

Interactive comment on “Reconstructing the natural hydrology of the San Francisco Bay-Delta watershed” by P. Fox et al.

P. Fox et al.

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Responses Referee #1 Comments Fox et al. Manuscript

The authors appreciate the review comments from the Referees. Our responses to each comment are shown below the comments.

Referee #1

Comment 1. Analysis conducted in this paper in terms of long term average annual flows is not sufficient to assess volume requirements on a seasonal basis.

Response: We agree with the reviewer’s comment and recognize the importance of characterizing intra-annual variability of natural outflow. Our manuscript recommends

C1706

that future work be conducted in this area. We have been engaged in modeling work to explore seasonal variability of natural outflow. However, due to the complexity of the subject matter and issues of excessive manuscript length, we determined that this subject would best be addressed in a future separate manuscript.

Comment 2. The authors assume the long term average annual ground water flows is unchanged. One condition is for the groundwater catchment to be the same as the surface water catchment. The authors should provide this.

Response: We understand and agree with the reviewer’s first statement. However, we do not understand the reviewer’s second sentence and seek clarification.

Comment 3. With the many assumptions the authors make, the analysis has been reduce to a simple mass balance evaluation (see Fig 6). In effect the flow to the bay is the rim inflows plus precipitation on the catchment valley floor less evaporation/evapotranspiration, and groundwater (and basin imports/transfers). Catchment precipitation is unchanged. Basin imports/transfers are comparatively small to the other components. Therefore the analysis has been reduced to a comparison of evaporation/evapotranspiration of the valley floor catchment cover under various vegetation cover. Calculations are made in terms of long term average annual flows. Under these conditions it is unsurprising that the authors conclude delta outflows are unchanged. The extent of assumptions made and time scale used does not make the analysis useful to addressing the questions posed and the concerns in this watershed.

Response: We agree with the reviewer’s characterization of the manuscript’s simple mass balance approach. However, we do not share the reviewer’s conclusion that our results are “unsurprising”. On the contrary, we find the similarities between annual water use under natural and current conditions to be highly counter-intuitive given (1) the extensive landscape changes that have taken place over the last 160 years and (2) the sizable out-of-basin transfers that support irrigated agriculture in the San Joaquin Valley and urban development in the San Francisco Bay area, along the central California

C1707

coast, and in southern California. We anticipate that most readers will find the results to be quite surprising and controversial. As described throughout the manuscript, ecosystem decline in the Bay-Delta has been attributed in part to assumed changes (i.e. human-induced reduction) in the amount of annual Delta outflow – changes that are not supported by our results.

Furthermore, we disagree with the reviewer's comment that the analysis is not useful for addressing the questions posed. Our analysis provides the first estimate of natural Delta outflow in the San Francisco Bay-Delta estuary, compares this natural outflow estimate with current level outflow, and demonstrates that unimpaired flow calculations significantly overestimate natural outflow and therefore should not be used as a surrogate measure of natural conditions or to set flow standards to restore ecosystem health.

Comment 4. The study has been useful and helpful in clarifying and quantifying unimpaired flows and natural Delta outflows.

Response: We thank the reviewer for the positive feedback on the usefulness of the study.

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