

Appendix 1A Introduction to Appendices and Modeling Information

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The appendices contained in this document provide supporting technical information for the impact analysis and effects analysis in the chapters. Table 1A-1 lists the appendices, which are numbered to corresponded with the associated chapter, and provides summaries of their contents.

Table 1A-1. List of Appendices

Appendices	Contents
Appendix 2A, Alternatives Screening and Evaluation	Alternatives considered but eliminated from further consideration.
Appendix 2B, Additional Alternatives Screening and Evaluation	Alternatives considered between 2017 and 2020 but eliminated.
Appendix 2C, Construction Means, Methods, and Assumptions	Methods, means, and assumptions for constructing facilities for each alternative.
Appendix 2D, Best Management Practices, Management Plans, and Technical Studies	Descriptions of best management practices, management plans, and technical studies that would be part of the Project.
Appendix 4A, Regulatory Requirements	Regulatory requirements for all resources.
Appendix 5A, Surface Water Resources Modeling of Alternatives	Introduction to surface model methods and assumptions for each alternative.
Appendix 5B, Water Resources System Modeling	Description of the CALSIM II model.
Appendix 5B1, Project Operations	CALSIM II model results of project operations.
Appendix 5B2, River Operations	CALSIM II model results of river flows.
Appendix 5B3, Delta Operations	CALSIM II model results of Delta flows.
Appendix 5B4, Regional Deliveries	CALSIM II model results of regional water supply deliveries.
Appendix 5C, Upper Sacramento River Daily River Flow and Operations Model	Description and summary of results from the Upper Sacramento River Daily Operations Model (USRDOM).
Appendix 6A, Water Quality Constituents and Beneficial Uses	Description of beneficial uses for surface waters in the study area.
Appendix 6B1, Sacramento–San Joaquin Delta Modeling, Salinity Results	DSM2-QUAL model methodology and salinity results for each alternative.
Appendix 6B2, Sacramento–San Joaquin Delta Modeling, Chloride Results	DSM2-QUAL model methodology and chloride results for each alternative.

Appendices	Contents
Appendix 6B3, Sacramento–San Joaquin Delta Modeling, X2 Results	DSM2-QUAL model methodology and X2 results for each alternative.
Appendix 6C, River Temperature Modeling	HEC5Q and Reclamation Temperature model methodology and results related to the Trinity, Sacramento, Feather, and American Rivers.
Appendix 6D, Sites Reservoir Discharge Temperature Modeling	Methodology and results for CE-QUAL-W2 model of water temperature in Sites Reservoir, and temperature blending of Sites Reservoir releases with the TC Canal and GCID Main Canal.
Appendix 6E, Water Quality Data	Surface water quality data in the study area.
Appendix 6F, Mercury and Methylmercury	Summary of methods of analysis for mercury and methylmercury.
Appendix 7A, Sedimentation and River Hydraulics Model	Detailed discussion of fluvial geomorphic setting information for the watercourses and other waterbodies in the study area
Appendix 7B, Hydrodynamic Geomorphic Modeling Results	Sediment transport, bedload, and river meandering modeling results from 2017 Draft EIR/EIS.
Appendix 8A, Groundwater Resources	Detailed description of groundwater basins and subbasins and existing sustainable groundwater management efforts in the study area.
Appendix 8B, Groundwater Modeling	Groundwater modeling results from 2017 Draft EIR/EIS.
Appendix 9A, Special-Status Plant Species	Special-status plant table, special-status plant species accounts, and species lists from California Natural Diversity Database, U.S. Fish and Wildlife Service, and California Native Plant Society used to determine the special-status species with the potential to occur in the study area.
Appendix 9B, Vegetation and Wetland Methods and Information	Discussion of the land cover types, wetlands and other waters, and invasive plant species in the study area.
Appendix 10A, Wildlife Database Results	Special-status wildlife table and the species accounts for non-listed wildlife species
Appendix 10B, Wildlife Habitat Models and Methods	Land cover type associations, model assumptions, and rationales used for the special-status wildlife species habitat models.
Appendix 10C, Special-Status Wildlife Impacts Tables	Special-status wildlife impacts tables listing the permanent and temporary Project impact acreages using modeled species habitat. Indirect effect acreages are included for vernal pool branchiopods.
Appendix 11A, Aquatic Species Life Histories	Special-status aquatic species information, including life histories, of those species identified as having the potential to occur in the study area.
Appendix 11B, Upstream Fisheries Impact Assessment Quantitative Methods	Methods and results for used as part of the fisheries impact assessment including modeling river and delta habitat, and fish life cycles.
Appendix 11D, Fisheries Water Temperature Assessment	Results for specific analysis of potential water temperature effects on fish in waterways upstream of the Delta.

Appendices	Contents
Appendix 11E, Reservoir Fish Species Analysis	Description of analysis used to evaluate potential impacts on aquatic species occupying reservoirs possibly affected by operation changes due to the Project.
Appendix 11F, Smelt Analysis	Quantitative methods and supplementary results used in the impact analyses of delta smelt and longfin smelt
Appendix 11H, Salmonid Population Modeling (SALMOD)	SALMOD model outputs, which simulates Sacramento River populations of winter-run, spring-run, fall-run, and late-fall run salmon, for the Project.
Appendix 11I, Winter Run Chinook Salmon Life Cycle Modeling	Two memoranda describing the results of the IOS (Interactive Object-Oriented Simulation) and OBAN (Oncorhynchus Bayesian Analysis) winter-run Chinook salmon life cycle models.
Appendix 11J, Through-Delta Survival of Juvenile Salmonids	Methods and modeling results for a through-Delta survival analysis of juvenile salmonids.
Appendix 11K, Weighted Usable Area Analysis	Methods and results for the weighted usable area analysis, which estimates of the amount of suitable spawning and rearing habitat of fishes available in rivers and streams at various levels of flow.
Appendix 11L, Sturgeon Delta Analyses	Methods and results of all sturgeon analyses, such as evaluation of other upstream flow, temperature-related effects, and in-Delta effects.
Appendix 11M, Yolo and Sutter Bypass Flow and Weir Spill Analysis	Documents analyses for fisheries impacts including the salvage-density analysis for south Delta entrainment risk and Delta outflow-year class strength regression analysis.
Appendix 11N, Other Flow-Related Upstream Analyses	Methods and results for analyses related to potential direct effects of flows on anadromous salmonids and green sturgeon in the Sacramento, Feather, and American Rivers.
Appendix 11O, Anderson-Martin Models	Descriptions of the Martin et al. (2017) and Anderson (2018) egg mortality models that were used to assess water temperature-related effect on winter-run Chinook salmon.
Appendix 11P, Riverine Flow-Survival	Discussion of methods applied to assess potential effects of Red Bluff and Hamilton City diversions on juvenile Chinook salmon riverine survival in the Sacramento River as a function of flow.
Appendix 11Q, Other Delta Species Analyses	Descriptions of the salvage-density method, X2-abundance index regressions, and the threadfin shad south Delta entrainment risk analysis used for analysis of potential effects of the Project in the Delta.
Appendix 12A, Soil Survey Map	Figure of NRCS mapped soil units in the project area
Appendix 12B, Soil Map Units	Description of soil units found in the project area
Appendix 17A, CVP/SWP Power Modeling	Power modeling methods and results used to examine the range of potential effects of Project operations on the electric power system in the western U.S.

Appendices	Contents
Appendix 19A, Noise Definitions and Noise Calculations	Definitions and descriptions related to noise and vibration, and detailed calculations of heavy equipment noise by distance and construction activity/component.
Appendix 20A, Methodology for Air Quality and GHG Emissions Calculations	Methods used to estimate criteria pollutant and GHG emissions; to model the pollutant concentrations; and to model the health effects associated with the pollutant concentrations.
Appendix 20C, Ambient Air Quality and Health Risk Analysis Technical Report	Methods used and results of the Ambient Air Quality Analysis and the Health Risk Assessment
Appendix 20D, Photochemical Modeling Study to Support a Health Impact Analysis	Methods used and results for the photochemical grid modeling Health Impact Analysis from construction activities for particulate matter (PM) with a diameter less than or equal to 2.5 micrometers (PM _{2.5}) and ozone precursors
Appendix 22A, Cultural Resources	Detailed cultural setting, including the study area’s flora, fauna, and geology relevant to cultural studies; the ethnographic context that describes the historical record pertaining to Native American ethnography in the study area, such as records of villages, homes, and ceremonies; the archaeological context that identifies and describes the archaeological models that characterize the study area’s early Native American history, including chronology from the terminal Pleistocene era to European contact, and regional cultures that are expressed through archaeological data; and the historical context that describes the post-Contact era and includes 19th- and 20th-century historical themes that characterize the study area’s post-Contact history, including colonial settlement, ranching and agriculture, county and city histories including the town of Sites, and regional transportation development.
Appendix 24A, Landscape Character Photos and Associated Maps	Photographs and associated maps from the 2017 Draft EIR/EIS, as well as photographs from 2021 and associated maps for the Dunnigan Pipeline.
Appendix 24B, Regional and Project Landscape Description	Detailed discussion on the regional and Project landscapes.
Appendix 27A, Environmental Records Search	Updated environmental record information used for the impact analysis in this document and summary of results of the previous environmental records review for the 2017 Draft EIR/EIS.
Appendix 30A, Regional Economics Modeling	Description of the methods used to assess Project effects on regional economics and summary of the regional economic modeling results.
Appendix 30B, Comparison of Regional Hydrologic Model Results to Inform Regional Economic Analyses	Comparison of regional hydrologic modeling results between the 2017 hydrologic model output and the current hydrologic output. This comparison is applied to the analysis of socioeconomic effects of the Project.

Appendices	Contents
Appendix 33A, 2017 Draft EIR/EIS Chapter 36, Consultation and Coordination	Consultation and coordination that occurred for the Project prior to the publication of the 2017 Draft EIR/EIS.
Appendix 33B, Previous Scoping Processes	Previous scoping processes reported in the 2017 DEIR/EIS
Appendix 33C, Planning Aid Memorandum	Planning Aid Memorandum for the North-of-Delta Offstream Storage/Sites Reservoir Project between Bureau of Reclamation and U.S. Fish and Wildlife

Models were used to generate results that inform various impact analyses in this document. The models and how they relate to various impact analyses are summarized below in Table 1A-2 along with relevant resources. Several impact analyses in this document refer to results from previous modeling, these models are summarized in Table 1A-3.

Table 1A-2. List of Models

Model	Model Output	Model(s) that Provide Input	Appendix	Relevant Resource(s)
CALSIM II: SWP and CVP Hydrology and System Operations Model	Flow, storage, and diversions	None.	Appendix 5B	Surface Water, Surface Water Quality
USRDOM: Upper Sacramento River Daily Operations Model	Flow, storage, and diversions	CALSIM II	Appendix 5C	Surface Water and Fluvial Geomorphology
HEC5Q Model: Trinity, Sacramento, and American Rivers	Water temperature	CALSIM II	Appendix 6C	Surface Water Quality, Aquatic Biological Resources
Reclamation Temperature Model: Feather River	Water temperature	CALSIM II	Appendix 6C	Surface Water Quality, Aquatic Biological Resources
CE-QUAL-W2: Sites Reservoir Temperature Model	Water temperature	CALSIM II, USRDOM and HEC5Q	Appendix 6D	Surface Water Quality, Aquatic Biological Resources
DSM2: Delta hydrodynamic and electrical conductivity model	Flow and electrical conductivity	CALSIM II	Appendix 6B	Surface Water Quality, Aquatic Biological Resources

Model	Model Output	Model(s) that Provide Input	Appendix	Relevant Resource(s)
The Central Valley Regional Water Quality Control Board mercury model	Concentration of methylmercury in fish tissue in the Delta	None	Appendix 6F	Surface Water Quality, Public Health, and Aquatic Biological Resources
<i>Eurytemora affinis</i> -X2 analysis	<i>Eurytemora affinis</i> density	CALSIM II	Appendix 11F	Aquatic Biological Resources
Delta Outflow-Longfin Smelt Abundance Analysis	Longfin smelt abundance index	CALSIM II	Appendix 11F	Aquatic Biological Resources
X2-Longfin Smelt Abundance Index Analysis	Longfin smelt abundance index	CALSIM II	Appendix 11F	Aquatic Biological Resources
SALMOD	Juvenile Chinook salmon production, flow- and temperature-related mortality of early life stages	CALSIM II, HEC5Q	Appendix 11H	Aquatic Biological Resources
Water Temperature Index Value/Range Analysis	Frequency and magnitude of exceedance above a biologically based index value or outside an index range	HEC5Q, Reclamation Temperature Model	Appendix 11D	Aquatic Biological Resources
IOS	Winter-run Chinook salmon spawner abundance	CALSIM II, DSM2, HEC5Q	Appendix 11I	Aquatic Biological Resources
OBAN	Winter-run Chinook salmon spawner abundance	CALSIM II, HEC5Q	Appendix 11I	Aquatic Biological Resources
STARS	Through-Delta survival of juvenile Chinook salmon	DSM2	Appendix 11J	Aquatic Biological Resources
Weighted Usable Area	Spawning and rearing habitat availability of Chinook salmon and steelhead	CALSIM II	Appendix 11K	Aquatic Biological Resources
Delta Outflow Year-Class Strength Regression Analysis	White sturgeon year-class strength	CALSIM II	Appendix 11L	Aquatic Biological Resources
Redd Dewatering Analysis	Percent of Chinook salmon and steelhead redds dewatered	CALSIM II, USRDOM	Appendix 11N	Aquatic Biological Resources

Model	Model Output	Model(s) that Provide Input	Appendix	Relevant Resource(s)
Juvenile Stranding Analysis	Percent of Chinook salmon and steelhead juveniles stranded	CALSIM II, USRDOM	Appendix 11N	Aquatic Biological Resources
Anderson-Martin Models	Temperature-based early life stage mortality of winter-run Chinook salmon	HEC5Q	Appendix 11O	Aquatic Biological Resources
Riverine survival flow threshold analysis	Juvenile Chinook salmon migration survival	Daily Divertible & Storable Flow Tool	Appendix 11P	Aquatic Biological Resources
Salvage-Density Analysis	South Delta exports weighted by historical fish salvage density	CALSIM II	Appendix 11Q	Aquatic Biological Resources
X2-abundance index regressions	Abundance indices of striped bass, American shad, starry flounder, and California bay shrimp	CALSIM II	Appendix 11Q	Aquatic Biological Resources
Threadfin shad south Delta entrainment risk analysis	Percentage of particles entrained	CALSIM II	Appendix 11Q	Aquatic Biological Resources
Lamprey redd dewatering	Frequency of exposure of Pacific and river lamprey redds to dewatering risk	CALSIM II	Chapter 11	Aquatic Biological Resources
Lamprey ammocoete stranding	Percent of Pacific and river lamprey cohorts exposed to range of stranding risks	CALSIM II	Chapter 11	Aquatic Biological Resources

Model	Model Output	Model(s) that Provide Input	Appendix	Relevant Resource(s)
CalEEMod 2016.3.2.	<p>Emission factors for criteria air pollutants and greenhouse gases;</p> <ul style="list-style-type: none"> • Off-road equipment exhaust • Grading dust • Bulldozing dust • Truck loading dust • Demolition dust • Striping of parking lots (off-gassing) • Asphalt paving (off-gassing) <p>Water- and wastewater-related greenhouse gas emissions</p>	None.	Appendix 20B	Air Quality; Greenhouse Gas Emissions
eGRID: Emissions and Generation Resource Integrated Database	Greenhouse Gas Emission Factors	None.	None	Greenhouse Gas Emissions
EMFAC 2017: Emission FACTors	On-road vehicle emission factors (criteria pollutants and greenhouse gases) for construction, operations and maintenance, and recreational vehicle trips.	None.	Appendix 20B	Air Quality; Greenhouse Gas Emissions
PC2014	Criteria pollutant and greenhouse gas emissions from personal watercraft; activity hours from personal watercraft.	None.	Appendix 20B	Air Quality; Greenhouse Gas Emissions
CAMx	Pollutant concentrations	WRF; SMOKE	Appendix 20D	Air Quality
SMOKE	Hourly gridded emissions files	None.	Appendix 20D	Air Quality
AERMOD	Pollutant concentrations	CalEEMod; EMFAC 2017	Appendix 20C	Air Quality
HARP2	Health effects from local pollutant concentrations	AERMOD	Appendix 20C	Air Quality

Model	Model Output	Model(s) that Provide Input	Appendix	Relevant Resource(s)
BenMAP	Health effects from regional pollutant concentrations	CAMx	Appendix 20D	Air Quality
LT-GEN: Reclamation Long Term Generation	CVP hydropower generation and capacity, pumping plant energy requirements, and net revenue	CALSIM II	Appendix 17A	Energy

Table 1A-3. List of Previous Models

Model	Model Output	Model(s) that Provide Input	Appendix	Relevant Resource(s)
SRH: Sedimentation and River Hydraulics - capacity, meander, and vegetation modeling	Sediment balance, erosion, deposition, channel migration, cottonwood growth and survival	USRDOM	Appendix 7B	Fluvial Geomorphology
Sites Reservoir seepage evaluation	Reservoir seepage	None	Appendix 8B	Groundwater Resources
SACFEM2013: Groundwater model of the Sacramento Valley Groundwater Basin	Groundwater levels in the Colusa Subbasin	Sites Reservoir seepage evaluation	Appendix 8B	Groundwater Resources
CVHM: U.S. Geological Survey Central Valley Hydrologic Model	Central Valley groundwater levels and groundwater-surface water interaction	CALSIM II	Appendix 8B	Groundwater Resources
IMpact Analysis for PLANning (IMPLAN) model	Estimate changes in regional output, labor income, value added, employment, and tax base.	SWAP	Appendix 30A	Environmental Justice and Socioeconomics
Statewide Agricultural Production (SWAP) model	Simulates decisions of agricultural producers to estimate changes to agricultural production, assuming that farmers maximize profit subject to available resources (including water) and economic conditions.	CALSIM II	Appendix 30A	Environmental Justice and Socioeconomics

Model	Model Output	Model(s) that Provide Input	Appendix	Relevant Resource(s)
Least Cost Planning Simulation (LCPSIM) model	Estimates economic benefits and other impacts of changes in urban water supply in the South Coast and South San Francisco Bay regions using a simulation/optimization framework.	CALSIM II	Appendix 30A	Environmental Justice and Socioeconomics
Other Municipal Water Economics Model (OMWEM)	Estimates economic benefits of changes in SWP and CVP water supplies in areas outside of the regions modeled in LCPSIM.	CALSIM II	Appendix 30A	Environmental Justice and Socioeconomics

Model output from currently run and previously run models is used as input to other models. Figures 1A-1 and 1A-2 identify the analytical framework at the system-wide and local levels.

1A.1 References

- Anderson, J. J. 2018. Using River Temperature to Optimize Fish Incubation Metabolism and Survival: A Case for Mechanistic Models. *BioRxiv*:1-24.
- Martin, B. T., A. Pike, S. N. John, N. Hamda, J. Roberts, S. T. Lindley, and E. M. Danner. 2017. Phenomenological vs. biophysical models of thermal stress in aquatic eggs. *Ecology Letters* 20: 50–59.

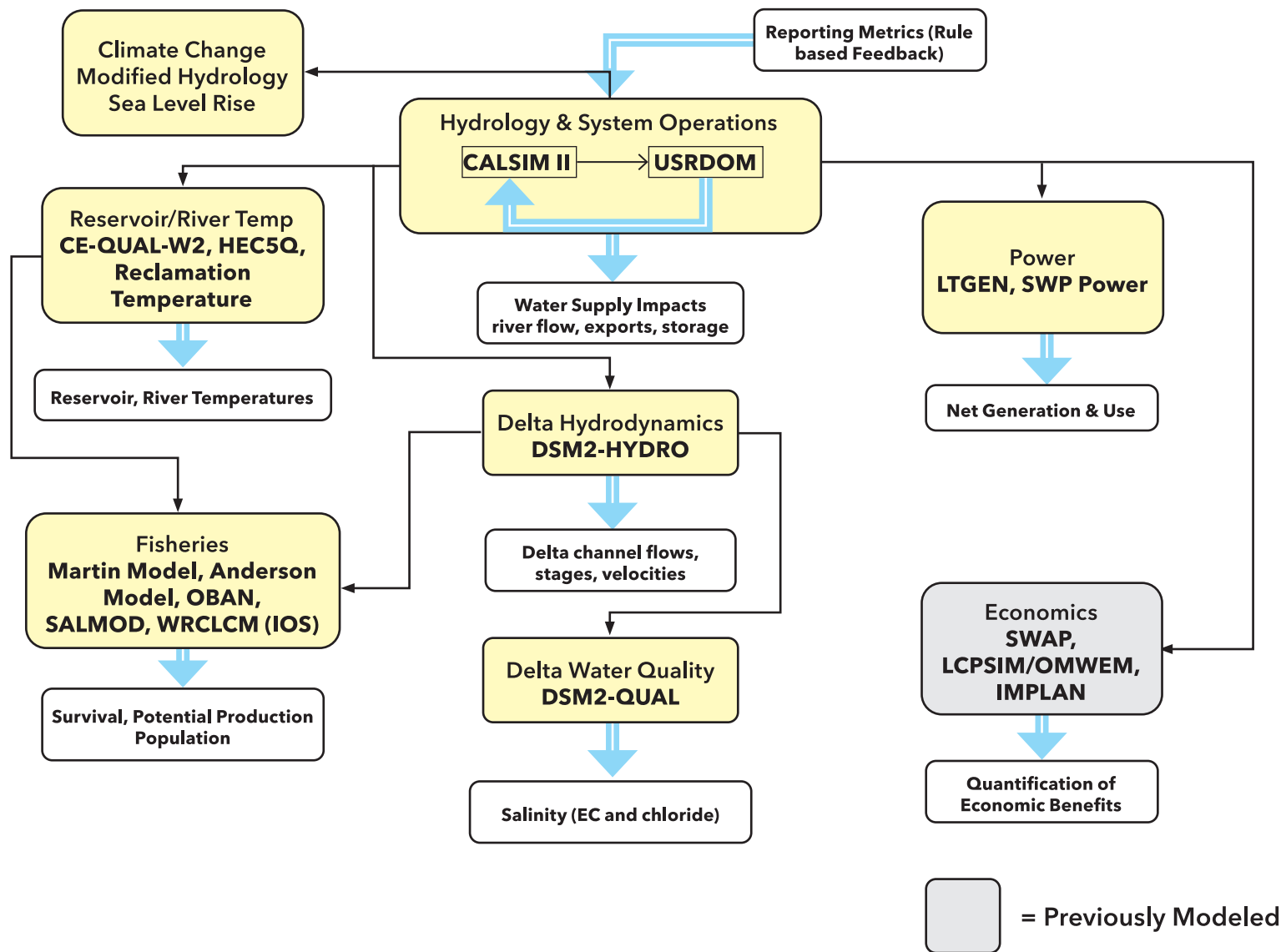


Figure 1A-1
RDEIR/SDEIS Analytical Framework - System

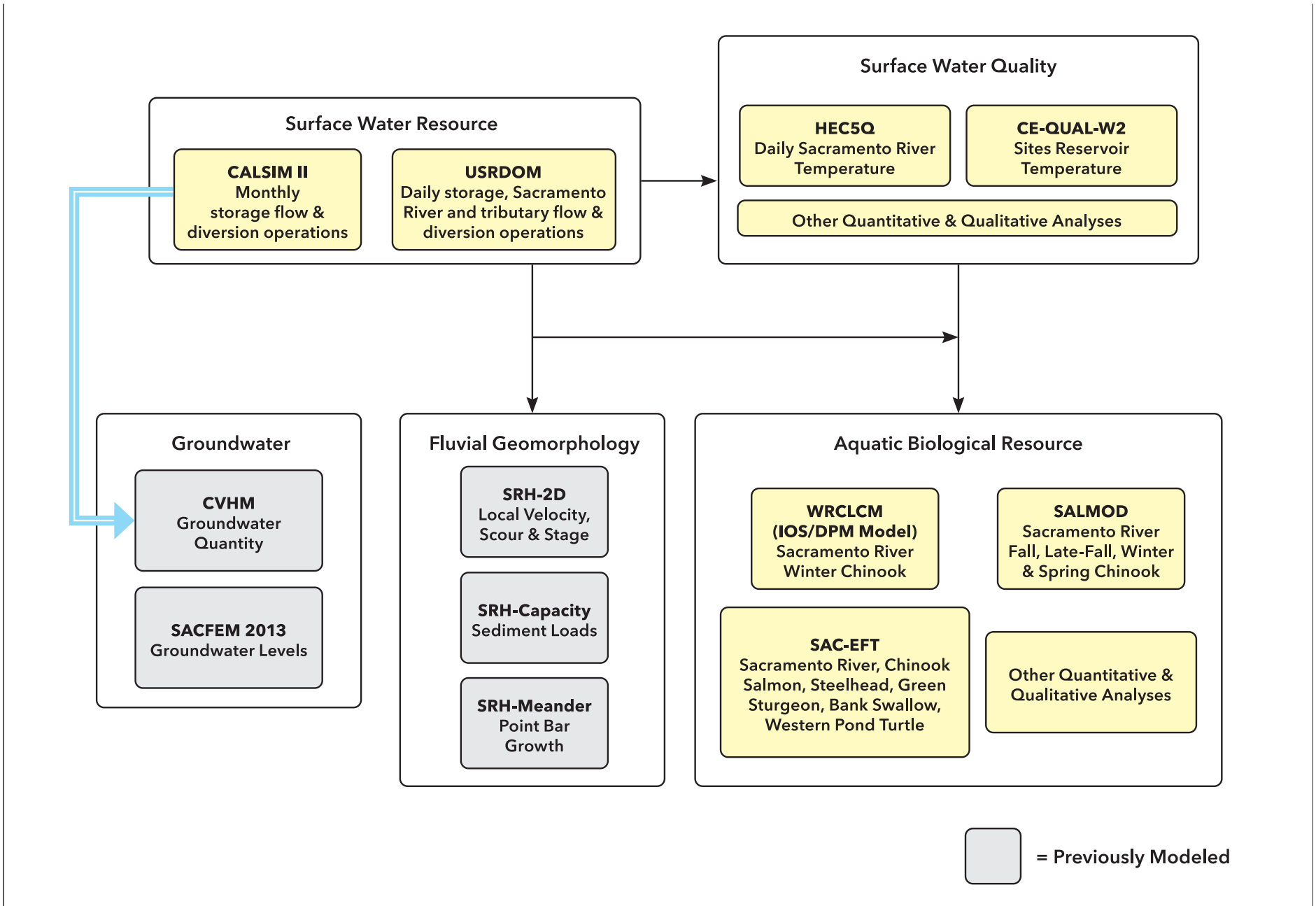


Figure 1A-2
RDEIR/SDEIS Analytical Framework - Local