

Substantive Draft EIR/EIS Revisions

The following sections provide a brief overview of the substantives changes and conclusions provided in the RDEIR/SDEIS. These changes in approach were made both in the Draft EIR/EIS which appears in this RDEIR/SDEIS as Appendix A, *Revisions to the Draft EIR/EIS*; and they are also carried forward in the analysis for Alternatives 4A, 2D, and 5A (which appear in Section 4 of this RDEIR/SDEIS). Appendix A includes modified excerpts of text that originally appeared in the Draft EIR/EIS, with underlining showing new language and strikeout showing eliminated text. Appendix A does not include Draft EIR/EIS text that was not changed or that may be modified in the Final EIR/EIS in a non-substantive manner, and is focused primarily nonimpact analysis revisions to Alternative 4, though other BDCP alternatives are addressed for some of the resources for various reasons. To give readers the best possible sense of the context in which such text changes occur, Appendix A includes section headings before and after modified passages, so that readers can understand precisely where within Draft EIR/EIS chapters the revisions occur. For a visual representation of how the document is laid out and how various segments relate to one another, please see the [Document Review Road Map](#) at the front of this document.

2.1 Fish and Aquatic Habitat Analyses

Draft EIR/EIS Chapter 11, *Aquatic Resources*, provided substantial information about the potential effects of the alternatives on fish and their habitats in the Plan Area and in upstream areas used by the evaluated species. Since release of the Draft EIR/EIS, the chapter has been revised to address design changes associated with the proposed project, to incorporate the latest engineering assumptions and modeling procedures, and to respond to comments raised by the public. Several comments requested elaboration on the methods used to arrive at CEQA conclusions and NEPA effects determinations and on the effects of contaminants. Additionally, commenters requested analyses of the effects on downstream bays (i.e., San Francisco Bay), and that all analyses include a NEPA conclusion. Since release of the Draft EIR/EIS, additional information has been developed pertaining to the following: the use of reusable tunnel material (RTM) for restoration efforts; the construction effects of the modification to Clifton Court Forebay; and the construction of an operable barrier at Head of Old River. This section briefly describes the revisions and their effects on the impact analysis. These revisions serve to better articulate the analysis of effects, but do not change the level of significance or magnitude of the effects. Please refer to the references to review specific sections of the revised chapter.

2.1.1 Methods Used

Several commenters noted that the analytical approach for determining the effects on fish and aquatic resources of various operational aspects of the alternatives was difficult to understand. This was especially related to the presentation of impacts for certain fish species that relied on multiple modeling results as evidence for CEQA conclusions and NEPA effects determinations. To better explain the rationale and process applied to the development of the CEQA conclusions and NEPA effects determinations, the methods section has been updated (Chapter 11, *Fish and Aquatic Resources*, Section 11.3.2, in Appendix A) to more explicitly describe for each species life stage what

1 methods were used and how the various modeling results were weighted. This approach was applied
 2 similarly for all alternatives. Additionally, information has been added to key impact analyses to
 3 articulate the biological linkages between changes in the physical environment and biological effects.
 4 Please refer to Chapter 11, *Fish and Aquatic Resources*, Section 11.3.2, in Appendix A.

5 **2.1.2 Effects Downstream of the Plan Area**

6 Chapter 11, *Fish and Aquatic Resources*, of the Draft EIR/EIS included a description of the potential
 7 changes in sediment loading as a result of the creation of new points of diversion under Alternatives
 8 1A through 8. This analysis was used to inform the impacts related to turbidity (water clarity) for
 9 delta and longfin smelt. In summary, these impacts were deemed to be less than significant/not
 10 adverse because there would be less than a 10% change in sediment loading and because
 11 restoration actions could serve to increase turbidity in some areas. Additionally, as part of an
 12 environmental commitment in Appendix 3B, *Environmental Commitments*, in this RDEIR/SDEIS
 13 (similar to Avoidance and Minimization Measure [AMM] 6), sediments collected at the intake
 14 facilities and RTM excavated during construction activities could be reintroduced into the Delta at
 15 proposed restoration sites. (See in Appendix A of this RDEIR/SDEIS) Consequently, the overall effect
 16 in the Plan Area/Delta was determined to be only a minor degradation. Based on comments
 17 received from the public and additional study of the likely characteristics of RTM material, this
 18 environmental commitment and its parallel AMM have been revised to describe the anticipated
 19 feasibility of reuse of this material, as well as the applicable regulatory standards that any such
 20 material would be required to meet prior to its beneficial reuse. For text revisions to this
 21 commitment, please refer to Appendix A, *Draft EIR/EIS In-Text Chapter Revisions*, in this
 22 RDEIR/SDEIS, which includes an expanded and modified version of Draft EIR/EIS Appendix 3B,
 23 *Environmental Commitments*.

24 As part of this RDEIR/SDEIS, additional analyses have been conducted to take into account sea level
 25 rise, restoration sediment demand, and the effects of the creation of new points of diversion in order
 26 to better understand the magnitude of potential changes in sediment loading into the San Francisco
 27 Bay and other areas downstream of the Plan Area (generally the Delta, Suisun Marsh, and Yolo
 28 Bypass). A range of sediment demand from existing wetlands and restoration activities was
 29 combined with the sea level rise assumptions to understand the rate at which restored areas would
 30 act as sediment sinks in order to maintain elevation as sea levels rise. Relevant literature was used
 31 to determine the overall contribution of sediments from the Delta to the Bay, and a range of volumes
 32 of potential supplemental materials from both the diversion sediment collection process at the
 33 north Delta diversions and the RTM was developed based on current engineering estimates. This
 34 RDEIR/SDEIS includes an analysis of changes in sediment loading to the Bay for all of the
 35 alternatives, with specificity to operations-related effects and restoration-related effects.

36 In addition to the sediment analysis, further analysis was undertaken to assess the consequences, if
 37 any, of the relatively minor changes in operations proposed across alternatives compared with the
 38 consequences already described in the Draft EIR/EIS. This new analysis evaluated the potential
 39 changes in water quality, salinity, flows, temperatures, and other factors potentially affecting fish
 40 habitat and behavior downstream of the Plan Area. The analyses indicated that these characteristics
 41 would be essentially unchanged, especially given the highly dynamic tidal environment of the Bay
 42 and its connection to the Delta. This analysis is included for Alternative 4A in Section 4.3.7, *Fish and*
 43 *Aquatic Resources*, for Alternative 2D in Section 4.4.7, for Alternative 5A in Section 4.5.7, and for the

1 remainder of the alternatives in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.5 in Appendix A
 2 of this RDEIR/SDEIS.

3 **2.1.3 Selenium and Mercury**

4 The analysis of selenium and mercury has been revised in three locations: revisions to Conservation
 5 Measure 12 *Methylmercury Management* and Avoidance and Minimization Measure 27 *Selenium*
 6 *Management* (see Appendix D); revisions to the CM4 tidal habitat contaminants analysis; and a new
 7 impact to specifically address effects of contaminants on fish as a result of change in operations (See
 8 Chapter 11, Impact AQUA-219 in Appendix A). Additional details on the mechanisms for
 9 mobilization of selenium and mercury into the food web and the potential for effects on aquatic
 10 resources have been added to the RDEIR/SDEIS, including details describing the uncertainties
 11 associated with the analytical methods. The conclusions regarding effects on water quality
 12 associated with BDCP water operations evaluated in Chapter 8, *Water Quality*, of the Draft EIR/EIS
 13 and the potential for effects on aquatic resources have been further evaluated, including details of
 14 the analytical methods, uncertainties and findings. This analysis is included as Impact AQUA-219,
 15 applicable to all alternatives in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.5 in Appendix A.

16 In response to reviewers' concerns that proposed restoration in Yolo Bypass could be a significant
 17 source of mercury methylation, a comparison of existing sediment and water quality data to the
 18 modeled conditions following proposed restoration activities has been included. To address the
 19 potential for selenium mobilization resulting from BDCP restoration actions, AMM27 has been
 20 expanded with specific requirements included to reduce the potential for bioaccumulation in
 21 covered fish species. Updated water quality data have been integrated into the selenium
 22 quantitative modeling for water and fish tissue under BDCP water operations, and results have been
 23 updated in Chapter 11, as shown in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.5 in
 24 Appendix A.

25 **2.1.4 NEPA Determinations**

26 A small number of NEPA determinations were, at the time of the Draft EIR/EIS, determined to be
 27 "uncertain," or no determination was made. These effects were related to effects of the alternatives
 28 on salmonid fish migrations through the project area, effects of outflow on delta smelt and longfin
 29 smelt, and contaminant effects on all species. As described above, substantial effort has been put
 30 forth to better understand and articulate the potential for selenium and mercury effects on fish as a
 31 result of both operations and restoration actions proposed under the alternatives. This effort has
 32 allowed a more certain determination for contaminants effects under NEPA, which have been
 33 determined to be not adverse across all alternatives:

- 34 • AQUA-8, Effects of contaminants associated with restoration measures on delta smelt
- 35 • AQUA-26, Effects of contaminants associated with restoration measures on longfin smelt
- 36 • AQUA-44, Effects of contaminants associated with restoration measures on Chinook salmon
 37 (winter-run ESU)
- 38 • AQUA-62, Effects of contaminants associated with restoration measures on Chinook salmon
 39 (spring-run ESU)
- 40 • AQUA-80, Effects of contaminants associated with restoration measures on Chinook salmon
 41 (fall-/late fall-run ESU)

- 1 • AQUA-98, Effects of contaminants associated with restoration measures on steelhead
- 2 • AQUA-116, Effects of contaminants associated with restoration measures on Sacramento
- 3 splittail
- 4 • AQUA-134, Effects of contaminants associated with restoration measures on green sturgeon
- 5 • AQUA-152, Effects of contaminants associated with restoration measures on white sturgeon
- 6 • AQUA-170, Effects of contaminants associated with restoration measures on Pacific lamprey
- 7 • AQUA-188, Effects of contaminants associated with restoration measures on river lamprey
- 8 • AQUA-206, Effects of contaminants associated with restoration measures on non-covered
- 9 aquatic species of primary management concern)

10 Regarding effects on salmonid migrations, uncertainty stemmed from contrasting model results for
 11 upstream flow conditions and effects of the north Delta diversion operations. Additional
 12 examination of modeling results, showing mixed conclusions for Alternative 4, indicates that it was
 13 modeling assumptions and not actual real-world changes in operations or criteria, that shifted the
 14 timing of releases from Lake Shasta, generating the mixed results for the upper Sacramento River.
 15 Additional coordination with NMFS and CDFW to develop the ability to make real-time adjustments
 16 to minimize effects on fish migrating past the intakes has resulted in greater confidence pertaining
 17 to migration effects. The analysis of Alternative 4A in Section 4.3.7, *Fish and Aquatic Resources*,
 18 Alternative 2D in Section 4.4.7 and Alternative 5A in Section 4.5.7 describe the analysis and
 19 determination of this effect, and the remainder of the alternatives are described in Chapter 11, *Fish*
 20 *and Aquatic Resources*, Section 11.3.5 in Appendix A.

21 **2.1.5 Clifton Court Forebay Modification, Head of Old River**

22 **Operable Barrier Construction, and Pile Driving**

23 **Effects**

24 The Draft EIR/EIS included relatively little discussion of the impacts on fish and aquatic resources
 25 from construction of the modified Clifton Court Forebay and the Head of Old River operable barrier
 26 under Alternatives 4. The main assumptions related to construction of these facilities were provided
 27 in Appendix 3C of the Draft EIR/EIS, and consideration and analysis of potential effects is provided
 28 in this RDEIR/SDEIS. The potential sources of effects on fish from these activities are similar to
 29 those discussed for construction of north Delta diversions and barge landing sites: temporary
 30 increases in turbidity; accidental spills; disturbance of contaminated sediments; underwater noise;
 31 fish stranding; in-water work activities; loss of spawning, rearing, or migration habitat; and
 32 predation. The impacts from construction of the modified Clifton Court Forebay and the Head of Old
 33 River operable barrier would be rendered less than significant by application of appropriate AMMs
 34 and mitigation measures.

35 The effects of underwater noise caused by pile driving were reassessed to account for changes in the
 36 proposed construction approach as outlined in Appendix 3C, *Construction Assumptions*, of the Draft
 37 EIR/EIS. While the in-water work windows of July through October were maintained (see Tables
 38 22B-1a through 22B-4d in Appendix 22B, *Air Quality Assumptions*, of the Draft EIR/EIS), the analysis
 39 was conducted assuming more concurrent pile-driving and without the use of attenuation
 40 structures. This analysis is included in Section 4.3.7, *Fish and Aquatic Resources* for Alternative 4A,

1 Section 4.4.7 for Alternative 2D, Section 4.5.7 for Alternative 5A, and Chapter 11, *Fish and Aquatic*
 2 *Resources*, Sections 11.3.1.1 and 11.3.5, in Appendix A of the RDEIR/SDEIS for all other alternatives.

3 **2.1.6 Non-Covered Fish Entrainment at the North Delta** 4 **Diversion**

5 The Draft EIR/EIS did not include a detailed analysis of the potential entrainment effects on non-
 6 covered aquatic species of primary management concern that have pelagic early life stages and
 7 therefore may be particularly susceptible to entrainment at the proposed north Delta diversions
 8 (i.e., egg and larval striped bass and American shad). An analysis has been included in this
 9 RDEIR/SDEIS to assess the potential for effects on these species because much of their spawning
 10 could occur upstream of the proposed north Delta intake locations, thus potentially subjecting eggs
 11 or larvae to entrainment. The analysis examines particle tracking model results from the
 12 Sacramento River upstream of the north Delta diversions. This impact analysis, and discussion of its
 13 relevance, is included in Chapter 11, Section 11.3.5, Impact AQUA-201, in Appendix A, and is
 14 applicable to all of the alternatives.

15 **2.2 Water Quality Revisions**

16 Chapter 8, *Water Quality*, of the Draft EIR/EIS evaluates effects on water quality from construction
 17 and operation of the proposed water conveyance facility (CM1) for Alternatives 1A, 1B, 1C, 2A, 2B,
 18 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9. Water quality impacts from other conservation measures (CM2–
 19 CM21) for these alternatives are evaluated at the programmatic level. Chapter 8 has been revised
 20 since release of the Draft EIR/EIS to address design changes associated with the proposed project, to
 21 include additional analysis, to make clarifications and correct errors, to update analyses based on
 22 more recent water quality data and/or criteria, and to respond to comments raised by local, state,
 23 and federal agencies and the public. Water quality constituent sections that received the most
 24 updating were electrical conductivity, chloride, selenium, bromide, and *Microcystis*. Additionally, an
 25 assessment of constituent effects downstream of the Plan Area (i.e., in San Francisco Bay) was
 26 added. Several other modifications and additions were made to the assessments for mercury,
 27 nutrients, trace metals, and dissolved oxygen. This section briefly describes the revisions to Chapter
 28 8 and their effects on the impact analyses and impact determinations. Please refer to the document
 29 links to review specific sections of the revised chapter.

30 Additionally, three new alternatives – Alternative 2D, 4A, and 5A – were evaluated for effects on
 31 water quality from construction and operation of the water conveyance facility (CM1) and from
 32 other Environmental Commitments (CM 3, 4, 6, 7, 9–12, 15, and 16). The Alternatives evaluated in
 33 Chapter 8 discussed above contain many similarities to each other from a water quality perspective,
 34 and thus are often grouped together in the following discussion. The three new alternatives are also
 35 very similar to each other, but from a water quality perspective, are fundamentally different than
 36 the Alternatives evaluated in Chapter 8 that are discussed above, in that they contain substantially
 37 less tidal restoration acreage. Although this section is focused on describing changes made in
 38 Chapter 8 from the Draft EIR/EIS, differences between the alternatives assessed in Chapter 8 and
 39 the three new alternatives are highlighted where appropriate.

2.2.1 Electrical Conductivity and Chloride

In the Draft EIR/EIS, all project alternatives (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) were found to have significant and unavoidable impacts on electrical conductivity and chloride in the Delta. These impacts were due in part to apparent exceedances of Bay Delta Water Quality Control Plan D-1641 water quality objectives shown in the modeling results at several locations under Existing Conditions, the No Action Alternative, and BDCP Alternatives. It was known that there are several factors related to the modeling approach that may result in modeling artifacts that show objective exceedance when, in reality, no such exceedance would occur. Appendix 8H Section 8H.1 of the Draft EIR/EIS described some of these factors, but the document did not include an evaluation of how many of these exceedances were thought to be a result of these factors and how many were expected to be actual project impacts. Furthermore, in the Draft EIR/EIS, mitigation measures for electrical conductivity and chloride called for additional modeling efforts to determine if impacts could be avoided or mitigated.

For chloride, most project alternatives evaluated in the Draft EIR/EIS were considered to have significant and unavoidable impacts in the Delta for the following reasons:

- modeling results showed exceedance of the 150 mg/L chloride objective,
- substantial increases in chloride were occurring in Suisun Marsh, and
- water quality degradation was occurring in the western Delta due to increased chloride concentrations.

For electrical conductivity, most alternatives evaluated in the Draft EIR/EIS were considered to have significant and unavoidable impacts for the following reasons:

- modeling results showed exceedance of the agricultural objective in the Sacramento River at Emmaton,
- modeling results showed exceedance of the agricultural objective in the San Joaquin River at San Andreas Landing,
- modeling results showed exceedance of the fish and wildlife objective between Prisoners Point and Jersey Point,
- modeling results showed exceedance of the agricultural objective in Old River at Tracy Bridge,
- substantial increases in EC were occurring in Suisun Marsh, and
- water quality degradation was occurring in the western Delta due to increased EC.

To address some of these issues, since publication of the Draft EIR/EIS, the Lead Agencies conducted sensitivity analyses and other analyses to evaluate whether exceedances were modeling artifacts (and thus would not occur) or were potential project-related impacts (which could occur). These included modeling runs investigating the impact of the following:

- Changing the existing Emmaton electrical conductivity compliance location to a new location at Threemile Slough, as proposed in the version of the BDCP circulated with the Draft EIR/EIS.
- Monthly-daily patterning at the Delta boundary locations (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), including the Suisun Marsh Salinity Control Gates, under the alternatives.

- 1 • Removing tidal restoration areas (i.e., assuming no tidal restoration, as opposed to the tidal
2 restoration areas that were previously assumed under Alternative 4 at the late long-term) as a
3 means of understanding the contribution of restoration vs. CM1 to exceedances.
- 4 • Revising Head of Old River Barrier operations during April and May.

5 Additionally, evaluation of individual exceedances was conducted in some cases to determine
6 whether modeling time step and averaging, model imprecision, or imperfections in the Artificial
7 Neural Network played a role in each exceedance shown by the modeling.

8 The findings and outcomes of the sensitivity analyses were the following.

- 9 • Regarding exceedances of the Sacramento River at Emmaton EC objective for protection of
10 agricultural beneficial uses (which is a maximum 14-day running average of mean daily EC and
11 applies April 1 through August 15, but varies in the specific numeric threshold by water year
12 type and season), assuming the electrical conductivity compliance location at Emmaton instead
13 of Threemile Slough greatly decreased exceedances of this objective at Emmaton to levels
14 similar to those occurring under the No Action Alternative. Based on this finding, the project
15 description for Alternative 4 was modified to remove the change in compliance point for the
16 Emmaton electrical conductivity objective. Previously, the project descriptions for all action
17 alternatives included a change in compliance point from Emmaton to Threemile Slough. The
18 revised version of Alternative 4 would maintain, and not propose to change, the existing
19 compliance point at Emmaton, while all other alternatives assessed in the Draft EIR/EIS (1A, 1B,
20 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9) still include the proposed change to Threemile Slough.
21 With this change, Alternative 4 no longer shows a significant impact with respect to the Bay-
22 Delta WQCP EC objective exceedance at Emmaton, while all other alternatives assessed in the
23 Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9) still show significant impacts
24 due to EC objective exceedance at Emmaton. The three new Alternatives assessed in this
25 RDEIR/SDEIS (4A, 2D, 5A) also maintain the existing compliance point at Emmaton, and thus,
26 for the reasons discussed above, do not show significant impacts due to EC objective exceedance
27 at Emmaton.
- 28 • Regarding exceedances of the San Joaquin River at San Andreas Landing EC objective for
29 protection of agricultural beneficial uses (which is a maximum 14-day running average of mean
30 daily EC and applies April 1 through August 15, but varies in the specific numeric threshold by
31 water year type and season), some of the modeled exceedances were found to be modeling
32 artifacts due to monthly-daily patterning effects (see Section 8.3.1.1 in Appendix A for a
33 description of monthly-daily patterning), and the small number of remaining exceedances were
34 small in magnitude, lasted only a few days, and could be avoided or otherwise satisfactorily
35 addressed with real time operations of the SWP and CVP (see Chapter 8, Section 8.3.1.1 in
36 Appendix A for a description of real time operations of the SWP and CVP). Based on these
37 findings, all project alternatives (those assessed in the Draft EIR/EIS, as well as the new
38 alternatives) no longer show significant impacts with respect to EC objective exceedance at San
39 Andreas Landing.
- 40 • Regarding exceedances of the San Joaquin River between Prisoners Point and Jersey Point EC
41 objective (which is a maximum 14-day running average of mean daily EC of 0.44 mmhos/cm and
42 applies April through May of all but critical water years), removing tidal restoration areas (i.e.,
43 assuming no tidal restoration, as opposed to the tidal restoration areas that were previously
44 assumed under Alternative 4 at the late long-term) reduced the number of exceedances, but

1 there were still substantially more exceedances than under Existing Conditions or the No Action
2 Alternative. Results of the sensitivity analyses indicate that the exceedances are partially a
3 function of the operations of the alternative itself, perhaps due to Head of Old River Barrier
4 assumptions and south Delta export differences. Appendix 8H Attachment 2 was added, which
5 contains a more detailed assessment of the likelihood of these exceedances impacting aquatic
6 life beneficial uses. Specifically, Appendix 8H Attachment 2 discusses whether these
7 exceedances might have indirect effects on striped bass spawning in the Delta, and concludes
8 that the high level of uncertainty precludes making a definitive determination. Thus, although
9 uncertain, significant impacts on EC remain relative to this objective for Alternatives 2, 4, 6, 7,
10 and 8. The physical effects and beneficial use at issue here relate to how suitable this stretch of
11 the San Joaquin River is for spawning of striped bass, a nonnative species that preys on the Delta
12 smelt. No such significant effects occur for Alternatives 1, 3, 5, and 9. Alternative 2D and 4A are
13 expected to result in fewer and lower magnitude exceedances of this objective due to the lower
14 acreage of tidal restoration, but to ensure that the objective is met, mitigation measures were
15 introduced that would adaptively manage the split between North and South Delta intake
16 diversions and Head of Old River Barrier operations. With the introduction of this mitigation
17 measure, Alternatives 2D, 4A, and 5A do not show significant impacts with respect to EC
18 objective exceedances at Prisoners Point.

- 19 ● Regarding exceedances of the Old River at Tracy Bridge EC objective for the protection of
20 agricultural beneficial uses (which is a maximum 30-day running average of mean daily EC of
21 0.7 mmhos/cm April through August and 1.0 mmhos/cm September through March), some of
22 these exceedances were found to be modeling artifacts due to monthly-daily patterning effects
23 (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), and the
24 remaining exceedances could be resolved by assuming the continuation of historical dry year
25 practices of installing barriers earlier in the year. Thus, no significant (CEQA) or adverse (NEPA)
26 effects would occur. Furthermore, as noted in Chapter 8, Section 8.1.3.7 of Appendix A, SWP and
27 CVP operations have relatively little influence on salinity levels at these locations, and the
28 elevated salinity in south Delta channels is affected substantially by local salt contributions
29 discharged into the San Joaquin River downstream of Vernalis.
- 30 ● Modeling of all alternatives assumed no operation of the Suisun Marsh Salinity Control Gates,
31 but the project description for all alternatives now assumes continued operation of the Salinity
32 Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity
33 analysis with the gates operational consistent with the No Action Alternative resulted in
34 substantially lower EC levels in Suisun Marsh than indicated in the original modeling results, but
35 EC levels were still somewhat higher there than EC levels under Existing Conditions and the No
36 Action Alternative for several locations in the Marsh and for several months. Another modeling
37 run with the gates operational and restoration areas removed resulted in EC levels nearly
38 equivalent to those found in Existing Conditions and the No Action Alternative, indicating that
39 design and siting of restoration areas has notable bearing on EC levels at different locations
40 within Suisun Marsh. These analyses also indicate that increases in EC levels shown in the
41 modeling conducted for the Draft EIR/EIS were related primarily to the hydrodynamic effects of
42 CM4 under the alternatives assessed (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), not
43 operational components of CM1. Based on the sensitivity analyses, optimizing the design and
44 siting of restoration areas for these alternatives consistent with proposed environmental
45 commitments, avoidance and minimization measures, and mitigation measures is expected to be
46 able to reduce EC increases, relative to Existing Conditions and the No Action Alternative, to
47 levels that would be less than significant. Mitigation Measure WQ-11d discusses these actions.

1 All of the same applies to chloride levels in Suisun Marsh, and Mitigation Measure WQ-7d
2 discusses these actions. The new alternatives 2D, 4A, and 5A, contain much lower acreage of
3 tidal restoration, and thus are anticipated to not have significant impacts with respect to EC and
4 chloride in Suisun Marsh.

5 The assessment of exceedances of the Bay Delta WQCP 150 mg/L chloride objective in the Draft
6 EIR/EIS was also revised based on discovery of errors made in the original analysis. The Bay-Delta
7 WQCP contains a chloride objective for Contra Costa Canal at pumping plant #1 or the San Joaquin
8 River at Antioch Water Works intake that specifies the number of days each calendar year that the
9 maximum mean daily chloride concentration must be less than 150 mg/L (must be provided in
10 intervals of not less than 2 weeks' duration). The days per year depend on water-year type, ranging
11 from 155 days for critical water-year types to 240 days in wet water-year types. In the original
12 analysis, the predicted exceedances of this objective were based on the number of days in a calendar
13 year that chloride is below certain specified limits at these locations. The DSM2 water quality model
14 projects future conditions based in part on a representative recent 16-year time period reflecting
15 varying hydrological conditions in California (i.e., water years 1976–1991). DSM2 was run for 16
16 *water* years (water years 1976–1991, i.e., October 1, 1975 – September 30, 1991), which only
17 includes 15 complete *calendar* years (1976–1990). The final calendar year of the DSM2 simulation,
18 1991, was inadvertently included in the compliance assessment, even though modeling for 1991 did
19 not include the whole calendar year, but stopped at the end of water year 1991 (i.e., September 30).
20 This resulted in reporting of exceedances of the objective for calendar year 1991, when in fact the
21 modeling results do not exist to determine if the objective was exceeded. Specifically, starting at the
22 beginning of the calendar year, the compliance assessment algorithm keeps a running total of the
23 number of days that meet the water quality criterion, then reports the total number of days in that
24 year that met the criterion, and that number of days is compared to the required number of days
25 from the water quality objective. Since modeling ended September 30, 1991, the last year only had
26 273 days available for counting, instead of the full 365. The minimum required number of days was
27 usually not achieved for this year, so it was denoted as an exceedance of the objective. However, had
28 the full 365 days been available, compliance with the objective may have occurred—the modeling
29 results do not exist to determine this issue. The assessment was revised to remove calendar year
30 1991, so assessment was based on calendar years 1976–1990 of the original modeled results (i.e.,
31 15 years instead of 16), and the impact conclusions were updated accordingly. Correcting of this
32 error resulted in a more accurate assessment, and resulted in fewer exceedances of the objective
33 under the project alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B,
34 6C, 7, 8, and 9) than previously indicated. The specific number of exceedances predicted under the
35 revised approach varied by alternative, and for some alternatives remained a significant impact. The
36 new alternatives 2D, 4A, and 5A, did not contain any exceedances of this objective, likely in part due
37 to the lower acreage of tidal restoration included in these alternatives.

38 Another issue that was resolved involved application of the correct water quality objectives based
39 on the water year type appropriate to the modeled time step. As discussed above, the Draft EIR/EIS
40 contained an assessment of compliance with Bay Delta Water Quality Control Plan electrical
41 conductivity and chloride water quality objectives based on outputs from the DSM2 model. The
42 modelling projects future conditions based in part on a representative recent 16-year time period
43 reflecting varying hydrological conditions in California (i.e., water years 1976–1991). Some of the
44 Water Quality Control Plan objectives are dependent on water year type (e.g., wet or dry). The water
45 year type is a designation used to denote the water supply or water availability for a given water
46 year, and is based on a formula that includes estimates of the unimpaired runoff in the Sacramento

1 River watershed. For each water year of the DSM2 simulation used (water years 1976–1991), the
 2 water year type that was used to define the objective was the water year type that was assigned
 3 under Existing Conditions hydrologic conditions. However, climate change assumptions alter the
 4 timing and magnitude of unimpaired runoff estimates, which alter the water year types assigned to
 5 the years in the DSM2 simulation. Because of this, 3 of the 16 water years in the simulation change
 6 their type in the late long term as a result of climate change. Thus, for the late long term scenarios,
 7 compliance should have been based on the objective defined according to the late long term water
 8 year types, not the Existing Conditions water year types. This change was made and the compliance
 9 assessment tables were updated. In general, this change resulted in the modeled predicted percent
 10 of days out of compliance increasing by 0–5% in both the No Action and the project alternatives,
 11 depending on the alternative and water quality objective evaluated. However, these changes did not
 12 fundamentally alter any of the impact conclusions at these sites.

13 Finally, understanding the uncertainties and limitations in the modeling and assessment approach is
 14 important for interpreting the results and effects analysis, including assessment of compliance with
 15 water quality objectives. Please refer to Chapter 8, Section 8.3.1.1, *Models Used and Their Linkages*,
 16 and Section 8.3.1.3, *Plan Area*, in Appendix A for a description of these limitations. In light of these
 17 limitations, the assessment of compliance was conducted in terms of assessing the overall direction
 18 and degree to which Delta EC or chloride would be affected relative to a baseline, and discussion of
 19 compliance did not imply that the alternative would literally cause Delta chloride to be out of
 20 compliance a certain period of time. In other words, the model results are to be used in a
 21 comparative mode, not a predictive mode. Furthermore, in reality, staff from DWR and Reclamation
 22 constantly monitor Delta water quality conditions and adjust operations of the SWP and CVP in real
 23 time as necessary to meet water quality objectives. These decisions take into account real-time
 24 conditions and are able to account for many factors that even the best available models cannot
 25 simulate. Thus, it is likely that some objective exceedances simulated in the modeling would not
 26 occur under the real-time monitoring and operational paradigm that will be in place to prevent such
 27 exceedances.

28 Based on the findings of all of the analyses discussed above, results of the electrical conductivity and
 29 chloride assessments were qualified, and the impact determinations were revisited. Additionally,
 30 because these efforts shed light on why certain exceedances were occurring, it was possible to
 31 revise mitigation measures to better address the causes of the exceedances. All alternatives assessed
 32 in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), remained significant and
 33 unavoidable for chloride and EC, but the reasons are now only the following:

- 34 ● Exceedance of water quality objectives for EC in the Sacramento River at Emmaton (Alternatives
 35 1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9 – but not Alternative 4)
- 36 ● Water quality degradation in the western Delta due to increased chloride concentrations and EC
 37 (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), and
- 38 ● Exceedances of the fish and wildlife EC objective between Prisoners Point and Jersey Point
 39 (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9).

40 Thus, although the impacts remain significant and unavoidable, the magnitude of the impacts is
 41 substantially less than was indicated in the Draft EIR/EIS.

42 Alternatives 2D, 4A, and 5A did not contain significant impacts for EC related to objective
 43 exceedance in the Sacramento River at Emmaton, did not contain substantial degradation in the
 44 western Delta due to increased chloride concentrations, had less water quality effects in the western

1 Delta related to EC, and fewer exceedances of the fish and wildlife EC objective between Prisoners
 2 Point and Jersey Point, such that it was feasible to introduce mitigation that would prevent
 3 significant impacts related to EC increases. After introduction of these mitigation measures,
 4 Alternatives 2D, 4A, and 5A contained less than significant impacts for EC. Alternatives 2D, 4A, and
 5 5A contained less than significant impacts for chloride as well.

6 Refer to Chapter 8, *Water Quality*, Sections 8.1.3.4 and 8.3.1.7 in Appendix A for a discussion of
 7 historical compliance with chloride and electrical conductivity objectives, respectively. Refer to
 8 Chapter 8, *Water Quality*, Section 8.3.1.7 (*Chloride* and *Electrical Conductivity* subsections) in
 9 Appendix A for a discussion of the change in water year types at different time steps and sensitivity
 10 analyses performed. Refer to Mitigation Measures WQ-7 and WQ-11 in Sections 8.3.3.1 through
 11 8.3.3.16 in Appendix A for the assessment and mitigation measures, which have been updated to
 12 account for water year type changes, sensitivity analyses performed, additional context, and
 13 corrections to the chloride 150 mg/L objective assessment; and to Appendix 8G and 8H in Appendix
 14 A for updated information supporting changes to the assessment. Refer to Section 4 and associated
 15 material in Appendix B for the assessment of Water Quality for Alternatives 4A, 2D, and 5A.

16 2.2.2 Selenium

17 Modeling for selenium (water concentrations and bioaccumulation modeling) was updated on the
 18 basis of a review and update of Delta source water concentrations of selenium. Public comments on
 19 the Draft EIR/EIS indicated that the source water concentrations for both the Sacramento River and
 20 San Joaquin River were likely biased high (i.e., the modeling approach used concentrations for both
 21 rivers that indicated more selenium than is currently actually present in the rivers). This bias was
 22 due to inclusion of older monitoring data that used higher detection limits (on both rivers), as well
 23 as to the decrease of selenium concentrations on the San Joaquin River that has occurred over time.
 24 The source water concentrations for the Sacramento River, San Joaquin River, Yolo Bypass, and San
 25 Francisco Bay were reevaluated and re-derived using the most recent data available, and the water
 26 concentration and bioaccumulation modeling was updated based on these updated source water
 27 concentrations. Results showed that there was generally a greater increase from Existing Conditions
 28 and No Action concentrations to the concentrations under the alternatives than previously
 29 predicted (i.e., the relative effect of the project was greater). However, the absolute values of all of
 30 the estimated concentrations for Existing Conditions, the No Action Alternative, and all Project
 31 Alternatives were lower than modeled previously in the Draft EIR/EIS, and thus were lower relative
 32 to thresholds of concern and water quality criteria used in the assessment.

33 The bioaccumulation modeling methodology for bass in the Delta was also updated.
 34 Bioaccumulation modeling is dependent on the choice of K_d , the ratio of selenium concentration in
 35 particulates vs. water. The higher the value of K_d , the greater the bioaccumulation of selenium.
 36 Previously, the choice of K_d was “static” for both bass and sturgeon, and did not vary by location or
 37 concentration of selenium in the water. The model was updated for bass based on more recent
 38 understanding that K_d tends to be higher at lower water concentrations than at higher
 39 concentrations. The result of this change is that predicted bass tissue concentrations in the Delta are
 40 more consistent across location and Alternative than was determined in the Draft EIR/EIS. This
 41 update could not be made for sturgeon bioaccumulation modeling because there was insufficient
 42 monitoring data with which that model could be calibrated for such a change.

43 Numeric thresholds used in the selenium assessment were also updated. Current ambient water
 44 quality criteria are based on waterborne selenium concentrations, but EPA released draft water

1 quality criteria for the protection of freshwater aquatic life from toxic effects of selenium in May
 2 2014. The draft criteria include tissue-based concentrations, which are most closely associated with
 3 reproductive effects. The criteria also include water concentrations, which are to be used when fish
 4 tissue data is not available. The draft criteria have not been finalized, but they represent the most
 5 current science on numeric thresholds protective of beneficial uses. Accordingly, these draft criteria
 6 were used in the updated assessment. Specifically, the whole-body fish tissue threshold was lowered
 7 from 9 mg/kg to 8.1 mg/kg. Additionally, the criterion against which water concentration changes
 8 were compared was lowered from 2 µg/L to 1.3 µg/L, which is the EPA draft criterion for lentic (i.e.,
 9 still or slow-moving) water bodies.

10 An expanded discussion of residence time in the Delta and its effect on selenium bioaccumulation in
 11 the Delta was added in response to agency comments. Increased water residence times could
 12 increase the bioaccumulation of selenium in biota, thereby potentially increasing fish tissue and bird
 13 egg concentrations of selenium. However, if increases in fish tissue or bird egg selenium were to
 14 occur due to residence time changes alone, the increases would likely be of concern only where fish
 15 tissues or bird eggs are already elevated in selenium to near or above thresholds of concern. That is,
 16 where biota concentrations are currently low and not approaching thresholds of concern, changes in
 17 residence time alone would not be expected to cause them to then approach or exceed thresholds of
 18 concern. Based on the analysis, the most likely area in which biota tissues would be at levels high
 19 enough that additional bioaccumulation due to increased residence time from restoration areas
 20 would be a concern is the western Delta and Suisun Bay for sturgeon. Nevertheless, estimates of
 21 residence time increases in these areas are small enough that they are not expected to substantially
 22 affect selenium bioaccumulation in the western Delta.

23 The changes discussed above did not result in any changes to the impact conclusions. Alternatives 6-
 24 9 remain adverse (under NEPA) and significant and unavoidable (under CEQA) due to modeled
 25 substantial increases in fish tissue concentrations for sturgeon in the western Delta, while
 26 Alternatives 1-5 remain less than significant.

27 Refer to Chapter 8, *Water Quality*, Section 8.1.3.15 in Appendix A for updated existing selenium
 28 concentrations in the affected environment and a description of the EPA draft criteria. Refer to
 29 Section 8.3.1.7 in Appendix A for the updated source water concentrations used in the modeling and
 30 updated thresholds used in the assessment. Refer to Impact WQ-25 in Sections 8.3.3.1 through
 31 8.3.3.16 in Appendix A for the selenium assessment updated based on the new modeling. Further
 32 details on the updates can be found in Appendix 8M, *Selenium*, in Appendix A.

33 **2.2.3 Bromide**

34 Additional description was added to describe more fully the CALFED bromide goal used in the
 35 assessment. Specifically, the additions describe the background behind derivation of the EPA
 36 bromate maximum contaminant level (MCL), its relevance to the CALFED numeric bromide goals,
 37 and the non-numeric portion of the CALFED goal regarding an equivalent level of public health
 38 protection using a cost-effective combination of alternative source waters, source control, and
 39 treatment technologies.

40 Additional descriptions regarding modeling uncertainty and assumptions were also added.
 41 Specifically, these address assumptions regarding sea level rise and the assumed footprint and
 42 design of restoration areas, and the performance and accuracy of DSM2 in the Barker Slough area.

1 Sensitivity analyses were conducted to evaluate what factors were causing or contributing to
 2 bromide increases in Barker Slough. Findings from these analyses were incorporated into the
 3 assessment, and mitigation measures were revised to better address the factors contributing to the
 4 increases. With regard to bromide, all alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B,
 5 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) remain adverse (under NEPA) and significant and unavoidable
 6 (under CEQA). However, it is now known that the cause of the modeled increases in bromide in
 7 Barker Slough, which was driving the impact determinations for almost all alternatives, is
 8 assumptions regarding CM4 implementation, not operations in CM1. Thus the mitigation measure
 9 was revised to more appropriately address actions that could lessen the projected impact, based on
 10 these findings.

11 Because the new alternatives (2D, 4A, and 5A) contain a lower acreage of tidal restoration,
 12 significant impacts with regards to bromide are not expected under these alternatives.

13 Refer to Chapter 8, *Water Quality*, Section 8.1.3.3, 8.3.1.7, and Impact WQ-5 in Sections 8.3.3.1
 14 through 8.3.3.16 in Appendix A for the bromide additions and revisions.

15 2.2.4 Mercury

16 Modeling results and findings for Impact WQ-13 under Alternative 8 were revised and updated.
 17 Specifically, results for water column and fish tissue methylmercury under Alternative 8 contained
 18 in the Draft EIR/EIS were inadvertently based on erroneous source water concentrations for
 19 methylmercury; accordingly, these were corrected and the modeling rerun. These corrections
 20 lowered the concentrations predicted under Alternative 8, but did not change the assessment
 21 conclusions. Alternative 8 previously contained an adverse (under NEPA) and significant and
 22 unavoidable impact (under CEQA) on mercury and methylmercury, and while the magnitude of the
 23 impact is now lower, it remains adverse and significant and unavoidable due to substantial increases
 24 in modeled methylmercury concentrations in multiple locations throughout the Delta.

25 Additional information regarding the uncertainty inherent in the mercury bioaccumulation
 26 modeling approach was added to Appendix 8I of Appendix A and referenced in the assessment. This
 27 information is important when interpreting smaller increases or decreases in fish tissue mercury
 28 levels that were estimated via the models. Refer to Chapter 8, *Water Quality*, Section 8.3.3.15, Impact
 29 WQ-13 in Appendix A for the updated Alternative 8 mercury assessment. Refer to Appendix 8I of
 30 Appendix A for the discussion of model uncertainty.

31 The three new alternatives – Alternative 2D, 4A, and 5A – differed from the alternatives assessed in
 32 the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) in their evaluation of effects
 33 on mercury from other environmental commitments (CM 3, 4, 6, 7, 9–12, 15, and 16). The three new
 34 alternatives contain substantially less tidal restoration acreage than those in the Draft EIR/EIS.
 35 Thus, although the potential types of effects on mercury resulting from implementation of the
 36 environmental commitments under the new alternatives would be generally similar to those
 37 described for alternatives assessed in the Draft EIR/EIS, the magnitude of effects on mercury and
 38 methylmercury at locations in the Delta related to habitat restoration would be considerably lower.

39 It is not expected that the level of tidal restoration proposed under Alternatives 2D, 4A, and 5A
 40 would cause fish tissue concentrations to increase, at a measurable level, outside of the immediate
 41 localized area of the tidal restoration sites. However, habitat restoration has the potential to
 42 increase water residence times and increase accumulation of organic sediments that are known to
 43 enhance methylmercury bioaccumulation in biota in the vicinity of the restored habitat areas. Fish

1 tissue concentrations in the Delta already frequently exceed the Water Quality Control Plan (Basin
 2 Plan) for the Sacramento River and San Joaquin River Basins objective of 0.24 mg/kg for trophic
 3 level 4 fish in the Delta. The proposed tidal restoration may cause or contribute to increased fish
 4 tissue concentrations at a local level, though the magnitude of the increase is not quantifiable. The
 5 Basin Plan also includes methylmercury allocations for wetlands for various areas of the Delta.
 6 Because the proposed tidal restoration acreage is very small, it is possible that, relative to the
 7 allocations, the increased loading would be very small. However, it is still unknown how and if the
 8 allocations can be attained. The Basin Plan also requires that for many areas of the Delta (i.e., those
 9 needing reductions in methylmercury), proponents of wetland restoration projects shall (a)
 10 participate in Control Studies, or implement site-specific study plans, that evaluate practices to
 11 minimize methylmercury discharges, and (b) implement methylmercury controls as feasible. Design
 12 of restoration sites would be guided by Environmental Commitment 12, which requires
 13 development of site-specific mercury management plans as restoration actions are implemented to
 14 minimize methylmercury production. The effectiveness of minimization and mitigation actions
 15 implemented according to the mercury management plans is not known at this time, although the
 16 potential to reduce methylmercury concentrations exists based on current research.

17 Although this would constitute a potential environmental impact, these increases would not be
 18 expected to cause injury to downstream water rights holders or other downstream water users,
 19 because effects would be localized to the restoration sites. Nor would such localized impacts
 20 adversely affect any other downstream beneficial users.

21 2.2.5 Microcystis

22 Assessment of the effects of the project on *Microcystis aeruginosa*, a nuisance and toxic
 23 cyanobacteria species, was added to the chapter. This section was added in response to public
 24 comments, as well as in recognition of the existing threat to water quality that *Microcystis* poses. In
 25 part because it is not technically a water quality constituent, and in part due to the lack of state or
 26 federal water quality standards, *Microcystis* did not appear in the screening analysis that was
 27 performed (Appendix 8C). Due to the combined effects of increased temperatures due to climate
 28 change (not related to the project) and increased residence times in the Delta (due primarily to the
 29 project related effects of CM1 and CM4), effects of project alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5,
 30 6A, 6B, 6C, 7, 8, and 9 on *Microcystis* were considered adverse (under NEPA) and significant and
 31 unavoidable (under CEQA). Mitigation measure WQ-32 was created to attempt to lessen the effects
 32 of the alternatives on *Microcystis*.

33 Because the new alternatives (2D, 4A, and 5A) contain a lower acreage of tidal restoration, residence
 34 times are not expected to increase as substantially as under the other alternatives, and thus
 35 significant impacts with regards to *Microcystis* are not expected under these alternatives, relative to
 36 the No Action Alternative.

37 Refer to Chapter 8, *Water Quality*, Section 8.1.3.18 for a description of the existing conditions
 38 regarding *Microcystis*, Section 8.3.1.7 for methodological considerations used in the assessment, and
 39 Impacts WQ-33 and WQ-34 in Appendix A for the *Microcystis* assessment.

40 2.2.6 Potential Seaward Effects of the BDCP

41 The western seaward boundary of the BDCP Plan Area has been delineated at Carquinez Strait.
 42 There are no actions in the BDCP proposed to occur in the bays seaward of the Plan Area. Thus, the

1 analysis in the Draft EIR/EIS focused on assessing the alternatives' effects on water quality in the
 2 upstream of the Delta Region, within the Plan Area, and in the SWP/CVP Export Service Areas.
 3 However, public and agency comments raised questions regarding water quality effects of the
 4 alternatives in the bays seaward of Carquinez Strait. Because net flows move seaward from the Delta
 5 toward the bays, water quality constituents present in the Delta water column could potentially be
 6 transported seaward. New screening and assessment of water quality constituent effects in San
 7 Francisco Bay was conducted in response to these concerns. These new assessments, which are
 8 reflected in new text added to the original Draft EIR/EIS analysis of Water Quality, did not identify
 9 any new adverse or significant impacts or any substantial increase in the severity of previously
 10 identified impacts, except in the case of selenium. For alternatives 6-9, projected increases in
 11 selenium loading and concentrations in North San Francisco Bay were considered adverse (under
 12 NEPA) and significant and unavoidable (under CEQA), while alternatives 1-5 were considered not
 13 adverse and less than significant. This is consistent with findings for the assessment of selenium in
 14 the Delta, in which the same conclusions were reached for the same alternatives. The driving factor
 15 for the adverse impacts under alternatives 6-9 in both the western Delta and the North Bay is
 16 modeled increases in selenium concentrations and loading, leading to potentially higher body
 17 burdens of selenium in certain species.

18 Refer to Appendix 80, *SF Bay Analysis Tables*, in Appendix A for the assessment of seaward water
 19 quality effects of the alternatives.

20 **2.2.7 Modeling and Methods Descriptions**

21 The existing section describing models and methods used in the analysis was revised and expanded.
 22 Several public comments and comments by agencies requested more thorough discussion of
 23 modeling accuracy and uncertainty. In the Draft EIR/EIS, this type of information was sometimes
 24 included only through reference to Appendix 5A, and in other cases it was not in the documentation
 25 at all. As a result, many readers apparently did not see, or could not find, the relevant information.
 26 Additionally, to provide context for electrical conductivity and chloride compliance results, a
 27 description of how CALSIM and DSM2 were used to conduct this analysis was necessary. The
 28 addition of this material to Chapter 8 improves the analysis by putting results into their proper
 29 context regarding the overall uncertainty in the modeling approaches, including both the accuracy
 30 and precision of the model output, as well as the validity of input assumptions.

31 Refer to Chapter 8, *Water Quality*, Section 8.3.1.1, and 8.3.1.3 in Appendix A for the expanded and
 32 revised description of models used and their linkages.

33 **2.2.8 Dissolved Oxygen**

34 Following publication of the Draft EIR/EIS, concerns were raised that the project may increase flows
 35 on the San Joaquin River at Stockton, causing the location of the minimum DO point to shift
 36 downstream. To assess this possibility, flows in San Joaquin River at Stockton were evaluated in
 37 light of the above information.

38 The analysis showed that in most cases, flows in the San Joaquin River at Stockton actually
 39 decreased by a small amount. Reports indicate that the aeration facility performs adequately under
 40 the range of flows from 250-1,000 cfs (ICF International 2010). Based on the analysis, the expected
 41 changes in flows in the San Joaquin River at Stockton were not expected to substantially move the
 42 point of minimum DO, and therefore the aeration facility would likely still be located appropriately

1 to keep DO levels above minimum basin plan objectives. Since the aerators are assumed to be
 2 operated under the alternatives, just as in the Existing Conditions and No Action Alternative, effects
 3 of the alternatives on DO remained less than significant.

4 Refer to Chapter 8, *Water Quality*, Section 8.3.1.7 for methodological considerations used in the
 5 assessment, and Impact WQ-9 in Appendix A for the updates to the DO assessment.

6 **2.2.9 Miscellaneous Revisions and Updates**

7 Several minor, miscellaneous revisions and updates that do not fall into the categories above were
 8 also made.

9 Regarding the Trace Metals assessment, although aluminum was mentioned in the Screening
 10 Analysis (Appendix 8C) as being included in the Trace Metals assessment, it was inadvertently
 11 omitted. Additional discussion of aluminum (as well as of iron and manganese) was therefore added
 12 to *Affected Environment* and additional assessment of aluminum was conducted.

13 Regarding the assessment of nutrients, a discussion of nutrient objectives was added and language
 14 was added to the document to explain why the N:P (nitrogen to phosphorus) ratio was not
 15 specifically evaluated, why dissolved vs. total phosphorus was used in the assessment, and how
 16 upgrades to the Sacramento Regional Wastewater Treatment Plant would affect phosphorus
 17 concentrations in the late long term.

18 Refer to Chapter 8, *Water Quality*, Section 8.1.3.16 in Appendix A for the discussion of aluminum,
 19 iron, and manganese, and Section 8.3.3.1 Impact WQ-27 in Appendix A for the assessment of
 20 aluminum.

21 Refer to Chapter 8, *Water Quality*, Section 8.1.3.10 in Appendix A for the discussion of nutrient
 22 objectives, Section 8.3.1.7 in Appendix A for a discussion of the N:P ratio and total vs. dissolved
 23 phosphorus, and Section 8.3.1.7 in Appendix A for a discussion of upgrades to the Sacramento
 24 Regional Wastewater Treatment Plant effects on phosphorus.

25 **2.3 Air Quality, Health Risk Assessment, Traffic, and** 26 **Noise Revisions**

27 Chapter 22, *Air Quality and Greenhouse Gases*, evaluates criteria pollutant and greenhouse gas (GHG)
 28 emissions from construction and operation of the water conveyance facility (CM1). For all action
 29 alternatives other than Alternatives 4A, 2D, and 5A, air quality impacts from implementation of
 30 habitat restoration and protection activities (CM2 through CM11) are also evaluated (at the
 31 programmatic level). The chapter has been revised since release of the Draft EIR/EIS to address
 32 design changes associated with the proposed project, to incorporate the latest engineering
 33 assumptions and modeling procedures, and to respond to issues and concerns raised by the public.
 34 Where these design and engineering assumptions could result in substantive changes in other
 35 impact analyses, such revisions in other impact analyses have also been made since release of the
 36 Draft EIR/EIS. These parallel changes occur most notably in Chapter 19, *Transportation*, as well as
 37 those portions of Chapter 23, *Noise*, related to noise generated by vehicles and equipment associated
 38 with construction of water conveyance facilities. The following sections briefly describe the
 39 revisions and their effects on the impact analysis. Please refer to the Chapter 22, *Air Quality and*

1 *Greenhouse Gases*, in Appendix A and Section 4, *New Alternatives: Alternatives 4A, 2D, and 5A*, of this
 2 RDEIR/SDEIS to review the revised analysis.

3 **2.3.1 Mass Emissions Modeling for Construction of the** 4 **Water Conveyance Facility**

5 As described in Section 3, *Conveyance Facility Modifications to Alternative 4*, of this RDEIR/SDEIS,
 6 several design parameters for the water conveyance facilities under Alternative 4 (described as the
 7 modified pipeline/tunnel option) were revised following the release of the Draft EIR/EIS to reflect
 8 changes in operation and further reduce environmental impacts. DWR prepared an updated
 9 economic analysis (2014 cost estimate) to evaluate these design changes. The 2014 cost estimate
 10 provides detailed information on equipment and vehicle activity (e.g., operating hours per day), as
 11 well as the start date and number of working days for each construction phase. The mass emissions
 12 analysis for Alternative 4, as found in the Draft EIR/EIS, was revised to utilize the 2014 cost estimate
 13 assumptions, which reflect the optimized CM1 design. Because the assumptions and methodology
 14 developed for the 2014 cost estimate supersede the 2010/2012 cost estimate that was used as the
 15 basis of the Draft EIR/EIS air quality analysis, emissions estimates associated with the alternatives
 16 were likewise revised using a combination of the 2010/2012 and 2014 cost estimate assumptions¹,
 17 where appropriate, as well as activity scaling factors based on consultation with DWR's Engineering
 18 Workgroup.

19 In addition to updating the cost estimate, DWR also revised the Construction Equipment Exhaust
 20 Reduction Plan, as found in Section 3B.1.9 of Appendix 3B, *Environmental Commitments*, in Appendix
 21 A of this RDEIR/SDEIS, to provide additional implementation flexibility and to improve the level of
 22 achieved environmental protection. The revised Construction Equipment Exhaust Reduction Plan,
 23 now found in Appendix 3B as revised and reissued as part of this RDEIR/SDEIS, is comprised of
 24 several conservative performance standards. Specifically, an average performance standard of
 25 model year 2013 engines is identified for offroad equipment (equivalent to a Tier 3 to Tier 4 engine,
 26 depending on the equipment type and horsepower). This performance standard must be achieved at
 27 each construction site, although construction contractors may utilize a variety of control strategies
 28 to meet an emissions output equivalent to or better than a model year 2013 fleet. Potential control
 29 strategies include engine electrification, use of Tier 3 or 4 engines, and use of diesel particulate
 30 filters. The revised Construction Equipment Exhaust Reduction Plan also includes a performance
 31 standard of model year 2010 engines for onroad vehicles, a Tier 3 engine requirement for marine
 32 vessels, and a Tier 4 engine requirement for tunneling locomotives. The air quality emissions
 33 modeling for Alternative 4 and other alternatives have been revised to reflect implementation of
 34 these commitments.

35 The mass emissions analysis was also revised to incorporate new air quality models released since
 36 the Draft EIR/EIS, as well as to respond to public comments. The California Air Resources Board
 37 (ARB) released the EMFAC2014 model on December 30, 2014. This model supersedes the
 38 EMFAC2011 model, which was used to estimate emissions from onroad vehicles in the Draft EIR/EIS
 39 air quality analysis. Accordingly, onroad vehicle emission estimates have been revised using
 40 emission factors generated by the EMFAC2014 model. Helicopter emissions were also updated

¹ Features exclusive to the BDCP Alternatives (e.g., intake pumping plants) were not evaluated in the 2014 cost estimate for Alternative 4. Accordingly, the 2010/2012 cost estimate, which represents the best available data for the features, was used to evaluate emissions based on guidance from DWR's Engineering Working Group. Please refer to Appendix 22A, *Air Quality Analysis Methodology*, in Appendix A for additional information.

1 based on the Federal Aviation Administration's (FAA's) Emissions and Dispersion Modeling System
 2 (EDMS). Finally, minor technical revisions have been made in response to public input, including use
 3 of GHG emission factors that account for multiple concrete compression strengths. The revisions
 4 ensure that the mass emissions analysis and construction impact assessment use the most recent air
 5 quality modeling procedures and incorporate applicable public input.

6 This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section
 7 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22,
 8 *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS. The updated modeling
 9 resulted in slightly higher mass emission estimates than those presented in the Draft EIR/EIS.
 10 However, similar to the Draft EIR/EIS, the project proponents would pursue offsets to reduce
 11 emissions below air district thresholds or to net zero. Thus, this impact would be less-than-
 12 significant.

13 **2.3.2 Health Risk Assessment for Construction of the** 14 **Water Conveyance Facility**

15 The health risk assessment (HRA) prepared for the Draft EIR/EIS characterized cancer risks and
 16 non-cancer hazards from inhaled diesel particulate matter based on the mass emissions analysis
 17 conducted for construction of the water conveyance facilities. Because the mass emissions analysis
 18 has been revised based on changes to the project design and underlying engineering assumptions,
 19 the HRA was likewise revised to incorporate the updated modeling results. The revised HRA also
 20 reflects implementation of the modified Construction Equipment Exhaust Reduction Plan (see
 21 revised Appendix 3B), as well as changes to the onroad vehicle (EMFAC2014) and helicopter
 22 (EDMS) emission factors. These revisions ensure that the HRA utilizes the most recent engineering
 23 data and air quality modeling procedures. The cancer risk analysis was also updated to incorporate
 24 recent guidance from the Office of Environmental Health Hazard, which includes age-specific factors
 25 to account for increased sensitivity to carcinogens during early-in-life exposure.

26 This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section
 27 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22,
 28 *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS. The updates identify separate
 29 health risks associated with exposure to localized particulate matter (PM) and diesel particulate
 30 matter (DPM). Significant impacts from receptor exposure to localized PM were found for all
 31 alternatives, but would be reduced to less than significant through dust suppressants, receptor
 32 relocation, or onsite paving. Receptor exposure to DPM would result in significant impacts for all
 33 alternatives except for 4, 4A, and 9. A stepped mitigation approach would ensure that this impact
 34 would be less-than-significant.

35 **2.3.3 Mass Emissions Modeling for Operations and** 36 **Maintenance of the Water Conveyance Facility**

37 As improvements were made to the construction design, DWR similarly continued, following release
 38 of the Draft EIR/EIS, to refine operations and maintenance (O&M) protocols for the water
 39 conveyance facilities. DWR developed updated equipment and employee O&M assumptions to
 40 reflect the latest understanding of project operations. These new assumptions have been
 41 incorporated into the mass emissions modeling and operational air quality impact assessment. The
 42 analysis has also been revised to utilize onroad emission factors generated by the EMFAC2014

1 model. The combined revisions ensure that the analysis utilizes the most recent engineering data
2 and air quality modeling procedures.

3 This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section
4 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22,
5 *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS. The updated modeling
6 resulted in slightly higher mass emission estimates than those presented in the DEIR/EIS, but all
7 impacts would remain less than significant.

8 **2.3.4 Air District Thresholds and Localized Health Analysis**

9 The Lead Agencies have also added to Chapter 22, *Air Quality and Greenhouse Gases*, further
10 discussion identifying and disclosing the purpose of local air district thresholds with respect to
11 evaluating both regional and local air quality impacts. The added text highlights the fact that,
12 because the regional criteria pollutant thresholds are derived from air quality plans developed to
13 meet and attain the state and federal health-based ambient air quality standards on a regional basis,
14 these thresholds are not indicators of potential localized human health impacts. This additional
15 context better explains how the Plan Area air districts' criteria pollutant thresholds should be
16 applied; and it defines their purpose in evaluating air quality impacts. In general, the thresholds are
17 only used to assess the project's effect on *regional* attainment of the ambient air quality standards.
18 The new language in Chapter 22 explains why localized health impacts cannot be derived from
19 analyses of regional air quality impacts, and why localized exceedences of regional criteria pollutant
20 thresholds recommended by Plan Area air districts do not necessarily translate into adverse health
21 effects.

22 With these general principles in mind, the chapter has also been revised to explain better how both
23 regional and localized changes in pollutant emissions associated with a project could impact human
24 health. The revised analysis evaluates health effects from pollutants with the greatest potential to
25 result in a significant, material impact on human health. Because health effects related to regional
26 pollutants, such as ozone precursors (ROG and NO_x), are the products of emissions generated by
27 numerous sources throughout a region, minor increases in regional air pollution from project-
28 generated ROG and NO_x would have nominal or negligible impacts on human health. Consequently,
29 potential health effects related to increases in ozone precursors are discussed with respect to
30 cumulative air quality impacts. Project-level analysis of localized pollutants (particulate matter,
31 carbon monoxide, and the pathogenic fungus *Coccidioides immitis*, which can cause valley fever),
32 which can directly affect the health of certain sensitive receptors, has been added to the chapter. The
33 additional analysis addresses concerns regarding the relationship between localized pollutant
34 concentrations and human health by documenting the potential health outcomes induced by
35 project-generated emissions.

36 This analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section 4.4.18, for
37 Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22, *Air Quality
38 and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS (refer to Impacts AQ-9 through AQ-18 and
39 AQ-28 through AQ-31).

40 **2.3.5 Odor Analysis**

41 The Draft EIR/EIS air quality analysis evaluated potential odor impacts from equipment and
42 vehicles that would be required for construction and O&M of the water conveyance facilities. The

1 impact analysis has been expanded to assess potential odors from excavated organic matter during
 2 removal of reusable tunnel material (RTM) and sediment. If present in the muck and sediment,
 3 anaerobic decay of organic material can generate gases, specifically hydrogen sulfide. Hydrogen
 4 sulfide is commonly described as having a foul or “rotten egg” smell. Odor analysis for
 5 implementation of CM2 through CM11 has also been added to Chapter 22, *Air Quality and*
 6 *Greenhouse Gases*. The additional discussion provides a more thorough analysis of potential odor
 7 impacts associated with the project.

8 This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section
 9 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22,
 10 *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS (refer to Impacts AQ-19 and
 11 AQ-26). Odor impacts for all alternatives would be less than significant, consistent with what was
 12 presented in the DEIR/EIS.

13 **2.3.6 General Conformity Determination**

14 The project study area is in federally classified nonattainment and/or maintenance areas for ozone,
 15 carbon monoxide, and particulate matter. Consequently, to fulfill general conformity requirements, a
 16 general conformity determination was prepared for the applicant-preferred alternative (APA),
 17 Alternative 4A. Since construction and operation of the project under Alternative 4A would be
 18 identical to Alternative 4, the general conformity determination applies to those activities pertaining
 19 to both Alternative 4 and Alternative 4A (henceforth referred to as Alternative 4/4A).

20 The determination concluded that, with implementation of Mitigation Measures AQ-1 through AQ-4,
 21 which would develop and implement emissions offset programs, Alternative 4/4A would not conflict
 22 with or obstruct implementation of the applicable air quality plans. The Lead Agencies undertook an
 23 extensive consultation process with SJVAPCD and BAAQMD to confirm that sufficient emissions
 24 reduction credits were available to offset project-generated emissions to net zero. Copies of the air
 25 district consultation efforts have been provided in Appendix 22E, *General Conformity Determination*.
 26 The appendix also presents the complete general conformity determination for Alternative 4/4A.
 27 Consultation with SMAQMD and YSAQMD is still ongoing.

28 **2.3.7 Transportation and Noise Analysis for Construction** 29 **of the Water Conveyance Facilities**

30 As described in Section 2.3.1, *Mass Emissions Modeling for Construction of the Water Conveyance*
 31 *Facility*, an updated analysis was prepared to evaluate design changes, associated changes based on
 32 detailed information of revised equipment and vehicle activity (e.g., operating hours per day), and
 33 the start date and number of working days for each construction phase. The transportation and
 34 traffic-based noise analyses for Alternative 4 were revised to utilize these revised assumptions,
 35 which reflect the optimized design of the water conveyance facilities. Because the assumptions and
 36 methodology developed as part of this effort supersede those used as the basis for the Draft EIR/EIS
 37 transportation and traffic-based noise analyses, vehicle trip estimates associated with construction
 38 of the other alternatives, along with their associated impact discussions, were likewise revised
 39 where appropriate.

40 This revised construction traffic assessment is included for Alternative 4A in Section 4.3.15, for
 41 Alternative 2D in Section 4.4.15, for Alternative 5A in Section 4.5.15, and for the remainder of the
 42 alternatives in Chapter 19, *Transportation* in Appendix A of this RDEIR/SDEIS (refer to Impacts

1 TRANS-1 and TRANS-2). Detailed information on the updated traffic modeling results can be found
 2 in Appendix 19A, *Air Quality Analysis Methods*, Section 22A.1 in Appendix A. This revised
 3 construction noise assessment is included for Alternative 4A in Section 4.3.19, for Alternative 2D in
 4 Section 4.4.19, for Alternative 5A in Section 4.5.19, and for the remainder of the alternatives in
 5 Chapter 23, *Noise* in Appendix A of this RDEIR/SDEIS (refer to Impact NOI-1). Traffic volumes on
 6 certain segments and construction noise levels at some receptor locations increased, relative to the
 7 DEIR/EIS. Traffic mitigation to enhance capacity of congested roadway segments and improve the
 8 physical condition of affected roadway segments would be pursued, in addition to limits on
 9 construction hours and activity. Noise-reducing measures would also be implemented to reduce
 10 construction-related noise and vibration levels. However, impacts would remain significant and
 11 unavoidable, consistent with what was presented in the DEIR/EIS.

12 **2.4 Revised Project Descriptions and Enhanced** 13 **Level of Detail**

14 The RDEIR/SDEIS includes a number of revisions to the project description and an enhanced level of
 15 detail for Alternative 4. These include more explanation regarding the analysis of water conveyance
 16 facilities, updates to CM2–CM21, clarification on the role of the Bureau of Reclamation, and the use
 17 of CM3–CM11 to offset impacts related to CM1. As explained above, the RDEIR/SDEIS also includes
 18 new sub-alternatives 4A, 2D, and 5A. The project descriptions for these sub-alternatives are
 19 included in Section 4, *New Alternatives: Alternatives 4A, 2D, and 5A*, of this RDEIR/SDEIS.

20 **2.4.1 Analysis of Water Conveyance Facility Impacts**

21 Each component feature of the water conveyance facilities is analyzed at a resource-specific level,
 22 based on complete water conveyance facility project footprints developed by DWR’s Division of
 23 Engineering. Analyses of Alternatives 4, 4A, 2D, and 5A in the RDEIR/SDEIS reflect GIS data from
 24 DWR that incorporate recent revisions to the alignment of water conveyance features and
 25 associated lands required for construction. The features in this GIS dataset, which represents each
 26 conveyance facility component (e.g., intakes, intermediate forebay, tunnels, spoils areas), were
 27 overlaid onto resource-specific GIS data layers to identify physical effects of conveyance facility
 28 construction. This GIS-based approach facilitated both a component-specific, or project-level,
 29 analysis of the individual features of the conveyance facilities, as well as a program-level analysis of
 30 construction of the conveyance facilities in aggregate. For example, the local effects on parcels of
 31 agricultural land associated with construction of a particular intake facility can be assessed through
 32 GIS analysis; at the same time, the overall temporary and permanent loss of agricultural lands
 33 associated with construction of the conveyance facilities as a whole can be aggregated to convey a
 34 comprehensive picture of the effects on the resource.

35 **2.4.2 Updates to Conservation Measures, Environmental** 36 **Commitments, and Avoidance and Minimization** 37 **Measures**

38 The RDEIR/SDEIS reflects changes made to the conservation measures and avoidance and
 39 minimization measures (AMMs) for Alternative 4 and, where applicable, Alternatives 4A, 2D, and 5A.

1 These revisions are made to ensure that CM2–CM21 are described consistently where needed in the
 2 RDEIR/SDEIS and reflect additional detail that may have been developed since publication of the
 3 Draft BDCP. A discussion of the conservation measures and AMMs that have been substantively
 4 changed and that would potentially affect the characterization of impacts can be found in Appendix
 5 D.

6 The list of environmental commitments incorporated into all of the action alternatives (i.e., all
 7 alternatives except for the No Action/No Project Alternative) was updated extensively to account for
 8 refined project engineering. Like the formal mitigation measures prescribed in the Draft EIR/EIS,
 9 these environmental commitments, which sometimes take the form of best management practices
 10 (BMPs), were intended to avoid or minimize potential adverse effects (a NEPA term) and potential
 11 significant impacts (a CEQA term). Both DWR and the federal Lead Agencies were aware that, in
 12 many instances, the environmental commitments, as well as related “avoidance and minimization
 13 measures,” functioned as *de facto* mitigation measures. The Draft EIR/EIS is therefore written with a
 14 recognition that, where appropriate and necessary, its text should explain how the environmental
 15 commitments and avoidance and minimization measures would function, and whether particular
 16 commitments or measures would or would not be effective in reducing various significant or
 17 adverse effects to less-than-significant or less-than-adverse levels. Despite these efforts in the Draft
 18 EIR/EIS, which was issued for public review in December 2013, several commenters have asserted
 19 that the document does not comply with the requirements subsequently announced by the
 20 California Court of Appeal in a January 2014 decision known as *Lotus v. Department of*
 21 *Transportation*.² In response to these comments, [Appendix 3B \(in Appendix A\)](#) has been
 22 significantly modified as part of this RDEIR/SDEIS. In addition to the refinements made to some of
 23 the environmental commitments, Appendix 3B as modified now includes, after each specific
 24 environmental commitment and avoidance and minimization measure, one or more narrative
 25 discussions explaining both how it reduces the severity of environmental effects and whether the
 26 level of impact reduction is sufficient to render the effects less than significant.

27 2.5 Analysis of Geotechnical Investigations

28 As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, DWR
 29 will perform a series of geotechnical investigations along both the selected water conveyance
 30 alignment and at locations proposed for facilities or material borrow areas. The work to be
 31 performed will constitute a subsurface investigation program to provide information required to
 32 support the design and construction of the water conveyance facilities. Geotechnical investigations
 33 will be conducted to identify surface and subsurface conditions as necessary to complete design of
 34 the water conveyance facilities. The potential environmental effects resulting from conducting
 35 geotechnical investigations are described in [Chapter 31, Other CEQA/NEPA Required Sections](#),
 36 Section 31.5.1.1, of the Draft EIR/EIS.

37 Following publication of the Draft EIR/EIS, DWR developed a Draft Geotechnical Exploration Plan
 38 (Phase 2) for the Alternative 4 conveyance alignment. The geotechnical investigation plan provides
 39 additional details regarding the rationale, investigation methods and locations, and criteria for
 40 obtaining subsurface soil information and laboratory test data (California Department of Water
 41 Resources 2014). Because this new information allows for a more detailed assessment of the

² 223 Cal.App.4th 645.

1 potential environmental effects resulting from geotechnical investigations than that which appeared
2 in Chapter 31 of the Draft EIR/EIS, the activities described in the geotechnical plan have been
3 incorporated into the revised impact analysis for Alternative 4 in this RDEIR/SDEIS (see Section 3,
4 *Conveyance Facility Modifications to Alternative 4*, for a description of other revisions to facility
5 design and Appendix A for revised Draft EIR/EIS text).

6 **2.5.1 Draft Geotechnical Exploration Plan**

7 The proposed exploration is designed as a two-part program (Phases 2a and 2b) to collect
8 geotechnical data relevant to engineering issues associated with conveyance facility construction (as
9 opposed to learning more about the environmental impacts of those facilities). The two-part
10 program will allow refinement of the second part of the program to respond to findings from the
11 first part. The proposed subsurface exploration will focus not on environmental impact issues, but
12 on geotechnical considerations of the following aspects of water conveyance facility development:
13 engineering considerations, construction-related considerations, permitting and regulatory
14 requirements, and seismic characterization considerations.

15 The data obtained during the geotechnical exploration will be used to support the development of
16 an appropriate geologic model, to characterize ground conditions, and to mitigate the geologic risks
17 associated with construction of proposed facilities. The investigations will build on information
18 previously gathered in geotechnical data reports (California Department of Water Resources 2010a,
19 2010b, 2011, 2013) and conceptual engineering reports (California Department of Water Resources
20 2009a, 2009b, 2010c, 2010d, 2010e, 2010f, 2010g, 2014, 2015) that supported analysis in the Draft
21 EIR/EIS. A discussion of the environmental compliance efforts associated with previous
22 geotechnical activities is provided in Appendix 4A, *Summary of Survey Data Collection Efforts*, in the
23 Draft EIR/EIS.

24 Representative samples of subsurface materials will be collected from selected locations along the
25 MPTO alignment and at proposed facility sites, and the collected samples will be tested to support
26 design. The distance from Intake 2 (the northern extent of the MPTO) to the Clifton Court Forebay
27 (the southern extent) is approximately 39 miles. The proposed facilities include river intakes,
28 conveyance pipelines, sedimentation basins, pumping plants, transition structures, forebays,
29 construction and vent shafts, access roads, bridges, and tunnels. The proposed subsurface
30 exploration will consist of field tests and laboratory testing of soil samples. The field tests will
31 consist of soil borings, cone penetration testing (CPT), geophysical testing, pressure meter testing,
32 excavation of test pits, installation of piezometers and groundwater extraction wells, dissolved gas
33 sampling, and aquifer tests. The field exploration program will be planned to evaluate soil
34 characteristics and to collect samples for laboratory testing, which will include soil index properties,
35 strength, compressibility, permeability, and specialty testing to support tunnel boring machine
36 (TBM) selection and performance specification.

37 The proposed Phase 2a and 2b exploration on land will consist of approximately 1,500–1,550
38 exploration locations including drilling boreholes and performing CPTs as well as conducting
39 approximately 60 shallow test pit excavations (typically 4 feet wide, 12 feet long, and 12 feet deep)
40 in soils to evaluate bearing capacity, physical properties of the sediments, location of the
41 groundwater table, and other typical geologic and geotechnical parameters. CPT consists of pushing
42 a cone connected to a series of rods into the ground at a constant rate, allowing continuous
43 measurements of resistance to penetration both at the cone tip and the sleeve behind the cone tip.

1 The resulting information correlates to the nature and sequence of subsurface soil strata,
2 groundwater conditions, and physical and mechanical properties of soils.

3 Temporary pumping wells and piezometers may be installed at intake, forebay, pump shaft, and
4 tunnel shaft sites to investigate soil permeability and to allow sampling of dissolved gases in the
5 groundwater. Small test pits will be excavated to obtain near-surface soil samples for laboratory
6 analysis. Drilling will take place at project sites that are readily accessible by truck or track-mounted
7 drill rigs.

8 After each site is explored, the boring, CPTs, and/or piezometers will be backfilled with cement-
9 bentonite grout in accordance with California regulations and industry standards (Water Well
10 Standards, DWR 74-81 and 74-90). Test pits will be backfilled with the excavated material on the
11 same day as they are excavated with the stockpiled topsoil placed at the surface and the area
12 restored as closely as possible to its original condition.

13 Exploration activities may consist of auger and mud-rotary drilling with soil sampling using a
14 standard penetration test (SPT) barrel (split spoon sampler) and Shelby tubes; cone penetrometer
15 testing; temporary well installation; test pits; and electrical resistivity and other geophysical
16 surveys. All exploration methods will require a drill rig and support vehicle for the drillers and
17 vehicles for the geologists and environmental scientists. Best management practices applicable to
18 geotechnical exploration, such as those set forth in *Draft Geotechnical Exploration Plan – Phase 2*;
19 *Draft BDCP Appendix 3.C, Avoidance and Minimization Measures*; Appendix 3B, *Environmental*
20 *Commitments*, in Appendix A of this RDEIR/SDEIS, as well as those incorporated as mitigation
21 measures throughout the EIR/EIS, will also apply to the implementation of geotechnical
22 explorations, where applicable (e.g., in-water activities may, in some cases, require application of a
23 different set of commitments than activities taking place on land). Direct impacts to buildings,
24 utilities, and known irrigation and drainage ditches will be avoided during geotechnical exploration
25 activities. The various on-land exploration methods may last from a few hours to several days
26 depending on the exploration method and depth.

27 Approximately 90–100 overwater geotechnical borings and CPTs are proposed to be drilled in the
28 Delta waterways. These include approximately 30 overwater geotechnical borings and CPTs in the
29 Sacramento River to obtain geotechnical data for the proposed intake structures. Approximately 25–
30 35 overwater borings and CPTs are planned at the major water undercrossings along the planned
31 MPTO tunnel alignment. An additional 30–35 overwater geotechnical borings and CPTs are
32 proposed for the barge unloading facilities and Clifton Court Forebay modifications. The depths of
33 borings and CPTs are planned to range between 100 and 200 feet below the mud line (i.e., river
34 bottom).

35 DWR plans to conduct overwater drilling only during the period from August 1 to October 31
36 between the hours of sunrise and sunset. Duration of drilling at each location will vary depending on
37 the number and depth of the holes, drill rate, and weather conditions, but activities are not expected
38 to exceed 60 days at any one location. Overwater borings for the intake structures and river
39 crossings for tunnels will be carried out by a drill ship and barge-mounted drill rigs. Best
40 management practices applicable to construction of conveyance facilities, such as those set forth in
41 *Draft BDCP Appendix 3.C, Avoidance and Minimization Measures*, Appendix 3B, *Environmental*
42 *Commitments*, in Appendix A of this RDEIR/SDEIS, as well as those incorporated as mitigation
43 measures throughout the EIR/EIS, will also apply to the implementation of geotechnical

1 explorations, where applicable and feasible (e.g., in-water activities may, in some cases, require
2 application of a different set of commitments than activities taking place on land).

3 As discussed above, the proposed subsurface exploration has been structured into two major
4 phases: 2a and 2b. The elements of Phases 2a and 2b have been defined to support engineering
5 design and construction as described below.

6 **2.5.1.1 Phase 2a Geotechnical Exploration**

7 Phase 2a exploration will focus mainly on collecting data to support preliminary engineering. This
8 includes overwater and land-based soil borings and CPTs. The overwater explorations are planned
9 to collect subsurface information to support the design of intake structures and the major water
10 crossings along the MPTO. Land-based explorations are planned for the intake perimeter berms,
11 State Route 160 (SR 160), sedimentation basins, pumping plants, forebay embankments, tunnel
12 construction and vent shafts, and other appurtenant facilities proposed for the MPTO.
13 Approximately 600 boring and CPT locations are proposed for the Phase 2a exploration.

14 For the proposed MPTO tunnels, Phase 2a would entail soil borings approximately every 2,000 feet
15 along the tunnel alignment and CPTs approximately every 2,000 feet midway between the borings.
16 Overwater boreholes and CPTs are planned in Potato Slough, San Joaquin River, Connection Slough,
17 and Clifton Court Forebay. All of the land-based boreholes along the tunnel alignments will be
18 converted into piezometers. CPTs are also proposed to be co-located at every third borehole to
19 enable calibration of the CPT data with the in-situ geology encountered in the boreholes.

20 For tunnel shaft sites and Clifton Court Forebay pumping plant shaft sites (see Section 3, *Conveyance*
21 *Facility Modifications to Alternative 4*, of this RDEIR/SDEIS for a description of the revised location
22 for pumping plants under the MPTO), six soil borings and four CPTs will be advanced at each
23 planned shaft location. Once drilling is completed at each shaft site, two of the boreholes will be
24 converted into groundwater extraction wells and the other four boreholes will be converted into
25 piezometers.

26 Boreholes and CPTs are also proposed for the intake and pumping plant sites, as well as the planned
27 location for the realignment of SR 160 adjacent to each intake. Approximately six of the boreholes at
28 each of the north Delta diversions would be converted into piezometers.

29 **2.5.1.2 Phase 2b Geotechnical Exploration**

30 Phase 2b exploration is proposed to collect geotechnical data to support final design, permitting
31 requirements, and planning for procurement and construction-related activities. In addition to soil
32 borings and CPTs, test pits would be created as part of Phase 2b exploration. Additional explorations
33 may also be carried out before construction to affirm the validity of the data collected during the
34 design phase. The Phase 2b subsurface exploration will aim to collect geotechnical data from those
35 project site areas and facility locations that have been verified by preliminary engineering and other
36 associated studies. Approximately 950 boring, CPT, and test pit locations are proposed for the Phase
37 2b exploration.

38 For the proposed MPTO tunnels, the Phase 2b exploration will consist of advancing soil borings near
39 the Phase 2a CPT locations such that a borehole will have been located at approximately 1,000-foot
40 intervals along the entire tunnel alignment. CPTs will be advanced midway between the boreholes.
41 This configuration would provide for a land-based exploratory location (borehole or CPT) spacing of

1 approximately 500 feet along the tunnel alignment, a spacing that generally conforms to typical
 2 design efforts for tunnels such as those proposed as part of the MPTO. The exploration proposed for
 3 the construction and ventilation shaft sites in Phase 2a would be expanded to include areas for
 4 accessing the TBMs for equipment inspection and maintenance (“safe haven intervention sites”) in
 5 Phase 2b. Overwater boreholes and CPTs are planned in the Sacramento River, Snodgrass Slough,
 6 South Fork Mokelumne River, San Joaquin River, Potato Slough, Middle River, Connection Slough,
 7 Old River, North Victoria Canal, and Clifton Court Forebay.

8 **2.5.1.3 Schedule for Geotechnical Explorations**

9 The estimated duration to complete the proposed Phase 2a and 2b land-based explorations is about
 10 24 months, assuming six land-based drill rigs operating concurrently for six days per week. The
 11 estimated duration to complete the Phase 2a and 2b overwater explorations is about 14 months,
 12 assuming two drill rigs operating concurrently for 6 days per week. However, to maintain the
 13 project development schedule, it is likely that 10–15 land-based drill rigs would be used
 14 simultaneously for 12–18 months to complete the exploration. The exploration duration will vary
 15 depending on the availability of site access, drilling contractors and equipment, permitting
 16 conditions, and weather. Most of the proposed explorations are planned to be performed during the
 17 first 3 years of implementation.

18 **2.5.2 Methods for Environmental Analysis**

19 Based on information provided in the geotechnical plan and coordination with DWR’s engineering
 20 workgroup, assumptions were developed to incorporate the proposed geotechnical investigations
 21 into the analysis of relevant resource topics in this RDEIR/SDEIS. The geotechnical plan is a draft
 22 document that is based on conceptual engineering; consequently, the specific exploration locations
 23 shown on figures appended to the plan are approximate, and it is anticipated that they may be
 24 revised as engineering efforts are advanced and as access to the proposed exploration sites becomes
 25 available.

26 To account for this uncertainty, several steps were taken to develop assumptions for environmental
 27 analysis. First, for analyses based on the geographical extent of an impact, it was assumed that those
 28 geotechnical exploration sites will be co-located with or located adjacent to another CM1 surface
 29 feature were already considered as an affected area for the purposes of the impact analysis. For
 30 example, treating a proposed tunnel shaft location as an impact and then adding an additional
 31 impact for a geotechnical exploration proposed for the same location would lead to an overestimate
 32 of the overall impacts. However, where sites identified for on-land geotechnical explorations were
 33 not positioned with a corresponding conveyance feature or work site, several geotechnical
 34 exploration zones (GEZs) were created. These GEZs are located above the tunnel alignment, around
 35 Clifton Court Forebay, and at one existing bridge location on Bacon Island (see Mapbook Figure M3-
 36 4 for the locations of the GEZs). To account for the potential for surface impacts to take place
 37 anywhere within these zones but to avoid implying that the entire area will be affected, a
 38 proportional approach was developed to (1) estimate the typical area required for a single
 39 geotechnical investigation site (including associated access road), (2) calculate the total acreage
 40 required based on the number of sites within the GEZs, and (3) divide the total acreage required for
 41 the geotechnical investigation sites in the GEZs by the total acreage of the GEZs. This process
 42 allowed for the development of a multiplier (approximately 30%) that could be applied to specific
 43 acreage impacts in the GEZs. So, as an example for illustrative purposes, if 100 total acres within the

1 GEZs are identified as “prime farmland,” the impact analysis would assume that geotechnical
 2 investigations would affect 30 acres. This acreage estimate would then be included as part of the
 3 overall effect reported for the MPTO water conveyance facilities.

4 For proximity-based analysis (such as noise), relevant “buffers” were simply applied from the
 5 outside edges of the GEZs to ensure that any effects on sensitive receptors were included in the
 6 impact analysis. For analyses associated with air quality modeling, specific assumptions regarding
 7 equipment, vehicle use, and schedule information were incorporated into the existing models used
 8 for impact analysis. Finally, it was assumed that the overwater sites identified in the geotechnical
 9 plan would be representative of the sites ultimately chosen because it is anticipated that site
 10 selection for these investigations is more constrained than sites for on-land activities. Sites for
 11 overwater exploration would be chosen at the locations for the three proposed intake structures in
 12 the Sacramento River, Clifton Court Forebay, and at major water crossings along the tunnel
 13 alignment or areas proposed for barge unloading facilities, including Snodgrass Slough, Mokelumne
 14 River, Potato Slough, San Joaquin River, Connection Slough, Middle River, Santa Fe Cut, Woodward
 15 Canal, Old River, and Italian Slough.

16 **2.5.3 Applicability to Other Alternatives**

17 If the Lead Agencies ultimately select an alternative that proposes an alignment different from the
 18 modified pipeline/tunnel alignment, it is anticipated that a similar plan for geotechnical exploration
 19 would be designed and implemented, as described in Appendix 3B, *Environmental Commitments*, in
 20 Appendix A of this RDEIR/SDEIS. A discussion of the potential environmental effects resulting from
 21 implementation of these activities appears in Chapter 31, *Other CEQA/NEPA Required Sections*,
 22 Section 31.5.1.1 in the Draft EIR/EIS. Because additional detail pertaining to the location and extent
 23 of these efforts under the modified pipeline/tunnel alignment has been developed since the release
 24 of the Public Draft EIR/EIS, the potential effects of these activities have been incorporated into
 25 relevant portions of the impact analysis pertaining to construction of the water conveyance
 26 facilities.

27 **2.6 References**

28 **2.1 Fish and Aquatic Habitat Analyses**

29 None.

30 **2.2 Water Quality Revisions**

31 None.

32 **2.3 Air Quality, Health Risk Assessment, Traffic, and Noise** 33 **Revisions**

34 None.

2.4 Revised Project Descriptions and Enhanced Level of Detail

None.

2.5 Analysis of Geotechnical Investigations

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