

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 correspond with the associated chapter, and provides summaries of their contents.

Table 1A-1. List of Appendices

| Appendices | Contents |
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| 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. |

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| 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. |

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| 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. |

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| 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. |

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| 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.

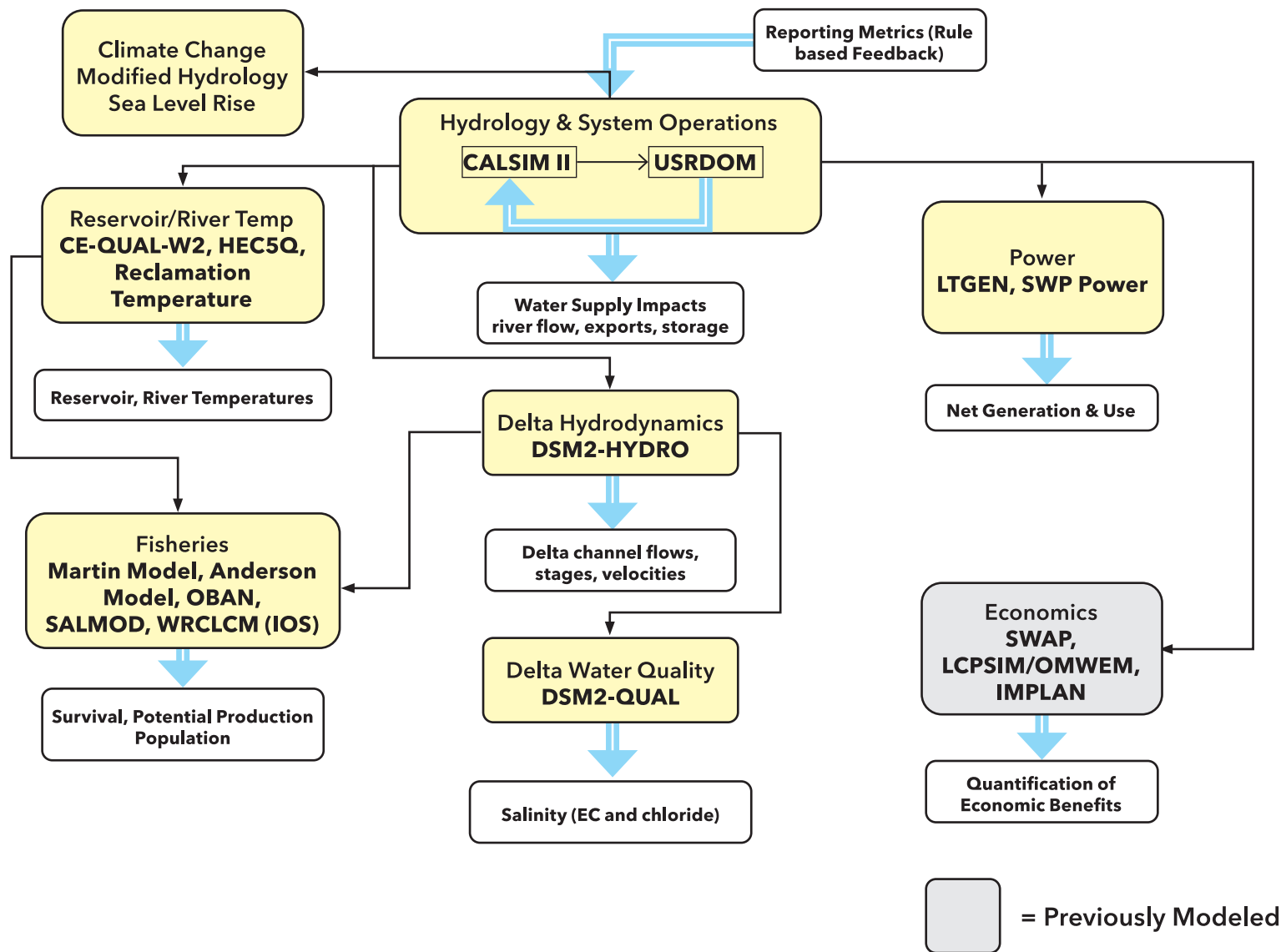


Figure 1A-1
RDEIR/SDEIS Analytical Framework - System

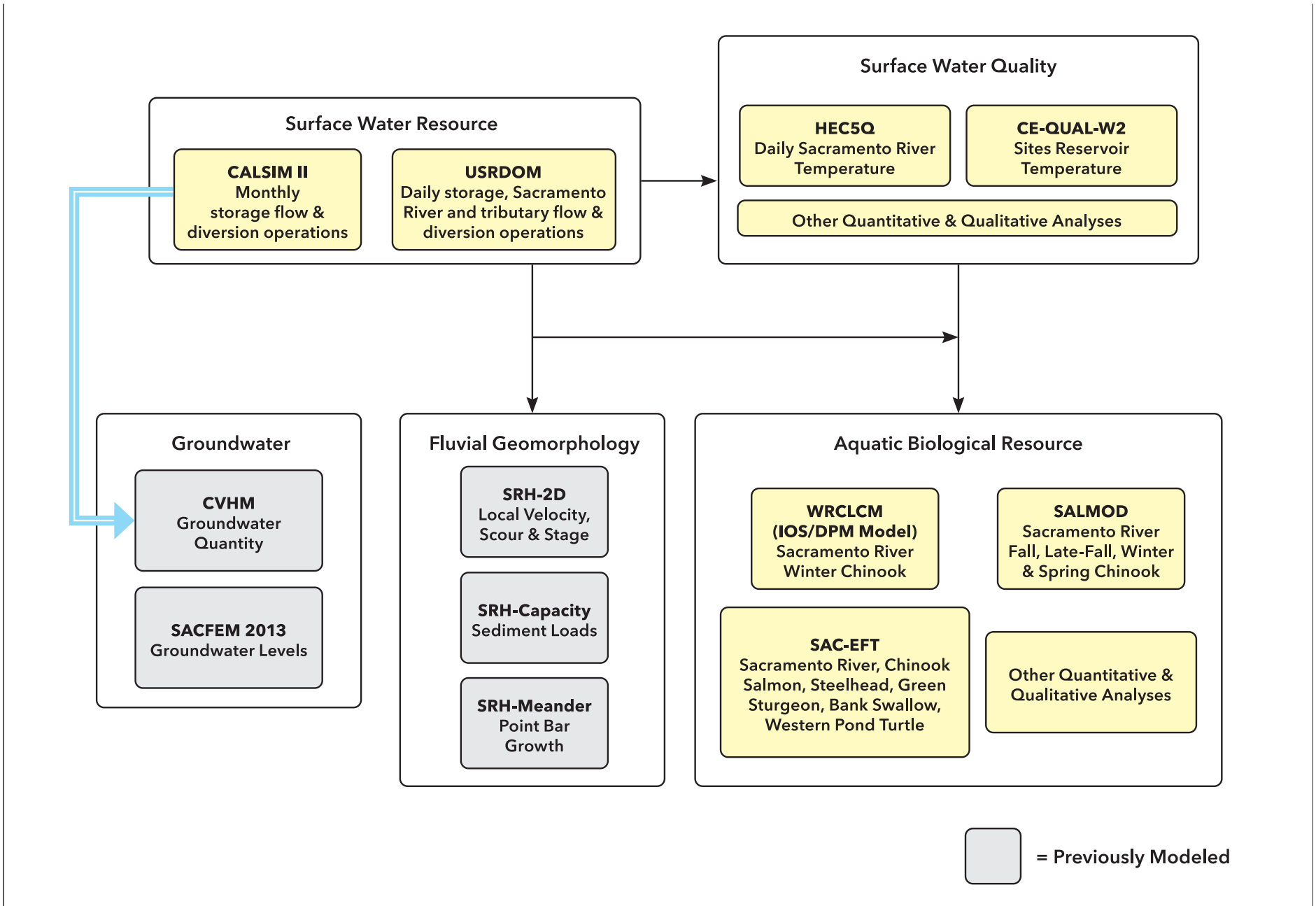


Figure 1A-2
RDEIR/SDEIS Analytical Framework - Local