DRAFT Delta Conveyance Project Draft Environmental Impact Report Review

Delta Independent Science Board
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Contents

1. Summary of Major Findings

The Delta Independent Science Board (Delta ISB) asked the following questions in their review of the Delta Conveyance Project draft Environmental Impact Report (EIR): 1) Does the EIR use robust and comprehensive scientific approaches to evaluate project alternatives and their effects? and 2) Is the information appropriately complete for effective decision making?

The draft EIR uses a wide variety of analytical methods and detailed performance metrics to compare the performance and impacts of nine alternatives for a Delta conveyance project. The draft EIR asserts multiple improvements in water supply outcomes, including increased operational flexibility and seismic risk mitigation, relative to the "no project" alternative. The analyses identify some substantial social and environmental impacts but concludes that due to "environmental commitments and mitigation measures," all ecosystem impacts evaluated will be reduced to less than significant impacts. Mitigation and community benefits initiatives are proposed for offsetting social (including economic) impacts but substantial impacts were still expected in some categories.

The draft EIR is generally thorough in scoping potential impacts and shows some improvement in analytic approaches relative to EIRs conducted for prior proposed Delta conveyance projects. A prominent improvement is that this analysis includes some assessment of climate change on the performance of alternatives in 2040 and a sensitivity analysis of 2070 conditions for selected effects. The document's thematic chapters provide detailed, descriptive background on current conditions of the California Delta's water, ecological, economic, social, and physical systems. The stated goals of the analyses are to identify potential impacts of construction, operations and maintenance, and some chapters are thorough in examining potential negative impacts of mitigation efforts. The analyses are often based on peer-reviewed, but not necessarily comprehensive, scientific methods, models and understanding. Overall, the analyses evaluating most of the impact areas considered appear fairly comprehensive.

Despite some strengths, the report has some major limitations in that it lacks key information necessary to support informed decision making. It lacks 1) clear illustrations of how the proposed project achieves the benefits claimed; 2) clarity in the evidence to support some of the findings of less than significant impacts; and 3) attention to future uncertainty of climate effects and mitigation effectiveness.

Some of these concerns stem from a lack of attention to operations effects, which are admittedly challenging to predict, but more detailed and comprehensive analysis could be supported by the available science. Further, methods to adaptively manage biophysical and social impacts are not rigorously defined nor planned in all chapters, especially those needed to address extreme and novel conditions.

An overarching concern with the Executive Summary is that the performance metrics specified by the California Environmental Quality Act (CEQA) promote analysis summaries that appear insufficient for assessing some important scientific and social impacts. In particular, CEQA criteria used to assess likely impacts often fail to fully evaluate expected performance under the climatic variability that can be reasonably anticipated for the Delta. We also have concerns about the degree to which broad systemic (across the ecosystem), additive (across drivers), or cumulative (over time) effects have been fully captured by indicators that narrowly apply science and reduce the project effects to individual species, annual average calculations, or individual groups of stakeholders.

The presentation of results creates interpretation challenges. The most relevant information for understanding potential benefits and impacts is often widely dispersed through chapters and appendices, making synthesis of impacts difficult. We also find some concerning omissions in specific analyses.

Our primary concerns about the draft EIR are described in this main body of our review and more specific analytical concerns are described chapter-by-chapter in Appendix A. Because information is not always well synthesized in the report, some of our concerns may reflect a lack of clarity of the presentation more than analytic shortfalls.

Major Concerns

The Delta ISB has eight major concerns for the draft EIR:

1. The EIR does not include a sufficiently diverse set of alternatives that fully and creatively explore and compare options for achieving water supply benefits while minimizing impacts.
2. Ecologically and socially relevant impacts are obscured in summary metrics that rely on long-term or spatial averages to describe effects from water flow changes, rather than using ecologically relevant seasons or user-relevant

time frames and locations that include effects for different types of water years (dry, average, wet).

3. The summary of impacts embeds optimistic assumptions about the reliability of mitigation performance and obscures short-term impacts, which may persist up to 15 years or more.
4. Representation of future conditions is uneven, inadequate, and potentially misleading where it obscures potential future risks.
5. Adaptive management is not given adequate or rigorous attention and planning given the likelihood of diverse problems in operations and mitigation efforts.
6. Systemic (across the ecosystem), additive (across drivers), and cumulative (over time) effects that arise through interactions among functional system changes, species and communities are inadequately assessed and prepared for.
7. Uncertainty and risk need to be explicitly evaluated to understand reliability of findings.
8. Some specific technical considerations create concerns about whether seismic risk, reservoir capacity, project benefits, nighttime noise, job creation, and other factors have been rigorously assessed.
9. The EIR would be a more effective decision support document by clearly comparing the likely magnitudes of benefits relative to costs and by considering how risks affect projected impacts.

2. Delta ISB's Review Mandate, Process, and Approach

The Delta ISB is evaluating this draft EIR in accordance with our responsibilities under the Delta Reform Act of 2009 to evaluate the broad range of scientific programs that support adaptive management of the Delta, including review of major Delta conveyance proposals. This review is a technical/scientific assessment of the quality and scope of the scientific analysis for informing decisions. We include recommendations for analysis that may not be required under CEQA but that the Delta ISB feels are necessary to adequately evaluate and compare alternatives.

The Delta ISB brings advantages of independence and broad perspectives on the adequacy of the scientific approaches, methods, and topics and their value for making water and environmental management decisions with long-term pervasive impacts. As a result, the Delta ISB is well-positioned to evaluate the adequacy of the scope and general methods of the scientific and technical analyses that have been applied to the Delta Conveyance Project. However, given the draft EIR's extensive breadth, depth, length, and complexity, our review cannot examine all the location-specific details in the EIR documents, nor fully address some questions that require specific and detailed knowledge of the systems being evaluated. Therefore, this review largely evaluates whether the analyses conducted support the conclusions drawn, using our experience in applying accepted analytic methods across diverse socio-ecological systems.

The Delta ISB reviewed 29 of 39 chapters, along with the Executive Summary, of the draft EIR with their accompanying appendices. Comments on the overall document and individual chapters were collected from individual members, then discussed at meetings, categorized, and refined to create this draft report. This draft will be made available for public comments before being finalized.

3. Some Strengths of the Draft EIR

The draft EIR document brings together extensive information and analyses about potential project impacts and shows improvement over previous iterations. The document addresses a wide scope of potential impacts, thoroughly describes current socio-ecological conditions, and uses peer-reviewed analytic techniques and models to evaluate potential impacts. Although the set of models used is limited, they are employed effectively. The analyses use an array of modeling tools ranging from the local/regional scale to the system-scale covering tributary watersheds of the Delta and downstream service areas. Many chapters (e.g., Geology and Seismicity, Water Supply) use state-of-the-practice analytic methods and models to evaluate potential impacts. Some chapters (e.g., Agricultural Resources) thoroughly summarize impacts as the combination of construction, maintenance, and mitigation activities, which aids in understanding the likely magnitude of additive impacts across these activities.

The EIR authors appear to have invested considerable time addressing prior issues identified with previous conveyance project documents. Compared with the draft and final EIRs submitted for previous versions (reviewed by Delta ISB in 2014, 2015, and 2017), this draft EIR shows better overall writing and summaries, and provides generally adequate details regarding many impacts. The report is more advanced than many past and recent EIR analyses in examining alternatives under a future that includes climate change, which provides some insights, as well as generates more questions. The development of both 2020 and 2040 conditions for evaluating the project, and 2070 and later conditions for a few special conditions (e.g., sea level rise and flooding) help understand future project risks and benefits.

4. Major Review Comments

Although many of the analyses used in the draft EIR apply appropriate scientific methods and understanding, we still have concerns regarding the analytic approaches, as outlined in this section. Additional chapter-specific strengths, weaknesses, and recommendations for improvement, including important analytic concerns not detailed here, are described in Appendix A.

4.1 Range of project alternatives is narrow

The alternative conveyance structures considered in the draft EIR are conceptually similar and do not fully reveal the reasoning behind the selected alternative. While the alternatives cover a reasonable range of Delta tunnel capacities, they only consider three tunnel alignments (central, east, and east + Bethany PP) and omit several western Delta alignments that have been discussed in the past. They also do not compare effects for any of the through-Delta canal alternatives that have been discussed in past planning. Although it is not feasible or desirable to compare all possible alternatives, a comparison of a broader range of alternatives will better inform public debate. At a minimum, the rationale for omitting popular or earlier versions of project alternatives would help stakeholders and decision makers understand the full range of options available for meeting the objectives.

Greater creativity of alternative conveyance solutions might have revealed opportunities to increase efficiency or net benefits through project design. For example, two of the major purposes for the conveyance structure are to reduce risk to water supply from seismic events and sea level rise. Both hazards could cause levee failures that would threaten State Water Project (SWP) deliveries. An alternative approach to address these threats, such as extensive remediation to improve levee stability in the Delta, was not evaluated. That same option would also reduce flood risk to Delta communities and enhance other aspects relevant to maintaining “Delta as Place”.

4.2. Presentation of analytic results obscures relevant effects, including project benefits and risks

Impacts identified in the Executive Summary and in individual chapters often fail to provide a clear and concise answer to the most relevant scientific and social issues.

For instance, missing from the introductory chapters is a sharper explanation of how the proposed project operationally meets the beneficial objectives of improving water supply reliability across diverse water years, while minimizing the projects impacts and the risks from sea level rise, climate change, earthquakes, and levee breaches in comparison to current operations of the SWP. Increasing water supply reliability, including reliability of total Delta water exports, and reducing impacts of flooding frequency are some of the key potential benefits but neither has been well quantified.

Importantly, the quantitative assessment of increased water supply reliability attributable to the increase in total Delta exports is examined on average but is lacking necessary detail to fully understand benefits and limitations (conveyance capacity, storage capacity, water demands, water availability, water rights, and environmental requirements). For instance, the average volumes reported in the Water Supply chapter can be misleading without information on interannual variability, particularly during droughts.

Some of the lack of clarity in the draft EIR Executive Summary can be explained by the CEQA criteria used to summarize project impacts, which are sometimes at odds with typical and credible scientific assessments of project effects. Several examples presented below highlight the mismatch between what was assessed and scientific questions.

Although the analysis using CEQA criteria suggests that, with mitigation, fish impacts will be less than significant, the siphoning of up to ~30% of some river flows (calculation based on Figure 3-37 and Tables 3-15 and 3-15 of the draft EIR) seasonally into a tunnel would be expected to have ecological consequences. In particular, high discharges are needed as cues for migration, reproduction, and other life stages and cannot be directly replaced through the proposed mitigation. Seasonal water availability is a key driver in maintaining (and retaining) the Delta's overall ecological structure, productivity, and resilience. The CEQA criteria further fail to consider the additive effects (summed across stressors and space) and cumulative effects (summed across time) of these impacts and how they could accumulate to influence fish populations.

The finding of a less than significant (LTS) impact on riparian habitat (Impact BIO-3: Impacts of the Project on Valley/Foothill Riparian Habitat) appears inconsistent with "a substantial adverse effect on a sensitive natural community is defined as a net loss of habitat function, including a net loss of acreage." (pg. 13-74, Lines 10-11).

Riparian habitat is scarce throughout the Delta and riparian habitat's influences extend well beyond their footprint. An impact to 2.7% of the riparian areas, or 23 – 75 acres (Table 13-0), can be ecologically significant. Riparian habitat supports a wide variety of wildlife species, as documented in the report. They are also important for their spatial positions in the landscape and for additional ecological reasons (Naiman et al. 2005).

Other examples occur in the summaries of social effects where the CEQA criteria are inconsistent with a robust analysis of social effects or public perceptions. Impacts to communities or populations that are deemed to be no impact (NI) or less than significant (LTS) using CEQA criteria could still represent significant concerns to particular communities within the Delta. An example is that the land use effect "Impact LU-1: Displacement of Existing Structures and Residences and Effects on Population and Housing" has an NI rating, despite that "Between 61 and 93 permanent structures would be removed within the water conveyance facility footprint" (p. 14-22). Similarly, the CEQA recreation impact criterion fails to address the harms from lost use or inability to make low-cost (e.g., nearby) substitutes specific to a lost recreation type by assuming that recreation areas are largely substitutable. The shortcomings of the summary performance criteria are not necessarily true of the detailed chapter analyses where local issues are considered, but effects are not well represented in the executive summary.

4.3. Optimistic assumptions about mitigation and lack of representation of short-term impacts is misleading

The findings of less than significant impacts for many ecological outcomes in the Executive Summary is based on combining anticipated ecological impacts with offsetting mitigation effects. Presentation of only the combined effects obscures the magnitude of initial ecological harm, the types of mitigation outcomes being used to offset impacts, and the performance risk of the mitigation efforts. The presentation of results also frequently classifies impacts that can last up to 15 years or more, as short-term effects. It was only with great effort that the Delta ISB was able to assess which mitigation actions were being used to offset which harms and we see that some aquatic system mitigations substitute different ecological functions or species to offset impacted ones. We are concerned by the lack of discussion of the tradeoffs associated with creating ecological structures and functions that differ from the impacts, such as using tidal wetland restoration to mitigate loss of flows on fish populations.

Most concerning is that the uncertainty of mitigation effectiveness is not discussed, addressed, or prepared for in the draft EIR, despite ample scientific evidence that mitigation is often less than fully effective at replacing lost ecological structures and functions (NRC 2001; Hough and Harrington 2019). A variety of methods are described in the EIR to minimize or mitigate project impacts, including avoidance, on-site mitigation, and off-site (and out of kind) mitigation, sometimes achieved using mitigation credits. Even if uncertainty of mitigation cannot be well characterized, readers should be provided with impacts prior to mitigation to be given the opportunity to qualitatively weigh uncertainty. Treating mitigation outcomes as certain to offset losses is inconsistent with the available scientific evidence and obscures the equivalency of species losses and gains. Uncertain mitigation performance and impact outcomes should be discussed and prepared for, such as outlining methods for confirming whether target species occupy new habitat as well as compensating for delays in achieving comparable functional equivalency.

4.4. Future conditions are evaluated inadequately and inconsistently

The draft EIR acknowledges the expected effects of climate change, including higher temperatures, changing seasonality of Delta inflows, potential changes in wet periods and droughts, increased wildfire risks, saltwater intrusion, higher sea levels, and decreased water quality during droughts. However, the EIR inadequately analyses future risk for extreme events and uses inconsistent future projections across outcomes. For example, project impacts under 2040 and 2070 conditions (during the proposed project lifetime) are buried in the EIR appendices (Appendix 3A and Appendix 4A) rather than incorporated into the main findings, which inhibits comparison across the project alternatives relative to the "no project" alternative. The result probably understates the potential for significant negative impacts from greater future variability and climate change on water supply reliability, aquatic ecosystems, and social performance.

Although climate change is considered in water supply reliability and some other outcomes, the year 2040 is used to represent two climate futures (2040 CT and 2040 Median), which seems inadequate for judging future project performance over the proposed project's long operational lifetime. Climate model results suggest that impacts of climate change are generally expected to increase substantially after mid-century and therefore will be poorly represented by the year 2040. Further, the method used to generate the 2040 streamflows used in the CALSIM model is a simple adjustment based on the “central tendency” of 20 potential climate scenarios (2040 CT). This scenario represents average seasonal shifts in runoff but does not represent the wider range of potential future climate risks and omits the potential for future changes in inter-annual variability of inflow/drought patterns. The evaluation of a range of potential 2070 climate conditions in Appendix 4A shows some important uncertainties and their implications for water flows, but has not been linked to the performance of project alternatives. Feedbacks between climate change and changes in water demand (e.g., residential use, vegetation evapotranspiration) seem absent in the water supply modeling.

One impact of the north Delta diversion operations is to reduce the flows in the lower Sacramento River, yet this finding is not well presented and not clearly carried through to some of the impact analyses. More disaggregated discussion of operational effects on flows would help clarify water supply benefits and impacts to water quality for ecological endpoints and environmental flows. The flows needed to maintain aquatic habitat or persistence of species of concern under existing or future climate were not addressed in the Surface Water (Chapter 5) nor in Appendix 3C (Defining Existing Conditions, No Project Alternative, and Cumulative Impact Conditions). Since the no project alternative shows that some fish populations will likely be lost due to climate change, overall future impact must be evaluated in the context of already-stressed native fish populations.

It is not clear if flooding has been adequately evaluated under changing climate conditions, even though projected conditions for the year 2072 have been examined. Project alternatives are compared using conditions of 100-year and 200-year floods in 2022 and 2072, and include sea level rise projections. However, it is unclear why there was no consideration for changing the magnitude of more extreme floods, given the evidence of changing hydrology, including amplification of atmospheric rivers in the coming decades. Further, changes in floods may extend beyond the limited area analyzed (Sacramento River between American River and Sutter Slough) and to Delta islands with implications for levee stability and the operation of upstream reservoirs.

Within some social impact chapters, future conditions for 2040 are evaluated for a “future without project” scenario only and not included in the evaluation of alternative impacts. Many identified impacts are based only on qualitative assessments. This treatment makes it difficult to assess the likely magnitude of future effects relative to a baseline. The inconsistent evaluation of future social impacts could lead to misleading conclusions since factors such as changing regulations, community behaviors, and increasing scarcity of resources may influence future project impacts.

We suggest that graphs similar to Figures 1 and 2 will be a more effective way to document impacts to flow compared to indicators used in the Executive Summary. Having such a graphic clarifies the distribution of changes (magnitude and timing) of flow extractions, which may better depict potential for ecological effects.

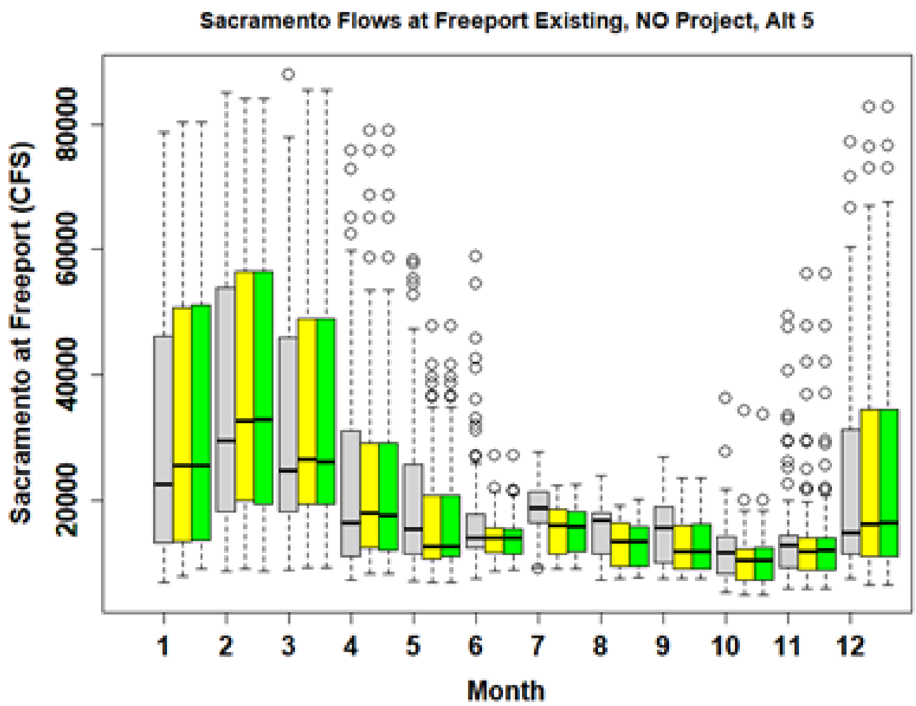

Figure 1. Monthly Sacramento Flows at Freeport for Existing Condition (gray), No Project Condition (yellow), and Alternative 5 (green).

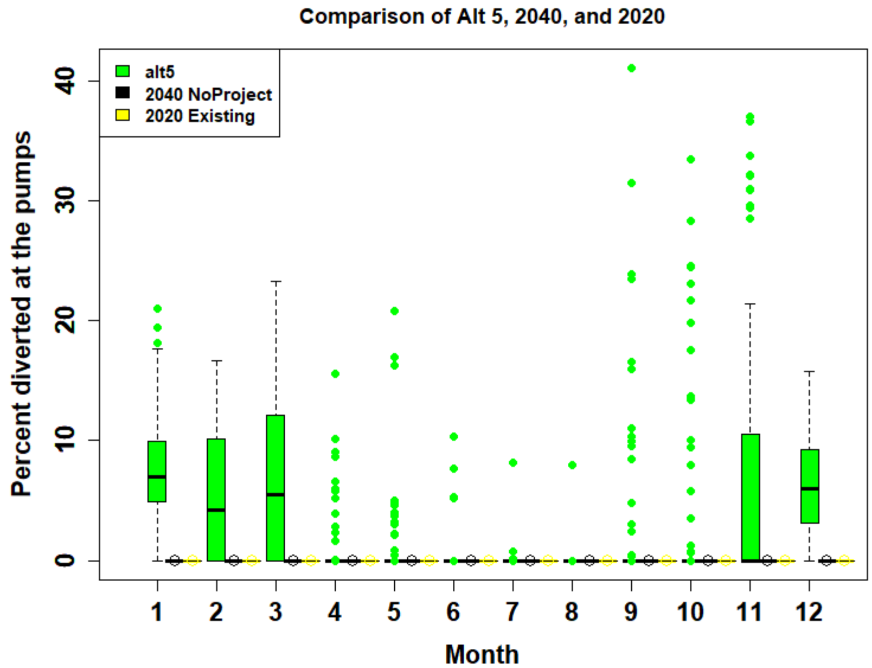

Figure 2. Percent Diverted at the Pumps for Existing Conditions (yellow), No Project Alternative (black) and Alternative 5 (green).

4.5. Adaptive management planning is inadequate

Adaptive management is required for this type of project and is invoked in several places in the draft EIR. However, the description of how (and who) would do the adaptive management was not well described. With a project this large and complex, it is highly likely that there will be impacts missed or mis-estimated in an EIR analysis. One would expect the authors to provide, at a minimum, a working "blueprint" of their adaptive management structure and process.

The adaptive management coverage in the draft EIR should include identifying funding sources, expertise, and administrative capacity to monitor and manage potential effects or impacts from the project, including those currently deemed less than significant. Details should also include establishing "Thresholds of Probable Concern" for biological responses, which would initiate the adaptive management process and actions. Establishing management goals, performance metrics and key decision triggers are essential parts of an effective adaptive management plan/program (Wiens et al. 2017) and should be outlined in the EIR, even if detailed plans will be produced later.

It would be reassuring to see realistic plans for providing adaptive capacity in response to unexpected events and outcomes, in both construction and operating phases. In contrast to the adaptive management currently used to modify intake operations in response to quantitative metrics of fish entrainment at water intakes (CDFW 2020), some proposed adaptive management approaches seem difficult to implement and not credible without further explanation of methods. For example, the project objective to minimize the 'down river' impact of operations caused by reduced flow, does not provide a feasible and specific adaptive management approach. In contrast, the fish impingement adaptive management appears somewhat more feasible because it outlines monitoring techniques (side-scan sonar, telemetry, etc.) and modeling to inform flow intake rate modifications. However, for down-river impacts, such details are not provided and the stated plan to detect changes in fish abundance, which are projected to be a maximum of 5% (Chapter 12), seems challenging given that changes of 5% or less are likely to be indistinguishable from the natural variability of fish populations. An adaptive management plan for the downstream effects needs to identify an amount of measurable change in a biological response, sustained over a specific period of time, that would trigger a change in flow intake or other operations. The plans for impingement management also raise concerns since the modeled relationship between flow and fish effects is based only on salmon, rather than species-specific models. In both types of adaptive management for fish, the uncertainty of measuring the ecological effects and how such uncertainty could be addressed would need to be a part of any initial adaptive management plan.

4.6. Systemic (across the ecosystem), additive (across impact types and space) and cumulative (across years) analyses of impacts, benefits and tradeoffs are missing

A better reflection of feedbacks between individual components and system-level responses to changes is critical for anticipating impacts and for designing effective adaptive management. Impacts by species are considered independently of each other in the EIR, with no synthesis and evaluation for the ecological system (see Table ES-2 of draft EIR). The cumulative effects sections could serve the purpose of synthesizing effects, but do not.

A primary concern with the lack of additive/cumulative analyses is that past changes in the Delta have severely reduced the aquatic ecosystem's ecological productivity and resilience. The proposed project, despite assurances of effective mitigation, will add to that burden. While no individual species impact on the ecological system is anticipated to cause notable declines in populations, the cumulative impacts of the project's activities along with the long history of human-alterations to the Delta are impossible to measure precisely.

By taking a species-by-species approach to examining effects, the systemic and cumulative impacts among the species (community-scale impacts) from individual and incremental changes are not adequately evaluated. From a systemic or additive perspective, there is virtually no discussion of species interactions, food webs or ecosystem production. For cumulative impacts, even small changes can compound. For example, a 5% annual reduction in a population can result in an impact of nearly 40% loss of the base population in 10 years, all else being equal. Further, the cumulative analyses neglect the prospect of thresholds in system behavior that may produce dramatic changes. An example of a threshold effect is the potential for the tunnel to result in invasive species transfers among water bodies, such as quagga and zebra mussels or non-native copepods.

Our recommendation for improving the evaluation of aquatic ecosystem effects is that additive and cumulative effects on fish population at the community/ ecosystem level be evaluated. The analysis should include impacts on ecological functions including primary and secondary productivity, decomposition, and biogeochemical processes. A thorough analysis would include impacts due to changes in inflows to the San Francisco Bay estuary and any gains in environmental resiliency from moving water through existing channels, rather than diverting it into a tunnel.

A lack of a system approach also occurs when impacts are addressed with a narrow set of users or endpoints, despite potential for more widespread effects. A specific concern is that water quality impacts are primarily addressed from a drinking water perspective, rather than recognizing that biota also are affected by water quality changes. In addition, the secondary effect of water quality on harmful algal bloom (HAB) frequency or intensity includes drinking water quality impacts, but not impacts on fish, anoxic "dead" zones, or human or animal health. Another example where a systems perspective is lacking is that while greenhouse gas emissions are estimated for some project activities, the analysis does not include the potentially substantial greenhouse gases created during the manufacture of the large amount of cement for concrete and grout needed for project construction.

Another place where additive/cumulative effects are lacking is when social impacts are not well integrated across the various chapters that explore these impacts. For example, in the Public Health chapter, most impacts assessed were water-related (including the Vector-Borne Diseases), with no assessment of other potential public health impacts such as air quality, noise, and climate change. The chapter impacts could be better tied together, similar to the approach taken in the Environmental Justice chapter.

4.7. Uncertainty and risk need to be explicitly evaluated to understand reliability of findings

We recognize that there is some level of uncertainty in any scientific assessment or prediction. Some levels of uncertainty can be calculated or estimated statistically. Other types of uncertainty are dealt with by recognizing these uncertainties (or unknowns) and then making assumptions, particularly when applying models. Uncertainty will have bearing on potential impacts, mitigation effectiveness, and tradeoffs.

In the draft EIR, many types of uncertainty in the analyses are undisclosed and/or unevaluated. Often models are not used effectively to bracket a range of uncertainties or to explore how uncertainties may propagate through the system. Other uncertainties arise because understanding of the mechanistic relationships is insufficient. For example, there is not a full mechanistic understanding of all of the impacts of flows on fishes (Delta ISB 2015) and population persistence, yet management and mitigation approaches seem to assume such relationships are well established. Similarly, understanding is limited of the species interactions, food webs or predator-prey interactions and how a change in one species level can influence other species. This limitation may be particularly important for those species not considered in the draft EIR (e.g., aquatic invertebrates). The potential for thresholds in system or species responses is also not fully acknowledged. Biological responses to changes in drivers can often be precipitous.

We suggest that the EIR could be more robust by clearly stating the uncertainties, unknowns, and the specific assumptions made to then pursue the assessments and conclusions.

4.8. Other important issues

- Economic Benefits. No systematic comparison of the benefits and costs (benefit-cost or cost-effectiveness analysis) created by pursuing the different alternatives is developed to support decision making. A benefit-cost analysis reveals whether a project's benefits exceed costs using monetized public and private benefits, although many benefits and costs cannot be monetized. A cost-effectiveness analysis uses benefit indicators (e.g., water deliveries, flood risk reduction) to compare alternatives in terms of relative benefits per dollar spent. Metrics to support cost-effectiveness are limited in the current analysis (e.g., job creation) and many useful indicators of the primary benefits are lacking. Either type of economic analysis could inform a discussion of whether the project is socially desirable.

- Transport of Invasive Species. One potential impact (perhaps low risk but high impact) is the transport of invasive species from the Sacramento River to the lower Delta and beyond. Although the screening process will eliminate larger animals from transport, one needs to ask, Will the tunnel be able to transport smaller, invasive larvae, veligers, or seeds to the lower Delta and beyond? Would Zebra mussel veligers survive in the tunnel transport system and beyond? What would happen if they are discovered in the Sacramento River?'
- Harmful Algal Blooms (HABs). HABs are becoming increasingly common in the Delta and warmer temperatures, reduced flow, high residence time, and more concentrated nutrients are likely to exacerbate the problem. HAB issues were mentioned in impacts under the "no-project" alternative, but only assessed for water quality impacts, rather than recognized for potentially broad effects on ecosystems, wild and domestic animals, and recreational activities.
- Seismic Hazard. The seismic hazard in the Delta has significant uncertainty because of the difficulty in characterizing the activity of Delta faults. Citing Bay Area probabilities reminds the reader that parts of California will have significant large earthquakes in the near term, but does not add much to the understanding of seismic hazard in the Delta. The risk from the West Tracy Fault, a major potentially active fault, is proposed to be explored late in the preconstruction period. This belated investigation is a concern given the potential for the fault to expose the project to substantial seismic risk (pg. 10-46, lines 30-34). The West Tracy Fault along with other, potentially active, faults in the Delta are the primary seismic threats to levee stability. Estimating their activity is challenging but essential to evaluating the seismic hazard in the Delta and the risk to levee stability.
- Nighttime sound levels. Although the nighttime sound criteria are exceeded for all alternatives, the magnitude of effect may be underestimated since

calculations do not consider nighttime temperature stratification effects which can increase sound levels (magnitude of A-weighted dB level) and the extent of the affected population.

- Tunnel capacity use. Average tunnel utilization is small, relative to its maximum conveyance capacity. A review of the report and the data provided by DWR shows that, for Alternative 5, the North Delta exports occur largely in December through March. But even in these months, tunnel utilization is below 40% in 50% of years (Figure 3). This result raises questions about optimal tunnel sizing.
- Operation effects on water supply outcomes are not well characterized. Reservoir storage at San Luis will sometimes limit useable tunnel capacity. Increased exports during wetter periods are expected to improve reliability of water supply obligated under contracts. This improved reliability depends on the timing difference between supply and demand. Given a higher demand during the summer months, the benefit of the exported water will be realized largely from storage of water in winter and spring. The main storage available is in San Luis Reservoir. The seasonal storage pattern in the receiving San Luis reservoir in the CALSIM output shows storage is higher for all months except September and October. As seen in Figure 4, the storage is generally higher for Alternative 5, with the reservoir often filling in winter and spring, which could then limit ability to export more water.

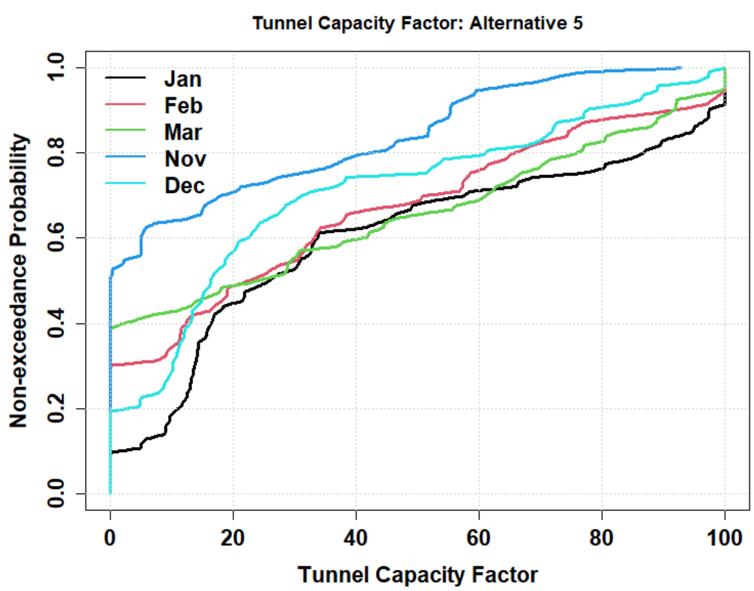

Figure 3. Tunnel utilization frequency (Capacity factor = Use/Capacity)

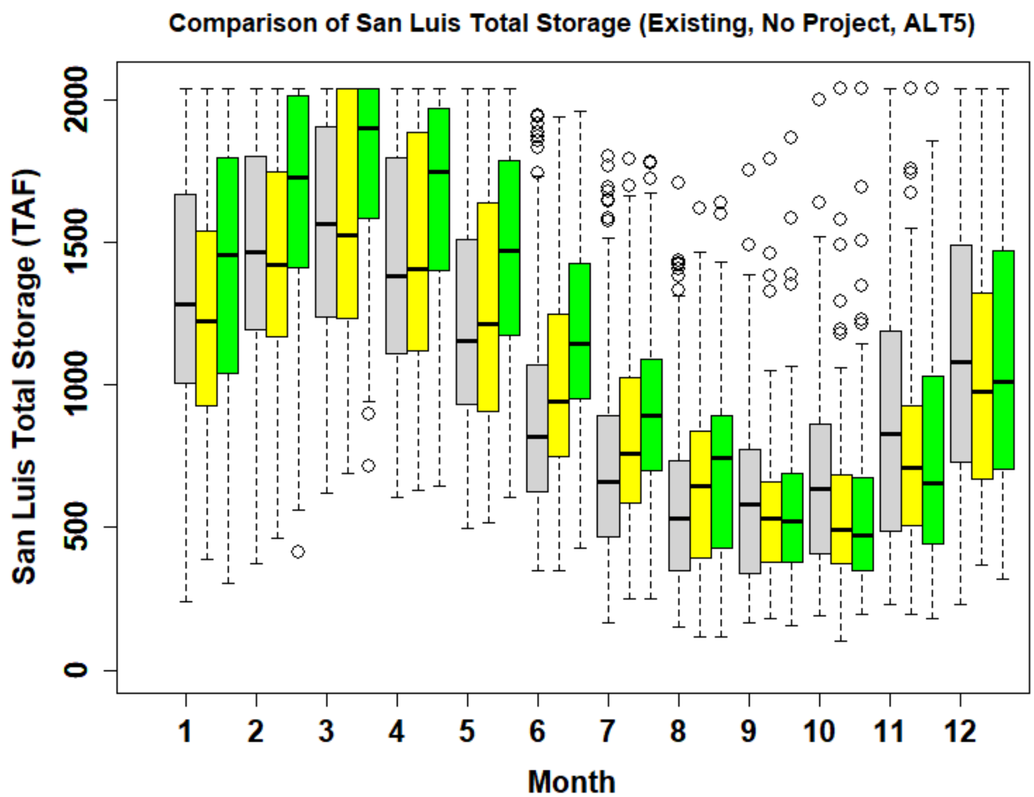

Figure 4. San Luis reservoir capacity under the existing (gray), no project (yellow), and alternative 5 (green) conditions.

4.9. The presentation of alternative performances and tradeoffs needs improvement

This document is not well structured or written to achieve the purpose of providing clear guidance on project net benefits, despite a large volume of relevant information and analyses. Many aspects of the presentation of key results in the executive summary makes it extremely difficult to simply and comprehensively compare the tradeoffs embedded in alternatives. Improving the summary criteria and reducing some of the repetition throughout the report might enhance its readability and accessibility.

The draft EIR sometimes uses language in an imprecise way or does not carefully define terms. Therefore, it would be useful to build on the definition of terms and guidance to deal with uncertainties as provided by the Intergovernmental Panel on Climate Change (IPCC) based on its many years of experience in communicating complex scientific terms to the public. Useful references and definitions are provided in Appendix B.

We recommend that a combination of graphical representations of quantitative metrics coupled with summary tables of non-quantitative assessments be developed to better serve decision makers and stakeholders trying to understand this complex socio-ecological system. Table 1 provides an example of the kind of summary comparison that serves to compare alternatives at a glance on some major quantitative performance objectives. Graphics and tables might be used to isolate the subset of significant effects to compare alternatives more succinctly.

Table 1. Example summary comparison of impacts of alternatives

		2020 Climate and conditions				
	Project Alternative	**No Project 2020**	**Alt. 4b, 2020**	**Alt. 4c, 2020**	**Alt 5, 2020**	**Alt. 4a, 2020**
	Tunnel capacity (cfs)	0	3,000	4,500	6,000	7,500
Water supply reliability	Avg total exports (cfs, CALSIM results)	6,891	7,494	7,631	7,708	7,749
	Avg exports (MAF/yr)	4.98	5.42	5.52	5.57	5.60
	% Avg export increase from No Project	0	8.7%	10.7%	11.9%	12.4%
	Avg North Delta Diversion (cfs, CALSIM)	0	773	935	1,034	1071
	Avg North Delta Diversion (MAF/yr)	0	0.56	0.68	0.75	0.77
	Tunnel capacity factor	-	0.26	0.21	0.17	0.14
Ecosystem health	Permanent aquatic habitat loss (ac) (Table 12-0)	0	11,600	14,700	8,700	18,300
	Bench inundation loss (ac)	0	1,600	2,200	2,500	2,800
	Mid. SWP SD Spring Run salmon entrainment (%)	0	-4%	-7%	-8%	-5%
	Mid. SD adult Delta Smelt entrainment change (%)	0	6	12	16	18
	Lost terrestrial and avian habitat (ac, Tbl 13-0)	0	3,400	3,700	3,200	4,600
In-Delta objectives	Impact AG-1: Convert a substantial amount of farmland(acres) facilities (total acres)	0	4,404	4,813	3,788	5,380
	Impact LU-2: Incompatibility with land use (acres, Tbl 14-0)	0	3,361	3,761	2,667	4,342
	Conflicts w/ existing structures (Tbl 14-2)	0	61	71	71	90
	Noise -Residences exceeding criteria (Tbl 24-0)	0	79	214	230	230
	Lost Delta ag production (Tbl 17-0, million/y)	0	3.1	4.5	4.5	5.7
	Changes in Delta agricultural jobs (Tbl 17-0)	0	-51	-61	-49	69

		2020 Climate and conditions				
	Project Alternative	**No Project 2020**	**Alt. 4b, 2020**	**Alt. 4c, 2020**	**Alt 5, 2020**	**Alt. 4a, 2020**
	Change in net employment (rows 4+5 Tbl 17-0)	0	-9	-5	4	-17
	Peak construction employment (Tbl 17-0)	0	1990	2597	3086	3647

Abbreviations: ac = acres, ag = agricultural, avg = average, cfs = cubic feet per second, MAF = million acre feet, SD = south Delta, SWP = State Water Project, Tbl = table, yr = year.

5. References

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Appendix A: Comments on Individual Chapters of the Draft EIR

To be released at a later date.

Appendix B: IPCC on Defining Types of Uncertainty

From - *INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE: Guidance Notes for Lead Authors of the IPCC Fourth Assessment Report on Addressing Uncertainties* (page 1): [Guidance Notes to Lead Authors of the (ipcc.ch)]

Table B.1. A simple typology of uncertainties

Type	Indicative examples of sources	Typical approaches or considerations
Unpredictability	Projections of human behavior not easily amenable to prediction (e.g., evolution of political systems). Chaotic components of complex systems	Use of scenarios spanning a plausible range, clearly stating assumptions, limits considered, and subjective judgments. Ranges from ensembles of model runs.
Structural uncertainty	Inadequate models, incomplete or competing conceptual frameworks, lack of agreement on model structure, ambiguous system boundaries or definitions, significant processes or relationships wrongly specified or not considered.	Specify assumptions and system definitions clearly, compare models with observations for a range of conditions, assess maturity of the underlying science and degree to which understanding is based on fundamental concepts tested in other areas.
Value uncertainty	Missing, inaccurate or non-representative data, inappropriate spatial or temporal resolution, poorly known or changing model parameters.	Analysis of statistical properties of sets of values (observations, model ensemble results, etc.); bootstrap and hierarchical statistical tests; comparison of models with observations

From Page 3:

“To avoid the uncertainty perceived by the reader being different from that intended, use language that minimizes possible misinterpretation and ambiguity.”

“A level of confidence can be used to characterize uncertainty that is based on expert judgment as to the correctness of a model, an analysis, or a statement. The last two terms in this scale should be reserved for areas of major concern that need to be considered from a risk or opportunity perspective, and the reason for their use should be carefully explained.”

Table B.2. Quantitatively calibrated levels of confidence.

Terminology	Degree of confidence in being correct
Very High confidence	At least 9 out of 10 chance of being correct
High confidence	About 8 out of 10 chance
Medium confidence	About 5 out of 10 chance
Low confidence	About 2 out of 10 chance
Very low confidence	Less than 1 out of 10 chance

From - 'Reisinger, Andy, Mark Howden, Carolina Vera, et al. (2020) The Concept of Risk in the IPCC Sixth Assessment Report: A Summary of Cross-Working Group Discussions. Intergovernmental Panel on Climate Change, Geneva, Switzerland. Risk-guidance-FINAL_15Feb2021.pdf (ipcc.ch)

“Risk - The potential for adverse consequences for human or ecological systems, recognizing the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species.” (pg. 4)

“Risk management - Plans, actions, strategies or policies to reduce the likelihood and/or magnitude of adverse potential consequences, based on assessed or perceived risks (see also risk assessment, risk perception, risk transfer).” (pg. 5)