Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Geology and Soils	Soil erosion	Soil types and characteristics	N/A	N/A	Changes in soils will be based on results of water and land use analyses and will focus on Sacramento and San Joaquin Valleys and Bay-Delta.
		Land uses (cover and types of disturbances)	Annual	Annual	
	Subsidence (of Delta lands)		Annual		
	Soil salinity and Soil contamination (drainage is included in Groundwater below)	Soil types and characteristics	N/A	N/A	
		Applied water rate	Annual	Annual	
		Leaching rates	Annual	Annual	
		Chemical retention rates	N/A	N/A	
		Water quality	10 years	10 years	
	River channel processes	Channel configuration	N/A	100 years	River meander changes will be assessed through GIS analysis and model predictions
	Levee stability and system integrity	Soil types and characteristics, levee condition, historical data on failures	N/A	N/A	
Water/Hydrology	Stream flows changes	Flows, annual hydrographs in different water years	Monthly	Monthly mean, minimum, maximum for hydrologic record	Surface-water analyses will focus on the Delta and major tributary rivers with controllable flows: Sacramento basin (Sacramento, Feather, Yuba, and American Rivers); San Joaquin basin (San Joaquin, Merced, Tuolomne, Mokelumne, and Stanislaus Rivers); and Bay-Delta. The focus of analysis of alternatives will be on assessing the monthly average hydrologic conditions for each river basin, the resultant inflow to the Bay-Delta, and the effect on water supply. Expected water demands will be based on historic data and DWR's Bulletin 160 with appropriate adjustments for conservation and reclamation actions.
			Monthly	Annual	
		Relationship with groundwater	Monthly	Annual	
		Diversions/storage			
	Reservoir storage level changes	Storage	Monthly	Annual carryover	
		Releases	Monthly	Monthly (canals)	
		Water surface elevations	Monthly	Annual plus selected months	
		Water surface area	Monthly	Annual plus selected months	

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Water/Hydrology (continued)	Bay and Delta inflow/outflow changes	Flows	Monthly	Monthly mean, minimum, maximum for hydrologic record/annual	The analyses will focus on the hydrologic characteristics of the Bay-Delta under each alternative. Delta outflow and flows in selected channels that are affected by alternatives will be analyzed.
		Affected channel flows	Monthly	Monthly	
		Export	Monthly	Monthly	
		Diversion	Monthly	Monthly	
	Surface drains	Volumne	Monthly	Monthly	
	Groundwater availability	Groundwater elevations	Monthly	Annual	Previously compiled groundwater data will be evaluated for the following geographic subregions: Sacramento Valley, San Joaquin Valley (east side and west side, including Tulare Basin), and Delta.
		Recharge rates	Monthly	Annual	
		Withdrawal rates	Monthly	Annual	
		Water quality (salts)	Monthly	Annual	
		Water quality standards	Monthly	Annual compliance	
		Drainage rates	Monthly	Annual	
		Drainage water quality (see above)	Monthly	Annual	
		Drainage effluent limitations	Monthly	Annual compliance	
		Subsidence rates	Annual	Annual	
Water/Hydraulics	Streams/Delta depths/velocities current forces	Depth, tidal elevations, velocity	Daily, monthly, annual	Daily, monthly, annual	
Surface-Water Quality	Streams	EC	Monthly	Annual	Historical surface-water quality data will be used to characterize relationships between EC and flow for major tributary rivers and Delta locations. Reservoir and river temperatures will be evaluated using a combination of historical data and water temperature models that respond to flow, reservoir storage, and meteorological conditions. Agricultural drainage and other potential sources of toxins will be evaluated as a function of assumed source loads and river dilution effects. Salinity intrusion of chlorides will be evaluated as a function of Delta outflow.
		Temperature	Monthly	Annual plus selected months	
		Toxics (includes herbicides and metals)	Monthly	Annual plus selected months	
		Water quality and flow standards	Monthly	Annual compliance	
	Reservoirs	Temperature	Monthly	Annual plus selected months	
		Water quality and flow standards	Monthly	Annual compliance	
	Bay and Delta	EC	Monthly	Seasonal/annual	
		Toxics	Monthly	Annual	
		Bromides	Monthly	Seasonal/annual	
		Chlorides	Monthly	Annual compliance	
		DOC	Monthly	Seasonal/annual	
		Petroleum hydrocarbons	Monthly	Seasonal/annual	
		Nutrients	Monthly	Seasonal/annual	
		Water quality and flow standards	Monthly	Annual compliance	

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Aquatic Ecology/ Fisheries					
Rivers and Tributaries	Decline in anadromous fish populations; effects on resident fish populations Habitat quality	Habitat indices: Flow Water quality (temperature) Food/nutrients Diversion Habitat area and quality (SRA)	Monthly	Annual plus selected months	The estimated response of species populations (i.e., potential changes in abundance and distribution) to CALFED actions will be represented by habitat indices. The impact mechanisms changed by CALFED actions (including water temperature, flow, entrainment in diversions, salinity, habitat area and quality, and reservoir drawdown) affect survival, growth, reproduction, and migration. The habitat indices incorporate known relationships between impact variables (e.g., water temperature) and survival, growth, reproduction, and migration. The indices portray the direction and magnitude of fish population response that may result from implementation of alternative CALFED actions. Habitat index evaluation will rely considerably on the collective professional judgement of resource managers and research biologists. Actual changes in population numbers, species interaction, and ecosystem function cannot be accurately predicted because biological responses to impact mechanisms occur under complex conditions that are not completely understood. Also, changes in the impact mechanisms themselves are approximate and coarse, and usually presented on a monthly time step.
		Population: Fishery Diversions	Monthly/seasonal	Monthly/seasonal	
Reservoirs	Maintenance of freshwater species and sport fish population and supporting forage base	Habitat indices: Surface elevation Surface area	Monthly	Annual	
		Population: Fishery Diversions	Monthly/seasonal	Monthly/seasonal	
Delta and Bay	Declines in estuarine, anadromous, and marine resident fish populations and their supporting forage base Habitat quality	Habitat indices: Flow Affected channel flows Water quality (EC, DOC, etc.) Export Diversion Habitat area and quality (SRA, tidal)	Monthly/seasonal/annual	Annual plus selected months	
		Population: Fishery Diversions	Monthly/seasonal/annual	Monthly/seasonal/annual	

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Vegetation					
Reservoirs	Riparian habitat	Surface elevation	Seasonal	Annual and seasonal habitat changes	The analysis will focus on the estimated vegetation changes resulting from changes in water availability and quality, associated land use changes, and changes from habitat restoration and facility conversion. The impact analysis presentation will focus on total vegetation changes in the Sacramento Valley, San Joaquin Valley (east side and west side, including Tulare Basin), Bay-Delta, and southern California.
	Wetland habitat	Surface elevation	Seasonal	Annual and seasonal habitat changes	
	Special-status species	Surface elevation	Seasonal	Annual and seasonal habitat changes	
Streams	Riparian habitat	Flows	Monthly	Annual and seasonal habitat changes	
	Wetland habitat	Flows	Monthly	Annual and seasonal habitat changes	
	Special-status species	Flows	Monthly	Annual and seasonal habitat changes	
	Riparian/wetland habitat	Restoration amount	Miles/acres	Annual and seasonal habitat changes	
Refuges	Riparian habitat	Water deliveries	Monthly	Annual and seasonal habitat changes	
	Wetland habitat	Water deliveries	Monthly	Annual and seasonal habitat changes	
	Special-status species	Water deliveries	Monthly	Annual and seasonal habitat changes	
Delta	Riparian/wetland and other habitat	Restoration amount	Miles/acres	Annual and seasonal habitat changes	
	Special-status species				
Upland/ Agricultural Lands	Upland habitat	Natural habitat types	Acres	Annual and seasonal habitat changes	
Wildlife (non-aquatic)					
Reservoirs	Special-status species/ resident and migrant populations	Fish indices and reservoir elevation	Seasonal (fall and winter)	Annual and seasonal wildlife changes	The analysis will focus on the estimated wildlife changes resulting from changes in water availability and quality, associated land use changes, habitat changes, and facility conversion. The impact analysis presentation will focus on total wildlife changes in the Sacramento Valley, San Joaquin Valley (east side and west side, including Tulare Basin), Bay-Delta, and southern California.
Streams	Riparian-dependent species/ Special-Status Species	Riparian and wetland habitat	Miles/acres	Annual and seasonal wildlife changes	
	Resident populations	Flows	Monthly	Annual and seasonal wildlife changes	
	Resident populations		Seasonal	Annual and seasonal wildlife changes	
Refuges	Resident and migrant populations	Water deliveries	Monthly	Annual and seasonal wildlife changes	
	Special-status species	Water deliveries	Monthly	Annual and seasonal wildlife changes	
Delta	Resident and migrant populations	Riparian and wetland habitat	Miles/acres	Annual and seasonal wildlife changes	
	Special-status species	Riparian and wetland habitat	Miles/acres	Annual and seasonal wildlife changes	

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Upland/ Agricultural Lands	Resident and migrant populations	Agricultural habitat types Natural habitat types	Acres	Annual and seasonal wildlife changes	
	Special-status species	Natural habitat types	Acres	Annual and seasonal wildlife changes	
Land Use					
Agricultural Uses	Crop acres	Water deliveries EWMPs Water supply costs Water quality	Annual/water year-type Annual/water year-type Per acre-foot Annual/water year-type	Annual acreage change Annual acreage change Annual acreage change Annual acreage change	The analysis for agricultural land uses will focus on changes in irrigated lands and crop patterns resulting from changes in water availability, quality, and costs. The impact analysis presentation will focus on land use changes in the Sacramento Valley, San Joaquin Valley (east side and west side, including Tulare Basin), Bay-Delta, and southern California.
M&I Uses	Developed acres	Water deliveries BMPs Water quality Water supply costs	Annual/water year-type Annual/water year-type Annual/water year-type Per acre-foot	Annual acreage change Annual acreage change Annual acreage change Annual acreage change	The analysis for M&I land uses will focus on changes in water availability, quality, and costs. The impact analysis presentation will focus on the Sacramento Valley, San Joaquin Valley (east side and west side, including Tulare Basin), Bay-Delta, and southern California. Expected conversion of other land uses to urban uses will be based on existing DWR data.
Open Space Use	Natural habitat acres	Crop acres Developed acres	Annual Annual	Annual acreage change Annual acreage change	The analysis for open space use will focus on the results of the agricultural and M&I land uses analyses.
Recreation				Visitor days:	Analysis of effects on recreation opportunities and use will be based on results of the water, fisheries, and wildlife analyses. The opportunities analysis will be based on recreation quality thresholds and the use analysis on empirical relationships between recreation use and streamflows, reservoir water levels, refuge water deliveries, and fish and wildlife populations at representative areas in different regions, including Sacramento Valley, San Joaquin Valley, southern California, and California coast.
Reservoirs	Changes in recreation use	Surface elevation Fish catch Hunting	Monthly Monthly	Annual/water year-type Annual/water year-type	
Rivers	Changes in recreation use	Flow Fish catch Hunting	Monthly Monthly	Annual/water year-type Annual/water year-type	
Delta	Changes in recreation use	Flow Fish catch Hunting	Monthly Monthly	Annual/water year-type Annual/water year-type	Results of the analyses will be presented at the regional level. Representative area analyses within each region will be assessed individually and cumulatively to determine the direction and relative magnitude of changes at affected areas within the region.

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Refuges	Changes in recreation use	Fish catch	Monthly	Annual/water year-type	
		Water deliveries	Monthly	Annual/water year-type	
		Wildlife populations	Monthly	Annual/water year-type	
		Hunting			
Coastal	Changes in recreation use	Fish catch	Monthly	Annual/water year-type	

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Economics					
Agriculture	*Value of crops, net income, crop acres, irrigation efficiency*	*Water deliveries* EWMPs Water supply costs Water quality	*Annual/water year-type* Annual/water year-type Per acre-foot Annual/water year-type	*Annual/water year-type, value of crops, net income, crop acres, irrigation efficiency*	Potential changes to the agricultural sector will be estimated for four regions within the Central Valley: Sacramento Valley, Delta, western San Joaquin Valley (including Kern County), and eastern San Joaquin Valley. If additional potential agricultural impacts are identified out-of-basin, these may need to be added as regions (for example, agricultural water delivery to Santa Clara Valley and the San Felipe service area). Potential impacts categories to be assessed include changes in: ■ crop mix and irrigated acreage; ■ cost of implementing regulatory changes, such as irrigation improvements and water quality controls; ■ gross farm income (value of production) and net farm income; ■ financial impacts of changes in the level of water supply and its uncertainty; ■ expected crop loss from levee failure and flooding. Both quantitative estimates and qualitative discussion of changes to the agricultural sector will be presented for the regions described above. Summary tables by region and impact category will assist readers in comparing alternatives to the baseline condition.

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Economics (continued)					
M&I	Avoided costs of obtaining water elsewhere or imposing shortages	Water deliveries Water quality BMPs Water supply cost	Annual/water year-type Annual/water year-type Annual/water year-type Per acre-foot	Annual/year-type avoided costs	Potential changes to the urban sector will be estimated for up to four regions: Sacramento Valley, San Joaquin Valley, Bay Area, and southern California. The split of uses within this sector (residential vs. industrial, outdoor vs. indoor) will not be assessed unless further refinement of alternatives indicates the need. The net benefits associated with changes in water supply and its variability will be compared across alternatives and the baseline condition. Net benefits may be measured as changes in consumer surplus or changes in the cost of alternative supplies. Costs of regulatory changes and water quality may also be compared if appropriate. Both quantitative estimates and qualitative discussion of changes to the M&I sector will be presented for the regions described above. Summary tables by region and impact category will assist readers in comparing alternatives with baseline conditions.

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Economics (continued)					
Recreation (excluding sportfishing)	Spending Benefits Direct employment Direct income	Recreation use	Annual	Annual	The analysis of sportfishing and other recreation-related economic impacts will focus on estimating changes in spending, net benefits, and direct economic effects (employment and income) at representative areas within different regions, including Sacramento Valley, San Joaquin Valley, southern California, and California coastal areas. Predicted changes in recreation use at representative areas will be used with expenditure profiles and net benefits of recreation users to estimate changes in total spending and net benefits. Employment and income coefficients will be used to translate changes in total spending to direct employment and income effects. The analysis of commercial fishing will focus on expected changes in the harvest of commercially caught salmon at representative landings along the California coast. To assess net income effects, changes in harvest value (revenues) less variable costs will be estimated. To assess changes in direct employment and income, appropriate employment and income coefficients will be used. The analysis of ecosystem preservation benefits will focus on identifying the nature and magnitude of benefits described in the literature for other relevant water resource projects. The validity and transferability of results from other studies to this project will be discussed. Results of the sport fishing, other recreation, and commercial fishing economics analyses will be presented at the regional level. Representative area analyses within each region will be assessed individually and cumulatively to determine the direction and relative magnitude of economic impacts associated with affected areas within the region. A comparative assessment of impacts across regions will be presented.
Sportfishing	Spending Benefits Direct employment Direct income	Sportfishing effort	Annual	Annual	
Commercial Fishing	Net income (profit) Direct employment Direct income	Fish harvest	Annual	Annual	
Ecosystem Preservation Values	Net willingness to pay	Habitat value (fish, wildlife, vegetation)	Annual	Annual	

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Regional Parks And Recreation Areas	Potential loss of future areas, deregualtion of existing	N/A	Annual	Annual	
Power Production	Avoided costs of obtaining power elsewhere or imposing shortages	Range of costs for replacement power	Monthly	Annual	The analysis will estimate the need for the Western Area Power Administration (Western) to purchase power to meet system loads and the associated costs.
		Water deliveries	Annual/water year-type	Annual/water year-type	
Regional	Regional income Regional employment	Direct employment and direct income (agricultural, M&I, FWR, power economics)	Annual	Annual	Employment and income multipliers derived from an economic input-output model will be applied to estimates of direct changes in economic conditions in the agriculture, municipal and industrial, recreation, and commercial fishing sectors to estimate project-related changes in regional employment and income levels. Regional effects will be evaluated for Sacramento Valley, San Joaquin Valley, coastal fishing areas, and southern California. Estimated project-related changes in regional employment and income levels will be compared with baseline regional conditions to assess the magnitude of project-related effects. Tables will be prepared showing the estimated direct and secondary (i.e., indirect and induced) change in employment and income in each region associated with the implementation of the project alternatives. These tables will highlight the comparative differences in economic conditions across the regions for each alternative. Additionally, tables will be prepared that compare project-related changes in regional economic conditions with baseline conditions within each region. The accompanying narrative will discuss the differences among regions and across alternatives. The text will also qualitatively address the potential changes in population conditions associated with regional changes in levels of economic activity.
Visual Aesthetics	Viewsheds	Land use	Post-project	Change in viewshed	The analysis will focus on regional assessment of change at rivers, reservoirs, Delta channels, and refuges resulting from habitat restoration, changes in water availability, and construction of facilities.
		Streamflows		Change in viewshed	
		Delta channels		Change in viewshed	
		Reservoir elevations and surface areas		Change in viewshed	
		Vegetation			

Issue Area	Specific Issues	Type of Data Required	Data Analysis in Tier 1 Document (proposed time step)	Data Presentation in Tier 1 Document (proposed time step)	Explanation/Comments
Cultural Resources	Historic resources Archaeological resources Ethnographic resources Native American Traditional Cultural properties	Identified resources	N/A	Potential changes	The analysis will focus on potential changes that could directly occur at reservoirs, conveyance facilities, streams, and refuges resulting directly from changes in water flows, elevations, or availability (as identified in the "Water" Issue Area); or resulting indirectly from changes in land use or recreational opportunities (as identified in the "Land Use" and "Recreation" Issue Areas).
Public Health	Vectors	Wetlands acreage Habitat value Vector populations (primarily mosquitos)	Periodically Periodically Periodically	Potential changes	The analysis of vectors and drinking-water quality will focus on potential changes that could occur in the geographic subregions that will be affected by changes in water availability and quality (as identified in the "Water" and "Vegetation" Issue Areas). The analysis of vectors will be based upon historical responses to changes in wetlands acreage.
	Drinking-water quality	Water-quality standards	Monthly	Annual compliance	
Power Production, Power Use	Power production	Water releases and associated generation capacity from facilities	Monthly	Annual	The analysis will focus on the changes in annual power production resulting from changes in CVP water releases and deliveries.
	Power use	Power use	Monthly	Annual	
Climate	None	Precipitation, temperature and wind	Monthly	N/A	Average monthly data for streams and reservoirs.
Air Quality	Potential increases in particulates, sulfur compounds, and carbon compounds	Existing air quality Emission rates for particulates Emission rates for fossil fuel power plants used by Pacific Gas & Electric Company Land use changes	Annual N/A N/A Annual	Annual Seasonal Seasonal Annual	Average annual data for air quality basins in the Sacramento and San Joaquin Valleys, Bay-Delta, and southern California.

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