growth would be less in the ELT, thus discharges of EC-elevating parameters in runoff and wastewater discharges to water bodies upstream of the Delta would be expected to be less than in the LLT. However, the state is regulating point source discharges of EC-related parameters and implementing a program to further decrease loading of EC-related parameters to tributaries. Based on these considerations, and those described in Section 8.3.3.9, EC levels (highs, lows, typical conditions) in the Sacramento River and its tributaries, the eastside tributaries, or their associated reservoirs upstream of the Delta would not be expected to be outside the ranges occurring under Existing Conditions.

For the San Joaquin River, increases in EC levels under Alternative 4A could occur, but would be slightly less than those described for Alternative 4 (see Section 8.3.3.9). This is because the effects of climate change on flows, which could affect dilution of high EC discharges, would be less in the ELT. The implementation of the adopted TMDL for the San Joaquin River at Vernalis and the ongoing development of the TMDL for the San Joaquin River upstream of Vernalis are expected to contribute to improved EC levels. Based on these considerations, substantial changes in EC levels in the San Joaquin River relative to Existing Conditions would not be expected to be of sufficient magnitude and geographic extent that would result in adverse effects on any beneficial uses, or substantially degrade the quality of these water bodies, with regard to EC.

Delta

Relative to Existing Conditions and the No Action Alternative (ELT), initial review of modeling results indicated that Alternative 4A would potentially result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton and San Joaquin River at Prisoners Point (Appendix 8H, *Electrical Conductivity*, Table EC-26). To understand and interpret these results, considerations must be made regarding uncertainty in the modeling and results from sensitivity analyses. In addition, modeling results indicate there would be small increases in long-term monthly average EC at modeled Suisun Marsh locations relative to Existing Conditions. These locations are addressed in detail below. At all other locations, the level of exceedance and modeled average EC levels under the alternative were approximately equivalent or lower than under Existing Conditions and the No Action Alternative (ELT).

Sacramento River at Emmaton

Modeling results indicated that the Emmaton EC objective would be exceeded more often under Alternative 4A than under Existing Conditions and the No Action Alternative (ELT), and that increases in EC could cause substantial water quality degradation in summer months of below normal, dry and critical water years. However, these increases in exceedance of the objective and degradation are expected to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Delta Cross Channel operation. Further discussion is provided below.

Modeling results indicated that the percentage of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions, or 12% under the No Action Alternative (ELT), to 16%, and the percentage of days out of compliance would increase from 11% under Existing Conditions, or 21% under the No Action Alternative (ELT), to 27% (Appendix 8H, *Electrical Conductivity*, Table EC-26).

Sensitivity analyses were performed that modeled Alternative 4 Scenario H3 at the LLT with Emmaton as the compliance point. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H, *Electrical Conductivity*, Attachment 1). Table 2 of Appendix 8H, *Electrical Conductivity*, Attachment 1, indicates that most of these exceedances are a result of modeling artifacts, but some exceedances are due to deadpool conditions that occurred under Alternative 4 and not under the No Action Alternative. As discussed in Chapter 5, *Water Supply*, Section 5.3.1, *Methods for Analysis*, under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be exceeded due to dead pool conditions. However, these results indicate that water supply could be either under greater stress or under stress earlier in the year.

The results of the EC modeling indicate there would be months with substantial degradation relative to the No Action Alternative (ELT), particularly during the drought period modeled. Long-term monthly average EC levels at Emmaton would increase in the months of April, and July through September by 3–30% for the entire period modeled (1976–1991) and 6–41% during the drought period modeled (1987–1991), relative to the No Action Alternative (ELT) (Appendix 8H, *Electrical Conductivity*, Table EC-29). The largest increases in EC would occur in below normal, dry and critical water year types. However, as stated above, these periods of degradation are expected to be addressed via real-time operations. The level to which modeling output depicts degradation of water quality with respect to EC is primarily a function of the modeling not being able to fully capture how the system would be operated in real-time to minimize or avoid such degradation.

Discussions with SWP operators indicated that real-time operations would ensure that the Bay-Delta WQCP EC objectives at Emmaton, applicable from April 1 through August 15, would be met. In latter August and September, the Threemile Slough standard in the North Delta Water Agency Agreement and the Bay-Delta WQCP municipal and industrial objective at Rock Slough are in effect. During this period of the year, the coordinated operations of the SWP/CVP system strives to meet both standards in the most water-efficient method available to the CVP and SWP. Real-time operation would result in less EC degradation than depicted by modeling output because in order to comply with Bay-Delta WQCP objectives and the the North Delta Water Agency Agreement during the summer period, operators could, for example, increase upstream reservoir releases for necessary periods of time, reduce North Delta diversions, and/or close (short-term) the Delta Cross Channel. These options as well as real-time and forecasted tides, winds and barometric pressure are considered when the projects schedule daily operations, which the modeling does not fully capture.

Alternaltive 4A does not change the Bay-Delta WQCP objectives or the the North Delta Water Agency Agreement which are primary drivers of operations and resulting water quality in the Sacramento River at at Emmaton during late August and September. Therefore, the EC degradation at Emmaton that would occur upon implementation of Alternative 4A would be lesser than that shown by the modeling and would not be expected to differ substantially from that which would occur under the No Project Alternative because the compliance targets are not changing due to Alternative 4A during these months and real-time operations would achieve the compliance targets.

The modeling results also show that in the remaining months there would be decreases in EC relative to the No Action Alternative (ELT) of 3–21% for the entire period modeled and 2–28% for the drought period modeled. These decreases would contribute to the long-term average EC levels decreasing by 1% for the entire period modeled and drought period modeled (Appendix 8H, *Electrical Conductivity*, Table EC-29).

San Joaquin River at Prisoners Point

Modeling results indicated that the EC objective that applies to the San Joaquin River between Jersey Point and Prisoners Point would be exceeded at Prisoners Point more often under Alternative 4A than under Existing Conditions and the No Action Alternative (ELT). However, these exceedances also are expected to be able to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Head of Old River Barrier management. Further discussion is provided below.

Modeling results estimated that the percentage of days the Prisoners Point EC objective would be exceeded would increase from 6% under Existing Conditions, or 2% under the No Action Alternative (ELT), to 12%, and the percentage of days out of compliance with the EC objective would increase from 10% under Existing Conditions, or 2% under the No Action Alternative (ELT), to 13% (Appendix 8H, *Electrical Conductivity*, Table EC-26). The magnitude of the exceedances is estimated to be very small—the objective is 440 μmhos/cm, and the EC during times of exceedance was between 440 and 600 μmhos/cm—and the exceedances generally occurred in drier water years (4 of the 5 years in which there were exceedances were dry water year type), when flows would be lower (Appendix 8H, *Electrical Conductivity*, Figures EC-1 through EC-5). During these times, the EC in the San Joaquin River at Vernalis is greater than in the Sacramento River entering the Delta, and is high enough on its own to cause an exceedance of the Prisoners Point EC objective.

There are two main drivers of the increase in exceedances under the alternative: an increase in San Joaquin River flow at Prisoners Point during April and May under the alternative, relative to Existing Conditions and the No Action Alternative (ELT), and a reduction in the amount of Sacramento River water moving past Prisoners Point under the alternative. The result is increased San Joaquin River water at Prisoners Point, and a reduction in the dilution that the Sacramento River provides the higher EC San Joaquin River. The increase in San Joaquin River flow at Prisoners Point is due to a reduction in pumping from the south Delta under the alternative, as well as due to the presence of the Head of Old River Barrier, which increases flow in the San Joaquin River downstream of Old River by preventing flow from entering Old River. The reduction in Sacramento River water influence is due to less pumping at the south Delta pumping plants (i.e., greater pumping draws more Sacramento River water through the Delta).

Sensitivity analyses conducted for Alternative 4 Scenario H3 at the LLT indicated that if the Head of Old River Barrier was open in April and May, exceedances would be reduced by about 5 percentage points. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT. Results of the sensitivity analyses indicate that the exceedances are partly due also to operations of the alternative itself, due to Head of Old River Barrier assumptions, and south Delta export differences (see Appendix 8H, Attachment 1, for more discussion of these sensitivity analyses). Appendix 8H, Attachment 2, contains a more detailed assessment of the likelihood of exceedances estimated via modeling adversely affecting aquatic life beneficial uses. Specifically, Appendix 8H, Attachment 2, discusses whether these exceedances might have indirect effects on striped bass spawning in the Delta, and concludes that the high level of uncertainty precludes making a definitive determination for those alternatives. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Suisun Marsh

For Suisun Marsh October–May is the period when Bay-Delta WQCP EC objectives for protection of fish and wildlife apply. Modeling results indicate that average EC for the entire period modeled would increase in the Sacramento River at Collinsville during the months of March and April relative to Existing Conditions, by 0.1–0.2 mS/cm (Appendix 8H, *Electrical Conductivity*, Table EC-32). In Montezuma Slough at National Steel, average EC levels would increase in March through May by 0.2 mS/cm (Appendix 8H, Table EC-33). There would be similarly small increases in long-term average EC in the months of March through May in Montezuma Slough near Beldon's Landing, Chadbourne Slough near Sunrise Duck Club, and Suisun Slough near Volanti Slough, ranging 0.1–0.4 mS/cm depending on month and location (Appendix 8H, Tables EC-34 through EC-36). Relative to the No Action Alternative (ELT), the modeled long-term average EC under the alternative would be similar or lower from October through May for these locations (Appendix 8H, Tables EC-32 through EC-36).

The Suisun Marsh EC objectives are expressed as a monthly average of daily high tide EC, which does not have to be met if it can be demonstrated "equivalent or better protection will be provided at the location" (State Water Resources Control Board 2006:14). Long-term average EC increases relative to Existing Conditions may, or may not, contribute to adverse effects on beneficial uses, depending on how and when wetlands are flooded, soil leaching cycles, how agricultural use of water is managed, and future actions taken with respect to the Marsh. Given the Bay-Delta WQCP narrative objective regarding "equivalent or better protection" in lieu of meeting specific numeric objectives, the small increases in EC under Alternative 4A, relative to Existing Conditions, would not be expected to adversely affect beneficial uses of Suisun Marsh. While Suisun Marsh is CWA Section 303(d) listed as impaired because of elevated EC, the potential increases in long-term average EC concentrations, relative to Existing Conditions, would not be expected to contribute to additional impairment, because the increase would be so small (<1 mS/cm) relative to the daily fluctuations in EC levels as to not be measurable and beneficial uses would not be adversely affected.

Further, the EC changes in Suisun Marsh relative to Existing Conditions reflect the influence of both operations of the alternative and sea level rise due to climate change, whereas the changes relative to the No Action Alternative (ELT) are due solely to operations of the alternative. As described above, there would be no increase in the long-term average EC at modeled Suisun Marsh locations, and for some locations long-term average EC would decrease. Therefore, it is expected that this alternative would not contribute to exceedances of EC objectives or additional impairment of beneficial uses, as affected by EC or other salinity-related parameters.

The effects of Alternative 4A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to effects in the ELT. With greater climate change and sea level rise, additional outflow may be required at certain times to prevent increases in EC in the west Delta, but this requirement would not be due to the alternative.

SWP/CVP Export Service Areas

Under Alternative 4A, at the Banks pumping plant, the frequency of exceedance of the EC objective would be 1% for the entire period modeled and 2% for the drought period modeled (Appendix 8H, *Electrical Conductivity*, Table EC-27). Relative to Existing Conditions, average EC levels under