

Guiding and Management Questions	Monitoring Questions	Indicator No.	Indicators	Metrics	Data Type and Source	Locations and Frequency of Reports of Findings				
						Benchmark Sites	Reference Sites	Selected Project Sites	Regional Survey	Regional Inventory
All, but mainly 1	What is the distribution and abundance of the estuary's tidal wetlands and other baylands?	1	Map of baylands habitat types and elements (vegetated tidal marsh, tidal flats, diked marsh types, levees, channels, pannes, etc); impact areas and projects.	Acres and locations of habitat types and elements differentiated by hydrology, salinity, vegetation cover, and elevation capital.	Impact Areas and Project areas using Project Tracker SOP; Remote Sensing Special Study will provide details but new BAARI SOP will likely involve satellite LIDAR w/ ground-truthing for a regional comprehensive inventory	NA	NA	Annual updates	NA	Baseline and every 5 yrs
All, but mainly 1	What are the elevations of the estuary's existing and restoring tidal wetlands? What is their elevation capital?	2	Map of tidal wetland elevations and elevation capital	Elevations (ft NAVD) and elevation capital (Z"); relative to local MHHW)	transects and SETs tied to dedicated tide gauges and geodetic benchmarks at Benchmark Sites; migration space derived from DEM using NOAA, BCDC and other transgression models/maps, plus ABAG land use maps and best available veg maps	Baseline and every 5 yrs	Baseline and every 5 yrs	Baseline and every 5 yrs	Baseline and every 5 yrs	Baseline and every 10 yrs
Mainly 1	Where do tidal wetlands have space to migrate upslope?	3	Map of estuarine-terrestrial transition zones and migration space.							
All	Where do tidal wetlands support complex habitat diversity and connectivity?	4	Map of "complete marshes" as defined by BEHGU and fluvial/upland/riparian connectivity.	Acres and location of marshes with combinations of the elements of "complete marshes" (marsh plain, channel, pond/panne, transition zones, riparian connection)	See Indicators 1, 2, and 3 above	NA	NA	NA	NA	Baseline and every 10 yrs
All	What is the distribution and abundance of tidal wetland habitats that can support special-status species?	5	Map of tidal wetland special-status species habitats.	Acres and location of habitat types that could support special-status species.	See Indicators 1, 2, and 3 above; Answers are derived from interpretations of maps of marsh 3D and vegetation (e.g. high tide refugia, pannes, some channel, etc within specific salinity regimes)	Baseline and every 5 yrs	Baseline and every 5 yrs	Baseline and 5, 10 yrs or longer if required by permit	NA	Baseline and every 10 yrs
Mainly 2-4	Where are shorelines eroding landward and/or growing seaward?	6	Map of changes in the lateral extents of natural foreshores (tidal marsh and beach).	Shoreline location	SFEI/BCDC shoreline change detection tool	Baseline and every 5 yrs	Baseline and every 5 yrs	Baseline and 5, 10 yrs or longer if required by permit	NA	Baseline and every 5 yrs
All, but mainly 1	What is the current distribution, extent, and diversity of dominant vegetation communities in the estuary?	7	Percent cover, height, and patch characteristics of major dominant veg. groups within sub-basins.	Remote Sensing Special Study will provide details; Likely to include acres and location of dominant tidal wetland vegetation alliances, patchiness, total % cover, veg height, etc.	Remote Sensing Special Study will provide details; SOPs will likely involve satellite and UAS aerial imagery (4-band) and gradsects along channels and along elevation and salinity gradients within each sampled marsh	Baseline and every 5 years	Baseline and every 5 years	Baseline and 5, 10 yrs or longer if required by permit	NA	Baseline and every 10 years
Mainly 2-4	What are the rates of change over time in the spatial extent and distribution of dominant vegetation communities (including native and non-native vascular plants) along the primary and secondary salinity gradients of the estuary	8	Direction and magnitude of changes in percent cover, height, and patch characteristics of major dominant veg. groups within sub-basins.	Remote Sensing Special Study will provide details; Likely to include acres and location of dominant tidal wetland vegetation alliances, patchiness, total % cover, veg height, etc.	SOPs will likely involve satellite and UAS aerial imagery (4-band) and gradsects along channels and along elevation and salinity gradients within each sampled marsh	Baseline and every 5 years	Baseline and every 5 years	Baseline and 5,	NA	Baseline and every 10 years
Mainly 2-4	Where are unvegetated areas such as channels, ponds, and pannes expanding?	9	Changes in drainage network length, channel density, channel width, numbers and sizes of pannes, size of un-vegetated areas of tidal marsh plains.	Remote Sensing Special Study will provide details; Likely to include 2nd-order and larger channels, mosquito control and other ditches, size-frequency of pannes, etc.	SOPs will likely involve Lidar and satellite and UAS aerial imagery (4-band) plus ground-truthing	Baseline and every 5 years	Baseline and every 5 years	Baseline and 5,	NA	Baseline and every 10 years
All, but mainly 1 - 3	Where are non-native species a significant component of the dominant tidal wetland vegetation community? Where are they expanding?	10	Distribution and abundance of selected non-native, invasive plant species.	Remotely sensed marsh 3D and veg metrics; CRAM Index and Attribute Scores	Regional WRMP habitat maps and CRAM surveys	Baseline and every 5 years	Baseline and every 5 years	Baseline and 10	NA	Baseline and every 10 years
All, but mainly 2 - 4	What is the overall condition or health of the estuary's tidal wetlands?	11	CRAM site scores and regional Cumulative Distribution Functions (CDFs).	CRAM Index and Metric scores relative to regional CRAM CDFs	CRAM assessments using the CRAM SOP	Baseline and every 5 years	Baseline and every 5 years	Baseline and 5,	NA	Baseline and every 10 years
All, but mainly 2 - 4	How are the elevations of marsh plains (including high tide refugia) changing over time, and where in the estuary are tidal wetland accretion rates keeping up with rates of sea level rise?	12	Spatial and temporal trends in marsh plain and tidal flat vertical change and accretion rates.	Marsh plain and tidal flat accretion rates relative to local tidal datums and NGVD	SETs, field surveys and remotely sensed elevation data tied to vertical control benchmarks	Continuous in-situ SSC measurements and tide stage measurements with annual elevation and accretion measurements	In-situ SSC measurements and tide stage measurements with elevation and accretion measurements as needed to support projects	Baseline and annually for at least first 5 yrs	NA	NA

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All, but mainly 2 - 4	Where is there adequate suspended sediment to support rates of accretion that are equal to or greater than sea level rise (SLR), and monitoring data are needed to develop and calibrate numerical models that forecast the variations in suspended sediment supply?	13	Spatial and temporal trends of SCC in tidal marsh channels in relation to watershed yields of SS and SSC in estuarine shallows and bays.	Suspended sediment concentrations	Acoustic SSC sondes co-located with water level sondes (continuous), grab samples (event-based), sediment rating curves, near-shore SSC (Bay RMP), and rainfall, flow data and wave energy estimates for Benchmark Sites	Continuous in-situ SSC measurements and tide stage measurements with annual elevation and accretion measurements	in-situ SSC measurements and tide stage measurements with elevation and accretion measurements as needed to support projects	Baseline and annually for at least first 5 yrs	NA	Sediment Rating Curves and Bay RMP
All	How do tidal inundation regimes differ throughout the estuary's tidal wetlands, and are they muted, choked, or otherwise different from source tides?	14	Spatial and temporal trends in the frequency, duration, and depth of tidal inundation of marsh plains.	Tidal inundation regime	Tidal stage and tide height statistics plus site topography relative to local MHHW.	Continuous in-situ tide stage measurements; Site vertical change every 5 yrs	Continuous in-situ tide stage measurements; Site vertical change every 5 yrs	Continuous in-situ tide stage measurements; Site vertical change every 5 yrs	NA	NA
All	What are the regional rates of sea level rise and how do they vary throughout the estuary?	15	Spatial and temporal trends in the rate of sea level rise.	Annual mean sea level rise. There will be the ongoing observations by NOAA at the GG and other permanent tide stations, plus the gages at the BM sites, plus any other gauges properly installed and maintained for at least one year.	Tide height data from all gauges in the region that meet QAQC requirements	Continuous in-situ tide stage measurements	Continuous in-situ tide stage measurements	Continuous in-situ tide stage measurements	NA	Continuous in-situ tide stage measurements
All, but mainly 2 - 4	How are the primary and secondary salinity gradients in the estuary's tidal wetlands changing over time?	16	Spatial and temporal trends in aqueous salinity of tidal marsh channels and porewater salinity along gradsects.	Aqueous (in-channel) and porewater salinity	Sonde salinity data in tidal marsh channels; Seasonal insitu porewater salinity measurements in root zone along gradsects	Continuous sonde data; Seasonal porewater to capture annual min and max values	Continuous sonde data; Seasonal porewater to capture annual min and max values		NA	NA
All, but mainly 1, 3, and 5	Where do tidal wetlands and channels provide adequate water quality to support fish and other aquatic life?	17	Mercury loading into tidal marsh food webs.	Hg concentrations in blood or tissue of bio-sentinel species representing tidal flats, young marshes (reference sites), and mature marshes (Benchmark Sites).	Dedicated field collection of biota or their tissue/blood using existing bio-sentinel SOPs	Annual based on species natural history	Annual based on species natural history	To be decided by Technical Advisory Committee upon further discussion of how age of marsh (developmental stage of projects), drought, and deluge, affect Hg loading into marsh foodwebs, such that it can promulgate objectives or narrative guidance for project performance	NA	NA
All, but mainly 1, 3, and 5	Where do tidal wetlands and channels provide adequate water quality to support fish and other aquatic life?	18	DO in tidal marsh channels.	DO concentrations	DO concentrations from in-situ instrument in selected tidal marsh channels	Timed for tide phase, tide cycle, and time of year of likely minimum values	Timed for tide phase, tide cycle, and time of year of likely minimum values	Timed for tide phase, tide cycle, and time of year of likely minimum values	NA	NA
All, but mainly 2-4	What is the response of resident tidal marsh birds?	19	Distribution and abundance of indicator species.	California Ridgway's Ridgeway Rail, California Black Rail, tidal marsh Song Sparrowspp., Saltmarsh Common Yellowthroat, throat, abundance, trends in abundance	Dedicated field surveys at selected Benchmark Sites, Reference Sites, and Projects using existing SOPs: Tidal marsh passerines, Secretive marsh birds.	Annual based on species natural history	Annual based on species natural history	Annual based on species natural history	Baseline and every 10 yrs	NA
All, but mainly 2-4	What is the response of resident tidal marsh small mammals?	20	Distribution and abundance of indicator species	SMHM, perhaps California Vole	Dedicated field surveys at selected Benchmark Sites, Reference Sites, and Projects using existing SOPs	Annual based on species	Annual based on species natural history	Annual based on species natural history	Baseline and every	NA

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All, but mainly 2-4	What is the response of resident tidal marsh fishes?	21	Distribution and abundance of indicator species	Abundance of Longjaw Mudsucker; community composition, abundance, and distribution of estuarine fish (pelagic/larval and marshplain), and anadromous fish (Chinook salmon and steelhead trout)	Dedicated field surveys at selected Benchmark Sites, Reference Sites, and Projects using existing SOPs	Annual based on species natural history				
Mainly 5	What is the distribution and abundance of tidal marsh mosquito habitats?	22	Distribution and abundance of potential mosquito breeding areas	Total area and patch size of known and potential areas of mosquito production	Maps based on LiDAR and satellite and UAS aerial imagery (4-band) and vegetation	Biannual baseline and every 5 years to capture summer high tide and winter rainfall maximums	Biannual baseline and every 5 years to capture summer high tide and winter rainfall maximums	Biannual baseline	NA	NA
Mainly 5	What is the production of mosquitoes by tidal marshes?	23	Mosquito production	Counts of mosquito adults and larvae by species	Surveillance SOP	Seasonal based on species natural history	Seasonal based on species natural history	Seasonal based	NA	Ongoing by MADs