Appendix 4E

Operations Sensitivity to Climate Change, Temporary Urgency Change Petitions, and the Interim Operating Plan

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4E.1 Introduction

For a description of why Alternative 1 is used in this document rather than the Proposed Project, please refer to Appendix 4J.

DWR has included modeling of Temporary Urgency Change Petitions (TUCPs) in this appendix for informational purposes only. It would be speculative to predict with specificity hydrology, timing, and demands that would be considered in future dry conditions. For more information related to TUCPs and relative operational sensitivities, please see Appendix 4I.

This document summarizes key findings from a sensitivity analysis of operational changes to the Baseline Conditions and Alternative 1 under climate change and sea level rise conditions, Temporary Urgency Change Petitions (TUCPs), and the Interim Operating Plan (IOP). The Baseline Conditions and Alternative 1 for this Environmental Impact Report (EIR) were simulated using CalSim 3 under the historical hydrologic conditions. For this sensitivity analysis, the Baseline Conditions and Alternative 1 were simulated using CalSim 3 and modeled using a 30-year climate period centered around year 2022 with 15 cm of sea level rise. Additional information on model assumptions, changes to CalSim 3 inputs, climate projections, and sensitivities for these climate change conditions are provided in Appendix 4D. In addition to climate change conditions, the Baseline Conditions and Alternative 1 were also modeled to incorporate TUCPs and exclude the IOP. Additional detail on assumptions pertaining to these elements are included in the subsections below.

Operations results from these simulations were analyzed to understand if the incremental changes between the Baseline Conditions and Alternative 1 remain similar under climate change, with TUCPs, and without the IOP. The Reclamation No Action is included in this analysis to serve as the Baseline Conditions under climate change and sea level rise conditions, TUCPs, and no IOP. The following sections summarize key CalSim 3 results for the Baseline Conditions and Alternative 1 under the 2022 climate conditions and 15 cm of sea level rise with the addition of TUCPs and the exclusion of the IOP.

4E.1.1 Temporary Urgency Change Petitions

TUCPs are petitioned by DWR and Reclamation in challenging years. In recent TUCPs, D-1641 requirements are adjusted to prevent severely impairing public water supply. TUCPs are not modeled in both the Baseline Conditions and Alternative 1 for this EIR. For the Baseline Conditions and Alternative 1 scenarios in this sensitivity analysis that include TUCPs, triggering criteria for this action is based on the Sacramento River Valley Water Year Index and/or Lake Shasta storage levels. While both of these criteria are considered, extremely dry conditions for one criterion can outweigh conditions for the other and trigger TUCPs. During these years, TUCPs relax the criteria that drive

releases from storage for Delta outflow and D-1641 requirements between February and April; this is modeled as a 4,000 cfs Net Delta Outflow Index (NDOI) requirement. If water quality requirements are relaxed in February through April, they cannot be initiated until May and only if challenging conditions have dissipated. If these conditions persist in May and continued relaxation of D-1641 requirements are warranted, TUCPs are enabled through September and shift to a 3,000 cfs NDOI requirement in June through September. Furthermore, the D-1641 requirement for Emmaton is moved to Threemile Slough. Exports are limited to health and safety conditions if NDOI is less than the full regulatory standard.

4E.1.2 Interim Operating Plan

Under the Baseline Conditions for this EIR, the Spring Maintenance Flow is modeled as the maximum allowable SWP export of 600 cubic feet per second (cfs) or up to 40% of the total permittable export under the following San Joaquin River: Inflow to Export (SJR IE) ratio regulations. SWP export limitations only occur when Delta Outflow is less than 44,500 cfs. The Spring Maintenance Flow may limit SWP exports by up to 150 TAF in San Joaquin Valley 60-20-20 wet years. The following SJR IE regulations are in effect from April to May when San Joaquin River flow is less than 21,750 cfs:

- For Wet and Above Normal years, SJR IE is modeled as a 4 to 1 ratio.
- For Below Normal years, SJR IE is modeled as a 3 to 1 ratio.
- For Dry years, SJR IE is modeled as a 2 to 1 ratio.
- For Critical years, SJR IE is modeled as a 1 to 1 ratio.

Under the IOP, the CVP also operates to the Baseline Conditions Spring Outflow Requirement in April and May when Delta Outflow is less than 44,500 cfs. However, the CVP export is the maximum of 900 cfs or up to 60% of the total permittable export under the same SJR IE regulations listed above. This is consistent for both the Baseline Conditions and Alternative 1 for this EIR.

4E.2 Study Objectives

The CalSim 3 model was applied to evaluate the sensitivity of the Baseline Conditions and Alternative 1 under future climate and sea level rise conditions, TUCPs, and without the IOP. The CalSim 3 model was used for quantifying the changes in river flows, delta channel flows, exports, and water deliveries. Key output parameters from this analysis are shown in Figure 4E-1 through Figure 4E-9. Effects of climate change, the inclusion of TUCPs, and exclusion of the IOP are summarized below.

4E.3 Climate Change and Operations Sensitivity Analyses

For this sensitivity analysis, the Baseline Conditions and Alternative 1 scenarios were generated using the modified hydrologic inputs based on the projected runoff changes under a future climate scenario centered around 2022. TUCPs are also included in these scenarios; IOP-related

assumptions included in the Baseline Conditions and Alternative 1 for this EIR are excluded. CalSim 3 simulations for the Baseline Conditions and Alternative 1 in this sensitivity analysis only differ with respect to climate change, TUCPs, and the IOP. None of the other system parameters have been changed.

The purpose of conducting these simulations is to help describe the sensitivity in projected SWP system operations under the Baseline Conditions and Alternative 1 to the inclusion of TUCPs and the exclusion of the IOP under climate change and sea level rise conditions. The incremental changes between the Baseline Conditions and Alternative 1 were compared to the incremental changes of these scenarios with the 2022 hydrologic conditions and 15 cm of sea level rise with TUCPs and without the IOP.

Figure 4E-1 through Figure 4E-9 show CalSim 3 simulation results for the Baseline Conditions (black lines); Alternative 1 (red lines); Reclamation No Action (purple lines); and Alternative 1 under 2022 future climate and 15 cm of sea level rise, TUCPs, and without the IOP (orange lines). The plots presented in this document are relevant to assessing whether the conclusions in the hydrology, water quality and aquatic biological resources analyzed in the EIR hold under the projected climate change conditions and operational changes described above. Several key observations can be made based on these simulations:

- Under 2022 climate change conditions and 15 cm of sea level rise with TUCPs and without the IOP, monthly long-term average Sacramento River flow at Freeport for the Baseline Conditions and Alternative 1 remains similar. Consistent with historical hydrologic conditions, Alternative 1 flow shows little to no change from Baseline Conditions across all months.
- Yolo Bypass flows are higher during December through March under the 2022 climate projection and operational changes considered in this analysis relative to the historical hydrologic conditions and operations modeled in the EIR. However, long-term average monthly flow patterns under Alternative 1 and the Baseline Conditions are nearly identical within each of these representations (i.e., with or without climate change and sea level rise, TUCPs, and the IOP).
- Incremental changes in flows between Alternative 1 and the Baseline Conditions at Georgiana Slough are similar under 2022 climate and 15 cm of sea level rise conditions with TUCPs and without the IOP. These flows reflect similar patterns shown for Sacramento River flow at Freeport due to climate change and sea level rise influence on tidal conditions in the estuary.
- Delta Cross Channel (DCC) flow is lower during August through October under the 2022 climate projection and operational changes considered in this analysis relative to the historical hydrologic conditions modeled in the EIR. However, incremental changes in flows between Alternative 1 and the Baseline Conditions at the DCC are similar under 2022 climate and 15 cm of sea level rise conditions with TUCPs and without the IOP.
- While patterns differ across some months, incremental changes in Qwest flows due to Alternative 1 compared to Baseline Conditions are largely consistent across both the historical hydrology and 2022 climate change conditions with 15 cm of sea level rise, TUCPs, and the exclusion of the IOP. Alternative 1 operations result in lower Qwest flows in April and May compared to Baseline Conditions. In addition, Alternative 1 displays slightly lower flows than the Baseline Conditions in July through September, and slightly greater flows in winter months and June, under both with and without climate change and sea level rise conditions, TUCPs, and the IOP.

- Incremental changes in Delta outflow due to Alternative 1 operations compared to the Baseline Conditions under 2022 climate change and 15 cm of sea level rise, TUCPs, and no IOP are similar as compared to historical hydrologic conditions, no TUCPs, and the IOP across all months. Delta outflow is higher in December through March and lower in May and June under these climate change, sea level rise, and operational conditions.
- Old and Middle River (OMR) flow incremental changes under Alternative 1 compared to the Baseline Conditions across all months are relatively consistent with and without climate change and sea level rise, TUCPs, and the IOP. However, incremental changes in September are lower under 2022 climate change and 15 cm of sea level rise with TUCPs and no IOP, displaying a reduction in the decrease of OMR flow from the removal of the 2020 SWP ITP Summer - Fall Actions for Adaptive Management outflow block of 100 TAF under Alternative 1. The effects of the exclusion of the IOP are apparent at this location as OMR flow is greater (i.e., more negative) in April and May under the Reclamation No Action and Alternative 1 with 2022 climate change and TUCPs.
- Simulated exports show similar patterns in incremental changes under 2022 climate change and 15 cm of sea level rise with TUCPs and no IOP to those presented above for OMR. With warming climate and salinity intrusion associated with sea level rise, available water supply and exports under the Baseline Conditions and Alternative 1 decrease, particularly in July through November. Exports in the months that are significantly constrained (i.e., December through March) are not as sensitive to climate change and sea level rise. Increases to exports for the Baseline Conditions (i.e., Reclamation No Action) and Alternative 1 under climate change, 15cm of sea level rise, and TUCPs occur in April and May, consistent with the anticipated impacts of the exclusion of IOP-related assumptions. Additionally, the inclusion of TUCPs results in lower minimum annual exports, even under 2022 climate and sea level rise conditions, due to exports being limited to health and safety requirements under sub-regulatory standard NDOI conditions.

Overall, the relative incremental changes due to Alternative 1 as compared to the Baseline Conditions under 2022 climate and sea level rise conditions, TUCPs, and no IOP are similar to that described under the historical hydrologic conditions, no TUCPs, and the IOP in the EIR. While future climate and sea level rise will alter some of the magnitude of flows, the relative incremental changes due to Alternative 1 are similar when compared to the Baseline Conditions, even with TUCPs and without the IOP. Furthermore, TUCPs appear to have limited influence on the changes to these patterns under these conditions; climate change, sea level rise, and IOP (for exports in April and May only) considerations appear to be the primary drivers for shifts in the magnitude of flows.

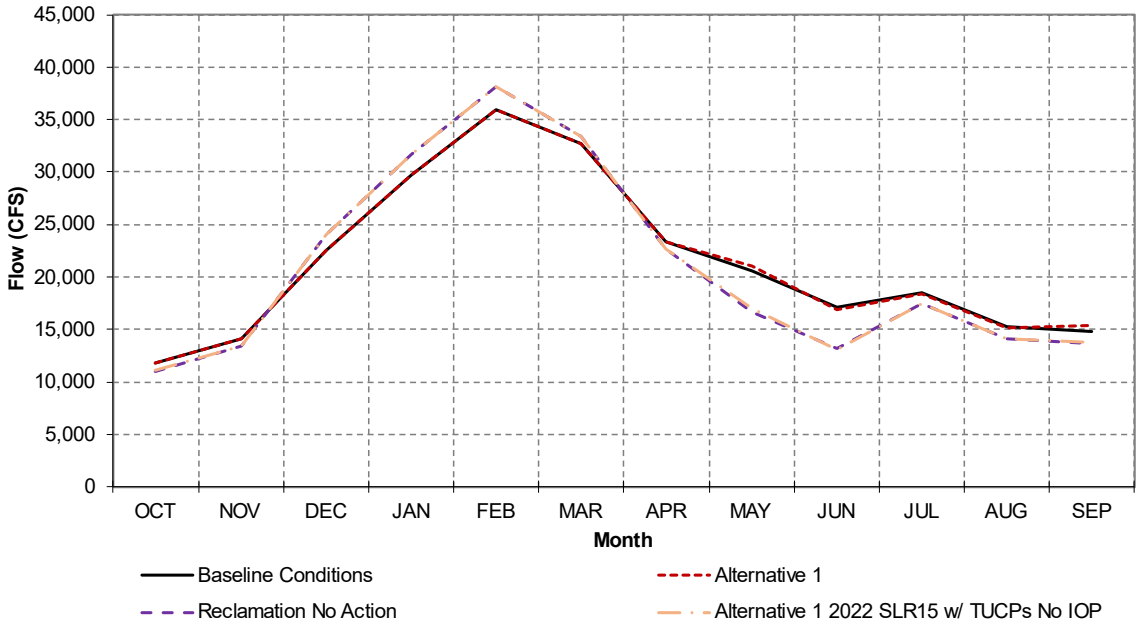

Figure 4E-1. Sacramento River at Freeport Monthly Long-term Average Flow for the Baseline Conditions and Alternative 1 under Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

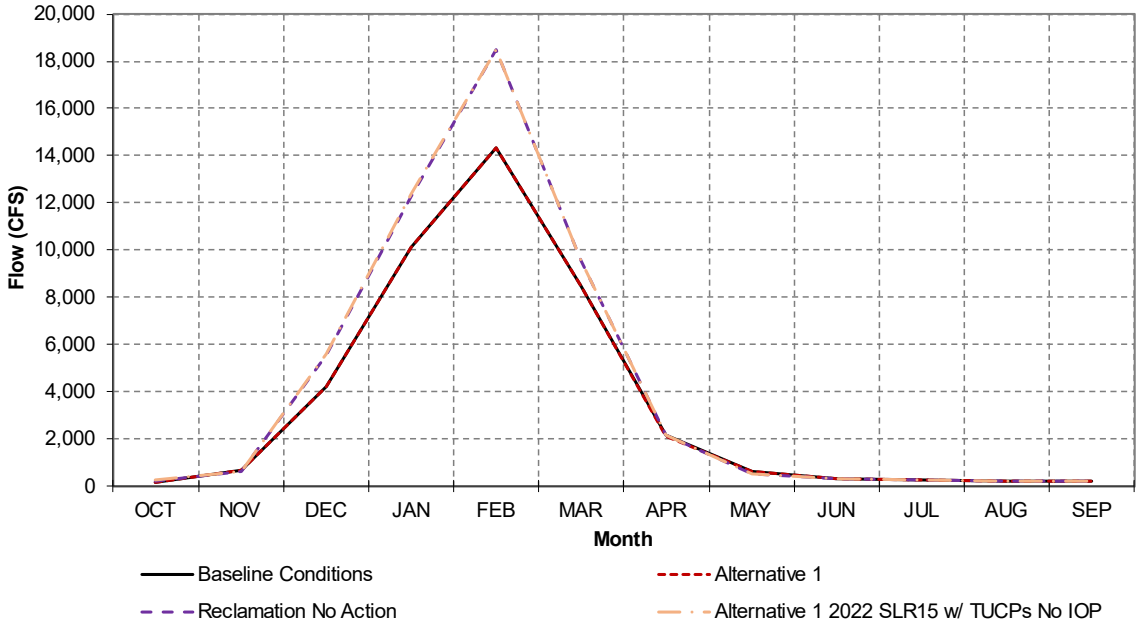

Figure 4E-2. Monthly Long-term Average Yolo Bypass Flow for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

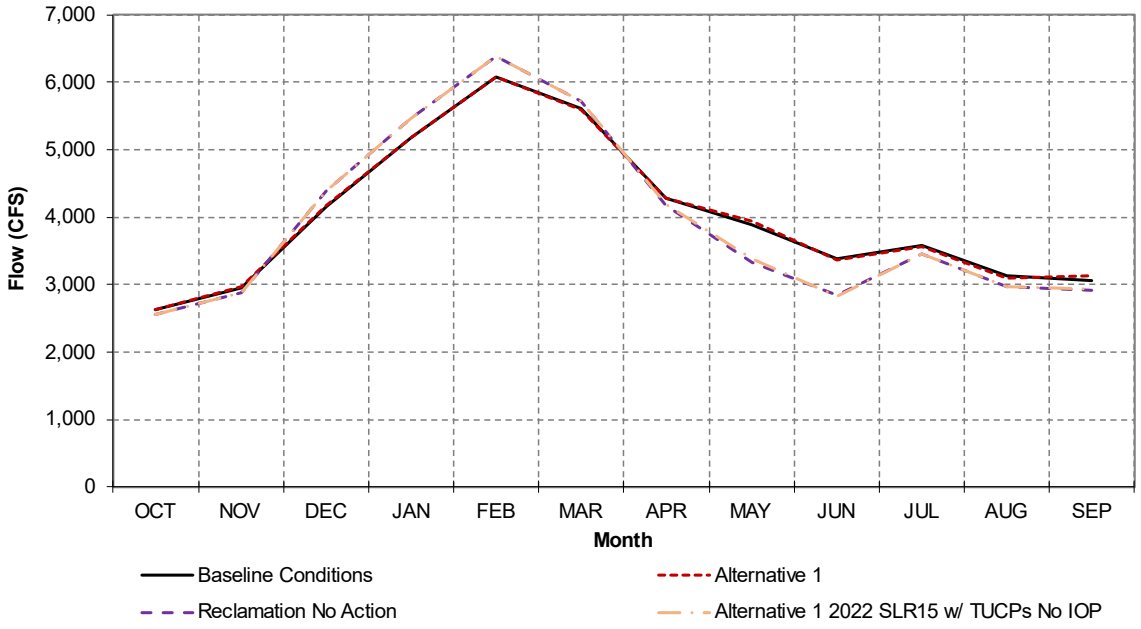

Figure 4E-3. Monthly Long-term Average Georgiana Slough Flow for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

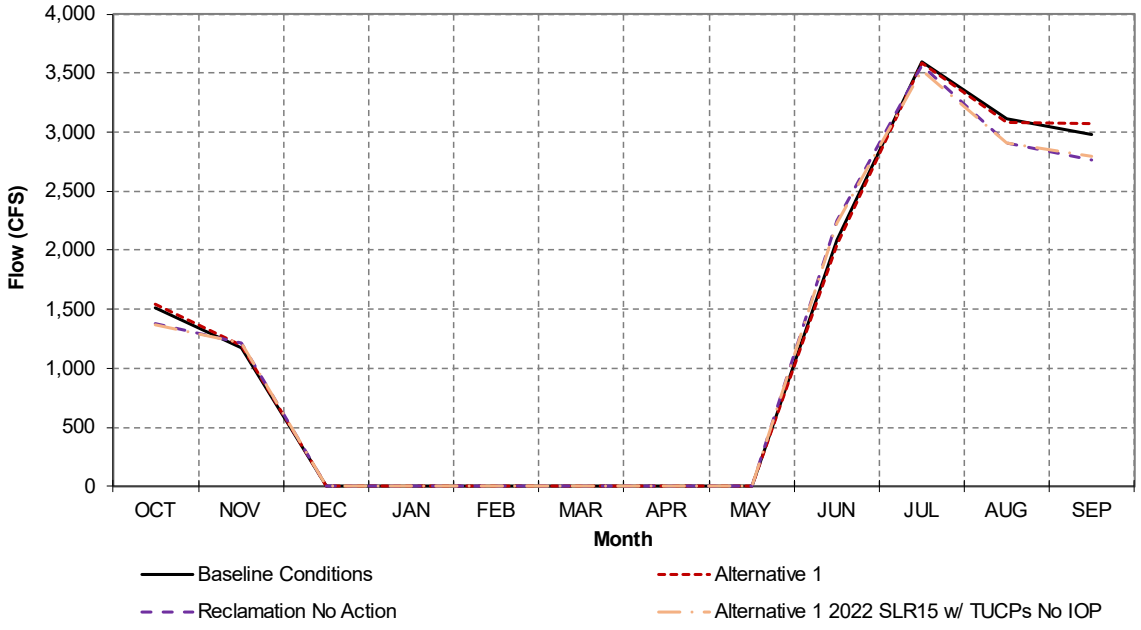

Figure 4E-4. Monthly Long-term Average Delta Cross Channel Flow for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

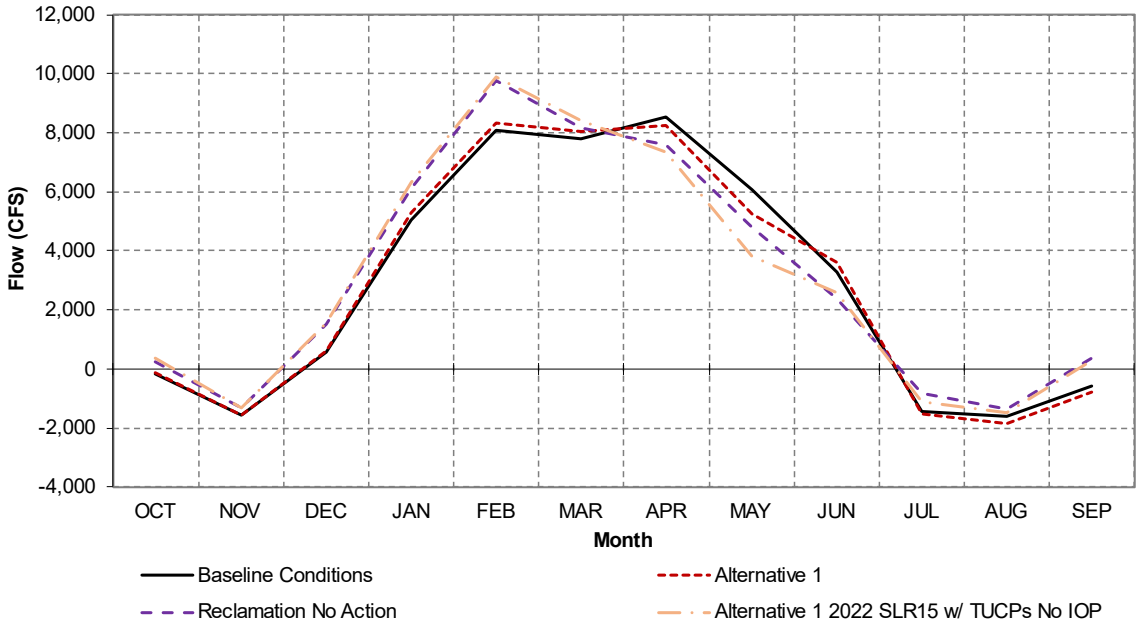

Figure 4E-5. Monthly Long-term Average Qwest Flow for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

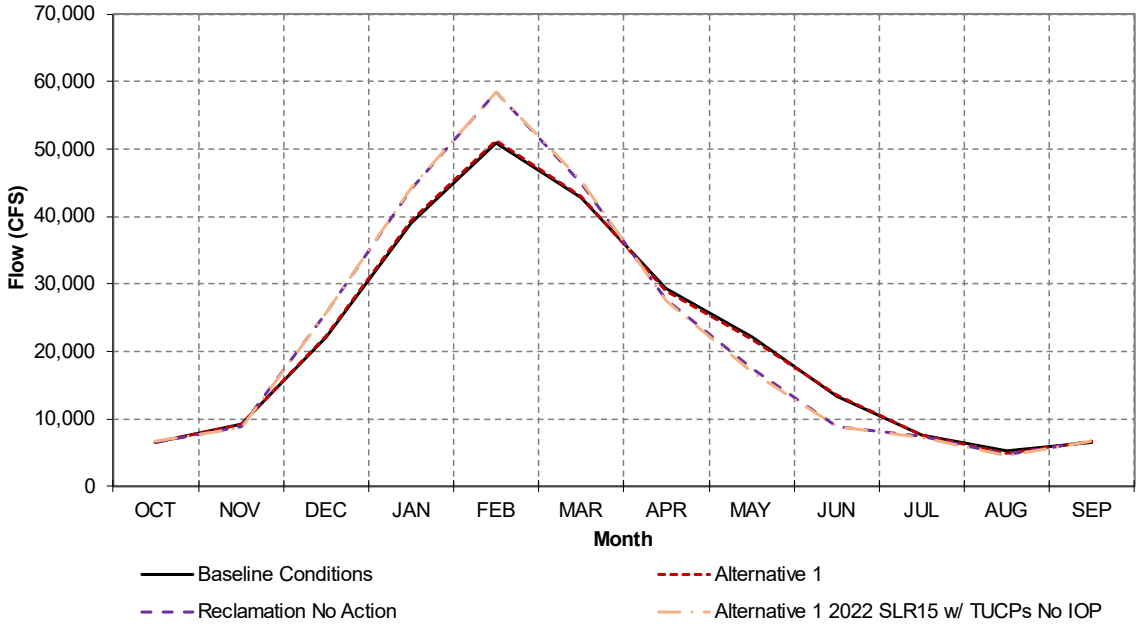

Figure 4E-6. Monthly Long-term Average Delta Outflow for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

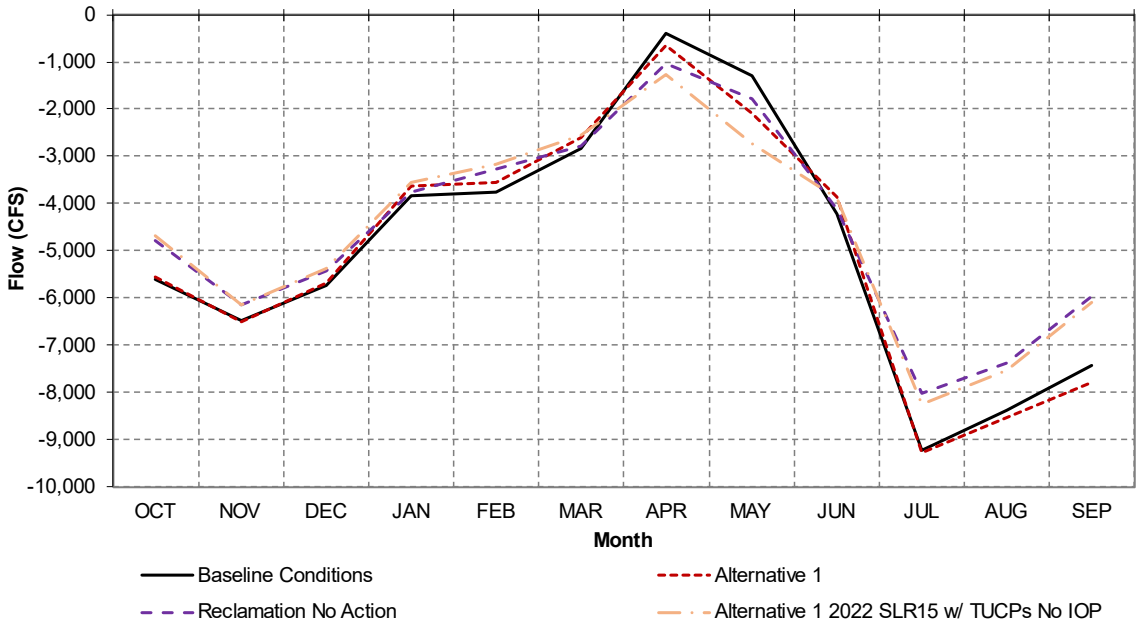

Figure 4E-7. Combined Old and Middle River Monthly Long-term Average Flow for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

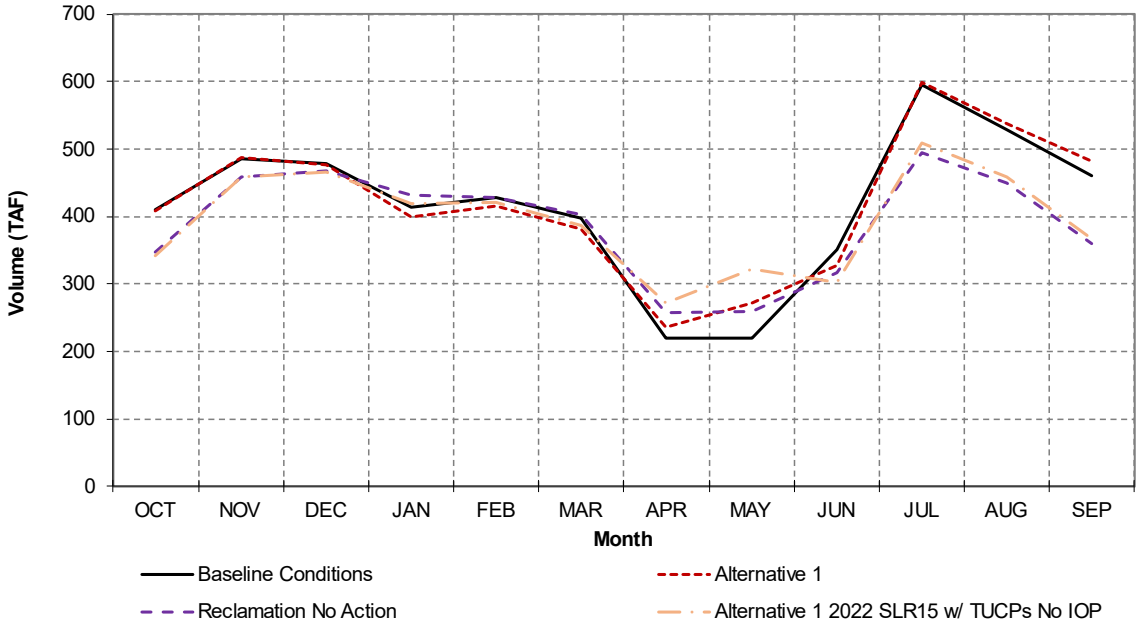

Figure 4E-8. Monthly Long-term Average Delta Exports for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP

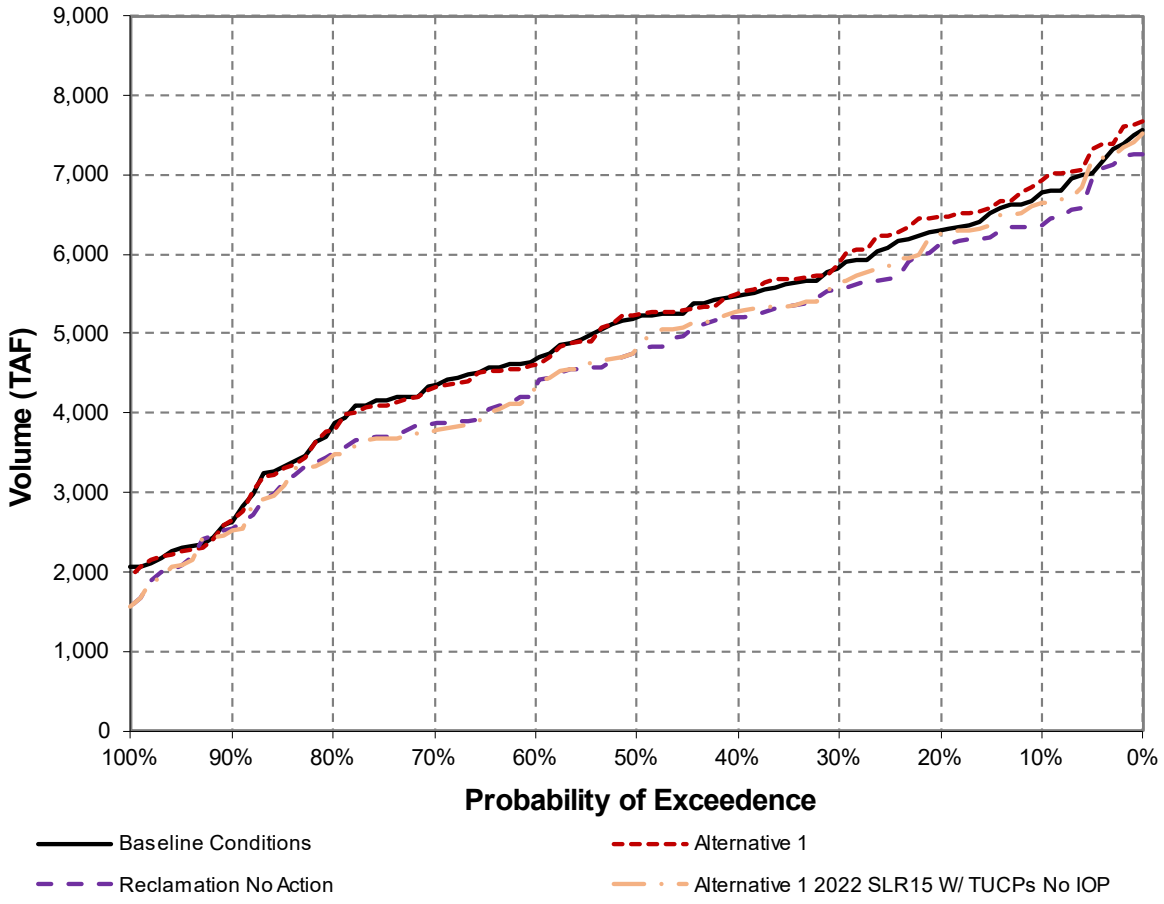

Figure 4E-9. Annual Delta Exports for the Baseline Conditions and Alternative 1 under Historical Hydrology and Future Climate Centered around 2022 with 15 cm of Sea Level Rise with and without TUCPs and the IOP