Exponent®

EXTERNAL MEMORANDUM

TO: WATERFIX Comments (WATERFIXComments@icfi.com)
P.O. Box 1919
Sacramento, CA 95812

FROM: Dr. Susan Paulsen

DATE: October 27, 2015

PROJECT: 1405064.000

SUBJECT: Technical Comments on the Draft Bay Delta Conservation Plan (BDCP) and Associated Draft Environmental Impact Report and Environmental Impact Statement (RDEIR/SDEIS)

Dear WATERFIX/WaterFix:

On behalf of the City of Brentwood (the City), Exponent is pleased to submit comments on the Bay-Delta Conservation Plan (BDCP) and Associated Partially Recirculated Draft Environmental Impact Report / Supplemental Environmental Impact Statement (RDEIR/SDEIS) during the public review period.

The City's analysis of the impacts of the RDEIR/SDEIS relies on the City's analyses of the modeling of Alternative 4, which forms the basis for the current RDEIR, and a comprehensive review of the RDEIR/SDEIS. In addition, the City of Brentwood has been working closely with other Delta agencies and reserves the right to rely on all other comments submitted, including those submitted by the Contra Costa Water District (CCWD) and the City of Antioch.

The Proposed Project was not modeled. The RDEIR/SDEIS identifies Alternative 4A, also known as the "WATERFIX," as the preferred alternative. However, Alternative 4A was not explicitly modeled. Instead, the environmental impacts of Alternative 4A were assessed using modeling of Alternative 4 (first presented in the 2013 Draft RDEIR/SDEIS) and a limited sensitivity analysis.

Although the RDEIR/SDEIS states, "Lead agencies have determined that they may reasonably rely on modeling conducted for Alternative 4 to accurately predict the environmental effects of Alternative 4A,"[1] the differences between Alternative 4 and Proposed Project Alternative 4A are significant, as shown in Table 1. As detailed below, three of the differences between the

[1] See *New Alternatives: Alternatives 4A, 2D and 5A* (Chapter 4 of the Bay Delta Conservation Plan/California WaterFix RDEIR/SDEIS) at page 4.1-43, lines 17-19("Physical Modeling").

models—the amount of tidal restoration, the salinity objective compliance location, and the operation of the barrier at the Head of Old River—have direct and immediate impacts on the salinity levels predicted to occur throughout the Delta, including at Brentwood's intake. In addition, salinity within the Delta often behaves in a non-linear fashion, such that without being modeled, it is not possible to reliably infer the effects of multiple changes in model assumptions on model output.

In summary, and as detailed below, the differences between Alternative 4A and Alternative 4 are significant enough that the environmental impacts of Alternative 4A cannot be determined based on the existing modeling.

Table 1. Comparison of modeled conditions and conditions of proposed project Alternative 4A

Condition	Model Parameters for Alternative 4 (2013)	Proposed Project Alternative 4A (2015)
CEQA baseline	Existing conditions (EBC1)	Existing conditions (EBC1)
NEPA baseline	NAA ELT	NAA ELT
Sea level rise	15 cm (ELT)	15 cm (ELT)
Fall X2	Included	Included
Conservation measures/ Environmental commitments	25,000 acres of tidal restoration of wetlands (at ELT), and 65,000 acres at LLT	Up to 59 acres of tidal wetland restoration
Yolo Bypass Restoration	8,000 acres of restoration included	0 acres
EcoRestore	No separate project—Alternative 4 included restoration commitment	Separate project, not modeled
Salinity objective compliance location	Three Mile Slough	Emmaton
Suisun marsh salinity control gates	Not operated	Operated
Head of Old River Barrier (HORB) operations	Barrier 50% open Jan–Jun 15 and parts of October; closed during San Joaquin pulse but 100% open during other times	Barrier closed Jan-Jun 15, October and November

The appropriate timeframes for the Proposed Project were not evaluated. The RDEIR/SDEIS indicated that two baselines were used in the current analysis: the "Existing Conditions" baseline defined in the 2013 Draft EIR/EIS was used for the CEQA impact analysis, and the "No Action Alternative Early Long-Term" (NAA-ELT) scenario was used for the NEPA impact analysis. The impacts of the proposed project were evaluated quantitatively only in the Early Long Term (ELT) timeframe. Long-term impacts of the proposed project were evaluated only qualitatively, even though the 2013 EIR did evaluate Alternative 4 (the 2013-proposed project) for a Late Long Term (LLT) timeframe quantitatively, even though the project documents note that the project "would continue indefinitely."[2] As detailed below, water quality impacts for the LLT using DSM2 model runs provided by DWR were evaluated previously for another City (City of Antioch) in the Western Delta (see Attachments A and B) close to Brentwood. Model results showed significant water quality impacts in the LLT timeframe, which we anticipate would have significant impacts on the City of Brentwood's ability to take use water from the Delta. Because the project "would continue indefinitely," a quantitative analysis of the long-term impacts of the project is needed.

The baseline condition used to evaluate the BDCP Proposed Project is flawed and inappropriate. The RDEIR/SDEIS indicated that two baselines were used in the current analysis: the "Existing Conditions" baseline defined in the 2013 Draft EIR/EIS was used for the CEQA impact analysis, and the "No Action Alternative Early Long-Term" (NAA-ELT) scenario was used for the NEPA impact analysis. The 2013 Draft EIR/EIS used a model run previously called "EBC1" to simulate the existing condition, and the 2015 RDEIR/SDEIS continues to use the same "Existing Conditions" model run (i.e., "EBC1").

As noted by the City and its technical consultants in Figure 1 (and in comments provided by the City of Antioch, Attachments A and B), the EBC1 existing-conditions scenario used to evaluate project impacts is flawed and does not accurately represent existing conditions with respect to salinity. At Brentwood, Figure 1 illustrates how EBC1 deviates from measured salinity, specifically in fall 1974, 1975, and 1978 during the time period 1974–1979. By contrast, a second existing-conditions model run, called "EBC2," was also conducted and was available for use at the time the 2013 Draft EIR/EIS was prepared, and more accurately represents existing conditions.[3] The primary difference between EBC1 and EBC2 is whether Delta outflows are managed to achieve the Fall X2 provision (hereafter referred to as "Fall X2") of the 2008 US Fish and Wildlife Service Biological Opinion (the "2008 BiOp"): the EBC1 scenario does <u>not</u> operate to Fall X2, whereas the EBC2 scenario <u>does</u> operate to Fall X2.

As described in comments provided by the City of Antioch, the City's consultants obtained from DWR the modeling results from the Delta Simulation II (DSM2) model, which was used to simulate hydrodynamics and water quality throughout the Delta for a range of model scenarios.

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[2] The RDEIR/SDEIS states, on p. 4.1-42, "The same 'Existing Conditions' baseline defined in the Draft EIR/EIS applies to Alternatives 4A, 2D, and 5A, for the purposes of the CEQA impact analysis… Because Alternatives 4A, 2D, and 5A, contemplate a shorter permit period for project implementation than the other alternatives, the new "No Action Alternative Early Long-Term" (No Action Alternative ELT) is used as the NEPA point of comparison for these alternatives. The No Action Alternative ELT is described and analyzed in Section 4.2. However, because <u>the project would continue indefinitely</u>, the analysis qualitatively examines impacts at the Late Long-Term timeframe for Alternative 4A, 2D, and 5A, but does not make a CEQA or NEPA conclusion based off the No Action Alternative LLT baseline" (emphasis added).

[3] The March 2013 Revised Administrative Draft used both EBC1 and EBC2, while both the 2013 Draft EIR/EIS and the 2015 RDEIR/SDEIS use only the EBC 1 scenario, which has been renamed as the "existing conditions" scenario.

Model results for EBC2 generally agree well with salinity measurements made near Brentwood. By contrast, the EBC1 scenario (the 2015 and 2013 "Existing Conditions" scenario) showed poor agreement, particularly in the fall of 1974, 1975, 1978, 1980, 1984, and 1986, or 6 of the 17 years modeled, when modeled salinity values were significantly greater than measured salinity values.[4]

To further illustrate the impacts of selecting a biased and incorrect baseline, Table 2 shows the conditions that were modeled for each scenario and the number of usable days[5] for each scenario. For example, the incorrect "Existing Conditions" baseline (EBC1) predicts that, for the modeled time period 1974–1991, usable water will be available for 333.9 days, while the correct "Existing Conditions" baseline (EBC2) predicts that usable water will be available for 341.8 days; thus, the incorrect choice of baseline condition means that the number of usable days is underpredicted by about 7.9 days per year, or about 126 days during the simulation period. The failure to implement a Fall X2 condition in the "Existing Conditions" model runs artificially biases the model results with respect to the current condition at Brentwood's intake, and in effect gives the Proposed Project an unwarranted "free pass" for 126 days during the 16-year period.

Failing to include Fall X2 in the Existing Conditions scenario makes the baseline condition appear to be more saline than it actually is, so that the potential impacts of the BDCP appear to be significantly smaller than they would be with an appropriate baseline.

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[4] Note that the time period evaluated in the RDEIR/SDEIS appears to have changed. Whereas the 2013 EIR/EIS evaluated the full modeled period, the current 2015 RDEIR/SDEIS appears to have evaluated a shorter time period, as indicated on p. ES-26: "Chloride modeling results were updated: New calculation of exceedances of the 150 mg/L chloride objective were prepared based on calendar years 1976-1990 of the original modeled results (i.e., 15 years instead of 16) because the objective applies on a calendar year basis." The City's analysis evaluated model results provided by DWR for the 1974–1991 time period.

[5] For the purposes of these comments and for convenience, water at the City's intake was defined as usable when salinity is below 250 ppm chloride, approximately equivalent to an electrical conductivity of about 976 µS/cm.

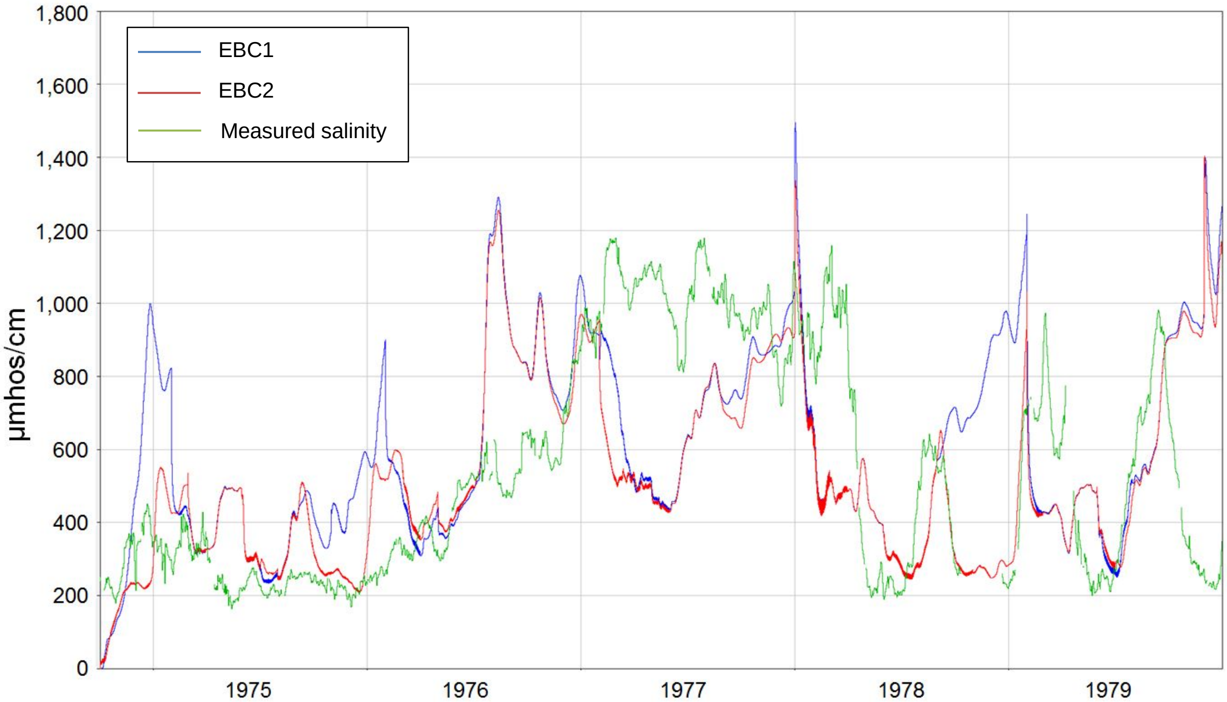

Figure 1. Measured and simulated average electrical conductivity (EC) at Brentwood (1974–1979). Measured data are from station CHCCC006, located approximately 8 miles from Brentwood's intake. DSM2 simulations EBC1 and EBC2 were provided by DWR (results are shown for model node 206, within Rock Slough).

Table 2. Description of available baseline scenario model runs, together with DSM2 model results showing the number of days Brentwood will be able to use water at its intake (node 206), under EBC1, EBC2, and NAA ELT scenarios (1974–1991) by year type

	EBC1 2015 CEQA Baseline Existing Condition Does not include Fall X2 No sea-level rise	EBC2 "Correct" Existing Condition Includes Fall X2 No sea-level rise	NAA_ELT 2015 NEPA baseline condition Includes Fall X2 15-cm sea-level rise
Year Type	Model Results (number of usable days)		
All years	333.9	341.8	324.5
Critical years	322.4	332.2	303.2
Dry years	333.3	345.5	342.8
Above- and below-normal years	323.2	333.1	286.4
Wet years	352.2	353.0	354.1

* Salinity threshold 976 µS/cm.

Operations of the Proposed Project, Alternative 4A, are not defined. The RDEIR/SDEIS states that Operations Scenario H3+, which is bounded by Operations Scenarios H3 and H4 from the 2013 Alternative 4, represents the operations proposed under Alternative 4A. As with Alternative 4 Operations Scenarios H3 and H4, the operations scenario described for the Proposed Project includes both Fall X2 operations and criteria for spring outflow, bounded by the criteria associated with H3 and H4.

However, these operations will be modified via the use of an Adaptive Management and Monitoring Plan (AMMP). The AMMP is to be implemented to develop additional science during the course of project construction and operation, to inform and improve conveyance facilities operational limits and criteria, and the AMMP is anticipated to result in modifications to operations of the North Delta bypass flows, South Delta export operations, head of the Old River barrier operations, spring Delta outflows, and the Rio Vista minimum flow standard in January through August.[6] No operational "limits" are provided in the RDEIR/SDEIS that would inform the City regarding how the project can be operated, and no additional model runs are provided that would indicate the water quality impacts that may result from modified operations. Thus, the operational conditions described for Alternative 4A are essentially unconstrained, providing an undefined degree of flexibility that can be expected, based on

[6] RDEIR/SDEIS at p. ES-18.

model runs for Alternative 4 Operations Scenarios H1 and H2 (which do not include Fall X2), to result in significant impacts to water quality at Brentwood's intake.

Further, the criteria for some operational parameters, such as winter and summer outflow, are worded vaguely: "Flow constraints established under D-1641 will be followed if not superseded by criteria listed above."[7] It is difficult to discern the proposed water operations flow criteria with this lack of clarity in description.

Particularly noteworthy to the City is the fact that the very limited discussion of operational flexibility that does exist indicates that operations will be modified based solely on impacts to fish species, including critically important operations parameters for both spring outflow (to be managed for longfin smelt)[8] and Fall X2 (to be managed for delta smelt).[9] No mention is made of the importance of spring outflow and Fall X2 to water quality in the western Delta, and no indication is given that operations would be constrained to avoid a worsening of water quality in the western Delta.

As detailed below, operations criteria are vitally important as a determinant of water quality at Brentwood's intake. For this reason, the City requests that project proponents make a direct and binding commitment to operate the project in such a manner that water quality degradation in the western Delta is limited to the range evaluated in the RDEIR/SDEIS, or to implement full mitigation of any potential impacts from such operations.

The Adaptive Management and Monitoring Program (AMMP) is undefined, and is likely to have adverse environmental impacts, including impacts to water quality. The AMMP is included within the RDEIR/SDEIS as a means to accommodate flexibility in the proposed project that is required due to the "considerable scientific uncertainty… regarding the Delta ecosystem, including the effects of CVP and SWP operations and the related operational criteria."[10] It is well-established that substantial uncertainty exists in the Delta ecosystem, and an adaptive management strategy is necessary. However, an adaptive management strategy should not be used as a means of circumventing project planning.

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[7] RDEIR/SDEIS at p. 4.1-10, regarding the operations parameter "winter and summer outflow."

[8] For example, p. 4.1-9 of the RDEIR/SDEIS indicates that, for spring outflow, "To ensure maintenance of longfin smelt abundance, initial operations will provide a March-May average outflow bounded by the requirements of Scenario H2, which are consistent with D-1641 standards, and Scenario H, which would be scaled to Table 3-24 in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS… Adjustments to the criteria above and below these outflow targets may be made using the Adaptive Management Process and the best available scientific information available [*sic*] regarding all factors affecting longfin smelt abundance."

[9] For example, p. 4.1-9 of the RDEIR/SDEIS indicates that "September, October, November implement the USFWS (2008) BiOp Fall X2 requirements. However, similar to spring Delta outflow and consistent with the existing RPA adaptive management process, adjustments to these outflow targets may be made using the Adaptive Management and Monitoring Program described below and the best available scientific information regarding all factors affecting delta smelt abundance."

[10] RDEIR/SDEIS at p. 4.1-18, line 17.

Proposed Project Alternative 4A relies heavily on the AMMP to dictate changes in operation of water conveyance facilities, habitat restoration, and other factors during project construction and operation. The AMMP is a central component of Alternative 4A, yet remains almost wholly undefined. Beyond an introduction to basic principles of adaptive management, there is little discussion of how the AMMP will be implemented, nor does it appear that there will be a review process for the considerable changes that may be recommended as a result of the AMMP. Although the AMMP is described as a means to adjust operations criteria, there is no discussion of how this iterative process will occur. In addition, no operational boundaries are defined with regard to its potential application of the AMMP within Alternative 4A.[11]

The RDEIR/SDEIS indicates that "collaborative science and adaptive management will, as appropriate, develop and use new information and insight gained during the course of project construction and operation to inform and improve… the operation of the water conveyance facilities under the Section 7 biological opinion and 2081b permit…"[12] As with the discussion of the project operations, the RDEIR/SDEIS appears to indicate that the only (or at least the primary) factor that will be considered in modifying operations will be impacts to fish. The City is concerned that an AMMP focused solely on fish will fail to consider the potentially substantial water quality impacts that could be induced by even modest changes to project operations.

Considering the previous discussion, it is unreasonable and without foundation to assume, as the RDEIR/SDEIS does, that "For the purposes of analysis, it is assumed that the Collaborative Science and Adaptive Management Program (AMMP) developed for Alternative 4A would not, by itself, create nor contribute to any new significant environmental effects."[13]

Even given concerns with the modeling analysis, it is clear that water quality impacts are significant. As noted throughout these comments, there are significant differences between the 2013 Alternative 4 (which was modeled) and the Proposed Project (2015 Alternative 4A, which was not modeled). Even though the current RDEIR/SDEIS envisions that Alternative 4A would use preliminary project operations based on Operations Scenarios H3 and H4 (which would have lesser impacts to salinity than Operations Scenarios H1 and H2), these scenarios were part of the original project modeling, and thus, the basis for a shift from "significant and unavoidable impacts" to "no significant impacts" is unclear. (In fact, effects on chloride concentrations are

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[11] See also the September 30, 2015, report of the Delta Independent Science Board, which noted at p. 5, "There is a very general and brief mention of the steps in the adaptive management process in Section 4 (p. 4.1-6 to 4.1-7), but nothing more about the process… We did not find examples of how adaptive management would be applied to assessing—and finding ways to reduce—the environmental impacts of project construction and operation… To be effective in addressing unexpected outcomes and the need for mid-course corrections, an adaptive-management team should evaluate a broad range of actions and their consequences from the beginning, as plans are being developed, to facilitate the early implementation and effectiveness of mitigation activities." The Delta Independent Science Board report is attached to the City's comments as Attachment C.

[12] RDEIR/SDEIS at p. 4.1-18.

[13] RDEIR/SDEIS at p. 4.1-18.

listed as "LTS," or "less than significant," for Alternative 4 in the RDEIR/SDEIS Executive Summary,[14] even though the same alternative was determined, using the same model runs, to have "significant and unavoidable" impacts to salinity in the western Delta in 2013; the basis for this change relative to findings for Alternative 4 in the 2013 EIR/EIS is also unclear.)

In addition, the severity of impacts at Brentwood's intake is concealed, because the RDEIR/SDEIS presents model results as daily, monthly, or yearly averages. Water for Brentwood's use is taken from discrete locations within the Delta, and does not rely on average salinity, but on salinity measured at each instant in time. Thus, it is only through a detailed examination of model results that Brentwood can evaluate the water quality impacts that the Proposed Project is expected to induce.

In addition, the sensitivity analyses performed in support of the RDEIR/SDEIS appear to indicate significant increases in chloride concentrations in the interior Delta, including in Old River at Rock Slough, one of the locations from which Brentwood obtains its water supply, under certain conditions. For example, the Supplemental Modeling for New Alternatives indicates that the Proposed Project (Alternative 4A, Operations Scenario H3) would cause increases in chloride concentrations at this location relative to the existing-condition run (which, as noted above, is biased toward higher-than-actual salinity) in drought years during the months of March (+5%), May (+9%), and June (+32%). Similarly, in all year types during the 1976–1991 simulation period, salinity would increase in the months of March (+4%) and June (+12%). Even relative to the No Action Alternative-Early Long Term, salinity would increase at Rock Slough in nearly all of these months by as much as +16% (in June of drought years).[15]

In addition to increases in chloride concentrations (i.e., salinity), the City is concerned about increases in bromide concentrations that will be caused by the Proposed Project. The RDEIR/SDEIS notes that "multiple interior and western Delta assessment locations would have an increased frequency of exceedance of 50 µg/L, which is the CALFED Drinking Water Program goal for bromide as a long-term average applied to drinking water intake… These locations [include] Franks Tract, Old River at Rock Slough [a source of supply to Brentwood]… Similarly, these locations would have an increased frequency of exceedance of 100 µg/L, which is the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts… The greatest increase in frequency of exceedance of 100 µg/L would occur at Franks Tract (6% increase) and San Joaquin River at Antioch (4-5% increase depending on operations scenario)."[16] Yet the RDEIR/SDEIS concludes that impacts due to bromide are "less than significant."[17] This conclusion is not credible.

14 RDEIR/SDEIS at p. ES-43.

15 See RDEIR/SDEIS Appendix B at p. B-94.

16 RDEIR/SDEIS at p. 4.3.4-9. The RDEIR/SDEIS discussion regarding bromide states (incorrectly) that "the use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. Opportunity to use these intakes would remain, and the predicted increases in bromide

Two differences between the model runs and the Proposed Project will have particularly significant impacts on salinity at Brentwood's intake, and these are not disclosed in the RDEIR/SDEIS. The first is the impact of tidal marsh restoration. The model runs for the Proposed Project include 25,000 acres of tidal marsh restoration at the ELT timeframe and 65,000 acres of tidal marsh restoration at the LLT timeframe, but this restoration is not part of the Proposed Project (Alternative 4A includes only "up to 59 acres" of marsh restoration; see Table 1). Model runs were conducted in 2013 as part of the 2013 EIR/EIS process to evaluate the impact of tidal marsh restoration on salinity levels within the Delta; those model runs determined that tidal marsh restoration under ELT conditions is expected to decrease tidally averaged EC (surrogate for salinity) in the western Delta as compared to the base case.[18] Salinity impacts of tidal restoration are less clear near the City of Brentwood. However, because the proposed Alternative 4A ELT does not include 25,000 acres of the tidal marsh, it is reasonable to assume that salinity levels in the western Delta during the subject time period would be higher than disclosed in the RDEIR/SDEIS. Thus, salinity impacts that are disclosed in the RDEIR/SDEIS are almost certainly incorrect because of the failure to conduct model runs that accurately represent the limited tidal marsh restoration contemplated by the Proposed Project.

A second major concern involves the operation of the barrier at the Head of Old River. Per the proposed project, the Head of the Old River Barrier (HORB) will potentially remain closed from January to June 15th, and during October and November.[19] However, for modeling purposes, it was assumed that the HORB is 50% open from January to June 15th and during days in October prior to the D-1641 San Joaquin River pulse. Also, for modeling purposes, the HORB was assumed to be closed during the San Joaquin River pulse but 100% open during other months. This highlights another significant difference between the proposed project and the modeling. Closing the HORB for a longer duration (per the Proposed Project), and closing the HORB completely, will limit the amount of flushing that occurs in the South Delta. This in turn will result in salinity increases at interior Delta locations such as Brentwood, as flushing flows are needed to dilute the salinity and other water quality impacts of return flows in the Delta. Hence, the impact of the Proposed Project in Brentwood will be underestimated.

Also, based on analysis of DWR modeling results (using a salinity threshold of 976 µS/cm), the numbers of usable days at Brentwood's intake were 15.6 (EBC1) and 19.1 (EBC1) greater under the existing-conditions scenario compared to the Alt H3 scenario during fall months (Sep–Nov) for above- and below-normal years. Also, during the entire simulation period 1974–1991, the

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concentrations at Antioch and Mallard Slough would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations."

[17] RDEIR/SDEIS at p. ES-43.

[18] See Figure 6-26 in the 2013 Draft BDCP EIR/EIS Appendix 5A, Section D, Attachment 2, which presents the percent increase in tidally averaged EC for the ELT scenario compared to baseline for September 2002.

[19] *New Alternatives:* Alternatives *4A, 2D and 5A* (Chapter 4 of the Bay Delta Conservation Plan/California WaterFix RDEIR/SDEIS, Table 4.1.2)

number of usable days was greater under the existing conditions scenarios (EBC1, 5.6 days; EBC2, 6.8 days) compared to Alt H3 for the fall months (Sep–Nov). This trend was true also for the dry-year (8–10 days) and critical-year (5–7 days) scenarios.

Summary. In summary, it is difficult, if not impossible, to assess the impacts of the Proposed Project on water quality at Brentwood, because the Proposed Project was not modeled, and because there are major differences between the Proposed Project and the model runs used to assess impacts. Even so, our analysis of the modeling indicates that the Proposed Project will have significant impacts on water quality at Brentwood's intake, and these impacts are not disclosed in the RDEIR/SDEIS.

The modeling performed to support the Proposed Project used an inaccurate baseline condition; because the CEQA "Existing Conditions" model run does not include Fall X2 operations, the baseline is not representative of current conditions, results in worse water quality in the Delta than actually occurs, and thereby masks the impacts of the Proposed Project. Although these comments have been provided previously, they have not been addressed to date, despite the fact that an accurate "Existing Conditions" model run was conducted by DWR and has been available for use since at least 2013.

In addition, certain features of the proposed project that were not evaluated (e.g., the model runs include 25,000 acres of tidal marsh restoration that is not part of the Proposed Project, the operations of the Head of Old River Barrier) are expected to result in significantly higher salinity in the Delta than is shown in the model runs.

Finally, the Proposed Project operations are not defined, and the Adaptive Management and Monitoring Program (AMMP) that will be used to modify project operations has not been defined. There appear to be no constraints that would be imposed on project operations, and modifications to operations appear to be designed to protect fish species, without consideration of water quality impacts. As detailed in prior comments and as is apparent from existing model runs, even small changes in project operations can cause significant impacts to water quality in the Delta, including at Brentwood's intake.

Attachment A

Technical Comments on the BDCP and Associated EIR/EIS Letter Prepared by Flow Science Incorporated

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July 17, 2014

BDCP Comments
Ryan Wulff, NMFS
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Via email: BDCP.Comments@noaa.gov

Subject: Appendix A to the City of Antioch Comment Letter
Technical comments on the Draft Bay Delta Conservation Plan (BDCP) and associated Draft Environmental Impact Report and Environmental Impact Statement (EIR/EIS)

Dear Mr. Wulff:

On behalf of the City of Antioch (the City), Flow Science is pleased to submit comments on the Bay-Delta Conservation Plan (BDCP) and Associated Environmental Impact Report/Environmental Impact Statement (EIR/EIS) during the public review period. These technical comments constitute **Appendix A** to the City's comment letter.

SUMMARY OF TECHNICAL COMMENTS

Flow Science has reviewed the BDCP Plan and EIR/EIS, and has evaluated the impacts that are likely to occur at the City of Antioch. Flow Science's key findings regarding the technical analysis presented in the EIR/EIS can be summarized as follows:

- The baseline condition ("Existing Conditions") scenario used to evaluate project impacts is flawed and inappropriate, and does not accurately represent current salinity conditions at Antioch. Use of an incorrect baseline conditions results in an understatement of the impacts of the BDCP Proposed Project.
- The BDCP Proposed Project will cause salinity at Antioch to increase significantly, and will significantly reduce the City's ability to use its intake to supply water within its service area. Contrary to assertions in the EIR/EIS, these impacts will result from the Proposed Project and not from sea level rise.

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- The BDCP Proposed Project assumes a change in water quality standards that has not yet happened and that would require State Water Board action. Given that historical, natural salinity in the western Delta was far lower than current levels, Antioch believes that changes in water quality standards would be inappropriate and detrimental to the health of the Delta.
- Because project operations have not been clearly defined, it is not possible to determine with any certainty the impacts of the Proposed Project.
- Mitigation for the significant impacts that are expected to occur at Antioch is not detailed within the EIR/EIS. The EIR/EIS finds that water quality impacts are "considered to remain significant and unavoidable." Despite statements in the EIR/EIS that the assistance provided by BDCP proponents is intended to "fully offset" increased treatment or delivery costs, the BDCP and EIR/EIS suggest no concrete measures that will be implemented to accomplish this.

Additional detail is provided below and in **Appendix C** to the City's comment letter.

BACKGROUND

As detailed in the City's comment letter, the City is located along the San Joaquin River in the western portion of the Sacramento and San Joaquin River Delta (Delta). Since the 1860s, Antioch has obtained all or part of its freshwater supply directly from its intake on the San Joaquin River[1] pursuant to a pre-1914 appropriative water right with a priority of 1867.[2]

Contrary to incorrect statements contained in the EIR/EIS, Antioch continues to obtain much of its water supply from its own diversion facility.[3] Antioch has a substitute

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[1] Much of the water in the western Delta (including the City's water supply) comes from the Sacramento River. Historically, significant amounts of Sacramento River water flowed into the San Joaquin River east of Antioch at Three Mile and Georgiana Sloughs. Sacramento River water also reaches Antioch where the river merges with the San Joaquin River just west of the City.

[2] Antioch has vested pre-1914 water rights to water from the San Joaquin River as well as to the tributary flow of the Sacramento River via Georgiana and Three Mile Sloughs. This was determined as a matter of law by the California Supreme Court in the case of Town of Antioch v. Williams Irrigation District et al. (1922) 188 Cal. 451,455.

[3] The City of Antioch uses water from its intake as its main source of supply when salinity at the intake is below specified thresholds. Although the EIR/EIS states that Antioch's intake is "seasonal" and used "infrequently" (EIR/EIS Chapter 8 at p.8-185, lines 13-14), this is not true.

water agreement with the Department of Water Resources (DWR) that partially compensates the City for water purchases from Contra Costa Water District (CCWD). That agreement presently has a 15-year term, which will end at approximately the same time the BDCP is anticipated to begin operations.[4]

Because of its position in the western Delta and its legacy as a fresh water Delta town, the City is also particularly concerned with the ecological health of the Delta, the City's long-term viability as a recreational destination, and the potential significant adverse impacts of urban decay resulting from the BDCP.

DETAILED TECHNICAL COMMENTS RELATED TO WATER QUALITY IMPACTS

The baseline condition used to evaluate the BDCP Proposed Project is flawed and inappropriate. A modeling study was used to delineate the potential effects of the proposed BDCP project on salinity at locations throughout the Delta, including at Antioch's drinking water intake in the western Delta. Our review of the impacts to water quality (Chapter 8 of the EIR/EIS) indicates that two different baseline scenarios were used—the "Existing Conditions" scenario was used to represent baseline for the CEQA evaluation, and the "No Action Alternative" (NAA) was used to represent baseline for the NEPA evaluation. The main differences between these two scenarios appear to be (a) whether Delta outflows are managed to achieve the Fall X2 provision (hereafter referred to as "Fall X2") of the 2008 US Fish and Wildlife Service Biological Opinion (the "2008 BiOp"); and (b) whether the impacts of sea level rise are included. The Existing Conditions scenario does not include Fall X2 or sea level rise, while the No Action Alternative includes both. As detailed below, failing to include Fall X2 in the Existing Conditions scenario makes the baseline condition appear to be more saline than it actually is, so that the potential impacts of the BDCP appear to be significantly smaller than they would with an appropriate baseline.

As noted in prior comments submitted by the City and its consultants to the BDCP and to the State Water Resources Control Board (SWRCB)[5], the western Delta historically exhibited freshwater conditions. In 1928, "Carquinez Strait marked

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[4] On October 29, 2013, the term of the agreement between the State of California and the City of Antioch was extended through September 30, 2028.

[5] See **Appendix D** to the City's comment letter.

approximately the boundary between salt and fresh water under natural conditions," and "[p]rior to diversions for irrigation, Suisun Bay was brackish in the late summer and salt water may have penetrated as far as Antioch, but only for a few days at a time in years of lowest run-off"[6]. Such conditions no longer exist, as saline water is now common at Antioch. However, historic salinity conditions should be considered when assessing the impacts of proposed actions on the fish and wildlife that live in the Delta and that were historically adapted to fresher conditions.

The City asserts that Fall X2 should be included in both baseline conditions, including the Existing Conditions. Legally, the 2008 BiOp represents the requirement to operate to achieve Fall X2, and predates the NOP for the BDCP. Technically, and as discussed further below and in **Appendix C** to the City's comments, simulated water quality is more representative of measured (historic) data with the inclusion of Fall X2.

Antioch and its consultants have received from DWR modeling results[7] obtained from the Delta Simulation Model II (DSM2) model, which was used to simulate hydrodynamics and water quality throughout the Delta for a range of model scenarios. These model runs included two scenarios that were representative of "existing conditions." The "existing biological conditions 1" (EBC1) scenario included current sea levels but not Fall X2, while the "existing biological conditions 2" (EBC2) scenario included current sea levels and Fall X2. The March 2013 Revised Administrative Draft made use of both EBC1 and EBC2, while the current BDCP EIR/EIS utilizes only EBC1, which is renamed as the "Existing Conditions" scenario. Model results for the EBC2 scenario agree well with salinity measurements made near Antioch (see **Figure 1, Appendix C**), while the EBC1 scenario showed poor agreement, particularly in the fall of 1974, 1975, 1978, 1980, 1984, and 1986, or 6 out of the 17 years modeled. The plots of EBC1 shown in **Appendix C** are consistent with Figures 5C.A-104 through 5C.A.-107 of Attachment 5C.A to Appendix 5C of the Draft BDCP (confirming that EBC1 is the "Existing Conditions" scenario defined in the EIR/EIS), which show substantial increases in salinity in the western Delta in the fall of 1978, 1980, 1984, and 1986. These periods

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[6] Means, Thomas. "Salt Water Problem: San Francisco Bay and Delta of Sacramento and San Joaquin Rivers. San Francisco, CA: Thos. H. Means, Consulting Engineer - 1928. p. 57.

See also CCWD, 2010, Historical Fresh Water and Salinity Conditions in the Western Sacramento-San Joaquin Delta and Suisun Bay: A summary of historical reviews, reports, analyses and measurements; Technical Report WR10-001, available at http://www.ccwater.com/salinity/HistoricalSalinityReport-2010Feb.pdf.

[7] Flow Science Incorporated received modeling results from DWR via mailed hard-drives in January 2012, April 2013, and May 2013.

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of higher salinity are not consistent with field measurements, further confirming that the omission of Fall X2 from the Existing Conditions scenario is not technically appropriate to represent the existing water quality in the Delta.

The data contained in Appendix 8G of the EIR/EIS show a significant difference in chloride concentrations in the San Joaquin River at Antioch between the Existing Conditions and the No Action Alternative (NAA) scenarios. Specifically, the average chloride concentrations are higher under the Existing Conditions, particularly in the late summer and fall. Table C1-1 shows that the mean chloride concentration is higher under the Existing Conditions scenario than under the NAA scenario by 447 mg/l and 382 mg/l in October and November, respectively. Because there are two significant differences between these scenarios—i.e., Fall X2 and sea level rise—the data do not indicate which of these factors is responsible for the differences in simulated salinity levels.

Generally, the impact of a project is determined by comparing the Proposed Project scenario and the Existing Conditions scenario, and the impacts of non-project factors are determined by comparing the NAA scenario and the Existing Condition scenario. Here, we cannot make the latter comparison, as the Existing Conditions and No Action Alternative scenarios are not on common ground regarding Fall X2. In order to determine the impacts of sea level rise alone, the NAA scenario must be compared to the EBC2 scenario, since both the NAA scenario and the EBC2 scenario include operations to meet Fall X2. Once the impact of sea level rise has been determined, the impacts of BDCP could be more accurately delineated.

While the EBC2 scenario was not provided in the December 9, 2013 DRAFT BDCP and EIR/EIS, it was previously provided to Flow Science by DWR. **Figure 3** of **Appendix C** shows that, from September through November of above normal, below normal, and wet years, the availability of usable water at Antioch is higher under the EBC2 scenario than under the Existing Conditions (EBC1) and NAA scenarios; this is expected, as EBC2 includes Fall X2. These same plots also show that usability is greater under the NAA than under Existing Conditions (EBC1). Thus, the exclusion of Fall X2 (Existing Conditions) decreases usability more than sea level rise (captured in the NAA) during the fall of above normal, below normal, and wet years. This comparison highlights the importance of Fall X2, and further supports that it should be included in the CEQA baseline scenario.

As the City has noted in prior comments on the BDCP process and in testimony to the SWRCB, salinity levels in the western Delta, including at Antioch's intake, will be substantially higher if Fall X2 is not included in the Existing Conditions model runs. (See **Appendix D** to the City's comments.) The exclusion of Fall X2 from the Existing Conditions will increase the salinity simulated under this condition and thus downplay the impacts of the BDCP Proposed Project on salinity in the western Delta; in fact Table Cl-28 in Appendix 8G of the EIR/EIS shows that annual mean chloride concentrations decrease relative to Existing Conditions (i.e., EBC1) for all Operational Scenarios, which is misleading—relative to EBC2, mean annual usability decreases at Antioch for all year types under Scenarios Alt4-H1 and Alt4-H2. Ultimately, the use of the Existing Conditions scenario without Fall X2 would be neither legally nor technically appropriate, and misrepresents the anticipated impacts of the BDCP project.

In summary, Flow Science's analysis shows that the "Existing Conditions" scenario used to represent baseline conditions in the EIR/EIS does not accurately represent current conditions because it does not include Fall X2. Even though model scenario EBC2, which does include Fall X2, was used in prior drafts of the EIR/EIS and was made available to Flow Science and others as early as 2012, it was not used in the CEQA analysis. Because the incorrect existing conditions baseline scenario was used in the CEQA analysis, impacts to the City of Antioch have been underestimated significantly.

Thus, Antioch requests that Fall X2 be included in all modeling scenarios used to describe baseline conditions.

Please note that, because the City asserts that the Existing Conditions scenario is an inappropriate baseline, the impacts of BDCP in this comment letter will be assessed compared to the EBC2 and the No Action Alternative scenarios.

The BDCP will cause salinity at Antioch to increase and will reduce the City's ability to use its intake significantly. Appendix 8G of the EIR/EIS shows the predicted impact to chloride concentrations in the San Joaquin River at Antioch, both in terms of the monthly and daily mean concentration and in terms of compliance with the Bay-Delta Water Quality Objective (250 mg/l as a daily average). However, these metrics do not describe Antioch's ability to use the water[8], as its ability depends only on the instantaneous chloride concentration and not on daily or monthly averages. Thus, the

[8] The 1968 Agreement defines "usable river water" as occurring when the "chloride ion content in the surface zone at slack current after daily higher high tide (HHT) is 250 parts per million [ppm] or less." Throughout these comments, "usable water" is the term applied to water with a chloride content of 250 ppm or less.

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potential impacts described in Appendix 8G significantly underestimate the impacts to Antioch.

To determine the actual impacts to the City's municipal water supply, Antioch and its consultants evaluated salinity impacts using DSM2 model results obtained from DWR. Specifically, Flow Science assessed the instantaneous salinity concentration (i.e., model results at 15-minute intervals) to determine how the BDCP Proposed Project is predicted to impact the usability of water at the City's intake. Flow Science compared the percent of time that water can be diverted under the worst-case project conditions (Scenario Alt4-H1) to the EBC2 scenario and to the No Action Alternative. (As noted above, the EBC2 scenario is most representative of existing conditions and should be used as the baseline for CEQA analysis of the BDCP project.)

The increased salinity in the western Delta that is predicted to occur due to the BDCP Proposed Project will significantly impact Antioch's ability to use water. However, the severity of this impact is concealed in the EIR/EIS because model results are presented in the form of annual, monthly and daily averages. For example, Table Cl-28 of the EIR/EIS shows that, under worst-case operations and evaluated as a long-term average, compliance with the chloride objective will decrease by only 2% (the difference between Scenario Alt4-H1 and the No Action Alternative). However, as demonstrated below and in **Appendix C** to the City's comments, the decrease in usable water will be far more severe. On an annual basis, the impacts to usability at Antioch are significant. Over the 17 years modeled, the availability of usable water decreased by 6%, or 9.2 days per year on average as a result of BDCP Proposed Project Scenario Alt4-H1. The availability of usable water is expected to decrease even more during wet years; in these years, usability could decrease by 12%, or over 28 days per year. Importantly, and as detailed in **Appendix C**, these changes result from the BDCP Proposed Project alone, not from sea level rise.

The BDCP Proposed Project is simulated to have the most significant impacts during the fall months, where on average the availability of usable water at Antioch may decrease by up to 64% (**Appendix C**) with Operational Scenario Alt4-H1 relative to the No Action Alternative (i.e., without the impacts of non-project factors such as sea level rise). Evaluating results by month indicates potentially even greater effects. Under all year types, usability during September is simulated to decrease from 5.3 days to 0.8 days, an 85% decrease. The largest loss of usable days is predicted to occur in October, and totals 6.6 days on average.

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Breaking the results down by year type also shows significant impacts during the fall months. For example, excluding wet years, the availability of usable water under Operational Scenario H1 from September through November is predicted to decrease from 13.1 to 1.7 days[9], a loss of 11.4 days relative to the NAA; in non-wet years, there are only 0.3 to 3 days of usability in the fall under Proposed Operational Scenario Alt4-H1. The percent difference is most significant during critical and dry years, at 97% and 93% of usable days lost, respectively, in the September through November time period (**Table 4, Appendix C**). The most significant losses are simulated to occur during dry and wet years, when 23.0 and 22.7 days of usable water, respectively, are anticipated to be lost over this three-month period. Thus, the impacts of the BDCP Proposed Project to the City of Antioch, especially during the fall, are much greater than reported in the EIR/EIS.

The modeling performed to assess the water quality impacts of BDCP assumes full implementation of restoration measures—that is, 65,000 acres of tidal marsh restoration. This amount of tidal restoration is expected to occur in year 2060 and beyond, if at all. None of the model results characterizes the potential impacts of restoration on salinity in the years prior to 2060. Because the tidal marsh restoration will be phased, there will be several intermediate conditions during which the hydrodynamics may differ significantly from both the current conditions and the conditions under full tidal marsh restoration. Depending on the design and location of restoration efforts, and the sequence in which restoration is conducted, the volume of water that "sloshes" into and out of the Delta on every tidal cycle may be increased, thus increasing salinity in the western Delta.

Although the City's primary concern is with salinity at its intake, the City would like to incorporate by reference the comments of others that suggest that concentrations of other water quality constituents (e.g., bromide, mercury) may increase as a result of implementation of the Proposed Project. The City is concerned with any degradation of water quality at its intake. In addition, changes in water quality may affect the treatment options available to the City.

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[9] These numbers are the arithmetic averages of the non-wet years (i.e., critical, dry, above and below normal years) from **Table 4**, **Appendix C**

The BDCP Proposed Project assumes a change in water quality standards that has not yet happened and that would require State Water Board action. One aspect of the Proposed Project (represented by Scenarios H1 through H4) is the proposed change of "water quality requirements criteria" in the Delta. The Draft BDCP document states that the BDCP operations "include water operations in accordance with State Water Board D-1641 related to north Delta and western Delta agricultural and municipal and industrial requirements, except that the Sacramento River compliance point for the agreement with the North Delta Water Agency would be moved from Emmaton to Threemile Slough" (p. 3-188, emphasis added). Moving the compliance point landward by about 2.5 miles (the approximate distance from Emmaton to Threemile Slough), as proposed, would allow salinity in the western Delta to increase and thus would further impair Antioch's ability to use the water for municipal purposes. Further, the 2008 BiOps include requirements to meet Fall X2 under certain conditions, as described above, and two of the operational scenarios (Scenarios Alt4-H1 and Alt4-H2) eliminate the Fall X2 requirement; eliminating the Fall X2 requirement would also allow salinity to increase still farther in the western Delta.

Given the fact that historical, natural salinity in the western Delta has been far lower than current levels, and given the serious impacts that may occur to Antioch's water supply and to the ecosystem if salinity is allowed to increase further, Antioch asserts that such a change in water quality standards would be inappropriate. For this reason, the BDCP EIR/EIS should be amended to include scenarios that do not involve changes in water quality standards.

Because project operations have not been clearly defined, it is not possible to determine the impacts of the Proposed Project. Under the Proposed Project as described in the Plan and EIR/EIS, Delta outflow requirements in the spring and fall would be determined using a decision tree. There are four possible combinations of spring and fall outflow criteria, which define four operational scenarios (H1 through H4). Model runs were performed for each of these scenarios, as any of the four may be used each year. However, the decision tree that describes Operational Scenario H—specifically, what "triggers" each operational scenario—has not been defined in the Draft BDCP nor in the EIR/EIS and is "subject to a new determination by the fish and wildlife agencies" (p 3-207). Regarding spring outflows, the EIR/EIS states that "uncertainty exists regarding the mechanism through which higher Delta outflow improves the production and survival of early life stages of longfin smelt. Results of [future] investigations, including those directly related to the decision-tree process, will continue to be revealed and considered in the coming years" (p 3-208). However, neither the future studies nor their potential outcomes are discussed.

Regarding fall outflows, the EIR/EIS presents two hypotheses: first, that the fall habitat objective will be accomplished by providing flows necessary to position X2 in or near Suisun Bay in wet years; alternatively, that the new shallow-water habitat areas created through restoration of tidal communities (CM4) could accomplish this objective with lower outflows during the fall. Additional "scientific research to test each of these hypotheses will be conducted before initial operations of the north Delta facility" (p 3-208). Ultimately, neither the spring nor the fall portions of the outflow decision tree have been determined for the proposed BDCP project; thus, the potential impacts of the project cannot be determined with confidence.

Mitigation for water impacts is not provided. Chapter 8 of the EIR/EIS proposes mitigation measures for each foreseeable impact. For chloride (a surrogate for salinity), however, the proposed mitigation strategy consists entirely of additional study, with actions to be taken if identified. Because salinity in the western Delta originates primarily from the ocean, with salty water brought into the estuary by tidal action, Antioch and its consultants know of no such actions that would directly mitigate the impacts of the project on salinity in the western Delta, and none are identified in the EIR/EIS. In fact, the EIR/EIS states that, "because the effectiveness of [Mitigation Measure WQ-7] to result in feasible measures for reducing water quality effects is uncertain, this impact is considered to remain significant and unavoidable" (p, 8-429, emphasis added).

At the same time, and contrary to assertions that impacts are significant and unavoidable, the EIR/EIS expresses BDCP proponents' commitment to "assisting in-Delta municipal, industrial, and agricultural water purveyors that will be subject to significant water quality effects ... The assistance provided by the BDCP proponents is intended to fully offset any increased treatment or delivery costs attributable to CM1" (p. 3B-42, emphasis added). For municipal users, the proposed assistance includes providing funding assistance to acquire alternative in-basin water supplies, storage, conjunctive uses, or develop water transfers; develop water supply connections to SWP facilities or BDCP intertie; or develop demand management and/or conservation/recycling projects to extend available water supplies.

However, the methods to "fully offset" any water quality impacts as a result of CM1 may require changes to contracts already in place between DWR and municipal agencies. For example, California Department of Water Resources (DWR) has agreement contract with the City in which it has agreed to reimburse the City for *only* one-third of the cost it incurs to import water when water quality at its diversion point is unusable, as specified by formulae contained in the agreement. The EIR/EIS does not reference this contract, nor how it will distinguish BDCP CM1 impacts to water quality (for which the City should be fully compensated) from other instances of water quality degradation (for which the City should be reimbursed one-third, per the Antioch-DWR contract).

Antioch requests that BDCP proponents specify how they intend to identify and to fully offset the impacts of BDCP CM1 in a manner that is fair and just to all parties.

* * *

Please contact me at (626) 304-1134 or al@flowscience.com if you have any questions regarding these comments. We appreciate the opportunity to submit these comments, and we look forward to seeing these comments addressed in the final EIR/EIS for the BDCP.

Sincerely,

REGISTERED PROFESSIONAL ENGINEER
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CIVIL
STATE OF CALIFORNIA

Al Preston, Ph.D., P.E.
Project Engineer

Reviewed by:

E. John List, Ph.D., P.E.
Principal

Attachment B

Analysis of Water Quality Impacts to Antioch — Evaluation of DSM2 Modeling Performed in Support of the BDCP Proposed Project by Flow Science Incorporated

As detailed in **Appendix A** to the City of Antioch's comments on the BDCP and associated EIR/EIS, Flow Science has conducted a detailed review of hydrodynamic and water quality modeling performed by DWR to characterize the potential impacts of the BDCP Proposed Project on water quality at the City of Antioch's drinking water intake. This document (**Appendix C** to the City's comments) provides additional detail regarding Flow Science's technical analysis.

DSM2 model results were provided by DWR to Flow Science via hard drive in January 2012, April 2013, and May 2013. Flow Science analyzed these model results in order to assess the effects of the proposed BDCP project on salinity and usability of water at Antioch. The following analyses indicate that a technically inappropriate simulation was used for the baseline condition in the ADEIR, and that the proposed BDCP project is simulated to have significant impacts on the ability of Antioch to draw and use water from the San Joaquin River.

DATA SOURCES

The DSM2 simulation results used in the analyses are listed in **Table 1**. Each simulation used hydrology from WY1975-WY1991. Results for electrical conductivity (EC) at Antioch (RSAN007) were extracted on a 15-minute basis and used for Flow Science's evaluation. In addition to the model results, measured conductivity data[1] were obtained for RSAN008, located approximately one mile from the Antioch intake.

Table 1: DSM2 Simulations

Name	Scenario	Sea Level Rise (SLR) (cm)	Fall X2	Notes
Existing Condition (EBC1)[1]	baseline	0	No	Referred to as EBC1 in April 2013 EIR/EIS.
EBC2[2]	baseline	0	Yes	Not used in December 2013 EIR/EIS.
NAA[2]	No Action	15[4], 45	Yes	
Alt4-H1[3]	Low Outflow	15[4], 45	No	Proposed project can operate within (and beyond) the space defined by these four scenarios.
Alt4-H2[3]	Spring High Outflow	15[4], 45	No	
Alt4-H3[3]	Evaluated Starting Ops.	15[4], 45	Yes	
Alt4-H4[3]	High Outflow	15[4], 45	Yes	

1. Received from DWR on May 6, 2013.

[1] http://www.water.ca.gov/iep/products/data/dssnotice.cfm (accessed 3/7/2012).

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2. Received from DWR in January 2012. 3. Received from DWR in April 2013. 4. Results for SLR = 15 cm are not presented here.

ANALYSES

Baseline in EIR/EIS should incorporate Fall X2 provisions

The December 2013 EIR/EIS uses the "Existing Conditions" simulation for baseline purposes. As indicated in **Table 1,** the "Existing Conditions" simulation does not include Fall X2 provisions. By contrast, the "EBC2" simulation (a simulation used in the March 2013 Draft BDCP document, and received by Flow Science from DWR in January 2012) does include Fall X2.

The DSM2 modeling performed to evaluate water quality impacts of the proposed project simulated electrical conductivity (EC), which is a measure of salinity. **Figure 1** presents daily average simulated EC at Antioch for both Existing Conditions (Ex. Cond./EBC1) and EBC2, along with historical measured EC data. Simulation results were compared with historical measured EC. As shown in **Figure 1**, the exclusion of Fall X2 (i.e., the Ex. Cond./EBC1 simulation) results in EC at Antioch that is not representative of historical conditions. Specifically, salinity in the fall of 1974, 1975, 1978, 1980, 1984, and 1986 is substantially overestimated in simulation EBC1, when Fall X2 is excluded.

By contrast, the EBC2 simulation shows good agreement with measured EC at Antioch, indicating that the inclusion of Fall X2 into any baseline scenario is necessary in order to accurately represent current (pre-project) conditions at Antioch. In summary, the EBC2 scenario is the appropriate baseline model simulation for CEQA purposes, and EBC1 does not accurately represent current conditions and should not be used as the CEQA baseline for the BDCP project.

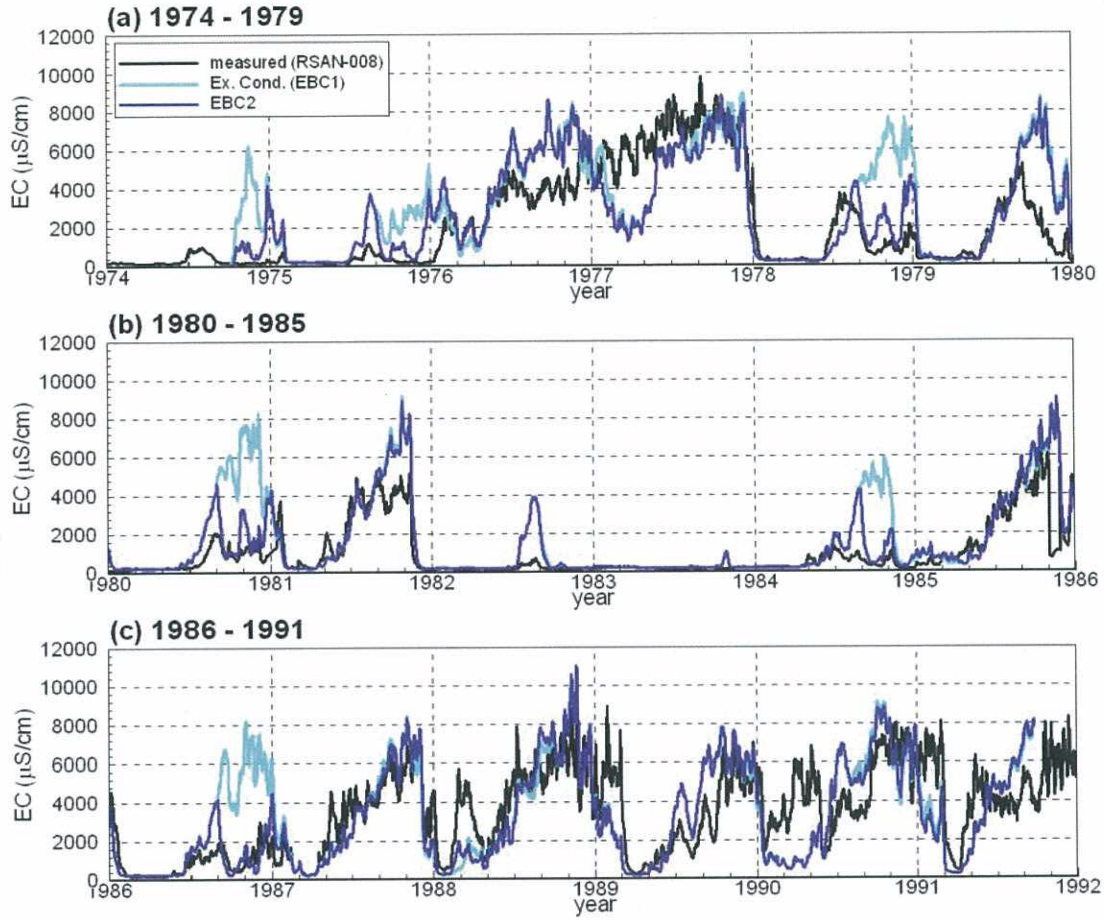

Figure 1. Measured and simulated daily average electrical conductivity (EC) at Antioch. Measured data are from station RSAN-008, located approximately one mile upstream from Antioch's intake. DSM2 simulations (EBC1 and EBC2) were provided by DWR.

BDCP Salinity Impacts at Antioch

In the December 2013 EIR/EIS, the preferred project is represented by the four Alt4 simulation scenarios listed in **Table 1**, with each scenario representing different operating regimes as determined by a "decision-tree" process that has yet to be explicitly defined. The H1 and H2 scenarios do not include Fall X2, whereas the H3 and H4 scenarios do include Fall X2 (**Table 1**).

To evaluate the anticipated impacts of the Proposed Project on salinity at Antioch, Flow Science plotted model results for salinity at Antioch using the EBC2 scenario, the NAA scenario, and the four Alternative 4 (Alt4) scenarios that represent the BDCP Proposed Project. Flow Science's evaluation focused on the EBC2 scenario (the most accurate representation of current conditions because it includes Fall X2), the NAA scenario (which includes both Fall X2 and anticipated sea level rise), and the Alt4 scenarios. The NAA scenario can be compared to the EBC2 scenario to examine the impact of sea level rise (SLR) alone on salinity at Antioch (i.e., without the BDCP Proposed Project). The BDCP Alt4 scenarios can then be compared to the NAA scenario to tease out the difference between increased salinity due to SLR and increased salinity due to the BDCP Proposed Project.

As shown below, the inclusion or exclusion of Fall X2 in the operating rules to be followed by the Proposed Project will have a substantial impact on the salinity at Antioch. DWR's model results indicate that the BDCP project may result in a substantially lower usability of water at Antioch, particularly in the fall months.

Figure 2 plots the percent of time that the salinity at Antioch is less than the usable threshold[2] in each month as computed from the DSM2 simulations for the simulation period 1975-1991[3]. Since the Ex. Cond. (EBC1) simulation is not an appropriate baseline (see above), the effect of sea level rise (SLR) was assessed by comparing the EBC2 and NAA simulations, and the effect of the proposed BDCP project (independent of SLR) was assessed by comparing the NAA and the four Alt4 scenario simulations.

Impact of Sea Level Rise. Comparison of the EBC2 simulation to the NAA simulation indicates that a SLR of 45 cm results in decreased usability in all months except July and October, when the usability under the NAA scenario is slightly higher than under the EBC2 scenario. As a long-term average over the simulation period, a SLR of 45 cm is predicted to result in a 15-day-per-year decrease in usability (i.e., Antioch

[2] Consistent with Antioch's agreement with DWR (first signed in 1968 and extended on October 29, 2013,), the usable threshold is 250 ppm as chloride (Cl^-), which corresponds to an EC of 976 μS/cm. This conversion was made using the relationship between chloride concentration and EC for "normal" years in Guivetchi (1986).

[3] Computed using the 15-minute DSM2 output at Antioch (RSAN007).

will be able to use their intakes 15 days less on average each year, see **Table 2**); as **Figure 2** shows, the decrease in usability is spread relatively uniformly over the year. The impact of sea level rise is most significant during dry years, when it accounts for over 26 days of usability lost, or a 19% decrease in usability.

Table 2. Annual usability at Antioch under EBC2 and the No Action Alternative for the entire simulation period and for different year types within the simulation period

Year Type	# of Usable Days Per Year Under EBC2	# of Usable Days Per Year Under NAA	Usable Days Lost Per Year	Percent Decrease
All Years	163.7	148.5	15.2	9%
Critical Years	63.1	55.6	7.5	12%
Dry Years	144.6	117.9	26.7	19%
Above & Below Normal Years	188.1	177.7	10.4	6%
Wet Years	264.8	248.5	16.3	6%

Impact of BDCP. Figure 2 also shows that, relative to both EBC2 and NAA, BDCP Scenario Alt4-H1 is predicted to result in a significant decrease in usability, particularly during the fall months. The average decrease in usability during the fall months, relative to the NAA, for the entire 17-year simulation period is presented in **Table 3**. On average during the September-November timeframe, simulation results anticipate that usability will decrease by 15.3 days. Simulated usability is almost completely lost during September, which corresponds to an 85% decrease. The largest predicted number of days lost (6.6 days) in one month occurs in October. Note that these impacts of the proposed BDCP project are due entirely to the project, as the effect of SLR has been accounted for by comparing results from Scenario Alt4-H1 to the NAA scenario, which incorporates SLR.

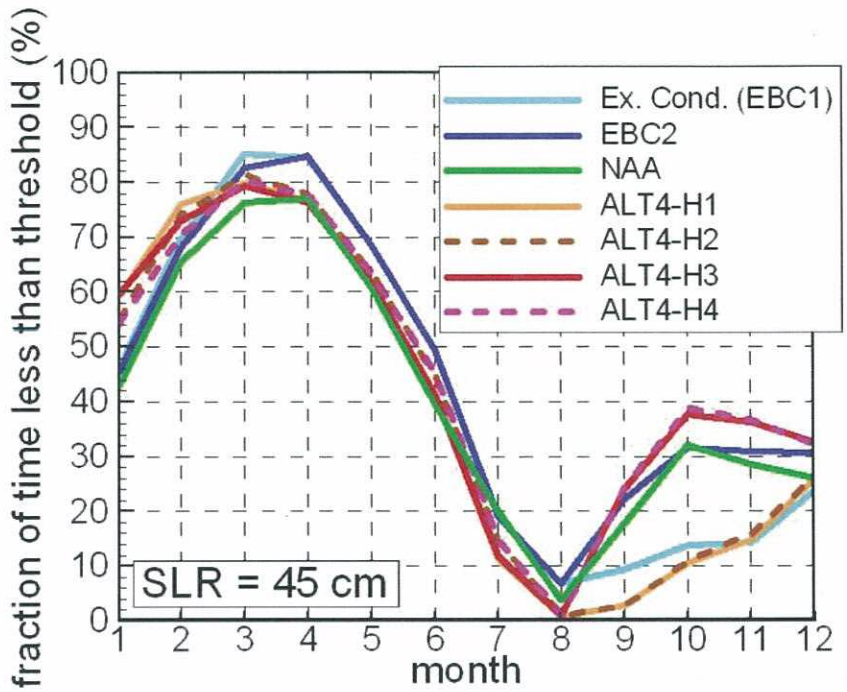

Figure 2. Percent of time water at Antioch's intake can be used for supply (i.e., when the simulated salinity is less than usable threshold at Antioch) by month as computed from DSM2 model results for the simulation period 1975-1991. SLR is zero for Ex. Cond. (EBC1) and EBC2, and 45 cm for all other simulations. Note that Fall X2 provisions are included in EBC2, NAA, Alt4-H3, and Alt4-H4.

Table 3. Decrease in usability at Antioch during the fall months simulated to occur as a result of implementation of the BDCP project (Scenario Alt4-H1)

Month	# of Usable Days/Year Under NAA	# of Usable Days/Year Under Alt4 (Operational Scenario H1)	Usable Days Lost/Year[1]	Percent Decrease[1]
September	5.3	0.8	4.5	85%
October	9.9	3.3	6.6	67%
November	8.5	4.4	4.1	48%
Sept-Nov	23.8	8.5	15.3	64%

[1]Results reflect changes resulting from BDCP project only, and not changes due to SLR. That is, BDCP project simulations with SLR = 45 cm were compared with NAA simulation, which also includes SLR = 45 cm.

Breaking the results down by year type (instead of presenting results in aggregated fashion) reveals that usability is almost completely lost during fall months of all year types except wet years. Also, the predicted salinity impacts, as expressed in terms of the number of days lost, are greatest during dry and wet years. These results are presented graphically in **Figure 3** and numerically in **Table 4**.

Figure 3 shows that usability under scenarios Alt4-H1 and Alt4-H2 during September through November is always less than 10%, and generally less than 5%, for all year types except for wet years. The number of usable days during the September-November simulation period (excluding wet years) ranges from 0.3 to 3 under Scenario Alt4-H1.

Figure 3 shows that the number of usable days during the fall months decreases significantly under Scenario Alt4-H1 compared the NAA, especially in dry and wet years. During dry and wet years, simulated usability decreases by 23 and 22.7 days in the fall, respectively. The largest percent decrease in usability occurs in critical and dry years, when usability decreases by 97% and 93%, respectively. These model results indicate that, in wet and dry year types, the City of Antioch would need to find alternative water supplies (because water at its intake would be unusable) for an additional 23 days in the fall months of each year, likely at significant cost.

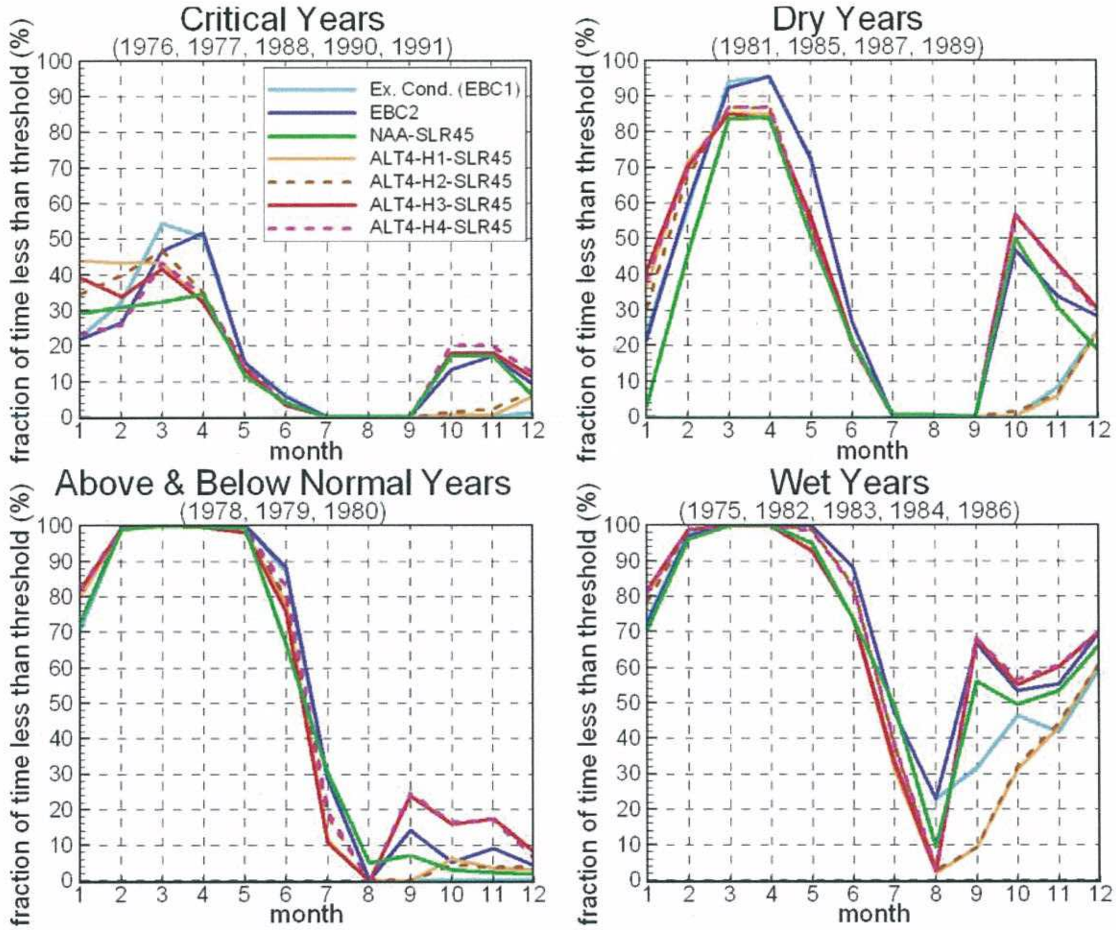

Figure 3. Percent of time water at Antioch's intake can be used for supply (i.e., when the simulated salinity is less than usable threshold at Antioch) by month and by year type as computed from DSM2 model results. SLR is zero for Ex. Cond. (EBC1) and EBC2, and 45 cm for all other simulations.

Table 4. Decrease in usability at Antioch in the Fall (September – November) predicted to occur as a result of the BDCP project scenario Alt4-H1 by year type

Year Type	# of Usable Days/Year Under NAA	# of Usable Days/Year Under Alt4 (Operational Scenario H1)	Usable Days Lost/Year[1]	Percent Decrease[1]
All Years	23.8	8.5	15.3	64%
Critical Years	10.6	0.3	10.3	97%
Dry Years	24.8	1.8	23.0	93%
Above & Below Normal Years	3.8	3.0	0.8	23%
Wet Years	48.1	25.4	22.7	47%

[1]Results reflect changes resulting from BDCP project only, and not changes due to SLR. That is, BDCP project simulations with SLR = 45 cm were compared with NAA simulation, which also has SLR = 45 cm.

Finally, the model results were used to compute the number of days of usable water over the entire simulation period, as an annual average. As **Table 5** indicates, model results show that the BDCP Proposed Project is simulated to cause a significant decrease in annual usability – 9.2 days per year – over all years. The loss is most significant during wet years, when more than 28 days of usability are lost; the highest percent decrease also occurs during wet years.

Table 5. Annual usability at Antioch under EBC2, No Action Alternative, and BDCP project scenario Alt4-H1 by year type

Year Type	# of Usable Days/Year Under NAA	# of Usable Days/Year Under Alt4 (Operational Scenario H1)	Usable Days Lost	Percent Decrease
All Years	148.5	139.3	9.2	6%
Critical Years	55.6	56.4	-0.8	-1%
Dry Years	117.9	115.6	2.2	2%
Above & Below Normal Years	177.7	175.0	2.7	2%
Wet Years	248.5	219.7	28.8	12%

[1]Results reflect changes resulting from BDCP project only, and not changes due to SLR. That is, BDCP project simulations with SLR = 45 cm were compared with NAA simulation, which also has SLR = 45 cm.

Attachment C

Review by the Delta Independent Science Board of the Bay Delta Conservation Plan/California WaterFix Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement

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Delta Independent Science Board

September 30, 2015

To: Randy Fiorini, Chair, Delta Stewardship Council
Charlton Bonham, Director, California Department of Fish and Wildlife

From: Delta Independent Science Board

Subject: Review of environmental documents for California WaterFix

We have reviewed the partially Recirculated Draft Environmental Impact Report/ Supplemental Draft Environmental Impact Statement for the Bay Delta Conservation Plan/California WaterFix (herein, "the Current Draft"). We focused on how fully and effectively it considers and communicates the scientific foundations for assessing the environmental impacts of water conveyance alternatives. The review is attached and is summarized below.

The Current Draft contains a wealth of information but lacks completeness and clarity in applying science to far-reaching policy decisions. It defers essential material to the Final EIR/EIS and retains a number of deficiencies from the Bay Delta Conservation Plan Draft EIR/EIS. The missing content includes:

1. Details about the adaptive-management process, collaborative science, monitoring, and the resources that these efforts will require;
2. Due regard for several aspects of habitat restoration: landscape scale, timing, long-term monitoring, and the strategy of avoiding damage to existing wetlands;
3. Analyses of how levee failures would affect water operations and how the implemented project would affect the economics of levee maintenance;
4. Sufficient attention to linkages among species, landscapes, and management actions; effects of climate change on water resources; effects of the proposed project on San Joaquin Valley agriculture; and uncertainties and their consequences;
5. Informative summaries, in words, tables, and graphs, that compare the proposed alternatives and their principal environmental and economic impacts.

The effects of California WaterFix extend beyond water conveyance to habitat restoration and levee maintenance. These interdependent issues of statewide importance warrant an environmental impact assessment that is more complete, comprehensive, and comprehensible than the Current Draft.

Review by the Delta Independent Science Board of the

Bay Delta Conservation Plan/California WaterFix Partially Recirculated Draft Environmental Impact Report/ Supplemental Draft Environmental Impact Statement

September 30, 2015

Contents

EXPECTATIONS FOR IMPACT ASSESSMENT OF CALIFORNIA WATERFIX

The Sacramento – San Joaquin Delta presents interconnected issues of water, biological resources, habitat, and levees. Dealing with any one of these problem areas is most usefully considered in light of how it may affect and be affected by the others. The effects of any actions further interact with climate change, sea-level rise, and a host of social, political, and economic factors. The consequences are of statewide importance.

These circumstances demand that the California WaterFix EIR/EIS go beyond legal compliance. This EIR/EIS is more than just one of many required reports. Its paramount importance is illustrated by the legal mandate that singles it out as the BDCP document we must review.

It follows that the WaterFix EIR/EIS requires extraordinary completeness and clarity. This EIR/EIS must be uncommonly complete in assessing important environmental impacts, even if that means going beyond what is legally required or considering what some may deem speculative (below, p. 4). Further, the WaterFix EIR/EIS must be exceptionally clear about the scientific and comparative aspects of both environmental impacts and project performance (p. 9).

These reasonable expectations go largely unmet in the Bay Delta Conservation Plan/California WaterFix Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement Draft (herein, "the Current Draft"). We do not attempt to determine whether this report fulfills the letter of the law. But we find the Current Draft sufficiently incomplete and opaque to deter its evaluation and use by decision-makers, resource managers, scientists, and the broader public.

BACKGROUND OF THIS REVIEW

The Delta Reform Act of 2009, in §85320(c), directs the Delta Independent Science Board (Delta ISB) to review the environmental impact report of the Bay Delta Conservation Plan (BDCP) and to provide the review to the Delta Stewardship Council and the California Department of Fish and Wildlife. On May 14, 2014, we submitted our review of the BDCP's Draft Environmental Impact Report/Draft Environmental Impact Statement (herein, the "Previous Draft"), which had been posted for review on December 9, 2013. This review[1] contained three main parts: an extended summary, detailed responses to charge questions from the Delta Stewardship Council, and reviews of individual chapters. Although the Previous Draft considered vast amounts of scientific information and analyses to assess the myriad potential environmental impacts of the many proposed BDCP actions, we concluded that the science in the Previous Draft had significant gaps, given the scope and importance of the BDCP.

The proposed BDCP actions have now been partitioned into two separate efforts: water conveyance under California WaterFix[2] and habitat restoration under California EcoRestore[3]. Environmental documents in support of California WaterFix (the Current Draft) were made available for a 120-day comment period that began July 10, 2015. The Current Draft focuses on three new alternatives for conveying Sacramento River water through the Sacramento – San

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[1] http://deltacouncil.ca.gov/sites/default/files/documents/files/Attachment-1-Final-BDCP-comments.pdf
[2] http://www.californiawaterfix.com/
[3] http://resources.ca.gov/ecorestore/

Joaquin Delta. One of them, Alternative 4A, is the preferred alternative, identified as California WaterFix.

The Delta Stewardship Council asked us to review the Current Draft and to provide our comments by the end of September 2015. We are doing so through this report and its summary, which can be found in the cover letter.

The review began in July 2015 with a preliminary briefing from Laura King-Moon of California Department of Water Resources (three Delta ISB members present). The Delta ISB next considered the Current Draft in a public meeting on August 13–14 (nine of the ten members present)[4]. The meeting included a briefing on California EcoRestore by David Okita of California Natural Resources Agency and a discussion of the Current Draft and California WaterFix with Cassandra Enos-Nobriga of California Department of Water Resources (DWR) and Steve Centerwall of ICF International.

The initial public draft of this review was based on our study of Sections 1-4 of the Current Draft and on checks of most resource chapters in its Appendix A. This public draft was the subject of a September 16 meeting that included further discussions with Cassandra Enos-Nobriga[5] and comments from Dan Ray of the Delta Stewardship Council staff. Additional comments on that initial draft were provided by DWR in a September 21 letter to the Delta ISB chair[6]. These discussions and comments helped clarify several issues, particularly on expectations of a WaterFix EIR/EIS.

This final version of the review begins with a summary in the cover letter. The body of the report continues first with a section on our understanding of major differences between the BDCP and California WaterFix. Next, after noting examples of improvement in the Current Draft, we describe our main concerns about the current impact assessments. These overlap with main concerns about the Previous Draft, which we revisit to consider how they are addressed in the Current Draft. Finally, we offer specific comments on several major Sections and Chapters.

DIFFERENCES BETWEEN THE BDCP AND CALIFORNIA WATERFIX

The project proposed in the Current Draft differs in significant respects from what was proposed as the BDCP in December 2013. Here we briefly state our understanding of some main differences and comment on their roles on this review:

- The time period for permitting incidental take under Section 7 of the federal Endangered Species Act (ESA) and Section 2081(b) of the California Endangered Species Act (CESA) is substantially less than the 50 years envisioned as part of a Habitat Conservation Plan (HCP) and Natural Community Conservation Plan (NCCP) in BDCP. As a result, the science associated with many impacts of climate change and sea-level rise may seem less relevant. The permitting period for the project proposed in the Current Draft remains in place unless environmental baseline conditions change substantially or other permit requirements are not met. Consequently, long-term effects of the proposed project remain important in terms of operations and expected benefits (p. 8).

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[4] http://deltacouncil.ca.gov/docs/delta-isb-meeting-notice-meeting-notice-delta-isb/delta-independent-science-board-isb-august-13

[5] Written version at https://s3.amazonaws.com/californiawater/pdfs/63qnf_Delta_ISB_draft_statement_-_Enos_-_FINAL.pdf

[6] http://deltacouncil.ca.gov/docs/response-letter-dwr

- In this shortened time frame, responsibility for assessing WaterFix's effects on fish and wildlife would fall to resource agencies (National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Wildlife). Other impacts would be regulated by a variety of federal and state agencies (Current Draft Section 1).
- The proposed habitat restorations have been scaled back. The Current Draft incorporates elements of 11 Conservation Measures from BDCP to mitigate impacts of construction and operations. Most habitat restoration included in the Previous Draft has been shifted to California EcoRestore. Our review of the Previous Draft contained many comments on the timing of restoration, species interactions, ecological linkages of conservation areas, locations of restoration areas and the science supporting the efficiency and uncertainty of effective restoration. Some of these comments apply less to the Current Draft because of its narrower focus on water conveyance.
- There remains an expected reliance on cooperative science and adaptive management during and after construction.
- It is our understanding that the Current Draft was prepared under rules that disallow scientific methods beyond those used in the Previous Draft. The rules do allow new analyses, however. For example, we noticed evidence of further analyses of contaminants, application of existing methods (e.g. particle tracking) to additional species (e.g., some of the non-covered species), and occasional selection of one model in place of the combined results of two models (e.g., fish life cycle models SALMOD and SacEFT).

IMPROVEMENTS ON THE PREVIOUS DRAFT

A proposed revamping of water conveyance through the Sacramento-San Joaquin Delta involves a multitude of diverse impacts within and outside of the Delta. Unavoidably, the EIR/EIS for such a project will be complex and voluminous, and preparing it becomes a daunting task in its own right. The inherent challenges include highlighting, in a revised EIR/EIS, the most important of the changes.

The new Sections 1 through 4 go a long way toward meeting some of these challenges. Section 1 spells out the regulatory context by discussing laws and agencies that establish the context for the Current Draft. Section 2 summarizes how the Previous Draft was revised in response to project changes and public input. Section 3 describes how the preferred alternative in the Previous Draft (Alternative 4) has been changed. Section 4 presents an impressive amount of detailed information in assessing the sources of habitat loss for various species and discussing how restoration and protection can mitigate those losses. Generally comprehensive lists of "Resource Restoration and Performance Principles" are given for the biological resources that might be affected by construction or operations. For example, page 4.3.8-140 clearly describes a series of measures to be undertaken to minimize the take of sandhill cranes by transmission lines (although the effectiveness of these measures is yet to be determined).

Section 4 also contains improvements on collaborative science (4.1.2.4, mostly reiterated in ES.4.2). This part of the Current Draft draws on recent progress toward collaborative efforts in monitoring and synthesis in support of adaptive management in the Delta. The text identifies the main entities to be involved in an expected memorandum of agreement on a monitoring and adaptive-management program in support of the proposed project.

Appendix A describes revisions to the resource chapters of the Previous Draft. Track-changed versions of the chapters simplify the review process, although this was not done for the key chapter on aquatic resources (p. 17). We noticed enhanced analyses of contaminants and application of methods such as particle tracking to additional species, including some of the non-covered taxa; a detailed treatment of *Microcystis* blooms and toxicity; more information about disinfection byproducts; improved discussion of vector control arising from construction and operational activities; and revised depiction of surficial geology. Potential exposure of biota to selenium and methylmercury is now considered in greater detail. Evaluations will be conducted for restoration sites on a site-specific basis; if high levels of contaminants cannot otherwise be addressed, alternative restoration sites will be considered (page 4.3.8-118). Incidentally, this is a good example of adaptive management, although it is not highlighted as such. Explanations were provided for why the nitrogen-to-phosphorus ratio was not specifically evaluated, why dissolved vs. total phosphorus was used in the assessment, and how upgrades to the Sacramento Regional Wastewater Treatment Plant would eventually affect phosphorus concentrations.

CURRENT CONCERNS

These and other strengths of the Current Draft are outweighed by several overarching weaknesses: overall incompleteness through deferral of content to the Final EIR/EIS (herein, "the Final Report"); specific incompleteness in treatment of adaptive management, habitat restoration, levees, and long-term effects; and inadequacies in presentation. Some of these concerns overlap with ones we raised in reviewing the Previous Draft (revisited below, beginning on p. 10).

Missing content

The Current Draft lacks key information, analyses, summaries, and comparisons. The missing content is needed for evaluation of the science that underpins the proposed project. Accordingly, the Current Draft fails to adequately inform weighty decisions about public policy. The missing content includes:

1. Details on adaptive management and collaborative science (below, p. 5).
2. Modeling how levee failures would affect operation of dual-conveyance systems (below, p. 7). Steve Centerwall told us on August 14 that modeling of the effects of levee failure would be presented in the Final Report.
3. Analysis of whether operation of the proposed conveyance would alter the economics of levee maintenance (below, p. 7).
4. Analyses of the effects of climate change on expected water exports from the Delta. “[A]n explanation and analysis describing potential scenarios for future SWP/CVP system operations and uncertainties [related to climate change] will be provided in the Final Report” (p. 1-35 of the Current Draft).
5. Potential impacts of climate change on system operations, even during the shortened time period emphasized in the Current Draft (below, p. 8 and 11).
6. Potential effects of changes in operations of the State Water Project (SWP) and Central Valley Project (CVP), or other changes in water availability, on agricultural practices in the San Joaquin Valley (p. 12).
7. Concise summaries integrated with informative graphics (below, p. 9 and 13). The Current Draft states that comparisons of alternatives will be summarized in the Final Report (p. 1-35).

While some of the missing content has been deferred to the Final Report (examples 2, 4, and 7), other gaps have been rationalized by deeming impacts “too speculative” for assessment.

CEQA guidance directs agencies to avoid speculation in preparing an EIR/EIS[7] . To speculate, however, is to have so little knowledge that a finding must be based on conjecture or guesswork. Ignorance to this degree does not apply to potential impacts of WaterFix on levee maintenance (example 3; see p. 7) or on San Joaquin Valley agriculture (example 6; p. 12).

Even if content now lacking would go beyond what is legally required for an EIR/EIS, providing such content could assist scientists, decision-makers, and the public in evaluating California WaterFix and Delta problems of statewide importance (above, p. 1).

Adaptive management

The guidelines for an EIR/EIS do not specifically call for an adaptive-management plan (or even for adaptive management). However, if the project is to be consistent with the Delta Plan (as legally mandated), adaptive management should be part of the design.

The Current Draft relies on adaptive management to address uncertainties in the proposed project, especially in relation to water operations. The development of the Current Draft from the Previous Draft is itself an exercise in adaptive management, using new information to revise a project during the planning stage. Yet adaptive management continues to be considered largely in terms of how it is to be organized (i.e., coordinated with other existing or proposed adaptive-management collaborations) rather than how it is to be done (i.e., the process of adaptive management). Adaptive management should be integral with planned actions and management—the Plan A rather than a Plan B to be added later if conditions warrant. The lack of a substantive treatment of adaptive management in the Current Draft indicates that it is not considered a high priority or the proposers have been unable to develop a substantive idea of how adaptive management would work for the project.

There is a very general and brief mention of the steps in the adaptive management process in Section 4 (p. 4.1-6 to 4.1-7), but nothing more about the process. We were not looking here for a primer on adaptive management. Rather, we expected to find serious consideration of barriers and constraints that have impeded implementation of adaptive management in the Delta and elsewhere (which are detailed in the Delta Plan), along with lessons learned on how adaptive management can be conducted overcome these problems.

The Current Draft contains general statements on how collaborative science and adaptive management under California WaterFix would be linked with the Delta Collaborative Science and Adaptive Management Program (CSAMP) and the Collaborative Adaptive Management Team (CAMT). These efforts, however, have taken place in the context of regulations and permits, such as biological opinions and biological assessments required under the Endangered Species Act. We did not find examples of how adaptive management would be applied to assessing—and finding ways to reduce—the environmental impacts of project construction and operations.

Project construction, mitigation, and operations provide many opportunities for adaptive management, both for the benefit of the project as well as for other Delta habitat and ecosystem initiatives, such as EcoRestore. To be effective in addressing unexpected outcomes and the need for mid-course corrections, an adaptive-management management team should evaluate a broad range of actions and their consequences from the beginning, as plans are being developed, to facilitate the early implementation and effectiveness of mitigation activities.

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[7] https://s3.amazonaws.com/californiawater/pdfs/bo0lx_Delta_ISB_Draft_Statement_&_Response_Letter_-_Enos_-_FINAL.pdf

The Current Draft defers details on how adaptive management will be made to work: "An adaptive management and monitoring program will be implemented to develop additional scientific information during the course of project construction and operations to inform and improve conveyance facility operational limits and criteria" (p. ES-17). This is too late. If adaptive management and monitoring are central to California WaterFix, then details of how they will be done and resourced should be developed at the outset (now) so they can be better reviewed, improved, and integrated into related Delta activities. The details could include setting species-specific thresholds and timelines for action, creating a Delta Adaptive Management Team, and capitalizing on unplanned experiments such as the current drought[8]. Illustrative examples could use specific scenarios with target thresholds, decision points, and alternatives. The missing details also include commitments and funding needed for science-based adaptive management and restoration to be developed and, more importantly, to be effective.

The protracted development of the BDCP and its successors has provided ample time for an adaptive-management plan to be fleshed out. The Current Draft does little more than promise that collaborations will occur and that adaptive management will be implemented. This level of assurance contrasts with the central role of adaptive management in the Delta Plan and with the need to manage adaptively as climate continues to change and new contingencies arise.

Restoration as mitigation

Restoration projects should not be planned and implemented as single, stand-alone projects but must be considered in a broader, landscape context. We highlighted the landscape scale in our review of the Previous Draft and also in an earlier review of habitat restoration in the Delta[9]. A landscape approach applies not just to projects that are part of EcoRestore, but also to projects envisioned as mitigation in the Current Draft, even though the amount of habitat restoration included (as mitigation) in the Current Draft has been greatly reduced. On August 13 and 14, representatives of WaterFix and EcoRestore acknowledged the importance of the landscape scale, but the Current Draft gives it little attention. Simply because the CEQA and NEPA guidelines do not specifically call for landscape-level analyses is not a sufficient reason to ignore them.

Wetland restoration is presented as a key element of mitigation of significant impacts (example below in comments on Chapter 12, which begin on p. 18). We noticed little attention to the sequence required for assessing potential impacts to wetlands: first, avoid wetland loss; second, if wetland loss cannot be avoided, minimize losses; and third, if avoidance or minimization of wetland loss is not feasible, compensate. Much of the emphasis in the Current Draft is on the third element. Sequencing apparently will be addressed as part of the permitting process with the US Army Corps of Engineers (USACE) for mitigation related to the discharge of dredged or fill material.[10] However, it is difficult to evaluate the impacts on wetlands in advance of a clarification of sequencing and criteria for feasibility.

Mitigation ratios

Restoring a former wetland or a highly degraded wetland is preferable to creating wetlands from uplands[11]. When an existing wetland is restored, however, there is no net gain of

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[8] http://deltacouncil.ca.gov/docs/adaptive-management-report-v-8
[9] http://deltacouncil.ca.gov/sites/default/files/documents/files/HABITAT%20RESTORATION%20REVIEW%20FINAL.pdf
[10] Letter from Cassandra Enos-Nobriga, DWR, September 21, 2015.
[11] http://www.nap.edu/openbook.php?isbn=0309074320

area, so it is unclear whether credits for improving existing wetlands would be considered equivalent to creating wetlands where they did not recently exist.

In view of inevitable shortcomings and time delays in wetland restorations, mitigation ratios should exceed 1:1 for enhancement of existing wetlands. The ratios should be presented, rather than making vague commitments such as "restore or create 37 acres of tidal wetland…." The Final Draft also needs to clarify how much of the wetland restoration is out-of-kind and how much is in-kind replacement of losses. It should examine whether enough tidal area exists of similar tidal amplitude for in-kind replacement of tidal wetlands, and whether such areas will exist with future sea-level rise. We agree that out-of-kind mitigation can be preferable to in-kind when the trade-offs are known and quantified and mitigation is conducted within a watershed context, as described in USACE's 2010 guidance for compensatory wetland mitigation.[12] Since then, many science-based approaches have been developed to aid decision-making at watershed scales, including the 2014 Watershed Approach Handbook produced by the Environmental Law Institute and The Nature Conservancy[13].

Restoration timing and funding

To reduce uncertainty about outcomes, allow for beneficial and economical adaptive management, and allow investigators to clarify benefits before the full impacts occur, mitigation actions should be initiated as early as possible. Mitigation banks are mentioned, but are any operational or planned for operation soon? The potential for landowners to develop mitigation banks could be encouraged so restoration could begin immediately, engendering better use of local knowledge, financial profit, and local support for the project. We are told that the timing of mitigation will be coordinated with other review processes that are currently ongoing.[6]

Levees

A comprehensive assessment of environmental impacts should relate California WaterFix to levee failure by examining the consequences each may have for the other. The interplay between conveyance and levees is receiving additional attention through the Delta Levee Investment Strategy.

On the one hand, the Current Draft fails to consider how levee failures would affect the short-term and long-term water operations spelled out in Table 4.1-2. A rough estimate was proposed under the Delta Risk Management Study[14] and another is part of a cost-benefit analysis for the BDCP[15]. The Final Report should provide analyses that incorporate these estimates.

On the other hand, the Current Draft also fails to consider how implementing the project would affect the basis for setting the State's priorities in supporting Delta levee maintenance. This potential impact is illustrated by a recent scoring system of levee-project proposals that awards points for expected benefits to "export water supply reliability"[16]. Further efforts to quantify these benefits have been recommended as part of a comprehensive risk assessment that

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[12] http://www.sac.usace.army.mil/Portals/43/docs/regulatory/Guidelines_for_Preparing_a_Compensatory_Mitigation_Planf.pdf
[13] https://www.eli.org/sites/default/files/eli-pubs/watershed-approach-handbook-improving-outcomes-and-increasing-benefits-associated-wetland-and-stream_0.pdf
[14] http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/docs/Delta_Seismic_Risk_Report.pdf
[15] http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Draft_BDCP_Statewide_Economic_Impact_Report_8513.sflb.ashx
[16] http://www.water.ca.gov/floodsafe/fessro/docs/special_PSP14_final.pdf

would guide the Delta Levees Investment Strategy[17]. Public safety, a focus of the Delta Flood Emergency Management Plan,[18] is just one asset that levees protect. The Current Draft does not evaluate how the proposed project may affect estimates of the assets that the levees protect.

The Current Draft cites levee fragility mainly as a reason to build isolated conveyance for Sacramento River water (examples, p. 1-1, 1-7, 1-9). In a similar vein, the California WaterFix website states, "Aging dirt levees are all that protect most of California's water supplies from the affects [*sic*] of climate change. Rising sea levels, intense storms, and floods could all cause these levees to fail, which would contaminate our fresh water with salt, and disrupt water service to 25 million Californians"[19]. Neither the Previous Draft nor the Current Draft, however, provides a resource chapter about Delta levees. Such a chapter would be an excellent place to examine interacting impacts of conveyance and levees.

Long-term effects

With the shortened time period, several potential long-term impacts of or on the proposed project no longer receive attention. While these effects may not become problematic during the initial permit period, many are likely to affect project operations and their capacity to deliver benefits over the long operational life of the proposed conveyance facilities. In our view, consideration of these long-term effects should be part of the evaluation of the science foundation of the proposed project.

The No-Action alternative establishes the baseline for evaluating impacts and benefits of the proposed alternative(s). It is therefore important to consider carefully how the baseline is established, as this can determine whether particular consequences of the alternatives have costs or benefits. Climate change, for example, is considered under the No-Action alternative in the Current Draft, as is sea-level rise. Climate change is expected to reduce water availability for the proposed northern intakes, and both climate change and sea-level rise are expected to influence tidal energy and salinity intrusion within the Delta[20]. Changes in water temperature may influence the condition of fishes that are highly temperature-dependent in the current analyses. These environmental effects, in turn, are likely to influence environmental management and regulation; from the standpoint of water quality they may even yield environmental benefits if agricultural acreage decreases and agricultural impacts are reduced.

Rather than consider such effects, however, the Current Draft focuses on how the proposed project would affect "the Delta's resiliency and adaptability to expected climate change" (Current Draft section 4.3.25). Quite apart from the fact that "resiliency" and "adaptability" are scarcely operational terms, the failure to consider how climate change and sea-level rise could affect the outcomes of the proposed project is a concern that carries over from our 2014 review and is accentuated by the current drought (below, p. 11).

The Current Draft states that "Groundwater resources are not anticipated to be substantially affected in the Delta Region under the No Action Alternative (ELT) because surface water inflows to this area are sufficient to satisfy most of the agricultural, industrial, and municipal water supply needs" (p. 4.2-16). This conclusion is built on questionable assumptions; the current drought illustrates how agriculture turns to groundwater when surface-water availability diminishes. Groundwater regulation under the recently enacted Sustainable

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[17] http://deltacouncil.ca.gov/docs/delta-levee-investment-strategy/dlis-peer-review-technical-memorandum-31

[18] http://www.water.ca.gov/floodmgmt/hafoo/fob/dreprrp/InterdepartmentalDraftDFEMP-2014.pdf.

[19] http://www.californiawaterfix.com/problem

[20] http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0024465

Groundwater Management Act (SGMA) can also be expected to have long-term effects on the proposed project—effects that the Current Draft does not assess. Ending of more than a million acre-feet of overdraft in the southern Central Valley under the SGMA is likely to increase demand for water exports from the Delta in the coming decades. The Current Draft discusses the potential effects of the project on groundwater (for example, in Sections 4.3.3 and 5.2.2.3), but we found only two brief, descriptive mentions of SGMA in the 235 pages of Section 5. The implications of prolonged droughts (e.g., on levee integrity) and of the consequences of SGMA receive too little attention in the Current Draft.

The Current Draft suggests that unnamed “other programs” that are “separate from the proposed project” will use elements of the Previous Draft to implement long-term conservation efforts that are not part of California WaterFix (Current Draft, p. 1-3). The Final Report should provide assurances that such other programs will step in, and could go further in considering their long-term prospects.

Informative summaries and comparisons

According to guidance for project proponents, “Environmental impact statements shall be written in plain language and may use appropriate graphics so that decision-makers and the public can readily understand them" (Code of Federal Regulations, 40 CFR 1502.8). Far-reaching decisions should not hinge on environmental documents that few can grasp.

This guidance applies all the more to an EIR/EIS of the scope, complexity, and importance of the Current Draft. It demands excellent comparative descriptions of alternatives that are supported by readable tables and high-quality graphics, enumeration of major points, well-organized appendices, and integration of main figures with the text. For policy deliberations, the presentation of alternatives should include explicit comparisons of water supply deliveries and reliabilities as well as economic performance. For decision-makers, scientists, and the public, summaries of impacts should state underlying assumptions clearly and highlight major uncertainties. The Current Draft is inadequate in these regards.

The Previous Draft provided text-only summaries for just the two longest of its resource chapters (Chapters 11 and 12). A fragmentary comparison of alternatives was buried in a chapter on "Other CEQA/NEPA required sections" (part 3 of Chapter 31) but fell far short of what was needed. Both the Previous and Current Drafts have been accompanied by a variety of outreach products for broad audiences (e.g., the descriptive overview of the BDCP Draft EIR/EIS[21]). These products do little to compensate for the overall paucity of readable summaries and comparisons in the Previous and Current Drafts.

For over three years, the Delta ISB has been specifically requesting summaries and comparisons: first in June 2012[22], then in June 2013[23], and again in a review of the Previous Draft in May 2014 (footnote 1, p. 1). Appallingly, such summaries and comparisons remain absent in the Current Draft. The generally clear writing in Sections 1 through 4 shows that the preparers are capable of providing the requested summaries and comparisons. Prescriptions in CEQA and NEPA in no way exclude cogent summaries, clear comparisons, or informative graphics. And three years is more than enough time to have developed them.

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[21] Highlights+of+the+Draft+EIS-EIR+12-9-13.pdf
[22] http://deltacouncil.ca.gov/sites/default/files/documents/files/DISB_Letter_to_JMeral_and_DHoffman-Floerke_061212.pdf
[23] http://deltacouncil.ca.gov/sites/default/files/documents/files /DISB%20Comments%20on%20Draft%20BDCP%20Document.doc_.pdf

On August 14, 2015, representatives of California WaterFix assured us that this kind of content would eventually appear, but only in the Final Report. That will be far too late in the EIR/EIS process for content so critical to comprehending what is being proposed and its potential impacts.

PRIOR CONCERNS AND THEIR RELEVANCE TO THE CURRENT DRAFT

The Delta ISB review of May 14, 2014 emphasized eight broad areas of concern about the scientific basis for the Previous Draft. Each is summarized below, followed by a brief appraisal of how (or whether) the concern has been dealt with in the Current Draft. While the reduced scope of the proposed project has reduced the relevance of some issues, particularly habitat restoration and other conservation measures, other concerns persist.

Our persistent concerns include the treatment of uncertainty, the implementation of adaptive management, and the use of risk analysis. These topics receive little or no further attention in the Current Draft. We also found few revisions in response to points we raised previously about linkages among species, ecosystem components, or landscapes; the potential effects of climate change and sea-level rise; and the potential effects of changes in water availability on agricultural practices and the consequent effects on the Delta. Our previous comments about presentation also pertain.

Effectiveness of conservation actions

Our 2014 review found that many of the impact assessments hinged on optimistic expectations about the feasibility, effectiveness, or timing of the proposed conservation actions, especially habitat restoration.

This is arguably less of a concern now, given the substantially shorter time frame of the revised project and narrower range of conservation actions designed for compensatory restoration. Nonetheless, the Current Draft retains unwarranted optimism, as on page 4.3.25-10: “By reducing stressors on the Delta ecosystem through predator control at the north Delta intakes and Clifton Court Forebay and installation of a nonphysical fish barrier at Georgiana Slough, Alternative 4A will contribute to the health of the ecosystem and of individual species populations making them stronger and more resilient to the potential variability and extremes caused by climate change.” A scientific basis for this statement is lacking, and an adaptive or risk-based management framework is not offered for the likely event that such optimism is unfulfilled.

Is it feasible for even the reduced amounts of mitigation and restoration to be completed within the time period proposed? Perhaps yes. Is it feasible that these actions will mitigate impacts over the long term? This is more problematic. To be effective, mitigation actions should deal with both the immediate and long-term consequences of the project. The proposed permitting should allow for monitoring long enough to assess the effectiveness of habitat restoration measures, which will need to extend beyond the initial permitting period.

Uncertainty

The 2014 review found the BDCP encumbered by uncertainties that were considered inconsistently and incompletely. We commented previously that modeling was not used effectively enough in bracketing uncertainties or exploring how they may propagate or be addressed.

In the Current Draft, uncertainties and their consequences remain inadequately addressed, improvements notwithstanding. Uncertainties will now be dealt with by establishing "a robust program of collaborative science, monitoring, and adaptive management" (ES 4.2). No details about this program are provided, so there is no way to assess how (or whether) uncertainties will be dealt with effectively. Although sensitivity modeling was used to address the effects of changes in the footprint and other minor changes of the revised project, full model runs were not carried out to assess the overall effects of the specific changes. Consequently, modeling that would help to bracket ranges of uncertainties or (more importantly) assess propagation of uncertainties is still inadequate.

Many of our prior concerns about uncertainties pertained to impacts on fish. If those uncertainties have now been addressed in Chapter 11, they are difficult to evaluate because changes to that chapter have not been tracked in the public draft (below, p. 17).

There are also uncertainties with the data generated from model outputs, although values are often presented with no accompanying error estimates. This situation could be improved by presenting results from an ensemble of models and comparing the outputs.

Effects of climate change and sea-level rise on the proposed actions

Our 2014 review stated concerns that the Previous Draft underestimated effects of climate change and sea-level rise across the 50-year timeline of the BDCP. With the nominal duration shortened substantially, most of the projected impacts of climate change and sea-level rise may occur later. But climate-related issues remain.

First, the Current Draft is probably outdated in its information on climate change and sea-level rise. It relies on information used in modeling climate change and sea-level rise in the Previous Draft, in which the modeling was conducted several years before December 2013. The absence of the climate-change chapter (Chapter 29) in the Previous Draft from Appendix A in the Current Draft indicates that no changes were made. In fact, the approaches and assumptions in the Current Draft remained unchanged from the Previous Draft in order to ensure consistency and comparability across all the Alternatives, even though newer scientific information had become available.[6] Yet climatic extremes, in particular, are a topic of intense scientific study, illustrated by computer simulations of ecological futures[24] and findings about unprecedented drought[25]. The Current Draft does not demonstrate consideration of recently available climate science, and it defers to the Final Report analysis of future system operations under potential climate and sea-level conditions. In fact, the Current Draft generally neglects recent literature, suggesting a loose interpretation of "best available science."

Second, climate change and sea-level rise are now included in the No-Action Alternative, as they will transpire whether or not WaterFix moves forward. A changed future thus becomes the baseline against which Alternative 4A (and the others) are compared. Changes in outflow from the Delta due to seasonal effects of climate change and the need to meet fall X2 requirements are considered in Section 4.3.1. The difference in outcomes then depends on assumptions about the facility and operations of Alternative 4A and the other Alternatives. Sensitivity analyses indicate that the impacts of the different Alternatives are generally similar in comparison to the No Action Alternative under the range of climate projections considered.[6] Thus, "Delta exports would either remain similar or increase in wetter years and remain similar

[24] http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0024465
[25] Cook, B.I., Ault, T.R., and Smerdon, J.E., 2015, Unprecedented 21st century drought risk in the American Southwest and Central Plains: *Science Advances*, v. 1, doi:10.1126/sciadv.1400082.

or decrease in the drier years under Alternative 4A as compared to the conditions without the project." (p. 4.3.1-4). Such an inconclusive conclusion reinforces the need to be able to adapt to different outcomes. Simply because the Alternatives are expected to relate similarly to a No Action Alternative that includes climate change does not mean that the Alternatives will be unaffected by climate change.

Interactions among species, landscapes, and the proposed actions

The Previous Draft acknowledged the complexities produced by webs of interactions, but it focused on individual species, particular places, or specific actions that were considered in isolation from other species, places, or actions. Potential predator-prey interactions and competition among covered and non-covered fish species were not fully recognized. Confounding interactions that may enhance or undermine the effectiveness of proposed actions were overlooked. In our 2014 review we recommended describing and evaluating the potential consequences of such interactions, particularly in Chapters 11 (Fish and aquatic resources) and 12 (Terrestrial resources).

The Current Draft recognizes that mitigation measures for one species or community type may have negative impacts on other species or communities, and mitigation plans may be adjusted accordingly. But the trade-offs do not seem to be analyzed or synthesized. This emphasizes the need for a broader landscape or ecosystem approach that comprehensively integrates these conflicting effects.

Effects on San Francisco Bay, levees, and south-of-Delta environments

In 2014 we pointed to three kinds of impacts that the Previous Draft overlooked: (1) effects on San Pablo Bay and San Francisco Bay in relation to Delta tides, salinity, and migratory fish; (2) effects of levee failures on the proposed BDCP actions and effects of isolated conveyance on incentives for levee investments; and (3) effects of increased water reliability on crops planted, fertilizers and pesticides used, and the quality of agricultural runoff. The Current Draft responds in part to point 1 (in 11.3.2.7) while neglecting point 2 (above, p. 7) and point 3.

On point 3: Although the Current Draft considers how the project might affect groundwater levels south of the Delta (7.14 to 7.18), it continues to neglect the environmental effects of water use south of (or within) the Delta. Section 4.3.26.4 describes how increased water-supply reliability could lead to increased agricultural production, especially during dry years. Elsewhere, a benefit-cost analysis performed by ICF and the Battle Group[26] calculated the economic benefits of increased water deliveries to agriculture in the Delta. The Current Draft does not fully consider the consequences of these assumptions, or of the projections that the project may enhance water-supply reliability but may or may not increase water deliveries to agriculture (depending on a host of factors). We have been told that to consider such possibilities would be "too speculative" and that such speculations are explicitly discouraged in an EIR/EIS. Yet such consequences bear directly on the feasibility and effectiveness of the project, and sufficient information is available to bracket a range of potential effects. Our previous concerns are undiminished.

The impacts of water deliveries south of the Delta extend to the question of how each intake capacity (3,000, 9,000, or 15,000 cfs) may affect population growth in Southern

[26] Hecht, J., and Sunding, D., Draft Bay Delta Conservation Plan statewide economic impact report, August 2013.

California. Section 4.4.1-9 treats the growth-enabling effects of alternative 2D lightly, saying that additional EIS review would be needed for future developments.

Implementing adaptive management

In the Previous Draft, details about adaptive management were to be left to a future management team. In our 2014 review we asked about situations where adaptive management may be inappropriate or impossible to use, contingency plans in case things do not work as planned, and specific thresholds for action.

Although most ecological restoration actions have been shifted to California EcoRestore (p. 5), we retain these and other concerns about adaptive management under California WaterFix. If the mitigation measures for terrestrial resources are implemented as described, for example, they should compensate for habitat losses and disturbance effects of the project. The test will be whether the measures will be undertaken as planned, be as effective as hoped, and continue long enough to fully mitigate effects. This is where adaptive management and having contingency plans in place becomes critically important. It is not apparent that the mitigation plans include these components.

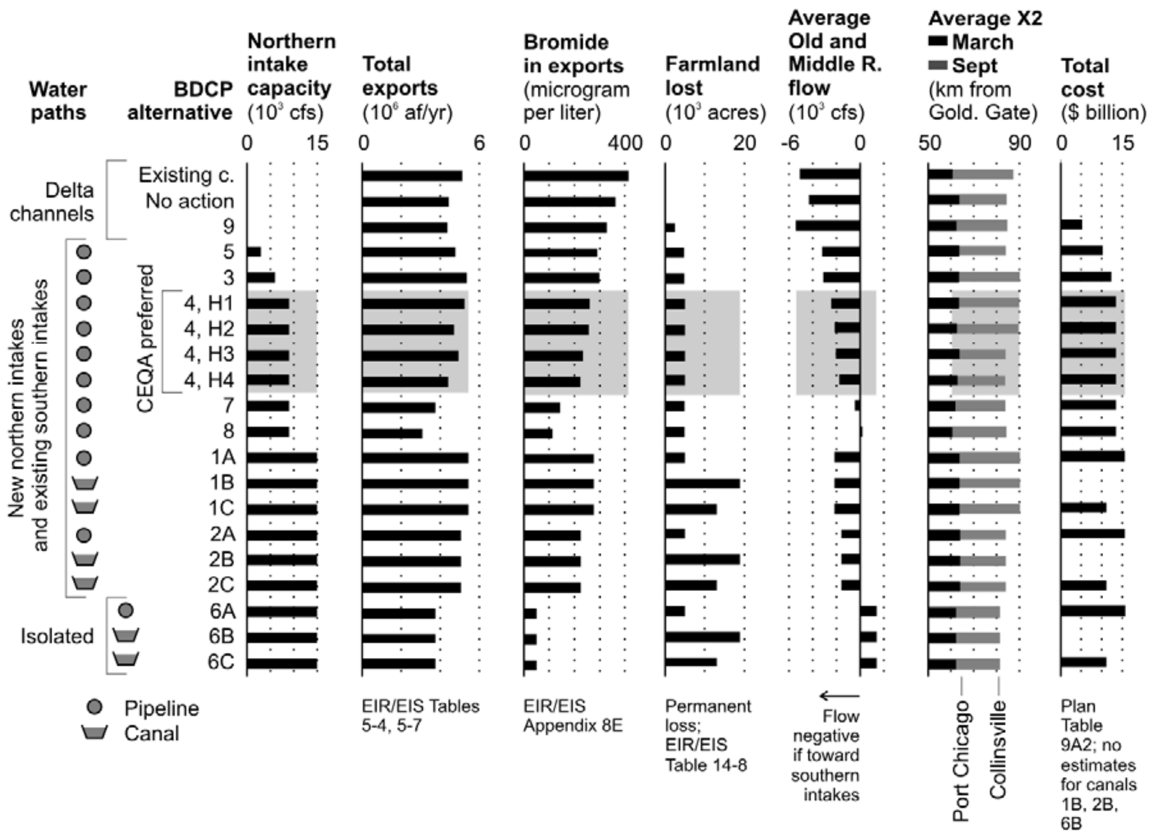
Reducing and managing risk

Our 2014 review advised using risk assessment and decision theory in evaluating the proposed BDCP actions and in preparing contingency plans. We noticed little improvement on this issue, just a mention that it might be considered later. This is not how the process should be used.

Comparing BDCP alternatives

The Previous Draft contained few examples of concise text and supporting graphics that compare alternatives and evaluate critical underlying assumptions. Rudimentary comparisons of alternatives were almost entirely absent. The Current Draft retains this fundamental inadequacy (p. 9).

Our 2014 review urged development and integration of graphics that offer informative summaries at a glance. We offered the example reproduced below. If the Current Draft contains such graphics, they would need to be ferreted out from long lists of individual pdf files. Because they are not integrated into the text where they are referenced in the Current Draft, the figures cannot readily illustrate key points.



COMMENTS ON INDIVIDUAL SECTIONS AND CHAPTERS

This final section of the review contains minimally edited comments on specific points or concerns. These comments are organized by Section or Chapter in the Current Draft. Many are indexed to pages in the section or chapter named in the heading.

Alternatives 4A, 2D, and 5A (Section 4)

It is good that the proposed alternatives are seen as flexible proposals, as it is difficult to imagine that any proposal for such a complex and evolving system could be implemented precisely as proposed. Some initial and ongoing modifications seem desirable, and unavoidable.

The operating guidance for the new alternatives seems isolated from the many other water management and environmental activities in and upstream of the Delta likely to be important for managing environmental and water supply resources related to Delta diversions. While it is difficult to specify detailed operations for such a complex system, more details on the governance of operations (such as the Real Time Operations process) would be useful. The operational details offered seem to have unrealistic and inflexible specificity. Presentations of delivery-reliability for different alternatives remain absent. Environmental regulations on Delta diversions have tended to change significantly and abruptly in recent decades, and seem likely to change in the future. How sensitive are project water supply and environmental performance to changes in operating criteria?

The collaborative science ideas seem philosophically attractive, but are not given much substance. Monitoring is mentioned, but details of organization, intent, and resources seem lacking. Adequate funding to support monitoring, collaborative science, and adaptive management is a chronic problem. Section ES.4.2 states that "Proponents of the collaborative science and monitoring program will agree to provide or seek additional funding when existing resources are insufficient." This suggests that these activities are lower in priority than they should be.

The three new alternatives, 4A, 2D, and 5A, seem to have modest changes over some previous alternatives, with the exception of not being accompanied by a more comprehensive environmental program. In terms of diversion capacities, they cover a wide range, 3,000 cfs (5A), 9,000 cfs (4A), and 15,000 cfs (2D). The tables comparing descriptions of the new alternatives to previous Alternative 4 are useful, but should be supplemented by a direct comparison of the three new alternatives.

The new Sustainable Groundwater Management Act (SGMA) seems likely to increase demands for water diversions from the Delta to the south to partially compensate for the roughly 1.5-2 maf/year that is currently supplied by groundwater overdraft.

The State seems embarked on a long-term reduction in urban water use, particularly outdoor irrigation. Such a reduction in urban water use is likely to have some modest effects on many of the water-demand and scarcity impacts discussed.

The climate change analysis of changes in Delta inflows and outflows is useful, but isolating the graphs in a separate document disembodies the discussion. The fragmentation of the document by removing each Section 4 figure into a separate file is inconvenient for all, and makes integrated reading practically impossible for many.

The details of the alternative analyses seem mostly relevant and potentially useful. Much can be learned about the system and the general magnitude of likely future outcomes from patient and prolonged reading of this text. An important idea that emerges from a reading of the No Action Alternative is that the Delta, and California water management, is likely to change in many ways with or without the proposed project. The No Action and other alternatives also illustrate the significant inter-connectedness of California's water system. The range of impacts considered is impressive, but poorly organized and summarized.

The discussion of disinfection by-product precursor effects in Delta waters is improved significantly, but could be made more quantitative in terms of economic and public-health impacts.

The discussion on electromagnetic fields is suitably brief, while the tsunami discussion could be condensed.

The effects of the likely listing of additional native fish species as threatened or endangered seems likely to have major effects on project and alternative performance. These seem prudent to discuss, and perhaps analyze.

Is Alternative 2D, with 15,000 cfs capacity, a serious alternative? Does it deserve any space at all?

Table 4.1-8 implies that tidal brackish/*Schoenoplectus* marsh. Should some of this be considered tidal freshwater marsh?

The dynamics of the Delta are largely determined by water flows. The Current Draft acknowledges that water flows and salinity will change in complex ways. There are statements about how inflows, outflows, and exports will change in Alternative 4A in relation to baseline (No-Action) conditions (p. 4.3.8-13). What is the scientific basis on which these changes will be managed? Will models be used? What confidence should we have in current projections? Have the effects of droughts or deluges been considered?

4.3.7-10, line 13: Text on disturbing sediments and releasing contaminants needs to add nitrogen and phosphorus to the concerns.

Water quality (Chapter 8)

8-3, line 13: *Microcystis* is singled out as a cyanobacterium that can (but doesn't always) produce the toxin, myrocystin; however, there are other cyanobacteria that sometimes produce other toxins. Different genera can differ in the nutrient that limits their blooms (see 2014 letter by Hans Paerl in Science 346(6406): 175-176). For example, *Microcystis* blooms can be triggered by N additions because this species lacks heterocysts, while toxin-producing *Anabaena* blooms can be triggered by P additions, because *Anabaena* has heterocysts and can fix N. The frequently repeated discussion of cyanobacteria blooms needs to be updated. Also cite Paerl on page 8-45 line 8. Ditto on page 8-103 and 8-106 line 34.

8-8. In our earlier comments, we recommended that carbon be separated into its dissolved and particulate forms for consideration of water quality impacts because dissolved organic carbon (DOC) is the form most likely to react with chloride and bromide and result in formation of disinfection by-products. The section on bromide focuses on interactions with total organic carbon (TOC), rather than DOC. Carbon is primarily considered with respect to formation of disinfection by-products but carbon plays a central role in the dynamics of the Delta, affecting processes such as metabolism, acidity, nutrient uptake, and bioavailability of toxic compounds. Carbon cycling determines ecosystem structure and function in aquatic systems. It also modifies the influence and consequences of other chemicals and processes in aquatic systems. Dissolved organic carbon (DOC), for example, influences light and temperature regimes by absorbing solar radiation, affects transport and bioavailability of metals, and controls pH in some freshwater systems. Respiration of organic carbon influences dissolved oxygen concentrations and pH.

8-18, line 12 says that salt disposal sites were to be added in 2014; were they?

8-19 and 8-20: "CECs" is not defined and seems to be used incorrectly. Change "CECs" to "EDCs" on page 8-19 and to "PPCPs" on page 8-20.

8-21, line 18-19: Such a statement should be qualified. The conclusion that marine waters are N-limited and inland waters are P-limited is outdated. Recent papers, including the above, find more complex patterns.

8-22, lines 18 and 30: Choose either "cyanobacteria" or "blue-green algae;" using both will confuse readers who may perceive them as different.

8-23, lines 15-16: Say how the N:P ratio changed composition, not just that it did change composition.

8-23 through 8-25: Uncertainties (e.g., standard deviation or standard error of the mean) associated with the mean concentrations of DOC should be presented. It is impossible to interpret differences between the values that are presented without knowledge of the variation around the mean values (e.g., without knowledge of variation around the mean, it is difficult to evaluate whether DOC concentrations at south vs. north-of-Delta stations and Banks headworks differ from one another; 3.9 to 4.2 mg/L vs. 4.3 mg/L).

8-65, line 12: Specify if DO is for daytime or night, and for surface, bottom or mid-water column.

8-75, line 6: The failure to consider dissolved P (DP) should be addressed; there is much greater uncertainty. The adherence of some P to sediment does not prevent considerable discharge of P as DP. Also on page 8-95 line 40, qualify predictions due to lack of consideration of DP.

8-82, line 4-5: It seems unlikely that current levels of *Microcystis* growth in the Delta are dependent on the exclusive uptake of ammonia. Temperature is one of the primary factors driving *Microcystis* blooms and global warming could promote bloom occurrence. Consider revising this section to, "Because it seems unlikely that current levels of *Microcystis* growth in the Delta are dependent on the exclusive uptake of ammonia, the frequency, magnitude and geographic extent of *Microcystis* under future scenarios is difficult to predict."

8-105, line 8: Would total nitrogen be dominated by nitrate just by increasing ammonia removal? Depending on redox and microbiota, why wouldn't nitrate be converted to ammonium?

A lot of attention is given to factors controlling *Microcystis* blooms in this chapter but little attention is given to its toxicity. Just as factors controlling blooms are not fully understood, the regulating factors of cellular toxin contents remain poorly understood. As a result, the impact of blooms on the environment can vary (e.g., large blooms of non-toxic or low toxin organisms may have impacts on environmental variables such as nutrient uptake and dissolved oxygen consumption while small blooms of highly toxic organisms could impact food webs) [see: Ma et al. (2015) Toxic and non-toxic strains of *Microcystis aeruginosa* induce temperature dependent allelopathy toward growth and photosynthesis of *Chlorella vulgaris*. Harmful Algae 48: 21–29].

Fish and aquatic resources (Chapter 11)

We found individual conclusions or new analyses difficult to identify in this key chapter because changes to it were not tracked in the public version of the Current Draft and there was no table of contents that could have assisted in side-by-side comparison with the Previous Draft.

Effects of temperature

We noticed more emphasis on temperature concerning the fish 'downstream' impacts (but without tracked changes this becomes difficult to document).

The main temperature variable used expresses the percentage of time when monthly mean temperatures exceed a certain rate or fall within a certain boundary. The biological impact, however, is difficult to assess with these numbers. If all of the change occurred just during operations or just during one day, the biological impact could be much different than a small change every day (provided by using means). Graphs of changes and listing of extreme highs and lows during a model run would have more biological meaning. Also, comparisons were made using current baseline conditions and did not consider climate change effects on temperatures.

Fish screens

It is unclear how (and how well) the fish screens would work. The description of fish screens indicates that fish >20 mm are excluded, but what about fish and larvae that are <20 mm, as well as eggs? Table 11-21 seems out of date, because some fish screens appear to have been installed, but data on their effects are not given. Despite the lack of specific data on how well screens function, the conclusion that there will be no significant impact is stated as certain (e.g., page 1-100 line 38).

Here, as in many other places, measures are assumed to function as planned, with no evidence to support the assumptions. The level of certainty seems optimistic, and it is unclear whether there are any contingency plans in case things don't work out as planned. This problem persists from the Previous Draft.

Invasive plants

Cleaning equipment is mentioned, but it is not specifically stated that large machinery must be cleaned before entering the Delta. Section 4.3.8-358 says equipment would be cleaned if being moved within the Delta. Cleaning is essential to reduce transfer of invasive species; a mitigating measure is to wash equipment, but it must also be enforced.

Weed control (fire, grazing) is suggested, but over what time frame? It may be needed in perpetuity. That has been our experience at what is considered the world's oldest restored prairie (the 80-yr-old Curtis Prairie, in Madison, WI).

Weed invasions can occur after construction is completed; how long will the project be responsible for weed control? 3-5 years won't suffice.

4.3.8-347. Herbicides are prescribed to keep shorebird nesting habitat free of vegetation, but toxic effects of herbicides on amphibians etc. are not considered.

4.3.8-354. Impacts of invasive plants seem underestimated. Impact analysis implies that the project disturbance area is the only concern, when dispersal into all areas will also be exacerbated. At the Arboretum, a 1200-ac area dedicated to restoration of pre-settlement vegetation, invasive plants are the main constraint. A judgment of no significant impact over just the disturbance area is overly optimistic.

4.3.8-356. Does not mention need to clean equipment to minimize import of seeds on construction equipment.

Cryptic acronym and missing unit

Figure 2: SLR x year: y axis lacks units; reader has to continue on to table 11-20 to find that it is cm.

Terrestrial biological resources (Chapter 12)

Effects on wetlands and waters of the United States (WOTUS)

Page 12-1, line 18-19 says: "Under Alternatives 2D, 4 , 4A , and 5A, larger areas of non-wetland waters of the United States would be filled due to work in Clifton Court Forebay; however, the Forebay would ultimately expand by 450 acres and thus largely offset any losses there." Is the assumption that, acre for acre, all jurisdictional waters are interchangeable, whether of different type or existing vs. created? The literature does not support this assumption.

The text argues that the wetlands would be at risk with levee deterioration, sea-level rise, seismic activity, etc. But the solution is for "other programs" to increase wetlands and riparian communities. What if this project causes the problem, e.g. via vibration?

CM1 alternative 4A would fill 775 acres of WOTUS (491 wetland acres); Alt 2D would fill 827 (527 wetland) + 1,931 ac temporary fill at Clifton Court Forebay; Alt 5A would fill 750 (470 wetland). That's a lot of area. The timing and details of mitigation measures are not provided. References to the larger Delta Plan suggest that compensations would come at unknown times. Piecemeal losses such as indicated here: "Only 1% of the habitat in the study area would be filled or converted" (Chapter 12, line 29, page 12-22) is how the US has lost its historical wetlands. What are the overall cumulative impacts of wetland losses in the Delta? What is the tipping point beyond which further wetland losses must be avoided? The proposed project is one part of the broader array of management actions in the Delta and should be considered in that broader context.

Habitat descriptions

How will mudflats be sustained for shorebirds? Exposed mud above half-tide can become vegetated rapidly. In the Delta, the bulrush *Schoenoplectus californicus* tolerates nearly continuous tidal submergence.

Are soils clayey enough for the proposed restoration of up to 34 acres of vernal pool and alkali seasonal wetland near Byron? These areas will need to pond water, not just provide depressions.

12-243, line 18: How would adding lighting to electrical wires eliminate any potential impact to black rails? This mitigation is overstated.

Several of the species accounts (e.g., bank swallow) indicate that there is uncertainty about how construction or operations will impact the species. In most cases, monitoring is proposed to assess what is happening. But to be effective, the monitoring results need to be evaluated and fed into decision-making, as visualized in the adaptive-management process. There is little explicit indication of how this will be done or funded.

Land use (Chapter 13)

Alternative 4A would allow water diversion from the northern Delta, with fish screens, multiple intakes, and diversions limited to flows that exceed certain minima, e.g., 7000 cfs. This would reduce flood-pulse amplitudes and, presumably, downstream flooding. How does this alter opportunities for riparian restoration? Which downstream river reaches are leveed and not planned to support riparian restoration? Where would riparian floodplains still be restorable?

Over what surface area does the pipeline transition to the tunnel? At some point along the pipeline-tunnel transition, wouldn't groundwater flow be affected?

Up to 14 years of construction activities were predicted for some areas (e.g., San Joaquin Co.); this would have cumulative impacts (e.g., dewatering would affect soil compaction, soil carbon, microbial functions, wildlife populations, and invasive species). What about impacts of noise on birds; e.g., how large an area would still be usable by greater sandhill cranes?

State how jurisdictional wetlands have been mapped and how the overall project net gain or net loss of wetland area has been estimated. If mitigation consists only of restoration actions in areas that are currently jurisdictional wetlands, then there would be an overall net loss of wetland area due to the project. A mitigation ratio >1:1 would be warranted to compensate for reduced wetland area. This was also a concern for Chapter 12.

Up to 277 ac of tidal wetlands are indicated as restorable; text should indicate if these are tidal freshwater or tidal brackish wetlands (or saline, as is the typical use of "tidal wetlands").

13-19. On the need to store removed aquatic vegetation until it can be disposed: there are digesters for this purpose, and they might be efficient means of mitigation if management of harvested aquatic plants will be long-term. A waste product could be turned into a resource (methane fuel).

13-19, line 12: Text says that "predator hiding spots" will be removed. What are these?

13-19, line 20: What are the E16 nonphysical fish barriers? An electrical barrier?

13-20, line 19: Boat-washing stations are mentioned; would these discharge pollutants (soap, organic debris?)