

South Bay Salt Pond Restoration Project: Table of Key Uncertainties and Phase I Studies  
(Table adapted from Adaptive Management Plan)

August 2010

	<b><u>Key Uncertainties</u></b> , in italics, are followed by specific, high-priority <b><u>Applied Study Questions</u></b> (in bold) with a <b><u>brief explanation</u></b> of the importance of each question.	<b>Where Studies are Planned (Year)</b>	<b>RFP Study or other Directed Study</b>	<b>Notes</b>
<b><i>Sediment Dynamics</i></b>	<i>Is there sufficient sediment available in the South Bay to support marsh development without causing unacceptable impacts to existing habitats?</i>			
1	<b>Will sediment accretion in restored tidal areas be adequate to create and to support emergent tidal habitat ecosystems within the 50-yr projected time frame?</b> Sediment deposition has varied greatly over the last 150 years. Large-scale restoration occurring over decades will also affect sediment dynamics throughout the South Bay and regional study will be required to understand these changes.	<u>Island Ponds A21</u> (2006-9) and <u>Pond A6</u> (2011-2012); <u>Project-wide</u> satellite imagery pre and post restoration (2009 – 2011)	Callaway Topic 1 RFP proposal;  Fullfrost Topic 1 RFP study	Final Callaway Report on Island Pond A21 on website
2	<b>Will sediment movement into restored tidal areas significantly reduce habitat area and/or ecological functioning (such as plankton, benthic, fish or bird diversity or abundance in the South Bay)?</b> Sediment accretion into the restored ponds is expected to reduce the amount of mudflat in the South Bay, but it is not known whether mudflat loss will be significant in terms of acreage or its effect on South Bay ecology. Such changes are expected to occur over decades.	Shoals area off SF2 (2009/10);  and Pond A6 Shoals (2010 - ?)	USGS Science funding  Takekawa Directed Study	
3	<b>Will restoration activities always result in a net decrease in flood hazard?</b> Increased tidal prism will scour slough channels within a relative short time frame (months to years) and reduce flood hazard. Changes in tidal elevations and prism in sloughs occurring over months to years may potentially increase flood hazard.	<u>Alviso Slough bathymetry</u> (2010 - ?);  <u>Alviso Slough</u> Cross sections	USGS Science funding;  Santa Clara Valley Water District	
<b><i>Bird Use of Changing Habitats</i></b>	<i>Can the existing number and diversity of migratory and breeding shorebirds and waterfowl be supported in a changing (reduced salt pond) habitat area?</i>			
4	<b>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?</b> Overall ecosystem changes and effects must be measured and compiled over decades to understand the overall implication of South Bay restoration on migratory birds. Some factors that could affect bird numbers are changes in disease and predation rates, food availability, and nest competition	<u>Pond islands</u> -nesting, roosting, foraging waterbirds – SF2, A12, A16? (2011-2012);	Ackerman Topic 3 RFP Study;	PRBO Topic 6 RFP study will provide baseline bird abundance, salt pond carrying capacity model,

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		<u>Shoals</u> - foraging – SF2 (2009/10/?); Foraging – A6 (2010 - ?) <u>SBSP Ponds</u> 2002-present); <u>Carghill Ponds</u> (2002-present); <u>Model</u> of shoals carrying capacity	USGS Science funding;  USGS SFBBO/PRBO;  Rowan Topic 9 RFP study	and identify data gaps.
5	<b>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?</b> Simple changes to existing pond management or simple habitat alteration may significantly benefit nesting snowy plovers while still providing nesting and foraging habitat for other species, but the extent of potential benefits is not known.	<u>Plovers</u> – Baywide and nesting (2003 – present); <u>Nesting, roosting, foraging waterbirds</u> – SF2, A12, A16? (2011-2012)	SFBBO/FWS (ongoing);  Ackerman Topic 3 RFP study	
6	<b>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?</b> Ponds managed as small-scale salt pond systems may provide enhanced benefits for wide range of birds. But, the extent to which they can improve the prey base and increase foraging shorebird densities in the short and long-term is not known.	<u>Baywide:</u> Benthic communities pre (1993 -95) and post ISP (2006 – 08); <u>Model</u> of bird abundance and salt pond habitat	Thompson Topic 5 and 6 RFP study;  Athearn Topic 9 study	

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7	<b>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?</b> Changing salt pond island configurations may result in significant increases in nesting and foraging bird densities but to what extent is not known.	Nesting, roosting, foraging waterbirds – SF2, A12, A16? (2011-2012)	Ackerman Topic 3 RFP	No long term studies yet planned
8	<b>Will pond and panne habitats in restoring tidal habitats provide habitat for significant numbers of foraging and roosting shorebirds and waterfowl over the long term?</b> Naturally-maintained pond and panne habitat within marshes could potentially provide significant habitat for many species that currently use ponds. But, little is known about the extent of potential benefits to waterbird species on short or long timescales.			Tidal pond and panne habitats not yet formed, will need to assess later.
9	<b>How do California clapper rails and/or other key tidal habitat species respond to variations in tidal marsh habitat quality and what are the habitat factors contributing to that response?</b> Increased tidal habitat is expected to boost populations of California clapper rails and other key species, but the data on the conditions that produce high quality habitat for survival and reproduction are needed.	Clapper rail population dynamics and habitat requirements	Overton Topic 9 RFP study	Tidal habitats not yet formed, will need to assess later.
<b><i>Effects on Non-Avian Species</i></b>	<i>Can restoration actions be configured to maximize benefits to non-avian species both onsite and in adjacent waterways?</i>			

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10	<b>To what extent will increased tidal habitats increase survival, growth and reproduction of native species, especially fish and harbor seals?</b> The extent to which restoring tidal habitats will affect native species, including steelhead, harbor seals, native fish and oysters, is unknown. This question requires long-term study on local and regional scales relevant to the species examined.	Island Ponds A19, A20, A21; Ponds A8, A6, & Alviso Slough/Coyote Creek; Ponds E9, E8X, E8, & Old Alameda Creek (2010 -2011); Pond SF2 Bair Island	Hobbs Topic 7 RFP Proposal	
<i>Mercury</i>	<i>Will mercury be mobilized into the food web of the South Bay and beyond at a greater rate than prior to restoration?</i>			
11	<b>Will tidal habitat restoration and associated channel scour increase MeHg levels in marsh and bay-associated sentinel species?</b> Restoration actions could increase the bioavailability of mercury in sediment and water. Bioavailable mercury becomes a problem when it leads to deleterious accumulation in wildlife and people. Sentinel species, such as some invertebrates, fish and birds, are a cost effective way to monitor this toxic pollutant.	<u>Alviso Ponds and Alviso Slough</u> fish/waterbird biosentinels;  <u>Alviso area, SF2 and Ponds A6 and shoals</u> Fish and waterbird eggs	Ackerman Topic 2 RFP study;  USGS Science Funding	
12	<b>Will pond management increase MeHg levels in ponds and pond-associated sentinel species?</b> Pond management could increase the bioavailability of mercury in sediment and water over pre-ISP conditions. Sentinel species, such as some invertebrates, fish and birds, are a cost effective way to monitor this pollutant.	<u>Alviso Ponds and Alviso Slough</u> fish/waterbird biosentinels (2010-2012); <u>Alviso area, SF2 and Ponds A6 and shoals</u> Fish and	Ackerman Topic 2 RFP study  USGS Science Funding	

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		waterbird eggs		
<i>Water Quality</i>	<i>Will restoration adversely affect water quality and productivity?</i>			
13	<b>What is the effect of a) pond management, including increased pond flows and associated managed pond effects, and b) increased tidal prism from tidal habitat restoration on water quality, phytoplankton and fish diversity and abundance, and food web dynamics in South Bay?</b> Pond management and resulting water discharges to the Bay have the potential to decrease slough and Bay water quality and affect Bay species, but little is known of the short or long-term effects of pond management on the South Bay ecosystem. Restoring tidal action to ponds will increase the tidal prism and tidal currents in South Bay. South Bay phytoplankton dynamics at the base of the food web are dependent on hydrodynamics and mixing.	Water quality monitoring of ponds and discharges required by RWQCB  <u>Baywide:</u> Benthic communities pre (1993 -95) and post ISP (2006 – 08)	USGS water quality monitoring  Thompson Topic 5 and 6 RFP study	No integrated controlled studies planned addressing all trophic levels; RFP studies will provide information on specific trophic levels
<i>Invasive and Nuisance Species.</i>	<i>Can invasive and nuisance species such as <u>Spartina alterniflora</u> (or the invasive <u>Spartina</u> hybrid), corvids and the California gull and, if warranted, raptors such as the northern harrier, be controlled. If not, how can the impacts of these species be reduced in future phases of the project?</i>			
14	<b>Where not adequately eradicated, does invasive <i>Spartina</i> and hybrids significantly reduce aquatic species and shorebird uses?</b> The Invasive Spartina Project is a comprehensive program to control <i>Spartina alterniflora</i> hybrids to a level at which native species are not threatened. If this Project is not successful, this applied studies question would need investigation.	Invasive Algerian sea lavender study	Archbald Topic 9 RFP study	Depends on Invasive Spartina Project results
15	<b>Will California gulls, ravens, and crows adversely affect (through predation and encroachment on nesting areas) nesting birds in managed ponds?</b> Data indicate that a number of native predatory species are increasing in population and are negatively affecting native breeding birds, but the extent of the impacts are not known.	CAGU nest surveys A1, A5, A6, A9/10, Coyote Hills and Mowry colonies;	Ackerman Topic 8 RFP study	

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		gull color-marking (2010 – 2012)		
<b><i>Public Access and Wildlife</i></b>	<i>Will trails and other public access features / activities have significant negative effects on wildlife species?</i>			
16	<b>Will increases in boating access significantly affect birds, harbor seals or other target species on short or long timescales?</b> While there is a strong constituency for increased boating access, there is almost no information in the San Francisco Bay on the immediate or long-term effects of recreational boating on birds or other target species in different habitat types.			No studies planned for birds or harbor seals
17	<b>Will landside public access significantly affect birds or other target species on short or long timescales?</b> Information on the short and long-term effects of general and specific trail uses, such as dog walking, on birds and other key species in different habitat types (ponds, sloughs, tidal habitat) is mostly lacking, as is information on effective mitigation measures.	<u>Plovers</u> – Eden Landing or Warm Springs; Foraging ( 2003-present) <u>Waterbirds</u> – E12/13, SF2, other locations (2010-2012)	SFBBO/FWS (ongoing)  Trulio Topic 4 RFP proposal	
18	<b>Will public access features provide the recreation and access experiences visitors and the public want over short or long timescales?</b> The public’s desire for recreational uses changes over time. Understanding and providing the opportunities people value, to the extent feasible, is essential for the Project engender stewardship and public support in the short and long-term.	Trail user surveys (2010 – 2012)	Trulio Topic 4 RFP proposal	