APPENDIX A
RESPONSES TO:
Charge to Delta ISB for Review of the Draft BDCP EIR/S

Completeness, Structure and Effectiveness of Description

The EIR/EIS describes alternatives more completely and clearly than it analyzes them. The report presents detailed information on how alternative actions were screened for feasibility. The identification of these alternatives could be put in a natural-resources context that was recently proposed by the Delta Plan and in the State Water Action Plan. The level of analysis presented for conservation measures may be in opposition to the coequal goals because of the greater detail and planning being presented for conveyance facilities than for habitat restoration. The itemized impacts exclude effects on San Francisco Bay and several related to Delta levees. The use of best available scientific information varies among chapters and falls short in some. Most chapters lack the analytical summaries that readers will need to make informed choices among the various alternatives. Though presented most conspicuously as a stand-alone document, the EIR/EIS relies on the BDCP Plan for crucial details about several important impacts.. These findings are elaborated below as responses to charge questions that ask how well the alternatives have been identified, articulated, and analyzed.

1. *Are the project objectives and purpose clearly articulated, to enable the identification of a reasonable range of alternatives?*

Chapter 2 clearly articulates overall objectives and relates them to challenges to meeting the coequal goals. The statements of purpose address CEQA and NEPA requirements. Subsequent sections discuss problems with ecosystems, water supply, and water quality. Supporting documents include primers on the Delta and water exported from it (Appendix 1A), potential risks from earthquakes and climate change (Appendix 3E), expected consequences of reducing exports to areas south of the Delta (Appendix 5B), and background on how the alternatives were developed (Plan, Appendix 3A).

Chapter 2 could frame water supplies more broadly to help show whether the range of alternative actions is "reasonable." For example, water exports from the Delta could be described as part of a portfolio of actions that include water storage, desalination, water conservation, and regional self-sufficiency. Supporting references could include the Delta Plan (2013) and the draft California Water Action Plan (2013).

2. *Are the alternatives clearly defined?*

Chapter 3 contains detailed descriptions of the action alternatives, and the meaning of "no action" is clarified by information in Appendix 3D, "Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions." The "Highlights" of the EIR/EIS brochure contains a well-illustrated guide to the action alternatives.

The name code for the action alternatives impedes understanding of how the various actions compare in their impacts. The existing code says too little about conveyance, notwithstanding the reminders built into resource-chapter headings such as "Alternative 1A—

Dual Conveyance with Pipeline/Tunnel and Intakes 1-5 (15,000 cfs; Operational Scenario A." We appreciated, in Chapter 12 (Terrestrial biological resources), the 13 summary tables in which action alternatives are conspicuously grouped by type, such as: "Dark shading = pipeline/tunnel, light shading = east alignment, no shading = west alignment and separate corridors." It would be clearer to use an informative code linked to conveyance type, alignment, and capacity, as in "DT15" for dual conveyance with a tunnel at 15,000 cfs.

The draft could identify the preferred CEQA alternative more clearly in several respects:
(1) How strongly preferred is Alternative 4 if the eventual project need not resemble it (Chapter 3, p. 3-4; Highlights brochure sidebar, p. 7)?
(2) "As of this EIR/EIS, the federal Lead Agencies have not identified a Preferred Alternative for the purposes of NEPA" (p. 3-3). Does the draft explain this situation? If so, it is not clear to us.
(3) What reasoning led to the preference for Alternative 4? We found only a brief paragraph of reasons (p. 3-3), an announcement by state and federal officials (p. ES-22), and emphasis on the screening process developed and used (EIR/EIS Chapter 3 and Appendix 3A; Plan Appendix 3A and Chapter 9).
(4) A defining element of Alternative 4 is its use of four operational variants of Scenario H. The Highlights brochure cites H1, H2, H3, and H4 (p. 20) but does so without defining them (p. 10). Chapter 3 defers first mention of any of the four by name until a footnote on page 3-67, and a table on page 3-208 defines them in obscure shorthand.

3. *From a scientific perspective, does the EIR evaluate a reasonable range of potentially feasible alternatives that would reduce or eliminate significant impacts of the project and obtain most of the basic project objectives and purpose? If potentially feasible alternatives are not fully evaluated, is a clear rationale provided as to why not? Are there potentially feasible alternatives that would reduce or eliminate significant impacts of the project and obtain most of the basic project objectives that should have been considered (and either rejected or fully evaluated) but were not?*

The alternatives not evaluated include reducing California's reliance on water from the Delta and its tributaries. The Delta Plan sets a policy of reducing reliance on this water "through improved regional water self reliance" (2013, policy WR P1, p. 102). Also, water conservation is the first of ten recommendations in the draft California Water Action Plan (2013).

We did not notice a clear statement in the EIR/EIS of why these reliance-reduction measures are not feasible. We found them mentioned only in Appendix 5B as responses to public policies, levee failures, or climate changes that would reduce supplies of water to areas south and west of the Delta.

4. *Are the alternatives studied in adequate detail to differentiate outcomes among the alternatives?*

Overall, the EIR/EIS offers detail that overwhelms the readers. Much of this detail is perhaps unavoidably redundant, given the large matrix of alternatives and impacts. However, the level of detail may be less important than the level of analysis and identification of impacts, as

well as whether the impact analyses are scientifically defensible and clearly summarized (see question 5, below).

4.a. Program vs. project

Does programmatic analysis suffice for the habitat conservation measures? The EIR/EIS makes clear that concurrent actions receive different levels of analysis (p. ES-4 to ES-5; 1-13 to 1-14; 4-2). The concurrent actions include construction of new north Delta diversion and conveyance facilities (CM1) and "near-term" acquisition and restoration of natural communities (CM3-CM10) (EIR/EIS, p. 3-21; Plan, p. 6-3). CM1 receives both program-level and project-level assessment, whereas the other actions receive program-level assessment only.

The EIR/EIS offers several explanations for the different levels of analysis: the BDCP is to be managed adaptively; few sites of ecosystem restoration have been selected; restoration is still “at a conceptual level” of design; and project-level analysis of habitat restoration is to be carried out as the restoration efforts progress (p. 4-2). Still, the difference in level of detail presented appears to give unequal weight to the co-equal goals.

4.b. Impacts identified

The impacts analyzed are described as "the direct and reasonably foreseeable indirect impacts associated with implementation of the BDCP alternatives" (p. 4-10). These exclude impacts to San Pablo and San Francisco Bays, and they also exclude several impacts related to Delta levees and to other components.

PLACEHOLDER: Do the BDCP documents provide strong reasons to discount effects on estuarine ecology beyond the Plan Area?

PLACEHOLDER: Impacts related to Delta levees. "Alternatives 1A through 8 would provide additional adaptability to catastrophic failure of Delta levees by providing an alternate conveyance route around the Delta. Alternative 9 adds additional resiliency to the Delta by strengthening and reinforcing levees critical to the through-Delta conveyance route. If the Delta were temporarily disrupted by levee failure, these alternatives would provide conveyance and interties that would enable continued water deliveries to SWP/CVP contractors and to local and in-Delta water users" (p. 4-9; similar text, p. 29-19 to 29-20 and p. 31-5).

Some of the impact assessment that belongs in the EIR/EIS must be sought instead in the Plan. In one set of examples, the EIR/EIS scarcely mentions the public health and ecological problems associated with potential toxicity from the alga *Microcystis.* By contrast, in the Plan *Microcystis* toxicity receives detailed coverage that includes discussion of its potential environmental effects in the majority of cases. This problem is considered further in our review of Chapter 25. The problem extends beyond Chapter 25, however, because of ambiguity about whether the EIR/EIS stands alone or whether it includes the Plan as well; and because the documents lack an index that covers the Plan as well as the EIR/EIS (section 5.b.4, below).

5. *Overall are the analyses reasonable and scientifically defensible? How clearly are the roll-up comparisons among alternatives conveyed in the text, figures and tables?*

5.a. Reasonableness and scientific defensibility

EIR/EIS Chapters 5 to 30 offer uneven levels of scholarship. Examples of chapters that appear to us authoritative and up to date information include Mineral Resources (Chapter 26).... Examples of chapters we found less than scholarly include Geology (Chapter 9)...Public Health (Chapter 25) NEED TO CALL OUT EXAMPLES AND THEIR IMPLICATIONS

Each chapter and appendix needs a date stamp that descibes when it was last updated and to what degree. The Effects Analysis appears up-to-date (Plan Chapter 5), but some of the impact assessments presented are several years out of date, as judged from the references cited (EIR/EIS Chapters 9, 10, and 12; Plan Appendices 3B and 5E).

5.b. Clarity

The immensity of the EIR/EIS obscures its findings about the comparative impacts of the non-action and action alternatives. Much of the draft contains excellent writing, incisive analysis, and cross-references among its various parts. But the draft almost completely lacks the analytical summaries, lists of assumption, and navigational aids needed to enable most readers to make bottom-line comparisons among the alternatives presented.

It could be argued that the existing draft is understandable enough to meet legal requirements. However, federal law provides grounds for expecting clarity in the EIR/EIS: "Environmental impact statements shall be written...so that decisionmakers and the public can readily understand them" (Council on Environmental Quality § 1502.8).

It could also be argued that there simply wasn't sufficient time for the draft to be made readily understandable, given it's length and complexity. However, calls for clarity from the DISB began over 18 months ago (http://deltacouncil.ca.gov/sites/default/files/documents/files/DISB_Letter_to_JMeral_and_DHoffman-Floerke_061212.pdf) and continued with comments on the 2013 Administrative EIR/EIS (pages 11 and 12 of http://deltacouncil.ca.gov/sites/default/files/documents/files/DSC_Letter_on_BDCP_Review.pdf) and the Plan has been 7 years in the making.

The public draft includes chapter summaries in a Highlights document and a tabular summary of impacts in an Executive Summary. However, these additions, while welcome, fall short of making the draft understandable. The Highlights document offers more background than analysis. Moreover, the Executive Summary lacks synthesis in its summary table, which is both long and cryptic.

5.b.1. Buried brief for preferred alternative.—The EIR/EIS summarizes its case for the preferred CEQA alternative but buries this summary in Chapter 31 (p. 31-4 to 31-8). A readily understandable report would contain an up-front summary of one or two pages that lays out the main arguments for (and against) the preferred alternative by comparing it against other options: the no-action alternative, the through-Delta channel corridors, the east and west canals, an isolated tunnel, and dual tunnels of various capacities.

The summary in Chapter 31 would go beyond that by complementing the text with one or more tables, diagrams, or both. These would help the reader visualize the main expected consequences of the various alternatives with respect to the co-equal goals,.

A table in Chapter 7 summarizes how the various alternatives play out in terms of modeled exports (p. 7-53). The data in this table could be graphed, with suitable error bars, for comparison with expected effects on ecosystems and species, such as those highlighted in the summary tables in Chapter 12.

5.b.2. Chapter summaries.—The report contains few incisive summaries of its chapters and appendices. The EIR/EIS offers a helpful table in its Executive Summary (p. ES-61 to ES-132) and summary comments are presented in the Highlights brochure. In addition, the Plan's prodigious Effects Analysis begins with a description of contents (section 5.1).

However, all these efforts fall short of providing the summaries needed to make the BDCP readily understandable to decision-makers or to the public at large. These summaries would approach in level of detail the sections that begin the climate appendices to the Effects Analysis (part 5A). The summaries would also proceed not just impact by impact, as done well in the chapter on Terrestrial Biological Resources (p. 12-5 to 12-31), but by alternatives (e.g., no-action vs. actions, certain kinds of actions vs. other kinds of actions).

As a project guided by science, the BDCP should follow standard protocol in scientific communications. Nearly all scientific journals require each published paper to begin with a well-written summary or abstract that lays out the main findings and what they imply for decisions to be made.

5.b.3. Lists of key assumptions,—PLACEHOLDER. Many of the analyses need to spell out underlying assumptions in an easily identified format. Bulleted lists of key assumptions could serve that purpose in [Steve's examples?].

5.b.4. Navigational aids.—Inconsistent statements about overlap with the Draft BDC Plan add to the challenge of understanding of the EIR/EIS. The Highlights document describes the EIR/EIS as being self-contained (p. 5 and 6), as does the section "EIR/EIS Organization" (p. 1-31 to 1-35). But according to footnotes on EIR/EIS pages ES-3, 1-2, and 3-3, the EIR/EIS includes Plan documents as well, including all their appendices. As mentioned above, different emphasis on impacts in the two documents is confusing and misleading.

The 145-page index to the EIR/EIS includes a select list of key terms and excludes the Plan documents altogether. The Plan documents appear to lack an index of their own. The documents contain many helpful cross-references but the use of hyperlinks would be far more user friendly.

References cited

California Natural Resources Agency, California Department of Food & Agriculture, and California Environmental Protection Agency, 2013, State water action plan, public review draft: , 17 p., http://resources.ca.gov/docs/Final_Water_Action_Plan.pdf.

Delta Stewardship Council , 2013, The Delta Plan; ensuring a reliable water supply for California, a healthy Delta ecosystem, and a place of enduring value: Final plan, 294 p., http://deltacouncil.ca.gov/delta-plan-0.

Approach, Analysis, Tools and Modeling

1. *Does the environmental impact analysis utilize appropriate evaluation methods? Were tools/analyses appropriate and described adequately?*

The EIR/EIS contains a great deal of information, but it would be hard to say that the document offers a systematic comparison of alternatives in a way that would help decision makers or the public reason their way through a very difficult and complex problem. The most fundamental comparative evaluation, that of a table comparing alternatives for a finite number of major project objectives with some accompanying discussion, is largely absent. This would not be hard to remedy in the final EIR/EIS, but seems essential for the credibility of the public process and the usefulness of the document for public and policy discussion.

Also, a statement on the evaluation tools used to select among alternatives might help in deciding the appropriateness.

Some more specific scientific areas where there seem to be problems of adequate analysis are:

- There are real problems with the final step in the effects analysis. [EXPLAIN]
- The hydrodynamic modeling seems to be for an unrealistic case where all failed island levees are repaired – something that has not occurred for most recently failed islands. Modeling with sea-level rise for this case might require more 3-dimensional modeling and thought – and has quite a few implications for Delta policy.[EXPLAIN]
- Photochemical modeling is absent in air-quality modeling

2. *How well is uncertainty addressed and communicated?*

Uncertainty is tremendously difficult to address and communicate for such a complex and dynamic problem. However, some discussion of the general order of magnitude of error or uncertainty in major results would be very useful to readers and policy-makers.

Uncertainty is addressed and communicated reasonably well in parts of the BDCP Plan, but that does not carry over to the EIR/EIS, where conclusions are often stated without adequately acknowledging uncertainties or discussing how the project might prepare for or respond to a variety of outcomes.

3. *Do the analyses describe sensitivity of conclusions to assumptions and uncertainty and how possible conflicting data and analyses are interpreted?*

This is done some in the Plan and associated appendices, but that is not carried over into the EIR/EIS. Given the complexity of problems, the deluge of data and the multitude of analysis techniques available, quantification of uncertainties will be difficult, but some estimates would be helpful.

4. *Is best available science employed in the environmental analysis of project alternatives and their effects?*

In places, yes, elsewhere no. See detailed comments in the various chapters and in our main points.

5. *Are assumptions used in modeling and for analytical purposes clearly articulated and reasonable considering the complexity and current scientific understanding?*

It would be particularly useful to see several likely sources of error in assumptions addressed:

- Error propagation in the hydrodynamic models;
- Major limitations of the models used
- Assumption of one configuration of restoration projects and inadequate assessment of sensitivity of the model results to this configuration;
- Assumptions about reservoir operations in the hydrodynamic models;
- Assumptions about continued existence of some of the most subsided and least reliable Delta islands.
- Assumptions on possible adaptive management

Monitoring and Adaptive Management

[I THINK THAT WHAT IS WRITTEN HERE BELONGS IN A SEPARATE ENTRY AS PART OF THE CHAPTER REVIEWS, PRECEDING THE EIR/EIS CHAPTERS (LIKE THE DECISION TREE REVIEW). WHAT IS NEEDED HERE ARE SHORT SUMMARY ANSWERS TO THE TWO QUESTIONS IN THE CHARGE. I'VE DONE NO EDITING OF THIS SECTION]

Adaptive Management is essential to achieving the goals of the Bay Delta Conservation Plan and is part of the legislative mandate for future Delta activities. This brief report examines the sections of the BDCP dealing with adaptive management and monitoring and research. Adaptive management is described primarily in section 3.6 with additional discussion specific to each conservation measure in section 3.4. Appendix 3G also has a section on monitoring, evaluation and adaptive management. Administration of adaptive management is described in Chapter 7 and some comments on implementation of adaptive management are made throughout Chapter 6. Appendix 3D deals with monitoring and research, providing tables listing potential compliance and effectiveness monitoring actions. Adaptive management monitoring and research are mentioned many times throughout the document but our comments are based primarily on the sections of the BDCP noted above. Our primary responsibility was to review the EIR/EIS for BDCP but, as there was nothing of substance concerning adaptive management or monitoring in that document we have focused on the BDCP documents.

Direction from the Stewardship Council provided us with four questions to address in evaluating how the BDCP incorporated adaptive management, monitoring and research. Our comments are organized in relation to these four questions.

1. How well is the adaptive management strategy described and are the stated goals achievable?

Adaptive management is described in section 3.6 as a 3 phase (1-plan; 2-do; 3-evaluate and respond) process consisting of 9 steps (1-characterize the problem; 2-identify biological goals and objectives; 3-model linkages between objectives and proposed management actions; 4-plan and design management actions; 5-implement management actions; 6-design and implement performance measures, and monitoring and research plans; 7-analyze, synthesize, and evaluate;

8-communicate current understanding; 9-adapt)[1]. The characterization of adaptive management in section 3.6 is consistent with standard works on the subject and draws from advice provided by the planning team's science advisors. Section 3.6 also describes many of the issues that need to be taken into consideration in designing a robust adaptive management experiment as well as the pitfalls in implementing an adaptive experiment. As a description of adaptive management and some of the issues that arise in trying to implement it, we think that this section is quite good.

However, an adequate description of adaptive management does not constitute a strategy for its implementation. In the BDCP, the specific details of design and implementation of adaptive management are left to an Adaptive Management Team, to be chaired by a Science Manager. Members of the Adaptive Management Team are drawn from the various agencies involved in the BDCP whereas the Science Manager is a new position established as part of the Implementation Office responsible for achieving the goals of the BDCP. Given the complexity of the scientific problems and uncertainties associated with implementing BDCP and the expressed importance of adaptive management to its successful implementation, it will be essential that the Science Manager be well versed in design and application of adaptive management. Especially important is for the Science Manager to know when it is appropriate to use adaptive management and when it is not. Yet experience in design and implementation of adaptive management is not one of the qualifications of the Science Manager listed in Chapter 7.

The Adaptive Management Team is to be comprised of managers because, the Plan argues, adaptive management is fundamentally a management activity. We agree that the Adaptive Management Team should be comprised of managers because buy in by managers is important to the success of adaptive management experiments. However, adaptive management is not part of the toolbox or the experience of most resource managers. Adaptive management experiments are like clinical trials in medicine. They have requirements for planning, execution, time lines and information gathering that differ from ordinary resource management. It is important, therefore, that the Science Manager be well versed in adaptive management practice and have the ability to interpret this novel way of implementing and managing conservation actions to the Adaptive Management Team. It will also be important for the Science Manager to consult with the community of experts in adaptive management and to draw from the experience of practitioners involved in other large scale adaptive management programs nationally and globally.

No specific goals are stated for adaptive management beyond its basic purposes of assisting managers to embrace uncertainty and to learn about the systems they are managing through the management actions that they implement. Because no specific adaptive management programs are described, it is not possible to determine whether the Plan will benefit from its incorporation of adaptive management. The BDCP recognizes that in other situations adaptive management has failed for a number of reasons including failure to plan adaptive experiments properly, failure to implement adaptive management plans and failure to follow through with effective monitoring of adaptive experiments (Walters 2007). The BDCP has included a number of measures in the Plan to prevent such failures. While we commend the Plan for its

[1] Note that in the BDCP, management actions are termed "implementation actions".

acknowledgement of the need to avoid the failures of the past we caution that, until a culture of adaptive management is developed in the participating agencies, the kinds of obstacles to success that Walters (1997, 2007) and Allen and Gunderson (2011) describe will continue to pose a threat to successful BDCP implementation.

An aspect of adaptive management that is important to the design of robust management experiments is having a working set of models that link conservation actions to desired outcomes through species or ecosystem dynamics. The BDCP has employed a broad range of models in its effects analysis (described in Chapter 5 and its appendices). However, it is not clear that these models are available or even suitable for designing adaptive management experiments. For example, habitat suitability models, on their own, are probably not sufficient. Furthermore, it was not clear from our reading of the documents the extent to which the Plan intended that the conservation measures would be implemented as experiments. Instead, it appeared that uncertainties would be dealt with primarily through targeted research projects.

Assuming that the BDCP will, in some instances, implement conservation measures as experiments, it is important to have an objective way to decide when conducting such experiments make sense. The Plan acknowledges that adaptive experimentation may not always be desirable but does not offer a clear approach to deciding when to experiment. Because adaptive experimentation requires resources, one way to assess the benefits of a particular experiment is to compare the cost of conducting the experiment against the value of the information that will be gained from the experiment. If the value of the incremental reduction in uncertainty that is likely to result from a particular experiment is small in relation to the cost of the experiment it may be more rational not to conduct the experiment. Although it remains important to acknowledge the uncertainty it is also important to acknowledge that the benefits of reducing uncertainty do not always justify the costs of experimentation.

In some instances (and these may be commonplace in the Delta) adaptive experimentation may not be possible because of confounding among conservation actions, lack of control over drivers of change, and physical, legal, or social constraints on the range of options that can be explored, or various other factors. In such cases other approaches to implementation may be better than adaptive management. Several such situations and possible alternative approaches are discussed by Williams et al. (2009) and Allen and Gunderson (2011).

We could sketch a range of other issues that will affect the application of adaptive management in the Delta, many of which have to do with the complexity of the conservation plan and the potential for confounding and conflict among objectives, actions and outcomes. But suffice it to say that this complexity reinforces our view that the Science Manager must have a firm grasp of the potential and the pitfalls of adaptive management and, we hope, an appreciation of other emerging approaches to managing complex adaptive systems.

2. Is the proposed monitoring adequate to evaluate if the goals and objectives are being achieved?

BDCP identifies three kinds of monitoring: 1. Compliance monitoring; 2. Effectiveness monitoring; and 3. Status and trends monitoring. This is a logical way of classifying monitoring

activities but does not necessarily mesh well with adaptive management. Adaptive management is designed to generate information that will clarify uncertainties in our understanding of the dynamics and responses of species and ecosystems. Depending on the particular issue, and the information needed, the required monitoring might not fit into the categories of either effectiveness or status and trends.

Compliance monitoring includes both monitoring for regulatory compliance and compliance with design standards for conservation measures. Potential compliance monitoring actions for each conservation measure are listed in Table 3D-1. Generally speaking, compliance monitoring needs are fairly straightforward, being dictated by a conservation measure's design criteria. Monitoring for regulatory compliance can be more complex as can, for example, monitoring to ensure compliance with flow or water quality design criteria. As the design criteria and outcomes for most conservation measures are not yet developed it is difficult to say whether the compliance monitoring actions listed in Table 3D-1 are both necessary and sufficient.

Effectiveness monitoring and status and trends monitoring are combined in Appendix 3D and potential monitoring actions for each conservation measure are listed in Table 3D-2. In the preamble to Table 3D-2 the Appendix states, "Precise details of each of the effectiveness monitoring actions are not presented here and will be developed and then periodically updated through the adaptive management and monitoring program." As the design details and associated outcomes of the various conservation measures have not been developed yet it is difficult to comment on the proposed monitoring actions. However, we can say that Table 3D-2 does not provide any clues as to how the proposed monitoring will tie into any adaptive management experiments.

Chapter 3, section 3.4 discusses each of the 22 conservation measures in turn and repeats some of the potential compliance and effects monitoring actions identified in Tables 3D-1 and 3D-2. In addition, for some conservation measures, section 3.4 provides a table of "key uncertainties" and suggested research projects to address them. Because uncertainty is central to the impetus to adopt adaptive management we examined section 3.4 for indications of how adaptive management would be used to address the key uncertainties. We found a number of peculiarities in the treatment of key uncertainties.

- First, key uncertainties are identified for only 8 of the 23 conservation measures. For the other conservation measures the Chapter specifically states that no key uncertainties (or needed research) were identified. Given the high uncertainty associated with <u>all</u> of the conservation measures we find this statement perplexing.
- Second, even where key uncertainties are identified, they seem to misrepresent the broad range of uncertainties inherent in the conservation measure. For example, only two key uncertainties are identified for CM-2, Yolo Bypass Fishery Enhancement: 1. Do the modifications at Yolo Bypass function as expected and are they effective; and 2. Does the increased frequency and duration of flooding in the bypass affect the health and vigour of riparian vegetation? The first uncertainty is extremely vague and, in our view, does not in any sense capture the extent and variety of uncertainties associated with such a major change in hydrology, floodplain inundation and habitat configuration that has effects both inside and outside the bypass itself.
- Third, the key uncertainties, where they are identified, are all to be addressed through

targeted research projects rather than being incorporated into the adaptive management program. Although it may be more efficient to address a number of uncertainties through targeted research, many could be more effectively addressed in the context of a proper adaptive management design. Yet, we see no indication that the authors of the Plan have considered this possibility. One of the principal strengths of adaptive management is that it allows managers to design their day to day management actions so that they provide critical information on key uncertainties. In our reading, the BDCP does not take advantage of this strength. Perhaps such design considerations are also to be part of the responsibilities of the Adaptive Management Team. This would be appropriate but, if so, we think the text should reflect this responsibility. This concern applies not only to the design of adaptive experiments but also to the clarification of key uncertainties.

- Fourth, another benefit of incorporating uncertainties into a broader adaptive management plan is that individual uncertainties and outcomes can be linked to one another. The Delta is an interconnected system and actions in one region are impacted by actions in other regions. Although there will be times when targeted research is the best option it will be important to imbed these efforts in a broad and holistic adaptive management framework in order to address the inter-connectedness.

Although the Plan does not appear to make effective use of the adaptive management process, the monitoring and research activities described may still be sufficient to measure progress toward achieving the BDCP objectives. Given the way the Plan is structured, however, it is difficult to determine if this is the case. In assessing the suitability of monitoring there is a logical flow of relationships from conservation objectives, to actions to achieve those objectives, to expected outcomes from the actions, to monitoring to detect those outcomes, and to evaluating criteria for success. Yet these variables are not associated in this way anywhere in the document that we have found. The necessary variables are all described in chapter 3, however, and we have combined some information from two different tables to illustrate the relationship between objectives, actions, outcomes and monitoring for CM-4 (tidal natural community restoration). A similar assessment could be done for other conservation measures.

Combined information from Tables 3.4.4-1 and 3.4.4-3 for CM-4 (restoration of tidal natural communities) showing biological objectives, how CM-4 advances the objectives, proposed monitoring actions, metrics to be measured during monitoring, and the proposed criteria for success.

Objective	How Action Advances the Objective	Monitoring Action	Relevant Metric	Success Criteria
Objective L2.5: Maintain or increase the diversity of spawning, rearing, and migration conditions for native fish species in support of life-	Tidal restoration is expected to improve some rearing habitat elements for Chinook salmon, Sacramento splittail, longfin smelt, delta smelt, sturgeons, and possibly steelhead. Tidal natural	Site Level Assessment	Use of restoration sites by covered fish species	Detection of site use by Chinook salmon, splittail, and the following covered fish species: longfin smelt and Delta smelt in the

history diversity.	communities restoration in West Delta ROA is also expected to improve future rearing habitat suitability for delta smelt within the anticipated eastward movement of the low-salinity zone with sea level rise.			Suisun Marsh, West Delta and Cache Slough ROAs; steelhead in the West Delta, Cache Slough and Cosumnes/ Mokelumne ROAs
Objective L2.7: Produce sinuous, high-density, dendritic networks of tidal channels through tidal areas to promote effective exchange throughout the marsh plain and provide foraging habitat for covered fish species.	Where feasible, tidal restoration projects will be designed to meet this objective. This habitat element will provide direct foraging opportunities for salmon and splittail and, with sufficient amounts of restoration, may provide prey for pelagic fishes.	Where feasible, tidal restoration projects will be designed to meet this objective. This habitat element will provide direct foraging opportunities for salmon and splittail and, with sufficient amounts of restoration, may provide prey for pelagic fishes.	Tidal natural community geomorphology	Presence of sinuous, high-density, dendritic networks of tidal channels through tidal areas
Objective L2.9: Increase the abundance and productivity of plankton and invertebrate species that provide food for covered fish species in the Delta waterways.	Restoration of tidal natural communities is expected to improve some rearing habitat elements for Chinook salmon, Sacramento splittail, longfin smelt, delta smelt, sturgeons, and possibly steelhead.	Plankton and invertebrate sampling in restored habitats	Plankton and invertebrate abundance in restored floodplain	Presence within and transport from restored tidal natural communities to adjacent open-water habitat occupied by covered fish species

From an examination of this table, one can certainly see that, at least at a superficial level, there is a logical connection between the conservation objective, restoration action, anticipated outcome, and the proposed monitoring. Perhaps at this stage in the planning that is the best one can expect. At a more detailed level, however, a multitude of questions remain. Consider Objective L2.5, "Maintain or increase the diversity of spawning, rearing, and migration conditions for native fish species in support of life-history diversity." Without questioning whether this objective is meaningful as a way to strengthen the viability of covered fish species, knowing whether one has achieved the objective depends on knowing the current diversity of spawning, rearing and migration conditions for native fishes (what are the metrics for these attributes of habitat?), knowing that this diversity of habitat supports life-history diversity (what

are the metrics of life-history diversity?) and that restoring tidal natural communities will increase habitat diversity for native species in ways that do, indeed, strengthen life-history diversity. Similar comments could be made about the objectives to create networks of dendritic channels in restored tidal marshes and to enhance plankton production. The proposed monitoring touches only on the superficial aspects of these objectives. Our purpose in pointing out these complexities is not to nit pick about conservation measures but to illustrate that the objectives are more nuanced and the potential outcomes more complex than is suggested by the proposed monitoring. At this stage we cannot say whether the proposed monitoring is necessary and sufficient to evaluate whether the goals and objectives are being achieved. Again, we assume that further refinement will be undertaken by the Adaptive Management Team. Such refinement, and the validation of monitoring actions would be greatly strengthened if the models linking objectives to outcomes were more clearly presented.

3. Are the data management, analysis, reporting and decision making processes adequate to create a defensible and transparent implementation of adaptive management?

Chapter 3, section 3.6.4, and chapter 7, section 7.3.4 address issues of data management, analysis and reporting. The proposed administrative structure for BDCP is hierarchical. At the top, providing oversight and dispute resolution is the "Authorized Entity Group" consisting of representatives of DWR, Reclamation and Water Contractors. State and federal fish and wildlife agencies will participate in a "Permit Oversight Group" which will ensure regulatory compliance with Plan authorizations. The actual implementation of the Plan, including adaptive management, monitoring, and research will be the responsibility of a newly created Implementation Office headed by a Program Manager who will report to the Authorized Entity Group. A key individual in the implementation office will be the Science Manager, who will report to the Program Manager and will have responsibility for guiding and facilitating adaptive management monitoring and research. In this capacity, the Science Manager will chair an Adaptive Management Team. The Adaptive Management Team will include representatives of DWR, Reclamation, CVP and SWP water contractors, CDFW, USFWS, and NMFS. The IEP Lead Scientist, the Delta Science Program Lead Scientist, and the Director of the NOAA Southwest Fisheries Science Center will serve as nonvoting members of the Team.

The Adaptive Management Team will take the lead in developing a framework for monitoring and will enlist the assistance of the IEP in implementing the program. The Science Manager and the Adaptive Management Team, will develop and implement a process for compiling, evaluating, and synthesizing the results of monitoring, and will prepare a plan to maintain databases of monitoring and synthesis results. The Adaptive Management Team will also manage the BDCP research program in coordination with IEP and the Delta Science Program. The Team will identify research priorities and will administer a process to select and coordinate the researchers who will be involved in the program. In addition, the Adaptive Management Team will be responsible for the compilation and synthesis of the results of studies and analyses undertaken by other organizations that are assisting in the implementation of the Plan. The Science Manager will ensure that BDCP science activities, reporting, and reviews are coordinated with other science activities being conducted in the Delta. Although not stated in the documents, the Science Manager and Adaptive Management Team should also identify the goals and objectives for monitoring, the desired outcomes and an adaptive framework for evaluating

when outcomes have been met. In Table 3.E-2, Effectiveness Monitoring Actions are described, for example, and in some cases the timing and duration for monitoring are described. Without knowing the responsiveness of the system, or how different restoration actions and climate change will interact with the desired outcomes, it does not seem feasible to establish a timeframe per se. Rather, the described timeframes should be viewed as initial guides that will be revised depending upon outcomes since it may take longer (or shorter) for outcomes to be achieved.

The Adaptive Management Team will have primary responsibility for the administration of the adaptive management program. The Team will work with the IEP and other science programs to assemble and analyze the results of BDCP monitoring and integrate the results of relevant scientific research conducted by other parties. Based on these analyses the Adaptive Management Team will recommend to the Program Manager any changes in the Plan or conservation measures.

This administrative structure centralizes the key administrative decisions regarding adaptive management, monitoring and research, data management, analysis and development of recommendations concerning science-based modification to the BDCP in the Adaptive Management Team headed by the Science Manager. Provided the individuals involved have the appropriate skills, and provided provision is made to link data management and data bases with existing relevant data bases (both in house and external to the main agencies involved in BDCP), the centralized system should be effective. The BDCP envisions making use of the science synthesis approaches developed in the Delta Science Plan and working with the Delta Science Program to assemble, analyze and synthesize the large volume of data that will be accumulated. We support this idea. We also support ensuring that the BDCP data are publically available so that researchers and individuals outside the BDCP can conduct their own analyses.

Large volumes of data will be generated as BDCP is implemented but BDCP is only one of many activities in the Delta that is generating a lot of scientific data. The National Research Council has complained that, “Currently, science efforts related to the Delta are performed by multiple entities with multiple agendas and without an overarching plan for coordinating data management and information sharing..” (NRC 2012). The Delta Science Plan has as one of its foci developing coordinated data management and sharing among agencies involved in Delta Science. The BDCP should work closely with the Science Program to ensure that science and data management for the BDCP are well integrated into the “One Delta, One Science” concept.

However, ensuring that the appropriate skill sets are present in the Implementation Office may be problematic. We have already noted that the qualifications of the Science Manager did not include expertise in adaptive management. But as this is a new position this shortcoming is easily corrected. Personnel for the Implementation Office, which will provide the staff to manage the data bases, analyses, modeling etc., will be drawn from existing staff in DWR and other state agencies. There may be insufficient staff with appropriate computer, analysis, and modeling skills to fill the need. In the past, ensuring that agency staff have the access to and the incentive to use the scientific literature has also posed a problem. The BDCP does not consider the possibility that shortage of skilled people may hinder the implementation and implementation success of BDCP. However, we consider this to be a real possibility and suggest that the BDCP needs a contingency plan to deal with such skill shortages.

Funding for adaptive management can also become a contentious issue (Walters 2007). The Plan (Chapter 8) identifies a budget on the order of $500 million for monitoring (both compliance and effectiveness monitoring) and an additional approximately $400 million for research (Tables 8-30 and 8-31). No funding specifically earmarked for adaptive management in the Plan. This is appropriate, as adaptive management should be an integral part of management planning and implementation, not a separate activity. However, adaptive management planning and implementation cost more than traditional management both in personnel and capital expenditure. It is not clear that these extra costs were taken into account in developing the budget for the Implementation Office. Chapter 3 identifies a separate "supplemental adaptive management fund" of at least $450 million (section 3.4.23.5) that could be accessed if other resources are insufficient or cannot be accessed to support an adaptive change in conservation measures. These funds are not available, however, for routine costs of management. The budgets presented in Tables 8-30 and 8-31 were based on estimated staff and resources required to undertake the monitoring and research actions listed in the Plan plus an additional $140 million to take account of the fact that not all monitoring and research needs were identified in the Plan. How the supplemental adaptive management fund of $450 million was decided is not clear.

The budget for monitoring and research is substantial but is actually small compared to the total cost of BDCP. Even a budget of this size could easily get used up by the multitude of possible monitoring actions for each of the conservation measures. The Plan has identified a broad range of possible monitoring and research actions related to the conservation measures but acknowledges that these will need to be reconsidered as the detailed implementation plans develop. The Adaptive Management Team will have the difficult task of determining how to allocate the inevitably limited resources for monitoring and research. Difficult trade-offs are inevitable.

Clearly, a great deal of planning and evaluation will need to be done during the early years of implementation. We imagine further analyses to clarify conservation actions and how to fit these into an adaptive management program, pilot testing of some conservation actions, negotiations for land acquisition, and many other tasks necessary to finalize the conservation program. This suggests a front loading of activity in the Implementation Office. However, the budget for the Implementation Office, on an annualized basis, does not differ much across the 50 year term of the project. We wonder if this will be sufficient and whether additional funds should be allocated for up-front planning and evaluation.

4. Will contingency plans be developed ahead of time as part of the adaptive management process?

Monitoring and adaptive management are proposed to evaluate whether conservation actions are achieving their intended objectives. However, what if things don't go as planned? The history of ecological restoration tells one that restoration projects rarely have exactly the intended consequences in the expected time frame. Chapter 3, section 3.4.3.4.2, states that contingency measures will be developed for site specific conservation actions to be implemented in the event that success criteria are not met. However, the Plan also states that these contingency measures differ from the adaptive management because they are site specific and targeted at meeting

success criteria. Similar contingency plans are mentioned for other conservation measures throughout section 3.4. There will inevitably be situations, however, in which the adjustments are not possible or incur too great a cost or where there is a large-scale failure of restored habitat to function as anticipated. What happens then? Given the complexity and the high stakes of many of the actions to be undertaken in BDCP, it would seem prudent to have contingency plans at least generally outlined before discovering that things aren't working. There is no mention of contingency plans in section 3.6, which describes adaptive management. Contingency planning is not mentioned in Chapter 7, Implementation Structure, nor in Chapter 6, Plan Implementation. We conclude, therefore, that the Plan does not consider the development of contingency plans as part of the adaptive management process. We feel that this is a significant shortcoming of the Plan.

5. Some Specific Comments

- How will funding and oversight of the monitoring and adaptive management plan assure the independence of the science supporting adaptive management?
- What kinds of management actions will be subject to adaptive adjustment? Are both operations and habitat conservation measures subject to adaptive management?
- What future conditions are likely to prompt adaptation? The draft mentions sea-level rise and changes in Delta outflow requirements. Other futures worth considering include the flooding of additional subsided islands, requirements for upstream reservoirs to release cold water, tightened water-quality standards for byproducts of disinfection, and salinity regulation for Delta and south-of-Delta agriculture.
- Everyone has commented that there is far too little information presented beyond what was in the administrative draft earlier this year. As we've all seen, almost nothing is in the EIS/EIR that is more than passing mentions of Adaptive Management or how it will be used. This has been a regular criticism of the document.
- The data to be used in documenting faunal response has not been clearly identified, which is a critical failing given that there is so much uncertainty in the system. Likewise no mention is given about how the targets that will contribute to actions will be set, or what conceptual models will require alternatives or modified actions.
- The DISB (2013) produced a review of Habitat Restoration and several points in that mentioned how adaptive management should be used. This might be a useful reference for the BDCP or the Adaptive Management Team.
- Requiring the Adaptive Management Team to reach consensus could significantly slow the process of implementation and could lead to inaction.
- The Delta Science Plan as described in section 3.6.2.4 has a significant role to play in design and coordination of adaptive management and monitoring in the Delta. The BDCP scarcely acknowledges this role for the Science Program but the BDCP could benefit greatly from a close relationship with the Science Program on adaptive management and monitoring.
- In the description of the 9-step adaptive management process in section 3.6.3.4, the interaction between the Adaptive Management team and the Implementation Team is critical for the success of this approach. More needs to be described about how these two teams will interact in actually doing adaptive management.
- In section 3.6.3.5.4 it is stated, "The adaptive management and decision-making

processes described in this section do not apply to these real-time operations." Isn't this a big limitation on the effective use of adaptive management?

- Appendix 3-G, Page 3, lines 32-37 states: "An equally important purpose of this memorandum is to introduce a simple deterministic, stage-based life cycle approach to define BDCP objectives, periodically review and update them, and monitor progress toward achieving the intermediate and final Cohort Replacement Rate (CRR) milestones.....it is imperative to establish interim objectives in order to guide monitoring and the management decision making process in the near term." Although they are not using the term, this is really the beginnings of an Adaptive Management Program. On page 6 they provide general assumptions and then introduce the models to be used. They discuss uncertainty in the Introduction as well.
- Appendix 3 G, Page 8 lines 25-27 states: "Where species-specific data were available they were used directly. More often, this will not the case and adjustments were made based on how different life history characteristics would be expected to influence survival." This was followed by assumptions, and they provided data from other areas that would lend support to the assumptions. We thought that this is probably the best they could do under the circumstances and it does seem fit into the early steps of the adaptive management process. Future challenges in model modification were also presented.
- Appendix 3 G, Page 11 lines 9-13 states: "There are several other factors that might be considered in further defining or revising these Interim Survival Objectives, including scaled objectives based on wet and dry years. However, at this point we are reluctant to more finely define or scale survival objectives until additional species-specific survival estimates are collected over a range of hydrologic conditions. However, as new information becomes available, the potential to define wet and dry year expectations should be revisited". Again, this statement both acknowledges and contributes to the adaptive management process. Likewise, climate change is presented as an uncertainty issue in terms of future annual variability scenarios.
- Appendix 3E-7 lines 6-8 states: "Precise details of each of the effectiveness monitoring actions are not presented here and will be developed and then periodically updated through the adaptive management and monitoring program (Section 3.6)." In terms of effectiveness monitoring, this is not an unexpected response. Some specific monitoring actions are mentioned in Table 3E-2 but these are very general and often repetitive.
- Research Questions. Table 3E-3. These are very broad, and in some cases somewhat repetitive in terms of data already collected in the Delta (which would require reanalysis or a meta-analysis). However, the document acknowledges that these will be modified over time.

6. References Cited

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Statutory Questions

1. *Comment on the scientific basis and clarity related to the EIR-EIS conclusions:*

The clarity of the conclusions is summarized in Item 1 of the response to the Charge as well as in the Major Points document. Comments on the scientific merit of the conclusions are detailed in each of the individual chapters and only summarized here.

a. *the review and analysis of the range of flow criteria, rates of diversion, and any other operational criteria required to satisfy the criteria for approval of a natural community conservation plan 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.*

   To be done and taken from overall review summaries.

b. *the potential effects of climate change (including possible sea level rise up to 55 inches), and possible changes in total precipitation and runoff patterns on the conveyance alternatives and habitat restoration activities considered in the EIR.*

   This review is detailed in the review of Chapter 29. The review concludes;

The Draft BDCP (and, in a less readable fashion, the EIR-EIS) does a good job of describing how might influence communities and species, and how the conservation measures may act to lessen these effects. Some effects are still likely to remain, however. The likelihood or magnitude of these effects is not clearly stated. More importantly, the potential effects of Climate Change/sea level rise on the effectiveness of the conservation measures, and therefore whether the actions will have the desired or stated benefits or mitigations, are not fully considered.

c. the potential effects on migratory fish and aquatic resources.

This review is detailed in the review of Chapter 11. The review concludes;

Overall the EIR/EIS could demonstrate a more balanced approach by fully discussing results from an ecosystem perspective (to add to the species-by-species discussions), fully embracing uncertainty and discussing it uniformly while distinguishing knowns from unknowns, and explicitly stating assumptions and differentiating conclusions from hypotheses. The detailed piece-by-piece and part-by-part treatment of CMs and species, although perhaps necessary, dilutes the merit of the overarching ecosystem perspective of the intent of this plan. Success will depend on a fully functioning system and analyses that incorporate integration across species, within a species, and across regions. Adaptive management will require a well-planned and comprehensive research and monitoring program that will target causality and test Plan hypotheses.

Our specific concerns with this chapter of the EIR-EIS include: (1) positive benefits of habitat restoration are highly uncertain, and if not realized, will invalidate the final conclusion of no net negative effect; (2) further analysis of effects of flow on entrainment is needed; (3) the decision-tree process is not adequately described; (4) interactions and synergies among species and the potential impacts on other ecologically important species are not adequately considered; (5) the qualitative nature of the effects analysis makes results more aligned with 'hypotheses' rather than 'conclusions' or 'predictions'; (6) full life cycles are not adequately considered; (6) a more complete description of adaptive management is needed; and (7) uncertainty in the conclusions is not adequately acknowledged throughout the EIR-EIS.

d. the potential effects of each Delta conveyance alternative on Delta water quality

This review is detailed in the review of Chapter 8. The review concludes;

Tracy, can you summarize the Chapter 8 review?