Adaptive Management Summary Table—Higher Trophic Levels Group

Category	Restoration Target	Monitoring Parameter (Method)	Spatial Scale for Monitoring Results	Expected Time frame for Decision-making	Management Trigger	Applied Studies	Potential Management Action
Clapper Rails Project Objective 1A	Meet recovery plan criteria for Clapper Rail habitat within the SBSP project area	Clapper rail habitat acreage, quality (see *Vegetation Establishment* above)	Entire South Bay	Likely decades for high-quality tidal marsh development (10-year targets)	See triggers for *Sediment Dynamics*, *Vegetation Establishment* above	* How do clapper rails and/or other key tidal marsh species respond to variations in tidal marsh habitat quality and what are the habitat factors contributing to that response?	* See *Vegetation Establishment* above * Reconsider movement up staircase
	Meet recovery plan criteria for Clapper Rail populations (0.25 birds/ac over 10-year period) within the SBSP project area	Winter numbers, censused during high-tide airboat surveys, and breeding-season numbers, censused at representative locations	Entire South Bay	Monitoring not expected to show substantial results until 5-10 years after cordgrass establishment in 300 acres or more (10-year targets)	* Populations drop below 0.20 birds/ac in any given year * Rate of increase deviates significantly from projection		* See *Vegetation Establishment* above * Applied studies of habitat parameters, contaminant levels, and predation pressure related to rail densities and productivity (and implement related management actions as appropriate) * Reconsider movement up staircase
Salt Marsh Harvest Mice Project Objective 1A	Meet recovery plan criteria for salt marsh harvest mouse habitat within the SBSP project area	Salt marsh harvest mouse habitat acreage, quality (see *Vegetation Establishment* above)	Entire South Bay	Likely decades for high-quality tidal marsh development (10-year targets)	See triggers for *Sediment Dynamics*, *Vegetation Establishment* above	* How do clapper rails and/or other key tidal marsh species respond to variations in tidal marsh habitat quality and what are the habitat factors contributing to that response?	* See *Vegetation Establishment* above * Adjust phasing and design; for example, add or enhance upland transition habitat within and between restored marshes * Reconsider movement up staircase
	75% of viable habitat areas within each large marsh complex with a capture efficiency level of 5.0 or better in five consecutive years	Capture efficiency (targeting multiple areas with a CE of at least 5.0)	Entire South Bay	Monitoring not expected to begin for 5-10 years after pickleweed establishment in 300 acres or more	Rate of increase deviates significantly from projection		* See *Vegetation Establishment* above * Adjust phasing and design; for example, add or enhance upland transition habitat within and between restored marshes * Reconsider movement up staircase

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Migratory Shorebirds Project Objective 1B	Maintain numbers of migratory shorebirds at pre-ISP baseline numbers	* Use previously collected data (USGS, PRBO, SFBBO) on foraging shorebird densities, as well as modeled densities, to set targets for densities of foraging shorebirds for each restored/managed habitat type (e.g., reconfigured ponds and restored mudflats) by season. Targets would be based on densities (by habitat type and/or geographic area) necessary to maintain pre-ISP numbers. Conduct limited surveys in a sample of habitats/locations within the SBSP Project area to estimate foraging densities. * Use existing data from Flyway Project surveys and data from initial few years of window surveys to determine the percentage of small migratory shorebirds that occur in the South Bay compared to the entire Bay. Monitor abundance in fall, winter, and spring via high-tide, baywide "window" surveys (in which multiple observers census a number of locations in a brief [e.g., 3-day] period) conducted throughout San Francisco Bay. SBSP Project would provide for the coordination of these surveys.	* Monitoring stations in a sample of habitats/locations within the SBSP Project area (for collection of data on shorebird densities in various habitats) and throughout the Bay area (for collection of data on the percentage of small migratory shorebirds that occur in the South Bay compared to the entire Bay)	*Changes in shorebird foraging densities are expected to be immediate upon changes in management (e.g., reconfiguration and management of a pond for optimal foraging depths, or conversion of a salt pond bottom to intertidal mudflat upon breaching of levees), although any changes in densities within a given habitat type will be slower. * May take years or decades for the percentage of S.F. Bay birds using the South Bay to change in response to SBSP Project.	* Three consecutive years in which observed densities of foraging shorebirds for selected habitat types are below targets. * Three consecutive years in which the percentage of S.F. Bay small migratory shorebirds that use the South Bay is below the baseline (as determined using window survey data).	* Will the habitat value and carrying capacity of South Bay for nesting and foraging migratory and resident birds be maintained or improved relative to current conditions? * Will ponds reconfigured and managed to provide target water and salinity levels significantly increase the prey base for, and pond use by waterfowl, shorebirds and phalaropes/grebes compared to existing ponds not managed in this manner? * To what extent will the creation of large isolated islands in reconfigured ponds maintain numbers (and reproductive success) of terns and other nesting birds in the South Bay, while increasing densities of foraging birds over the long term compared to ponds not managed in this manner? (including studies of mudflats and managed ponds invertebrate productivity, time-energy budgets for foraging birds, relative importance of and prey use in ponds with different salinities) * Will intramarsh pond	* Analyze all available monitoring data for South Bay, Bay Area, and entire Pacific Flyway to determine whether declines are likely the result of SBSP Project, or the result of external factors. Coordinate with other Pacific Flyway studies; develop the larger structure for a centralized flyway monitoring network. * If declines are likely the result of SBSP Project: --Adjust design, for example reconfigure more ponds for use by foraging shorebirds --Adjust management, for example, manage more ponds for optimal water levels and salinities for foraging shorebirds * Reconsider movement up staircase

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Category	Restoration Target	Monitoring Parameter (Method)	Spatial Scale for Monitoring Results	Expected Time frame for Decision-making	Management Trigger	Applied Studies	Potential Management Action
						and panne habitats in restoring tidal marshes provide habitat for significant numbers of foraging and roosting shorebirds and waterfowl?	
Breeding	Maintain numbers of breeding	* Monitor total numbers of	* Local (pond-level)	* Immediate response	* Decline in numbers	* Will the habitat value	* Analyze all available monitoring

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Category	Restoration Target	Monitoring Parameter (Method)	Spatial Scale for Monitoring Results	Expected Time frame for Decision-making	Management Trigger	Applied Studies	Potential Management Action
Avocets, Stilts, and Terns Project Objective 1B	avocets, stilts, and terns using the South Bay at pre-ISP baseline numbers	nesting Forster's and Caspian Terns in the South Bay via comprehensive breeding-season surveys (per methods currently employed by SFBBO). Baseline has been established through past/ongoing monitoring conducted by SFBBO. * Sample selected areas within the South Bay during the breeding season to determine the numbers of stilt/avocet nests in those areas. * Estimate reproductive success by sampling a subset of breeding locations/colonies and estimating the number of young fledged/nest.	scale for management actions, such as island creation, at specific ponds * Entire South Bay for estimates of numbers (with estimates of breeding success in a few representative areas)	(increase) expected due to Phase I actions * Longer-term trends monitored annually	(in the South Bay as a whole) or reproductive success of breeding stilts, avocets, and Forster's and Caspian Terns below baseline for two consecutive years	and carrying capacity of South Bay for nesting and foraging migratory and resident birds be maintained or improved relative to current conditions? * To what extent will the creation of large isolated islands in reconfigured ponds maintain numbers (and reproductive success) of terns and other nesting birds in the South Bay, while increasing densities of foraging birds over the long term compared to ponds not managed in this manner? (including predation and predator control studies, vegetation management techniques and Hg uptake in eggs, and related toxicity studies) * Will California gulls, ravens, and crows adversely affect (through predation and encroachment on nesting areas) nesting birds in managed ponds?	data for South Bay, Bay Area, and entire Pacific Flyway to determine whether declines are likely the result of SBSP Project, or the result of external factors (taking into account the downward trends in abundance of Forster's Terns over last few decades, which are unrelated to salt pond conversion). * If declines are likely the result of SBSP Project: --Undertake applied studies of habitat parameters, contaminant levels, prey availability and type, juxtaposition of nesting and brood rearing/foraging areas, predation pressure, and disturbance to determine appropriate design/management adjustments --Conduct Bay-wide survey to determine whether SBSP Project has simply displaced birds to other Bay-area locations. --Adjust design to construct more, or more optimal, nesting islands --Adjust design to reduce Hg uptake --Adjust management. For example, manage more ponds for optimal water levels and salinities for breeding and foraging stilts and avocets, manage more ponds for optimal water depths and salinities for foraging terns and/or control predation, vegetation, human disturbance. * Reconsider movement up staircase
Diving Ducks Project Objective 1C	Maintain numbers of diving ducks using the South Bay at pre-ISP baseline numbers	Use mid-winter waterfowl survey data to monitor winter numbers of diving ducks in the South Bay. Baseline has been	Entire South Bay	Local changes in abundance are expected to be immediate upon changes in management	Decline in South Bay numbers below baseline conditions for two consecutive years	* Will sediment movement into restored tidal areas significantly reduce habitat area	* Analyze all available monitoring data for South Bay, Bay Area, and entire Pacific Flyway to determine whether declines are likely the

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Category	Restoration Target	Monitoring Parameter (Method)	Spatial Scale for Monitoring Results	Expected Time frame for Decision-making	Management Trigger	Applied Studies	Potential Management Action
		set by previous mid-winter surveys and Accurso's studies.		(e.g., reconfiguration and management of a pond, or conversion of a salt pond bottom to intertidal mudflat upon breaching of levees). Larger-scale changes in abundance will likely be slower (on the order of years to decades).		and/or ecological functioning (such as plankton, benthic, fish or bird diversity or abundance in the South Bay? * Will the habitat value and carrying capacity of South Bay for nesting and foraging migratory and resident birds be maintained or improved relative to current conditions? * Will intramarsh pond and panne habitats in restoring tidal marshes provide habitat for significant numbers of foraging and roosting shorebirds and waterfowl over the long term?	result of SBSP Project, or the result of external factors * If declines are likely the result of SBSP Project: --Undertake applied studies of habitat use and effects of human disturbance to determine appropriate design/management adjustments --Adjust design to increase the restoration of shallow subtidal habitat --Adjust management. For example, manage more ponds for optimal water depths and salinities for foraging diving ducks and/or control human disturbance *Reconsider movement up staircase
Salt Pond Associated Migratory Birds (Wilson's and Red-necked Phalaropes, Eared Grebes, Bonaparte's Gulls) Project Objective 1B	* Maintain these species' use of SBSP project area * Minimize declines in the South Bay relative to pre-ISP baseline	Focused surveys would be conducted targeting seasonal peaks (i.e., late summer/early fall for phalaropes, fall and winter for Eared Grebes and Bonaparte's Gulls) and geographic concentrations (e.g., high-salinity ponds and other areas known to support large proportions of South Bay numbers of these species) to determine the numbers of these species using the South Bay.	Entire South Bay (as determined by surveys in areas where these species are concentrated)	Local changes in abundance are expected to be immediate upon changes in management (e.g., reconfiguration and management of a pond, or conversion of a salt pond bottom to intertidal mudflat upon breaching of levees). Larger-scale changes in abundance will likely be slower (on the order of years to decades).	Three consecutive years in which numbers are more than 25% below the NEPA/CEQA baseline, or any single year in which numbers are more than 50% below NEPA/CEQA baseline	* Will the habitat value and carrying capacity of South Bay for nesting and foraging migratory and resident birds be maintained or improved relative to current conditions? * Will ponds reconfigured and managed to provide target water and salinity levels significantly increase the prey base for, and pond use by waterfowl, shorebirds and phalaropes/grebes compared to existing ponds not managed in this manner?	* Analyze all available monitoring data for South Bay, Bay Area, and entire Pacific Flyway to determine whether declines are likely the result of SBSP Project, or the result of external factors (taking into account declines that have already occurred due to ISP). * If declines are likely the result of SBSP Project: --Adjust management to have more ponds with optimal water levels and salinities for foraging pond-associated birds *Reconsider movement up staircase

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Category	Restoration Target	Monitoring Parameter (Method)	Spatial Scale for Monitoring Results	Expected Time frame for Decision-making	Management Trigger	Applied Studies	Potential Management Action
Western Snowy Plovers Project Objective 1B	Contribute to the recovery of the Western Snowy Plover by providing habitat to support 250 breeding birds within SBSP project area, and maintain a 5-year average productivity of at least one fledged chick per male (per Draft Recovery Plan)	Snowy plover numbers and estimated nest success, determined through comprehensive, annual South Bay surveys and monitoring during the breeding season	Entire South Bay for estimates of numbers (with estimates of breeding success in a few representative areas)	Local changes in abundance are expected to be immediate upon changes in management (e.g., reconfiguration and management of a pond with nesting islands). Longer-term trends will be monitored annually.	* Rate of population change declines substantially from projected trajectory toward meeting target * South Bay population declines in any given year below 2006 baseline	Will shallowly flooded ponds or ponds constructed with islands or furrows provide breeding habitat to support sustainable densities of snowy plovers while providing foraging and roosting habitat for migratory shorebirds compared to existing ponds not managed in this manner? (including predation studies and predator control studies, vegetation management techniques, and Hg-related toxicity studies	* Analyze all available monitoring data for South Bay, Bay Area, and entire Pacific Flyway to determine whether declines are likely the result of SBSP Project, or the result of external factors (taking into account the downward trends in abundance of plovers over last few decades, which are unrelated to salt pond conversion). * If declines are likely the result of SBSP Project: --Undertake applied studies of habitat parameters, contaminant levels, prey levels/type, juxtaposition of nesting and brood rearing/foraging areas, predation pressure, and disturbance to determine appropriate design/management adjustments --Adjust design to construct more, or more optimal, nesting islands and/or to reduce Hg uptake --Adjust management of water levels and salinities in more ponds for optimal breeding and foraging habitat and/or control predation, vegetation, human disturbance * Reconsider movement up staircase
California Least Terns Project Objective 1B	Maintain numbers of California Least Terns breeding in the San Francisco Bay at 2006 baseline numbers (i.e., avoid negative effect of SBSP Project on Bay-area Least Tern numbers)	Counts of breeding pairs at Bay-area colonies	Breeding colonies	Local changes in abundance may be immediate upon changes in management (e.g., reconfiguration and management of a pond, or conversion of a salt pond bottom to intertidal mudflat upon breaching of levees). Larger-scale changes in abundance will likely be slower (on	Decline in total number of breeding pairs in the S.F. Bay area below 2006 baseline levels, in any given year		* If numbers decline, first use available information to attempt to determine whether declines are resulting from SBSP project or other factors (e.g., factors associated with spawning streams). * Conduct applied study of post-breeding habitat use and diet, especially in the South Bay. * Implement management or adjust design (e.g., if applied study finds more foraging occurs in ponds than

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				the order of years to decades).			Bay, manage more ponds for suitable Least Tern foraging conditions). *Reconsider movement up staircase.
Steelhead Project Objective 1C	Enhance numbers of salmonids and juvenile rearing habitat relative to NEPA/CEQA baseline numbers	Counts of upstream-migrating salmonids to monitor spawning populations in South Bay streams	South Bay spawning streams	5-10 years likely for effects of restoration on salmonids to be detectable	Reduction in number of upstream-migrating salmonids	Will increased tidal habitat increase native fish and harbor seal survival, growth and reproduction? (including specific study of steelhead)	* If numbers decline, first use available information to attempt to determine whether declines are resulting from SBSP project or other factors (e.g., factors associated with spawning streams). * Conduct applied study of constraints to population growth (ex: Hg, water quality, food chain). *Conduct applied study of condition of salmonids seaward of restoration site (sample Chinook using minnow net upstream from, at, and downstream from restoration sites before and after restoration; determine whether fish are larger and healthier after than before restoration). * If numbers decline, conduct diet studies on piscivorous birds (to determine whether increased bird predation is responsible). * Implement management or adjust design (e.g., restore more tidal habitat adjacent to spawning streams). *Reconsider movement up staircase.
Estuarine Fish Project Objective 1C	Enhance numbers of native fish and juvenile rearing habitat relative to NEPA/CEQA baseline numbers	* Presence/abundance of surfperch in restored marshes (as measured in permanent monitoring locations with pilings installed to facilitate monitoring) * Presence/ absence of native flatfish in restored un-vegetated shallow water areas	Monitoring results will reflect conditions at monitoring stations scattered throughout the SBSP Project area	Varies by trigger – *fish are expected to move into newly restored areas almost immediately but assemblages will change as habitat matures * surfperch not expected to use restored marshes	* Detection of a fish die-off * Absence of detections of surfperch using restored tidal marsh * Increase in percent of individuals sampled in restored marshes	Will increased tidal habitat increase native fish abundance and will restored habitat support healthy populations? (including specific study of native estuarine fish)	* Use available information to attempt to determine whether declines are resulting from SBSP project or other factors (e.g., factors associated with spawning streams). Applied study of constraints to population growth (ex: Hg, water quality, food chain) * If fish populations decline,

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		* Species richness and abundance of native fish species in restored marshes and associated unvegetated shallow water areas * Water quality parameters (see "Water Quality" Key Category)		until vegetation is established * negative impacts may be immediate if poor water quality from a pond discharge causes a die-off	that are non-native * Detectable reduction in water quality (as determined by monitoring described under "Water Quality" Key Category) * Deviation from expected trajectory of native fish use of restored marshes and associated unvegetated shallow water areas		conduct diet studies on piscivorous birds (to determine whether increased bird predation is responsible). * Consider possible effects of recreational angling pressure. * Implement management or adjust design (e.g., remove more levees to increase connectivity in restored ponds) based on study results *Reconsider movement up staircase
Harbor Seals Project Objective 1C	* Maintain or enhance numbers of harbor seals using the South Bay	* Conduct periodic monitoring at known South Bay haul-out sites (e.g., Mowry, Newark & Alviso Sloughs, and expand to include haul-out site in Corkscrew Slough) to determine trends in productivity and abundance, and changes in distribution. If incidental observations at other areas are not adequate to determine if new haul-out sites are established, periodically survey other locations as well. Existing data include over 5 years of weekly survey data for Mowry and Newark sloughs, and 5 years of monthly survey data for Alviso Slough. * Mercury parameters (see "Mercury" Key Category)	Focal areas (i.e., known haul-out sites) throughout South Bay	Negative response to human disturbance from improved public access may be immediate; response to habitat restoration or increased mercury availability may be longer-term (a decade or more)	* Decline in overall South Bay numbers and pup production at haul-out sites below 2006 baseline levels for 2 consecutive years * Reduction in frequency of use and pup production of Mowry Slough and adjacent haul-out/pupping areas	* Will increased tidal habitat increase native fish and harbor seal survival, growth and reproduction? * Will increases in boating access significantly affect birds, harbor seals or other target species on short or long timescales?	* See management actions under "Mercury" and "Public Access" Key Categories * Other potential management actions may include: --Restrict public access and/or improve public education near seal haul-out sites --Create seasonal closure in areas that might be appropriate for seal protection during pupping season, including buoys restricting access to sloughs to boats and land-based trails. --Enforce protective measures such as increased patrolling etc. * If seal populations decline or pupping rates decline, conduct studies on seal health (pollutant exposure), potential disturbance changes, habitat/prey alternations (fish declines or fish community changes), or reduced access to sites due to steep gradient, tidal restrictions, or insufficient deep water