt are attracted to areas with high turbidity, low salinities, and high levels of zooplankton (Source: Feyrer et al. 2007: IEP, Baxter et al. 2007)

b . It is likely that delta smelt spawn on sandy shoals (Sommer et al. In prep).

c. The DWSC has all of these features (Source: IEP, unpublished data).

3. Removing this habitat from their range would have a serious effect on their population.

a. Reducing the amount of delta smelt habitat can have population level effects (Feyrer et al. 2007).

b. Substantially altering the DWSC could have huge hydrodynamic effects that would radiate throughout the delta, the primary habitat for delta smelt. For example, USGS data indicate that 80 percent of tidal flows pass through the Cache Slough Complex (Jon Burau, USGS, unpublished data). The DWSC is the largest channel in this complex, so it probably dominates tidal flows through the region."

The presentation also stated that the Deep Water Ship Channel would require reconstruction because the facility (i) does not meet the Seismic Criteria for the Isolated Conveyance Facility, (ii) was not designed to withstand the 200-year return flood and associated inundation, and (iii) was not designed to withstand sea level rise that could occur over the next 100 years, and because levees may require improvement to store the additional water at higher elevations than existing flows.

The April 15, 2009 presentation included results from the 2006, 2007, and 2008 delta smelt surveys. The results showed the presence of over 700 delta smelt/10,000 cubic meters along the lower Deep Water Ship Channel near the potential locations of the new ship lock and intake. The information included in the presentation included results of an analysis that showed that the number of delta smelt observed was generally less than 5 percent of the delta smelt observed in the western Delta.

This concept was eliminated from further evaluation because it could adversely affect delta smelt and navigation along a federal navigation corridor. This concept would include the same intakes and conveyance facilities between the Sacramento River to the eastern levee of the Deep Water Ship Channel as in Conveyance Concept A3. Therefore, the difference in potential adverse impacts to the lands located to the east of the Deep Water Ship Channel would be limited to the

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lands located along the toe of the Deep Water Ship Channel levee. If the intake were located near the Port of West Sacramento, a single, large intake would be constructed at one location along the Sacramento River, which could result in localized impacts to aquatic resources and navigation, and could require modification of the locks at the Port of West Sacramento.

- **Conveyance Concept B6** - Isolated Conveyance with Diversion from the San Joaquin River near Antioch and Desalination Facilities, a Tunnel between the Desalination Facilities and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes - this concept was eliminated from further evaluation because this concept would depend upon the capacity of the desalination facility, the intake along the San Joaquin River shoreline could extend over three miles for a 15,000 cfs intake and the desalination facility could be several square miles in size. This could result in substantial impacts to land use, given the generally dense existing development in the affected areas. In addition, desalination of up to 15,000 cfs of flow would add an enormous ongoing cost not required for other options andwould result in substantial energy use and, absent the development of practicable "green" power sourcesthat could replace fossil fuel inputs, related substantial greenhouse gas emissions.Such emissions could undermine California's ability to meet its legislative mandate under the California Global Warming Solutions Act of 2006 to reduce the State's 2020 greenhouse gas emissions to 1990 levels. Other options would convey fresh water that would not need to be desalted prior to transport.
- **Conveyance Concept C2** - Through Delta Conveyance with Armored Corridors was evaluated with conceptual engineering designs (CER)- this concept was eliminated from further evaluation because this concept would result in substantial disturbance and either removal or placement of over 120 million cubic yards of materials for levee construction along the Mokelumne and Middle rivers and Victoria Canal. This could result in substantial adverse impacts to aquatic habitat, land use, air quality, and transportation in the area during construction. In particular, concentrated air quality effects from the huge number of diesel-powered truck trips could create hotspots of toxic air contaminants that would not exist with other potential alternatives. This concept would also take substantially longer to construct, again given the huge number of truck trips associated with importing 120 million cubic yards of materials.
- **Conveyance Concept C3 -** Through Delta Conveyance with West Delta Salinity Barrier- this concept was eliminated from further evaluation because this concept would result in the Delta becoming a freshwater lake that would not support the estuarine habitat required by the BDCP covered species and would reduce the ability of fish passage for anadromous fish. This concept would not support project objectives and aspects of the project purpose and need that focus on creating ecological improvements in the Delta ecosystem and contributing to recovery of declining listed species. Nor would the concept meet the coequal goal under the 2009 Delta Reform Act of "protecting, restoring, and enhancing the Delta ecosystem."

The remaining conveyance concepts were renumbered and presented below.

- **Dual Conveyance Concept A-** *Dual Conveyance with a Tunnel between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes*(Conveyance Concept A1).
- **Dual Conveyance Concept B -** *Dual Conveyance with a Lined or Unlined East Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes*(Conveyance Concept A2).
- **Dual Conveyance Concept C -** *Dual Conveyance with a Lined or Unlined West Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes*(Conveyance Concept A3).
- **Isolated Conveyance Concept A -** *Isolated Conveyance with a Tunnel between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes*(Conveyance Concept B1).
- **Isolated Conveyance Concept B -** *Isolated Conveyance with a Lined or Unlined East Canal*

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between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes(Conveyance Concept B2).

- **Isolated Conveyance Concept C -** *Isolated Conveyance with a Lined or Unlined West Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes*(Conveyance Concept B3).
- **Through Delta Conveyance Concept -** *Separate Corridors with new fish screens along the Sacramento River at the Delta Cross Channel and Georgiana Slough to convey water through the lower Mokelumne River system and across the San Joaquin River to Middle River and Victoria Canal; a siphon under Old River for continued conveyance to the existing SWP and CVP pumping plants; operable barriers on Snodgrass Slough, Head of Old River, Three Mile Slough or Seven Mile Slough, and at between Old River and Middle River (at Woodward Canal, Railroad Cut, and Connection Slough); dredging and setback levees along portions of Middle River; and continued use of the existing SWP and CVP South Delta intakes would occur during flood periods* (Conveyance Concept C1).

The general approaches to conveyance could be implemented with facilities of different diversion and conveyance capacities (e.g., 3,000, 6,000, 9,000, or 15,000 cfs). The ultimate decisions regarding what capacities should be addressed in particular EIR/EIS alternatives would turn in large part on how differing capacities would affect overall SWP/CVP systems operations. Operational issues are discussed below.

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X.8 Development of Conveyance Operations Concept by BDCP Steering Committee in 2010

This section describes the processes conducted by the BDCP Steering Committee to develop and evaluate a range of Delta water operations and integration of those operations with various habitat restoration elements. These processes included specific evaluations by the Conveyance Workgroup and the Habitat and Operations Technical Team, an independent review by scientists using an approach developed for the Delta Regional Ecosystem Restoration Implementation Plan, and the BDCP Steering Committee.

X.8.1 BDCP Steering Committee Conveyance Workgroup and Habitat and Operations Technical Team Development of Operations Concepts

In October 2007, the BDCP Steering Committee formed the Conveyance Workgroup and the Habitat and Operations Technical Team (HOTT) to develop and consider screening-level evaluations for the operations of conveyance facilities and restoration programs in the north, west, and South Delta. Working groups and technical teams met periodically to develop technical information or recommendations about aspects of the Conservation Plan elements for consideration by the Steering Committee. The following operational issues related to the Dual Conveyance and/or Isolated Conveyance concepts were evaluated.

- Diversion criteria for the new North Delta intakes along the Sacramento River for use with a Dual or Isolated Conveyance concepts, including limitations on timing and quantities of water to be diverted from the Sacramento River between the City of Sacramento and Walnut Grove.
- Diversion criteria for the new North Delta intakes along the Sacramento River for use with a Dual or Isolated Conveyance concepts, including river bypass flows, effects on Delta Cross Channel and Threemile Slough flows, and Rio Vista flows.
- West Delta outflow criteria.
- Summer-fall flow criteria on the San Joaquin River at Vernalis.
- Two alternative spring X2 operating assumptions:
    - (1) operations where salinity is maintained roughly to the requirements of State Water Resources Control Board Decision 1641 (D1641) but implemented as a function of Eight River Index and over the 5-month period between February and June, and
    - (2) a proposal by the environmental stakeholders where outflow is increased in many years and implemented as a function of the Eight River Index (which includes four more rivers in addition to the four Sacramento River basin rivers used in the more traditional Four-River Index that is used by DWR to define water year types).

These groups also addressed operational issues that were more related toNorth Delta diversion intake design criteria and habitat restoration conservation measures, including inundation of Yolo Bypass; establishment of new floodplain bypasses to be located to the east of the existing Sacramento Deep Water Ship Channel and between Sacramento River and Stone Lakes; hydraulic connections between the Sacramento River and upper reaches of Sutter and Steamboat sloughs; tidal habitat in the west Delta, South Delta, and Suisun Marsh; and effects of conveyance along Old

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River. As described in Subsection X.1, separate appendices have been prepared to describe the development of intake design criteria and habitat restoration conservation measures.

Throughout 2008, the work products and findings of several BDCP Steering Committee workgroups and technical teams were presented to the BDCP Steering Committee. The work products can be accessed on the BDCP website (baydeltaconservationplan.com/BDCPPlanningProcess/ BackgroundDocuments/SteeringCommittee/SteeringCommitteeAgendasandHandouts.aspx). The results were considered and incorporated into the following interactive screening evaluations by the Conveyance Workgroup, Habitat and Operations Technical Team, and Integration Team.

- **Fluctuating Delta Salinity.** Relaxations in the net Delta outflow requirements were investigated for summer and fall (4000 cfs in wet years, 3000 cfs in above normal years, 2000 cfs in below normal years, 1000 cfs in dry years, and 0 cfs in critical dry years) to explore a range of salinity and X2 effects (X2 is the location in the Delta that represents the location of 2 parts per thousand salinity contour, or isohaline contour, measured one meter above the bottom of the estuary, and reported in kilometers upstream of the Golden Gate Bridge [State Water Board 2000].)Rio Vista, salinity and Delta Export/Inflow (EI) ratio standards were also relaxed during this period. The goal was to evaluate the range of variable salinity conditions (increasing salinity in summer and fall of dry years) to be achieved and believed to provide a competitive advantage to native species. Preliminary results of the analyses are summarized below.
    - Higher fall and/or summer salinity could be managed with a rather rapid return to fresher water quality conditions in the western Delta in early winter, as long as salinity intrusion in the South Delta was not substantial.
    - South Delta water quality could be severely degraded during times without increased San Joaquin River flows or discharge of water from the Isolated Conveyance into the Lower San Joaquin River.
    - Upstream storage in the Sacramento River watershed is significantly enhanced and coldwater pools improved with fluctuating Delta salinity throughout the year, but Sacramento River flows would be reduced when Delta salinity is allowed to increase. Increased flow requirements at Rio Vista would increase Sacramento River flows.
    - Available water for SWP and CVP is increased under fluctuating salinity criteria, particularly if westernDelta salinity is allowed to increase in the summer.
    - Fluctuating salinity scenarios with increased Rio Vista flow criteria did not have a significant impact on upstream or Delta conditions.
- **Flooded Western Island.** Based on the DWR Delta Risk Management Study (DRMS) analyses, scenarios related to salinity intrusion due to levee failures and Sherman Island flooding were conducted. The workgroup and technical teams determined that the DRMS work suggested that such a flooding event could result in an eastward shift in X2 of approximately 6 kilometers (km). The conditions were evaluated to determine if flooding of large tracts of western islands may create large areas of low salinity habitat and allow X2 to be managed more at a more easterly location than under existing conditions. Preliminary results of the analyses are summarized below.
    - Significant salt water intrusion would occur if Sherman Island were flooded, and X2 would move eastward by almost 6 km if there were no changes in Delta outflow criteria.
    - Under the same X2 compliance conditions as prescribed in D1641, Delta outflow requirements would cause significant loss of water supply availability and largely eliminate the ability for coldwater pool management in upstream Sacramento River reservoirs due to the need to release water to maintain X2.
- **Preferential Diversion on the Sacramento River at Hood as Compared to South Delta Diversions.** All D1641 standards were removed from a basic Dual Conveyance simulation to

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evaluate system operations effects and incremental tradeoffs of potential regulatory actions. Preliminary results of the analyses are summarized below.

- North Delta Bypass criteria (also known as Hood Bypass Rules), Delta outflow criteria, and Old and Middle Rivers (OMR) reverse flow criteria in the South Delta could be used to modify Delta conditions in accordance with biological goals and objectives.
- Use of North Delta Bypass criteria without additional Delta outflow and OMR criteria did not substantially change water supply availability for SWP and CVP.
- Changing the location of the diversions from the North Delta to the existing South Delta intakes resulted in changes in salinity that were similar to those of the fluctuating salinity scenario.

- **Increased Spring River Flows.** Reservoir releases to increase peak flows in the Sacramento and San Joaquin rivers in March and April and achieve Yolo Bypass inundation of approximately 5,000 cfs were evaluated to determine the effects of substantially restoring spring hydrographs on the Sacramento and San Joaquin rivers. Preliminary results of the analyses are summarized below.
  - Spring releases both increased the extent of flooding with higher flows and re-shaped the hydrograph along the Sacramento River from Keswick Reservoir to Rio Vista.
  - Reductions in available water supplies for SWP and CVP due to spring reservoir release actions were potentially as high as 250,000 to 300,000 acre-feet/year without consideration of additional releases of San Joaquin River flows.
  - Increased San Joaquin River flows generally had a positive effect on spring time QWEST (net flow of the Lower San Joaquin River) and OMR flows, potentially decreasing entrainment effects and improving water quality at the existing South Delta SWP and CVP intakes.
  - Changing the flow targets to increase river flows in December through January could achieve some biological benefits for winter run salmon and improve water supply availability as compared to increase spring releases.
- **Increased Spring Delta Outflow.** The Eight-River Index approach to defining release patterns from upstream reservoirs to meet X2 criteria between February and June was evaluated except for critical dry years when the index was less than 5 million acre-feet. The objective was to evaluate the potential for achieving substantially higher Delta outflow without creating adverse coldwater pool management concerns in upstream reservoirs on the Sacramento River. Preliminary results of the analyses are summarized below.
  - Spring X2 was moved towards the west; however, water supply availability for SWP and CVP and Sacramento Valley water rights and CVP water users was reduced.
  - High Delta outflow requirements in the spring reduced upstream reservoir storage, especially during sequential drier years with some system recovery occurs during wetter periods.
  - Provision of "off-ramps," or adjustments (e.g., provisions to allow additional diversions from the Sacramento River if water storage in upstream reservoirs exceeded agreed upon values), based on upstream storage conditions reduced the impact, but failed to protect declining storage during extended drought periods.
- **Increased Fall X2 Delta Outflow.** Implementation of Fall X2 targets between September and November were explored based on water year types under the Eight River Index. Storage criteria were included to limit reductions in upstream storage, including maintaining Shasta Lake storage greater than 2.8 million acre-feet and Oroville Reservoir storage greater than 1.0 million acre-feet. The goal was to evaluate the potential for achieving higher fall Delta outflow targets without creating adverse coldwater pool management conditions in upstream reservoirs. Initial assessments indicated that the Fall X2 targets using a sliding scale based on the prior water year

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types under the Eight River Index appeared achievable with some reductions in SWP and CVP water supply availability.

- **Preferred South Delta Diversion.** Continued use of the existing South Delta intakes at an increased diversion rate resulted in limited reduction of entrainment effects as compared to existing conditions while reducing the need for higher diversion in the North Delta. Preliminary results of the analyses are summarized below.
  - Dual Conveyance operations with a preference for South Delta diversions could be configured to result in SWP and CVP water supply availability similar to what occurs under existing conditions.
  - Reducing flow conditions at the SWP and CVP South Delta intakes that may lead to entrainment could be accomplished through modification of OMR or managing South Delta intake diversions as a function of San Joaquin River flows.
  - Greater flexibility in opening of the Delta Cross Channel gates after August would reduce the potential for central and South Delta water quality degradation and could increase SWP and CVP water supply availability under a South Delta preferred point of diversion.
- **Fully Isolated Hood Diversion.** A set of scenarios were explored to evaluate the potential of a fully Isolated Conveyance from a North Delta diversion only and with more restrictive North Delta bypass flow operations. Preliminary results of the analyses are summarized below.
  - Project operations under a fully Isolated Conveyance with high flow North Delta bypass rules possibly could result in substantial reductions in SWP and CVP water supply availability in dry or critical dry years.
  - Increasing North Delta bypass flows would not necessarily result in a more natural hydrograph in the Sacramento River unless there were increased upstream reservoir releases.
  - Limitations on SWP and CVP water supply availability are often controlled by the North Delta Bypass requirements and Rio Vista flow requirements.

X.8.2 Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) Assessment of Core Elements

At the end of 2008, the BDCP Steering Committee approved a draft set of Core Elements of a Conservation Strategy for preliminary evaluation (BDCP 2008). The preliminary evaluation was principally designed to provide information for the conceptual ecosystem and species evaluation process known as the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP). The goal of this evaluation was to refine existing and develop new Delta specific restoration actions as well as to provide Delta specific implementation guidance, program tracking, performance evaluation and adaptive management feedback. The Core Elements consisted of the following items.

- Move primary point of diversion to a new North Delta diversion facilities with state-of-the-art fish screens with up to 15,000 cfs capacity subject to North Delta Bypass criteria, upstream river flows, downstream flow requirements, and conveyance limitations.
- Establishment of North Delta Bypass flow criteria (two scenarios) at North Delta diversion to limit diversions during low Sacramento River flows and during periods of concern for covered species, including 11,000 cfs and 5,000 cfs bypass flow scenarios in winter and spring.
- Manage diversions at existing South Delta intakes to reduce entrainment of fish and food resources, including limiting diversions when OMR is greater than -3,500 cfs in December through June, and greater than -5000 cfs in July through November.
- Closure of the Delta Cross Channel except during July, August, half of September, and October to

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protect central and South Delta water quality.

- Modification of Fremont Weir and Yolo Bypass to provide more frequent and greater duration of inundation, up to 4,000 cfs during December 1 through May 15.
- Large-scale tidal marsh restoration in the Cache Slough area of 5,000 - 15,000 acres; strategic tidal marsh restoration in the west Delta, and large-scale tidal marsh restoration in the Suisun Marsh area.

The results of modeling studies of these elements under two scenarios (Scenario 1 with high North Delta Bypass flow criteria, and Scenario 2 with low North Delta Bypass flow criteria) were presented to the DRERIP panel in early 2009 (BDCP 2009c).

The BDCP Steering Committee and the BDCP HOTT team considered the results of the DRERIP Course Evaluation in early 2009. The DRERIP analysis evaluated individual portions of the BDCP and synthesis of all portions of the BDCP (assuming a Dual Conveyance operations). The results related to conveyance indicated that joint operations of the North Delta diversions, Yolo Bypass, and South Delta intakes appeared to provide benefits for several covered fish species, but that more information would be needed to more fully understand potential outcomes (BDCP 2009d).

X.8.3 BDCP Steering Committee Project Description for Preliminary Effects Analysis

Based on the results of the DRERIP analysis, the following additional analyses were completed for the BDCP Steering Committee during 2009 to further evaluate water conveyance and operations.

- **Climate Change "Early-Look".** In order to include changes in hydrology in the Delta watershed due to climate change and increased sea level rise over the next fifty to sixty years, regional climate change scenarios were developed based on the climate scenarios developed by DWR, Reclamation, USFWS, and NMFS. Results from a preliminary set of model simulations indicated that climate change could have a substantial effect on the timing of watershed runoff with earlier runoff patterns due to more rain and less snow and earlier snowmelt due to higher temperatures. These changes resulted in significant reductions in late spring and summer streamflows. Upstream reservoir and coldwater pool management were found to be severely challenged under climate change and the ability to divert water from the Delta became less dependent upon upstream SWP and CVP storage operations. Salinity increased in the western and central Delta and X2 occurred at locations east of existing conditions. This required release of more Delta outflow to maintain the X2 location which resulted in less water availability for SWP and CVP.
- **North Delta Bypass Flows and Operations.** Operational criteria for North Delta diversion facilities were developed to refine tidal operations under low flow conditions.
- **Tidal Marsh and Delta Simulation.** Corroborative simulations with a two dimensional model were conducted to improve simulation of Suisun Marsh restoration components, other tidal marsh restoration actions, Cache Slough, and current inundation of Liberty Island.
- **Daily Operations.** Other modeling improvements were completed to incorporate daily operations of the Fremont weir operations and North Delta Bypass criteria and diversions.
- **Delta Island Consumptive Use Estimates.** The Delta island consumptive use and drainage assumptions were reviewed to better represent the local land uses and estimated water uses.

In December 2009, a "mini- effects analysis" was performed. The objective of this analysis was to prepare a final set of conservation measures for the hydrologic and water quality modeling of the Preliminary Proposed Project to be defined in January 2010. The results of the mini-effects analysis

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were considered with other information presented to the BDCP Steering Committee as part of the effort to define the long-term water operations criteria for evaluation in the Effects Analysis (BDCP 2010a). The results of this analysis were used to complete a preliminary Effects Analysis that was completed in 2010 and presented in the BDCP Steering Committee Progress Report published in November 2010 (BDCP 2010b). The description of the operational criteria as presented to the BDCP Steering Committee in February 2010, is presented in Table X-4 (located at the end of this appendix).

The operations, presented in Table X-4, were defined as the "January 2010 BDCP Operations" for Dual Conveyance. Initial modeling analysis completed for BDCP indicate that January 2010 BDCP Operations would increase SWP and CVP water supply availability as compared to existing conditions and would not adversely affect water deliveries to water rights holders and SWP and CVP water users located in the Sacramento Valley as compared to existing conditions.

Use of January 2010 BDCP Operations for Isolated Conveyance would be slightly different because the South Delta intakes would be abandoned, and therefore, there would not be any operations criteria for those intakes, as presented in Table X-5.

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X.9 Conveyance Operations Concepts Identified in 2011

Following the completion of the BDCP Steering Committee November 2010 Project Status Report, several additional conveyance concepts were identified or more fully defined by the following agencies or groups.

- Following collaborative efforts a series of model runs, Federal and State Agencies developed an operations proposal that became known as "Scenario 6," based on the fact that the final version was the product of six sets of model runs. Working together, the agencies used the "January 2010 BDCP Operations" as a starting point, but made several changes, including the addition of the "Fall X2" requirement from the USFWS 2008 Biological Opinion (USFWS 2008), modifications of Old and Middle River(OMR) criteria, modifications of the Head of Old River Barrier operations, and implementation of South Delta temporary agricultural barriers, as under existing conditions.[7]
- Federal and State Agencies proposed an "Enhanced Ecosystem Conveyance Operations Concept" - similar to "January 2010 BDCP Operations" with Fall X2 as under the USFWS 2008 Biological Opinion (USFWS 2008), reduced ability to divert water at the North Delta intakes through more stringent North Delta intake bypass criteria and Sacramento River flow requirements at Rio Vista, changes to OMR criteria, and reduced ability to divert water at the South Delta intakes.
- State Water Resources Control Board provided additional information related to the scoping comments submitted in 2008 and 2009 (State Water Board 2011a, State Water Board 2011b, and State Water Board 2011c). The proposal, "Enhanced Spring Delta Outflow," would provide additional spring Delta outflow in all water year types to promote abundance and productivity of longfin smelt and other estuarine species, and Delta inflows be modified to promote a more natural hydrograph.
- Several environmental organizations proposed three concepts (American Rivers et al 2011):
    - A concept to (i) achieve Fall X2, protections in the South Delta, (ii) re-establishment of a more natural hydrograph during winter and spring months, and (iii) reservoir operations to prevent unintended draw downs with a range of potential conveyance capacities. The operations would be similar to Scenario 6 with (i) Fall X2 as under the USFWS 2008 Biological Opinion (USFWS 2008), (ii) modifications to OMR flow criteria, (iii) proportional inflow bypasses from Shasta Lake, Folsom Lake, and Oroville Reservoir into the Sacramento River, and (iv) additional pulse flows in the late winter and through the spring to protect outmigrating fall run and spring run Chinook salmon.
    - Operations to provide Delta outflow as described in the State Water Resources Control Board Flow Recommendations for the Sacramento-San Joaquin Delta Ecosystem published in 2010 (State Water Board 2010b).
    - Operations as described above under Scenario 6 with a conveyance capacity of 9,000 cfs.
- Contra Costa Water District and other commenters proposed a Limited Dual Conveyance Facility - similar to "January 2010 BDCP Operations" with only 3,000 cfs capacity for the North Delta intakes, addition of Fall X2as under the USFWS 2008 Biological Opinion (USFWS 2008), and modifications to the San Joaquin River Inflow/Export ratio.

This section discusses considerations for these concepts.

[7] See "Rationale for Five Agency Proposed Alternative BDCP Initial Project Operations Criteria," May 18, 2011 Working Draft.

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X.9.1 Federal and State Agencies Concept: Scenario 6 Concept

Following the completion of the 2010 Project Status Report, which included a preliminary draft Effects Analysis, DWR, DFG, Reclamation, USFWS, and NMFS (Five Agencies) developed a series of critical issues to be addressed by a Five Agency Alternative for BDCP Initial Project Operations Criteria (DWR, DFG, Reclamation, USFWS, and NMFS 2011). The alternative operating criteria are based on the BDCP Steering Committee 2010 Project Operations with modifications as briefly described in section X.9 above and as more fully described below.

The issues of concern to DFG, USFWS, and NFMS can be characterized as follows (the references to "the PP" are intended to refer to the "Preliminary Proposal" based on the 2010 Project Operations):.

- **Reduced Sacramento River flows downstream of the intakes**. "New North Delta diversions will reduce net Sacramento River flows near Rio Vista…although the CALSIM II modeling showed the agreed upon North Delta diversion bypass criteria [in the PP] has generally been met, identified reductions in flow remain a concern…" (California Department of Water Resources et al. 2011).
- **San Joaquin River migratory fish survival.** "[The PP] proposed a 'non-physical barrier' and habitat restoration in the south Delta. The latter was not scheduled to come online until the late long-term time frame. This was not considered adequately protective of San Joaquin River basin salmonid fishes. There was also concern over Old and Middle River (OMR) flow levels during certain months"(California Department of Water Resources et al. 2011).
- **April–May OMR flows.** "The original 'Big 6' version of this issue was that April–May OMR flows in the January 2010 Project Operations modeling were more negative than the flows modeled for the Existing Baseline Condition scenarios. The issue expanded to include OMR flow criteria during other months to take advantage of operational flexibility the CALSIM II modeling indicated would be afforded by dual conveyance. The goal was to increase San Joaquin River flow variability (improving OMR flows in the Delta and flows in the San Joaquin River below the Head of Old River), and maximize improvements to south Delta hydrodynamics…" (California Department of Water Resources et al. 2011).
- **Spring Delta outflow issues related to longfin smelt.** "Changes in winter-spring Delta outflows correlate positively with changes in abundance of longfin smelt. A review of CALSIM II model output shows that the combination of new operating rules and increased conveyance capacity [in the PP] results in reduced net Delta outflows in the winter-spring period of wetter water years…instances of reduced Spring flows, food web productivity and other stressors remain a concern…"(California Department of Water Resources et al. 2011).
- **Fall X2**. "The existing U.S. Fish and Wildlife Service (UFWS) Biological Opinion (BiOp) includes a Reasonable and Prudent Alternative (RPA) element that specifies X2 location in September–October of above-normal and wet water year types. The January 2010 Project Operations did not include any action to meet or mimic the Fall X2 RPA component, raising concerns from USFWS and others whether the project operations would meet permit issuance criteria" (California Department of Water Resources et al. 2011).

"Scenario 6," proposed by the agencies as an alternative to the 2010 Operating criteria for evaluation in the Effects Analysis, includes modified criteria intended to address three of the five operational issues identified above: San Joaquin River migratory fish survival, April–May OMR flows, and Fall X2.

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Scenario 6 also includes an operable barrier at the head of Old River. Scenario 6 does not include modifications to address reduced Sacramento River flows downstream of the new intakes, or the Winter-Spring outflow issues related to longfin smelt (or the location of the north Delta intakes). The agencies' intent was to address these two issues in the development of adaptive ranges subsequent to completion of the Effects Analysis.

The operational criteria for Scenario 6 are presented in Table X-6. Initial modeling analysis completed for BDCP indicate that Scenario 6 operations would reduce SWP and CVP water supply availability as compared to the January 2010 BDCP Operations, increase SWP and CVP water supply availability as compared to Existing Conditions, and would not adversely affect water deliveries to water rights holders and SWP and CVP water users located in the Sacramento Valley as compared to existing conditions.

X.9.2 Federal and State Agencies Concept: Enhanced Ecosystem Conveyance Operations Concept

The Enhanced Ecosystem conveyance operations concept was developed by DFG, USFWS, and NMFS to be considered in the EIR/EIS. The operations were based upon the January 2010 BDCP Operations with Fall X2 as under the USFWS 2008 Biological Opinion (USFWS 2008). This concept increased the Sacramento River flow requirement at Rio Vista and constrained the ability to divert water at the North Delta intakes through more stringent North Delta intake bypass criteria than under the January 2010 BDCP Operations. This concept also reduced the potential for reverse flow in the South Delta with (i) changes to OMR criteria; (ii) changes to San Joaquin River inflow/export ratio criteria; and (iii) not allowing use of the South Delta SWP and CVP intakes in April, May, October, and November to protect migrating fish. The operational criteria for the Enhanced Ecosystem concept are presented in Table X-7.

It was determined that this concept would include a tunnel conveyance alignment concept to minimize surface disturbance to the ecosystem during construction and operations.

X.9.3 State Water Resources Control Board Enhanced Spring Delta Outflow Concept

Following development of the Enhanced Ecosystem Conveyance Operations Concept, preliminary modeling results were considered to determine if this concept also could be responsive to the scoping comments submitted by the State Water Board because this agency is a responsible agency with jurisdiction by law and special expertise. It was determined that based upon scoping comments and other information provided by the State Water Board, an additional concept would be required to be responsive to the agency's scoping comments. The State Water Board provided comments to the DWR 2008 and 2009 NOPs regarding the scope and content of the environmental analyses for the BDCP in letters dated May 30, 2008 (State Water Board 2008) and May 15, 2009 (State Water Board 2009). Additional information was provided from the Executive Director of the State Water Board to the Deputy Secretary of the Natural Resources Agency, in three letters dated April 19, 2011, August 24, 2011, and December 19, 2011 (State Water Board 2011a, State Water Board 2011b, and State Water Board 2011c).

The State Water Board's May 30, 2008 NOP scoping comments cited, among other things, the need for the BDCP EIR/EIS to "analyze a broad range of alternate water quality objectives and operational

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strategies, including reduction in exports, that may be more protective of fish and wildlife beneficial uses." The State Water Board's May 15, 2009 scoping comment letter referred specifically to the value of analyzing increased Delta outflow, as a percent of unimpaired flows (unimpaired flow is roughly defined as the flow that would occur without upstream reservoirs or diversions):

> "Combined with analyzing potential reductions in exports, an alternative for changes to Delta outflows (and potentially inflow requirements) should also be analyzed that reflects a more natural hydrograph. Current outflows and operations have tended to flatten the natural hydrograph and produce more static flow conditions in the Delta. Outflows and export regimes that support a more natural variable hydrograph should be analyzed, including both the naturally high outflow and naturally low outflow ends of the hydrograph for both the interim and long-term. One way to conduct this analysis would be to analyze the effects of providing various percentages of the unimpaired Delta inflow and outflow, and managing storage releases and exports to attempt to parallel this pattern."

Pursuant to the Sacramento-San Joaquin Delta Reform Act of 2009, the State Water Board prepared a report with flow criteria for the Sacramento-San Joaquin Delta Ecosystem that can be used to aid in the development of potential alternatives for Delta outflows (State Water Board 2010b), including the reduced export concept referenced in the State Water Board's previous NOP comments. On April 19, 2011, the Executive Director of the State Water Board sent a letter to the Deputy Secretary of the Natural Resources Agency stating (State Water Board 2011a):

> "The State Water Board's Delta Flow Criteria Report includes determinations of flow criteria for the Delta ecosystem to protect public trust resources. The report makes clear that the flow criteria do not consider the balancing of public trust resource protection with public interest needs for water. The flow criteria also did not consider other public trust resource needs such as the need to manage cold-water resources in reservoirs tributary to the Delta. Nonetheless, the flow determinations contained in the Delta Flow Criteria Report, together with recent scientific conclusions of other State and federal agencies, including the Department of Fish and Game, National Marine Fisheries Service, and the Interagency Ecological Program provide a useful guide to establish one side of a reasonable range of alternatives. State Water Board staff suggests that a reasonable range of alternatives may be established by making changes to the operational criteria already being evaluated in one or several of the alternatives considered by the BDCP per the September 1, 2010 Table 1: Modified Array of Alternatives. The changes should be made to address two of the summary determinations in the Delta Flow Criteria Report: 1) provide additional spring Delta outflow in all years to promote increased abundance and improved productivity for longfin smelt and other estuarine species; and 2) provide flows that promote a more natural hydrograph at all times."

The Delta Flow Criteria Report summary determination was presented as 75 percent of unimpaired net Delta outflow for January through June. As described in the letter, this determination did not consider the competing needs for water or other public trust resource needs such as the need to manage cold-water resources in tributaries to the Delta. Implementing such a flow would also likely affect water users beyond just CVP and SWP south of Delta deliveries. The letter therefore described an approach that could be used to develop a BDCP alternative concept that increased Spring Delta outflow:

> "Model runs for these revised alternatives should be made in an iterative fashion to ascertain the maximum additional fixed quantity of additional Delta outflow that would provide useful information to evaluate balancing of the beneficial uses of water and achieving the coequal goals. As a starting point, staff suggests adding 1.5 million acre-feet per year to Delta outflow."

The letter also suggested that State Water Board and DWR could refine this modeling approach. Staff met several times in the following months and identified a general approach that could be used to

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model an increased Spring Delta outflow concept.

As described in the August 24, 2011 letter from the Executive Director of the State Water Board to the Deputy Secretary of the Natural Resources Agency (State Water Board 2011b), the goal of this general approach was to increase Spring Delta outflow above that achieved in the Enhanced Ecosystem Conveyance Operations Concept (described in Subsection X.9.2) and increase Spring Delta outflow by approximately 1.5 million acre-feet, on average, above the NEPA baseline assumptions (No Action Alternative without the effects of sea level rise or climate change). The State Water Board anticipated that this would result in:

- No negative effects on cold water pool storage;
- Not drawing down Sacramento Valley groundwater levels;
- No decreased water supplies other than south-of-Delta Central Valley Project and State Water Project deliveries;
- No failure to deliver San Joaquin River exchange water rights; and
- No failure to deliver refuge water.

The specific goal for this concept was to increase Spring Delta Delta outflow by approximately 1.5 million acre-feet per year, on average. It was expected that this potential alternative would also result in an approximate average annual reduction in south of Delta deliveries of 1.5 million acre-feet per year. To achieve these goals, and to avoid the effects listed above, the concept includes a requirement of 55% of unimpaired flow, as estimated for the Sacramento River at Freeport, to become Delta outflow. No Sacramento River inflow-specific objective is intended; however, the goal of the concept is to achieve an increase in net Delta outflow of about 1.5 million acre-feet per year, on average. The State Water Board included modifications to minimum storage requirements for upstream reservoirs on the Sacramento River system in an attempt to achieve cold water pool storage goals of the State Water Board and the USFWS and NMFS biological opinions that affect operations of the SWP and CVP.

On December 19, 2011, the Executive Director of the State Water Board sent a letter to the Deputy Secretary of the Natural Resources Agency that summarized the results of the preliminary modeling of the proposed enhanced ecosystem alternative:

> "The State Water Board has been working with DWR to analyze an enhanced ecosystem protection alternative for the BDCP that results in reduced south of Delta diversions. Preliminary model results show that this alternative would result in increases to mean annual Delta outflow of approximately 1.6 million acre-feet per year for the February through June period at a cost of approximately 1.5 million acre-feet per year on average reduction in south of Delta diversions relative to the no action alternative. This alternative will allow DWR and other lead agencies, and the State Water Board to evaluate a sufficiently broad range of alternatives to inform their respective processes. As this enhanced ecosystem alternative results in a large negative water supply effect, it provides an alternative to the BDCP's preferred alternative that will assist in analyzing the project's effects. It is therefore useful to evaluate the tradeoffs that need be considered to achieve the two coequal goals required by the Delta Reform Act. Similar to what the State Water Board is doing for the evaluation of San Joaquin River flow objectives, an evaluation of the water supply and economic effects of the enhanced ecosystem BDCP alternative would be useful for the Board's decision-making. Ideally this evaluation of the water supply and economic effects of the enhanced ecosystem alternative could be performed in conjunction with an analysis of the costs and effects of obtaining alternative water supplies."

The operational criteria for the Enhanced Spring Delta Outflow concept are presented in Table X-8.

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X.9.4 Environmental Organizations Conveyance Operations Concepts

Following the completion of the 2010 Project Status Report, a consortium of environmental organizations (American River et al 2011) proposed three concepts (American Rivers et al 2011):

- A concept to (i) achieve Fall X2, protections in the South Delta, (ii) re-establishment of a more natural hydrograph during winter and spring months, and (iii) reservoir operations to prevent unintended draw downs with a range of potential conveyance capacities. The operations would be similar to Scenario 6 with (i) Fall X2 as under the USFWS 2008 Biological Opinion (USFWS 2008), (ii) modifications to OMR flow criteria, (iii) proportional inflow bypasses from Shasta Lake, Folsom Lake, and Oroville Reservoir into the Sacramento River, and (iv)additional pulse flows in the late winter and through the spring to protect outmigrating fall run and spring run Chinook salmon. For the purposes of this document, this concept is referred to as the "Proportional North Delta Inflow Bypass Concept."
- Operations to provide Delta outflow as described in the State Water Resources Control Board Flow Recommendations for the Sacramento-San Joaquin Delta Ecosystem published in 2010 (State Water Board 2010b).
- Operations as described above under Scenario 6 with a conveyance capacity of 9,000 cfs.

X.9.4.1 Proportional North Delta Inflow Bypass Concept

This potential alternative was proposed in a letter from American Rivers and other environmental organizations (American Rivers et al 2011). The letter stated:

> "The first alternative includes criteria to achieve the fall X2 requirement, additional protections in the South Delta, reservoir bypass criteria to reestablish a more natural hydrograph during winter and spring months, and reservoir release off ramps to prevent unintended draw downs. Criteria for the North Delta diversion are similar to scenario 6, but will require additional pulse protection in the late winter and through the spring (e.g. an extension of the protections for winter run juveniles that were incorporated in previous operational alternatives) in order to protect outmigrating fall run and spring run Chinook salmon. Partial details for these criteria are provided in tables 1, 2 and 3..., but the North Delta diversion rules will need to be more fully described. These criteria should be modeled with a broad range of canal sizes ... to identify the optimal canal size for this operating regime."

The operational criteria included in "tables 1, 2, and 3" and other criteria are presented in Table X-9.

X.9.4.2 Conveyance Operations Concept based on the State Water Resources Control Board Flow Recommendations for the Sacramento-San Joaquin Delta Ecosystem

Another conveyance operations concept proposed by the consortium of environmental organizations (American River et al 2011) was based on the 2010 State Water Resources Control Board flow recommendations for the Sacramento-San Joaquin Delta Ecosystem (State Water Board 2010).

In 2009, the State adopted SBX7 1, which requires the State Water Board to develop new flow criteria for the Delta ecosystem to protect public trust resources and a prioritized schedule to complete instream flow studies for the Delta and high priority streams in the Delta watershed as identified by DFG. In August 2010, the State Water Board completed the Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem (State Water Board 2010a and State Water

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Board 2010b). The final report presented flow criteria to protect the Delta and its ecological resources. This report provided an assessment of the flows needed to protect the Delta and its ecological resources, but does not address other public trust considerations. More specifically, as explained on page 3 of the final report,

> "[n]one of the determinations in this report have regulatory or adjudicatory effect. Any process with regulatory or adjudicative effect must take place through the State Water Board's water quality control planning, water rights processes, or public trust proceedings in conformance with applicable law. In the State Water Board's development of Delta flow objectives with regulatory effect, it must ensure the reasonable protection of beneficial uses, which may entail balancing of competing beneficial uses of water, including municipal and industrial uses, agricultural uses, and other environmental uses. The State Water Board's evaluation will include an analysis of the effect of any changed flow objectives on the environment in the watersheds in which Delta flows originate, the Delta, and the areas in which Delta water is used. It will also include an analysis of the economic impacts that result from changed flow objectives.
>
> Nothing in either the Delta Reform Act or in this report amends or otherwise affects the water rights of any person. In carrying out its water right responsibilities, the State Water Board may impose any conditions that in its judgment will best develop, conserve, and utilize in the public interest the water to be appropriated. In making this determination, the State Water Board considers the relative benefit to be derived from all beneficial uses of the water concerned and balances competing interests.
>
> The State Water Board has continuing authority over water right permits and licenses it issues. In the exercise of that authority and duty, the State Water Board may, if appropriate, amend terms and conditions of water right permits and licenses to impose further limitations on the diversion and use of water by the water right holder to protect public trust uses or to meet water quality and flow objectives in Water Quality Control Plans it has adopted. The State Water Board must provide notice to the water permit or license holder and an opportunity for hearing before it may amend a water right permit or license."

While informing the broader flow-standard-setting process, the report also underscores the importance to California of resolving future flow regime needs. SBX7 1 also stated that this report should be used to inform DWR in its preparation of environmental documentation for the BDCP. The flow criteria do not have regulatory effect but rather provide information to the State Water Resources Control Board that may be used in the development of future flow and water quality objectives and water rights decisions, including the ongoing Bay-Delta Plan Update and consideration for future BDCP permits and approvals. Although by statute State Water Board must consider its August 2010 flow recommendations at the point in time at which DWR and Reclamation seek to amend their existing water rights permits to include new authorized points of diversion, State Water Board's final August 2010 report makes it clear (on pages 3 and 4) that State Water Board's ultimate determinations regarding what Delta flow criteria to impose as part of such permit amendment must take into account a variety of factors, including ramifications for "all beneficial uses of water":

> "If the DWR and/or the USBR in the future request the State Water Board to amend the water right permits for the State Water Project (SWP) and/or the Central Valley Project (CVP) to move the authorized points of diversion for the projects from the southern Delta to the Sacramento River, Water Code section 85086 directs the State Water Board to include in any order approving a change in the point of the diversion of the projects appropriate Delta flow criteria.
>
> At that time, the State Water Board will determine appropriate permit terms and conditions. That decision will be informed by the analysis in this report, but will also take many other factors into consideration, including any newly developed scientific information, habitat conditions at the time, and other policies of the State, including the relative benefit to be derived

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> from all beneficial uses of water. The flow criteria in this report are not pre-decisional in regard to any State Water Board action. (See, e.g., Wat. Code, § 85086, subd. (c)(1).)"

The phrase, "other policies of the state," as used above, presumably includes the coequal objective of "providing a more reliable water supply for California," as well as the codified water rights priority system that has been place in some form since not much after statehood. Elsewhere in its August 2010 final report, State Water Board emphasized ongoing parallel processes – beyond the scope of the BDCP – in which the water rights of entities other than DWR and Reclamation might be affected. On pages 14 and 15, State Water Board explained that it

> " has a number of ongoing proceedings that may be informed by the development of flow criteria. Some of these proceedings will result in regulatory requirements that affect flow, or otherwise affect the volume, quality, or timing of flows into, within, or out of the Delta. In July 2008, the State Water Board adopted a strategic work plan for actions to protect beneficial uses of the San Francisco Bay/Delta (Bay-Delta). In accordance with the work plan, the State Water Board recently completed a periodic review of the 2006 Water Quality Control Plan for the Bay-Delta Estuary (Bay-Delta Plan) that recommended the Delta Outflow objectives, as well as other flow objectives, for further review in the water quality control planning process. Currently, the State Water Board is in the process of reviewing the southern Delta salinity and the San Joaquin River flow objectives contained in the Bay-Delta Plan."

On page 17, the final report notes that the *water quality control planning* process will provide another regulatory venue independent of the BDCP in which the August 2010 Delta flow recommendation can be revisited with far more players than just DWR and Reclamation "at the table," so to speak:

> "SB 1 requires any order approving a change in the point of diversion of the State Water Project (SWP) or the Central Valley Project (CVP) from the southern Delta to a point on the Sacramento River to include appropriate flow criteria and to be informed by the analysis in this report. (Wat. Code, § 85086, subd. (c)(2).) The statute also specifies, however, that the criteria shall not be considered predecisional with respect to the State Water Board's subsequent consideration of a permit. (*Id*., § 85086, subd. (c)(1).) Thus, any process with regulatory or adjudicative effect must take place through the State Water Board's *water quality control planning* or water rights processes in conformance with applicable law. Any person who wishes to introduce information produced during this informational proceeding, or the State Water Board's ultimate determinations in this report, into a later rulemaking or adjudicative proceeding must comply with the rules for submission of information or evidence applicable to that proceeding."

Notwithstanding the numerous regulatory and legal impediments associated with any long-term attempt to integrate State Water Board's 2010 flow recommendation into the fabric of California water quality control planning and water rights law, some initial modeling was conducted for the State Water Board in order to learn more about the real-world consequences of attempting to implement the 2010 recommended flows. The Draft report published in July 2010 (State Water Board 2010a) included results of preliminary model runs. Due to the inability to consider a balanced approach for implementation of the recommended flows, though, the final report did not include the model results (State Water Board 2010b). Even so, however, the preliminary results could be informative to determine general approaches to achieve increased Delta outflows. The two modeled scenarios provided for net Delta outflow of 75 percent of a 14-day average unimpaired flow for January through June and Fall X2 for September through November for wet and above normal years. One of the modeled scenarios also included estimated operations criteria for BDCP. Results of model runs indicated reductions in SWP and CVP water supplies and "end of September" reservoir storage in Trinity Lake, Shasta Lake, Oroville Reservoir and Folsom Lake in more years with the 2010 flow recommendations than under the baseline conditions (pages 178 - 191, State Water Board 2011a).

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The reduction in reservoir storage also resulted in an increased frequency of non-compliance with cold water storage in accordance with NMFS biological opinion requirements. It should be noted that these reductions would have become more severe if the model assumptions had not reduced agricultural water demands in the Sacramento Valley, including water demands of pre-1914 water rights holders, to reduce surface water diversions. Since these water rights holders are not applicants for the BDCP, these modeling assumptions do not represent a reasonable component of a BDCP action alternative. Reduced water diversions from these water rights holders cannot be feasibly accomplished through approval of the BDCP. The Lead Agencies therefore concluded that, absent reduced diversions by pre-1914 water rights holders, the adverse effects of cold water storage under a scenario based on the State Water Board's 2010 flow recommendation would be even worse than was predicted by the above-described modeling.

X.9.4.3 Scenario 6 Conveyance Operations Concept with Limited Dual Conveyance Facility Capacity of North Delta Intakes

Another conveyance operations concept proposed by the consortium of environmental organizations (American River et al 2011) was based on Scenario 6, as described in Subsection X.9.1 with a capacity of 9,000 cfs.

X.9.5 Contra Costa Water District Conveyance Operations Concept with Limited Dual Conveyance Facility Capacity

On February 2, 2011, Contra Costa Water District (CCWD 2011) submitted a letter to the Deputy Secretary of Natural Resources Agency identifying three key objectives towards resolving technical and policy issues the Delta ecosystem, water quality, and water supply reliability. The objectives included (i) providing assurances to in-Delta water users that water quality impacts will be mitigated; (ii) incorporating immediate and interim projects that address critical issues now, and will continue to provide benefits in the long-term; and (iii) reassessing the configuration of new facilities in the current draft BDCP. The new configuration addressed in the third objective was described in the following manner in the letter.

> "The 2009 legislative policy called for a reduction in reliance on the Delta in meeting California's future water supply needs (SBX7-1 85021). Nonetheless, some contractors have indicated they would not move forward with the project unless they can increase their water supply. Other BDCP participants oppose increasing water exports from the Delta. This disagreement must be addressed head-on before more money is wasted planning a project that either the contractors will not fund or the fishery agencies will not permit.
>
> A smaller conveyance facility (3 ,000 cfs instead of the 15,000 cfs now under consideration) appears to be the optimum solution based on the BDCP analysis and CCWD's own analysis, providing nearly the same water supply yield at half the cost of the larger facilities, and it allows the option to expand capacity later if necessary. The current BDCP studies show that 62% of the time, any capacity over 3,000 cfs is unused and unnecessary, and the full 15,000 cfs capacity is used only 1 % of the time ... The studies also make clear that the most pressing problem is extended droughts: there is more than a 30% chance of any year being dry or critically dry, and an isolated facility does nothing to change that or the water supply situation that results. Resolution of water supplies in dry years for fish and human activities is where the real focus should be: currently up to 80% of the water is removed from the system in dry years, and we still face severe shortages. It appears that incorporating storage is necessary to meet co-equal goals and would allow more water supplies to be captured in wet years, taking the stress off the ecosystem in dry years."

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Subsequently, DWR staff consulted with the Contra Costa Water District staff and also determined that this operations concept also should include Fall X2 and modifications to the San Joaquin River Inflow/Export ratio in order to improve water quality and to reduce impacts to fish in the South Delta, in accordance with the first objective in their letter. The letter was commenting on results of preliminary model runs for the "January 2010 Operations" and, therefore, it was assumed that this concept would be based upon those operations criteria. Operations criteria for Limited Dual Conveyance Facility Concept is presented in Table X-10.

X.9.6 Range of Capacities for Conveyance Concepts

In addition to a range of conveyance alignments and operations, the State and federal agencies also addressed the need to consider a range of North Delta intake capacities. Initial modeling results indicated that there was limited difference between SWP and CVP water supply availability for Dual Conveyance concepts between 15,000 cfs and 12,000 cfs capacity at the North Delta intakes based upon the January 2010 BDCP Operations (BDCP 2010c). These results occurred because the reduction in diversion capacity in the North Delta could be replaced with increased diversions at the existing South Delta intakes. The differences between 15,000 cfs capacity at the North Delta intakes and 9,000 cfs and 6,000 cfs capacities also was minimal but greater than the difference with 12,000 cfs.

Therefore, the EIR/EIS lead agencies determined that a range of capacities should be considered for Dual Conveyance concepts that included North Delta intake capacities of 3,000 cfs, 6,000 cfs, 9,000 cfs, and 15,000 cfs. Based upon the preliminary modeling results for the January 2010 BDCP Operations (BDCP 2010c), it appeared that results for capacities of 6,000 cfs, 9,000 cfs, and 15,000 cfs would be similar for Dual Conveyance concepts because in general when diversions were limited at the North Delta intakes water could be diverted at the South Delta intakes. Therefore, based upon the preliminary information, it was determined that the range of concepts to be considered in the second screening should include the following Dual Conveyance concepts to provide a range of flow criteria.

- Dual Conveyance with 15,000 cfs capacity at the North Delta intakes with January 2010 BDCP Operations Concept
- Dual Conveyance with 15,000 cfs capacity at the North Delta intakes with Scenario 6 Concept
- Dual Conveyance with 6,000 cfs capacity at the North Delta intakes with January 2010 BDCP Operations Concept
- Dual Conveyance with 9,000 cfs capacity at the North Delta intakes with Scenario 6 Concept

The Enhanced Ecosystem Conveyance Operations Concept also could be evaluated at a range of capacities. It was determined that a middle range value of 9,000 cfs for the North Delta intakes would be considered for the second screening process for the Enhanced Ecosystem Operations, Modified Enhanced Ecosystem Operations, Scenario 7a, and State Water Resources Control Board 2010 Flow Recommendations for Delta Ecosystem Operations. Taken together, this range of capacity options was determined to be sufficient to meet the directive in the Delta Reform Act that the BDCP EIR, in order for the BDCP to be considered for automatic inclusion in the Delta Plan, include a “reasonable range of . . . rates of diversion.” (Cal. Water Code Section 85320[b][2][A].)

Based upon the preliminary modeling results for the January 2010 BDCP Operations of the Isolated Conveyance Concept (BDCP 2010c), it appeared that the long-term average Delta exports for an Isolated Conveyance facility with capacities of 3,000 to 15,000 cfs would be less than for the No

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Action Alternative, as summarized below; and therefore would not necessarily meet the project objectives of the voluntary BDCP process.

- No Action Alternative (no Isolated Conveyance, continued use of Through Delta Conveyance) - 4.9 million acre-feet/year long-term average Delta exports
- 15,000 cfs Isolated Conveyance (no Through Delta Conveyance) - 4.5 million acre-feet/year long-term average Delta exports
- 12,000 cfs Isolated Conveyance (no Through Delta Conveyance) - 4.4 million acre-feet/year long-term average Delta exports
- 9,000 cfs Isolated Conveyance (no Through Delta Conveyance) - 3.8 million acre-feet/year long-term average Delta exports
- 6,000 cfs Isolated Conveyance (no Through Delta Conveyance) - 2.9 million acre-feet/year long-term average Delta exports
- 3,000 cfs Isolated Conveyance (no Through Delta Conveyance) - 1.7 million acre-feet/year long-term average Delta exports

Based upon this preliminary information, it was determined that it was not necessary to evaluate a range of North Delta intake capacities for the Isolated Conveyance concept for a reasonable range of alternatives.

The Through Delta Conveyance - Separate Corridors concept does not include facilities to reduce the amount of water to be conveyed from the Sacramento River to the South Delta intakes. Water would flow from the Sacramento River through Delta Cross Channel and Georgiana Slough by gravity through existing channels. Improvements to the channels and the diversion structures would be sized based upon existing channel capacity and not necessarily upon conveyance capacity, with the exception of improvements near Clifton Court. It was determined that maintaining the Through Delta Conveyance - Separate Corridors concept at the existing Through Delta capacity of 15,000 cfs would be more appropriate than construction of facilities to restrict the capacity of existing channels. Operations criteria for the Separate Corridors concept is presented in Table X-11.

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X.10 Results of the Second Screening of Conveyance Concepts

As described in Subsection X.7, the EIR/EIS process considered the results of the initial screening of conveyance concept alignments. Subsequently, as described in Subsections X.8 and X.9, operational concepts were identified to be considered in the second screening process. The conveyance concepts identified in Subsection X.10 were compared to the First, Second, and Third Level Screening Criteria and the Consistency Criteria, as described in Subsection X.3.The results of this process are summarized in this subsection.

X.10.1 Range of Conveyance Alignment Concepts Identified through the Initial Screening Process

The EIR/EIS process considered the following conveyance alignment concepts identified through the initial screening process.

- **Dual Conveyance Alignment Concept A-** *Dual Conveyance with a Tunnel between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes*
- **Dual Conveyance Alignment Concept B -** *Dual Conveyance with a Lined or Unlined East Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes*
- **Dual Conveyance Alignment Concept C -** *Dual Conveyance with a Lined or Unlined West Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Continued Use of Existing South Delta Intakes*
- **Isolated Conveyance Alignment Concept A -** *Isolated Conveyance with a Tunnel between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes*
- **Isolated Conveyance Alignment Concept B -** *Isolated Conveyance with a Lined or Unlined East Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes*
- **Isolated Conveyance Alignment Concept C -** *Isolated Conveyance with a Lined or Unlined West Canal between North Delta Intakes and the SWP and CVP Pumping Plants, and Abandonment of Existing South Delta Intakes*
- **Through Delta Conveyance Alignment Concept -** *Separate Corridors*

X.10.2 Range of Conveyance Operations Concepts Combined with the Conveyance Alignment Concepts

As described in Subsections X.8 and X.9, the following range of conveyance operations concepts were identified for the conveyance alignment concepts. The concepts were combined to develop the following Delta Conveyance Concepts to be compared to the screening criteria and identify the final range of conveyance alternatives to be evaluated in detail in the EIR/EIS.

- **Dual Conveyance Concept 1A-** *Dual Conveyance with a Tunnel - January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*

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- **Dual Conveyance Concept 1B -** *Dual Conveyance with a Lined or Unlined East Canal January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 1C -** *Dual Conveyance with a Lined or Unlined West Canal January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 2A-** *Dual Conveyance with a Tunnel - Scenario 6 Operations - 15,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 2B -** *Dual Conveyance with a Lined or Unlined East Canal Scenario 6 Operations - 15,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 2C -** *Dual Conveyance with a Lined or Unlined West Canal Scenario 6 Operations - 15,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 3A-** *Dual Conveyance with a Tunnel - January 2010 BDCP Operations - 6,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 3B -** *Dual Conveyance with a Lined or Unlined East Canal January 2010 BDCP Operations - 6,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 3C -** *Dual Conveyance with a Lined or Unlined West Canal January 2010 BDCP Operations - 6,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 4A-** *Dual Conveyance with a Tunnel - Scenario 6 Operations - 9,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 4B -** *Dual Conveyance with a Lined or Unlined East Canal Scenario 6 Operations - 9,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 4C -** *Dual Conveyance with a Lined or Unlined West Canal Scenario 6 Operations - 9,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 5A-** *Dual Conveyance with a Tunnel - Limited Conveyance Operations Concept - January 2010 BDCP Operations and Fall X2 - 3,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 6A-** *Dual Conveyance with a Tunnel - Enhanced Ecosystem Concept - 9,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 7A-** *Dual Conveyance with a Tunnel - Enhanced Spring Delta Outflow Concept - 9,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 8A-** *Dual Conveyance with a Tunnel - Proportional North Delta Inflow Bypass Concept - 15,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 9A-** *Dual Conveyance with a Tunnel - State Water Resources Control Board 2010 Flow Recommendations for Delta Ecosystem - 9,000 cfs North Delta Intake Capacity*
- **Isolated Conveyance Concept 1A -** *Isolated Conveyance with a Tunnel - January 2010 BDCP Operations - 15,000 cfsNorth Delta Intake Capacity*
- **Isolated Conveyance Concept 1B -** *Isolated Conveyance with a Lined or Unlined East Cana - January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Isolated Conveyance Concept 1C -** *Isolated Conveyance with a Lined or Unlined West Canal - January 2010 BDCP Operations - 15,000 cfsNorth Delta Intake Capacity*
- **Through Delta Conveyance Concept 1 -** *Separate Corridors Operations - 15,000 cfsNorth Delta Intake Capacity*

These concepts were compared to the screening criteria in a second screening process. The results of that process are described in the following subsection.

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X.10.3 Results of the Second Screening of Conveyance Concepts

The results of that comparison are summarized in Tables X.12 through X.17 (located at the end of this appendix).

Based upon the results of the comparison of the Conveyance Concepts to the screening criteria, Dual Conveyance Concept 9A - *Dual Conveyance with a Tunnel - State Water Resources Control Board 2010 Flow Recommendations for Delta Ecosystem - 9,000 cfs North Delta Intake Capacity* - was eliminated from further analysis. This concept was eliminated because of the preliminary modeling results presented in a draft report by the State Water Board (State Water Board 2010a) that indicated the possibility of reductions in cold water pool storage in Trinity Lake, Shasta Lake, Oroville Reservoir, and Folsom Lake that would lead to increased levels of non-compliance with the NMFS Biological Opinion and adverse impacts to salmonids in the Sacramento and Feather rivers as compared to Existing Conditions or No Action Alternative. It is also noted that the preliminary model runs resulted in the possibility of these adverse impacts following the reduction of water available to pre-1914 water rights holders in the Sacramento River basin. This would have the potential to require changes in the legal Sacramento River water rights or water entitlements of third parties other than BDCP permit applicants that are beyond the scope of the regulatory authority of the agencies charged with considering approval of the proposed BDCP (including DFG that approves the NCCP and USFWS and NMFS that approve the HCP). In addition, the State Water Board specifically stated in the 2010 report (State Water Board 2010b) that the report provided an assessment of the flows needed to protect the Delta and its ecological resources, but does not address other public trust considerations. More specifically, the final report describes that "Any process with regulatory or adjudicative effect must take place through the State Water Board's water quality control planning, water rights processes, or public trust proceedings in conformance with applicable law." For these reasons, it was determined that, in addition to failing to meet the purpose and need for the BDCP, this alternative concept was likely to violate federal and state statutes or regulations and was not considered in a detail analysis in the EIR/EIS.

X.10.4 Identification of Conveyance Concepts with Similar Conveyance Facilities

As described in Subsections X.3.1.1 and X.3.1.2, the range of reasonable alternatives need not consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decision making and public participation. The DOI NEPA regulations are more specific and provide that "when there are potentially a very large number of alternatives then a reasonable number of *examples* covering the full spectrum of reasonable alternatives" will suffice.

Based upon a review of the range of conveyance concepts, it was determined that the Conveyance Facilities for Dual Conveyance Concepts 1A through 1C and Dual Conveyance Concepts 2A through 2C would be identical to Conveyance Facilities for Dual Conveyance Concepts 3A through 3C and Dual Conveyance Concepts 4A through 4C except for the number of North Delta intakes. The footprint of disturbance for construction of a tunnel would be assumed to be the same for a range of North Delta intake capacities between 6,000 and 15,000 cfs. Similarly, the footprint of disturbance

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for construction of a canal would be assumed to be the same for a range of North Delta intake capacities between 6,000 and 15,000 cfs. In addition, the North Delta intakes are anticipated to be identical between concepts with conveyance concepts using a tunnel, eastern canal, or western canal. Therefore, it was determined that results of detailed analyses of construction of conveyance facilities with an eastern canal or western canal for Dual Conveyance Concepts 1B through 1C and 2B through 2C would be adequate to disclose potential adverse impacts and benefits that could occur for Dual Conveyance Concepts 3B and 3C and 4B and 4C. Therefore, the following conveyance concepts were eliminated from further detailed analyses in the EIR/EIS.

- **Dual Conveyance Concept 3B -** *Dual Conveyance with a Lined or Unlined East Canal January 2010 BDCP Operations - 6,000 cfs North Delta Intake Capacity*
  - Potential impacts due to construction and operations of the North Delta and South Delta intakes will be the same as under Dual Conveyance Concept 3A
  - Potential impacts due to construction of the eastern canal will be the same as under Dual Conveyance Concept 1B
- **Dual Conveyance Concept 3C -** *Dual Conveyance with a Lined or Unlined West Canal January 2010 BDCP Operations - 6,000 cfs North Delta Intake Capacity*
  - Potential impacts due to construction and operations of the North Delta and South Delta intakes will be the same as under Dual Conveyance Concept 3A
  - Potential impacts due to construction of the western canal will be the same as under Dual Conveyance Concept 1C
- **Dual Conveyance Concept 4B -** *Dual Conveyance with a Lined or Unlined East Canal Scenario 6 Operations - 9,000 cfs North Delta Intake Capacity*
  - Potential impacts due to construction and operations of the North Delta and South Delta intakes will be the same as under Dual Conveyance Concept 4A
  - Potential impacts due to construction of the eastern canal will be the same as under Dual Conveyance Concept 1B
- **Dual Conveyance Concept 4C -** *Dual Conveyance with a Lined or Unlined West Canal Scenario 6 Operations - 9,000 cfs North Delta Intake Capacity*
  - Potential impacts due to construction and operations of the North Delta and South Delta intakes will be the same as under Dual Conveyance Concept 4A
  - Potential impacts due to construction of the western canal will be the same as under Dual Conveyance Concept 1C

X.10.5 Identification of Conveyance Concepts with Similar Conveyance Operations

In a similar manner as described in Subsection X.10.4, operations under the following conveyance concepts appear to be similar.

- **Dual Conveyance Concept 7A-** *Dual Conveyance with a Tunnel - Enhanced Spring Delta Outflow Concept - 9,000 cfs North Delta Intake Capacity*
- **Dual Conveyance Concept 8A** - *Dual Conveyance with a Tunnel - Proportional North Delta Inflow Bypass Concept - 15,000 cfs North Delta Intake Capacity*

Both of these concepts include methods to achieve Fall X2, provide additional protections for the South Delta as compared to the January 2010 Operations or Scenario 6, include reservoir releases to

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achieve a more natural hydrograph as compared to Existing Conditions or No Action Alternative, include provisions to minimize reductions in cold water storage, and provide for additional Delta outflow as compared to Existing Conditions or No Action Alternative. Because the Proportional North Delta Inflow Bypass Concept (proposed, as noted above, by the consortium of environmental organizations) maybe more protective of the cold water pool due to the restrictions provided to reduce reservoir bypasses during periods of low storage, it is anticipated that the Enhanced Spring Delta Outflow Concept (proposed by the State Board) may result in lower Delta exports and more severe cold water pool storage reductions. Therefore, the Enhanced Spring Delta Outflow Concept will be evaluated in detail in the EIR/EIS as the "bookend" alternative with the most severe potential adverse impacts and less Delta exports of these two concepts.

Notably, the Proportional North Delta Inflow Bypass Concept is very similar to the Enhanced Spring Delta Outflow Concept, and would also function as either a low-end bookend or as an option close to the low end of the spectrum of potential alternatives.

X.10.6 Range of Conveyance Alternatives to be Evaluated in Detail in the EIR/EIS

Based upon the results of the screening analysis and consideration of similar conveyance concepts, as summarized in Tables X-18 and X-19, the final range of conveyance alternatives to be evaluated in the EIR/EIS is presented below. The conveyance alternatives have been renumbered to be consistent with information presented in the BDCP process.

- **Alternative 1A -** *Dual Conveyance with a Tunnel - January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative 1B -** *Dual Conveyance with a Lined or Unlined East Canal January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative1C -** *Dual Conveyance with a Lined or Unlined West Canal January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative2A-** *Dual Conveyance with a Tunnel - Scenario 6 Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative2B -** *Dual Conveyance with a Lined or Unlined East Canal Scenario 6 Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative 2C -** *Dual Conveyance with a Lined or Unlined West Canal Scenario 6 Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative 3-** *Dual Conveyance with a Tunnel - January 2010 BDCP Operations - 6,000 cfs North Delta Intake Capacity*
- **Alternative4-** *Dual Conveyance with a Tunnel - Scenario 6 Operations - 9,000 cfs North Delta Intake Capacity*
- **Alternative 5-** *Dual Conveyance with a Tunnel - January 2010 BDCP Operations and Fall X2 - 3,000 cfs North Delta Intake Capacity*
- **Alternative 6A -** *Isolated Conveyance with a Tunnel - January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative 6B -** *Isolated Conveyance with a Lined or Unlined East Canal- January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*
- **Alternative 6C -** *Isolated Conveyance with a Lined or Unlined West Canal - January 2010 BDCP Operations - 15,000 cfs North Delta Intake Capacity*

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- **Alternative 7 -** *Dual Conveyance with a Tunnel - Enhanced Ecosystem Operations - 9,000 cfs North Delta Intake Capacity*
- **Alternative 8 -** *Dual Conveyance with a Tunnel - Modified Enhanced Ecosystem Operations to Increase Delta Outflow per Scoping Comments from State Water Resources Control Board - 9,000 cfs North Delta Intake Capacity*
- **Alternative 9 -** *Through Delta Conveyance - Separate Corridors Operations - 15,000 cfs North Delta Intake Capacity*

X.11 References

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