



San Francisco Bay National Estuarine Research Reserve MANAGEMENT PLAN 2018-2023



San Francisco Bay
National Estuarine Research Reserve
MANAGEMENT PLAN 2018-2023
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ACRONYMS AND ABBREVIATIONS

BCDC	San Francisco Bay Conservation and Development Commission
BCC	Bay Conference Center
CDPR	California Department of Parks and Recreation
CDMO	Centralized Data Management Office
CFR	Code of Federal Regulations
CRS	Coastal Resilience Specialist
CTP	Coastal Training Program
CZM	Coastal Zone Management
EAC	Education Advisory Committee
EC	Education Coordinator
EPA	Environmental Protection Agency
ERD	Estuarine Reserves Division
FoCC	Friends of China Camp
GIS	Geographic Information System
IT	Information Technology
KEEP	K-12 Estuarine Education Program
MOU	Memorandum of Understanding
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCM	Office for Coastal Management
RC	Research Coordinator
RCD	Resource Conservation District
Reserve	San Francisco Bay National Estuarine Research Reserve
RTC	Romberg Tiburon Center
Sanctuary	Richardson Bay Audubon Center and Sanctuary
SC	Stewardship Coordinator
SFBJV	San Francisco Bay Joint Venture
SF Bay NERR	San Francisco Bay National Estuarine Research Reserve
SFE	San Francisco Estuary
SFEI	San Francisco Estuary Institute
SFEP	San Francisco Estuary Partnership
SF State	San Francisco State University
SFSCC	San Francisco Bay and Outer Coast Sentinel Site Cooperative
SERC	Smithsonian Environmental Research Center
SRCD	Solano Resource Conservation District
SWMP	System-Wide Monitoring Program
SWRCB	State Water Resources Control Board
TOTE	Teachers on the Estuary
USFWS	U.S. Fish and Wildlife Service
WSCTP	Wetland Science and Coastal Training Coordinator

EXECUTIVE SUMMARY

Plan Purpose and Scope

This plan is intended to guide management activities for the SF Bay NERR (Reserve) from 2018 to 2023. It applies specifically to the boundaries of Reserve components consisting of China Camp State Park (China Camp) and Rush Ranch Open Space Preserve (Rush Ranch), to its headquarters at the Romberg Tiburon Center for Environmental Studies (RTC), and more generally to the San Francisco Estuary (SFE).

This Plan is intended to:

- Provide a vision and framework to guide Reserve activities during the five- year period;
- Enable the Reserve and NOAA to track progress and realize opportunities for growth;
- Present Reserve priority issues, goals, objectives and actions to constituents;
- Guide program evaluations under Section 312 of the Coastal Zone Management Act; and enable the Reserve to acquire construction and land acquisition funds.

The Reserve's Manager, Education Coordinator, Research Coordinator, and Coastal Training Program Coordinator wrote this plan cooperatively in consultation with other Reserve staff, the Reserve's partners, and NOAA.

Reserve Context

The Reserve was designated on August 27, 2003 after more than ten years of planning. Encompassing approximately 1600 square miles in area, the SFE is generally divided into a more fresh-water flow-influenced upper estuary with two sub regions (Delta and Suisun) and a lower estuary dominated by salt-water tidal processes with three distinct sub regions (San Pablo Bay, Central Bay, and South Bay) (Sloan and Karachewski 2006, Moyle et al. 2010). The Reserve components include exemplary remnants of both the upper and lower estuarine landscapes. The upper estuary component consists of Rush Ranch, a 2,070-acre property that is owned and managed by the Solano Land Trust (SLT). It contains the largest and most intact tidal brackish marsh in the Suisun sub-region embedded in an undeveloped grassland landscape that is part of a working ranch. The lower estuary component is China Camp, a 1,640-acre property along the shore of the San Pablo Bay subregion with outstanding tidal salt marshes surrounded by extensive mudflats and upland wooded ridges and hills. China Camp is owned by California Department of Parks and Recreation (California State Parks) which is the lead agency for ecological and cultural resource management under the California Environmental Quality Act (CEQA). It is currently operated by a non-profit citizen support group, the Friends of China Camp (FOCC). Thus, the three core land-managing partners of the Reserve are the Solano Land Trust, California State Parks, and Friends of China Camp. Total acreage for the Reserve is 3,710 acres.

The State lead agency for the Reserve is San Francisco State University (SF State). The Reserve Headquarters is based at RTC, SF State's estuary and ocean science center, which is located on the Tiburon Peninsula in Marin County. RTC hosts an active group of marine and estuarine scientists, a graduate studies program, labs, vessels, vehicles, classrooms and office space.

Threats and Stressors

The estuary as a whole is threatened and stressed by a combination of urbanization, non-native invasive species, and rapid environmental change. In addition, the primary short-term anthropogenic stressors at China Camp include problems associated with a county road that transects tidal marshes and recreational use. Rush Ranch is also potentially

impacted by cattle grazing in upland grasslands as well as prominent invasive non-native species such as pepperweed and feral pigs. Endangered and threatened species occur at both sites and present additional management challenges.

Priority Management Issues and Reserve Goals

The SFE is known as one of the most urbanized estuaries in the world (Conomos et al. 1979). It is the heart of California's economy and an estuary of international conservation significance. Priority management issues are:

1. Need for improved capacity to prepare, respond to and recover from changing environmental conditions and unpredictable extreme events (Coastal Resilience)
2. Need for timely, actionable information to make informed choices about management decisions that support the conservation and restoration of the estuary (Coastal Intelligence)
3. Need for broader engagement of diverse audiences to support estuarine conservation and stewardship activities

Goals for the Reserve are (1) to increase and improve scientific knowledge of the SFE ecosystem; (2) to expand understanding, practice and application of estuarine and coastal science; and (3) to increase, enhance, and help to disseminate on an annual basis research by students and scientists working at Reserve sites.

Reserve Niche

The Reserve is unique in the San Francisco Estuary by combining place-based long-term scientific assessment and research with education and coastal training programs that draw upon and extend beyond the boundaries of the two Reserve sites, with the capacity to integrate science across disciplines and audiences. Foundational to our success is the strength of our signatory partnerships and collaboration with a wide range of entities and programs in the SFE and the NERRS national network.

Reserve Programs Overview

The Reserve is proud of its' cross-sectoral integration of research, education, training, and stewardship activities that reflect its' dedication to improving the scientific understanding and management of natural and cultural resources in the SFE. Reserve programs consist of required activities supported by NERRS including Administration, Research and Monitoring, Education, and Coastal Training Program coordination. These Reserve programs take place for the most part on Reserve components and at RTC. Reserve programs are not prescriptive in that field activities are the responsibility of land managing partners who own and direct Reserve actions that take place on Reserve components. However, although field components are not under the direct management of the Reserve, as part of a federally designated program, each field component is encouraged to be compliant with resource protection, public access, and stewardship practices that are consistent with the national system. The collaborative nature of Reserve programs both among staff and with our partners allows the Reserve to accomplish much more programmatically than funding would permit if all activities were constrained by Reserve operations and cost-share funding.

INTRODUCTION TO THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

The National Estuarine Research Reserve System was created by the Coastal Zone Management Act of 1972, as amended, to augment the National Coastal Zone Management Program, which is dedicated to comprehensive, sustainable management of the nation's coasts.

The reserve system is a network of protected areas representative of the various biogeographic regions and estuarine types in the United States. Reserves are established for long-term research, education, and interpretation to promote informed management of the nation's estuaries and coastal habitats (15 C.F.R. Part 921.1(a)). The system currently consists of 29 reserves in 24 states and territories, protecting over one million acres of estuarine lands and waters.

The National Estuarine Research Reserve System is a partnership program between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states. NOAA provides funding, national guidance, and technical assistance. The state partner manages reserve resources on a daily basis and works collaboratively with local and regional partners.



Figure 1. National Estuarine Research Reserve Sites

Estuaries are biologically rich, economically valuable, and highly vulnerable ecosystems. The vision and mission of the reserve system reflect the importance of these systems within our communities.

Vision: Resilient estuaries and coastal watersheds where human and natural communities thrive.

Mission: To practice and promote stewardship of coasts and estuaries through innovative research, education, and training using a place-based system of protected areas.

The National Estuarine Research Reserve System program goals, from federal regulations 15 C.F.R. Part 921.1(b), include the following:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
2. Address coastal management issues identified as significant through coordinated estuarine research within the system;
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
4. Promote federal, state, public, and private use of one or more reserves within the system when such entities conduct estuarine research; and
5. Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

NOAA and the states work together to create a dynamic five-year reserve system strategic plan to meet these program goals and NOAA's mission of science, service, and stewardship. The 2017-2022 Reserve System Strategic Plan focuses reserve core strengths of research, education, and training on three core issues: environmental change, water quality and quantity, and habitat protection and restoration. The reserve system's strategic plan goals are as follows:

1. Protecting Places: Enhance and inspire stewardship, protection, and management of estuaries and their watersheds in coastal communities through place-based approaches.
2. Applying Science: Improve the scientific understanding of estuaries and their watersheds through the development and application of reserve research, data, and tools.
3. Inspiring Communities: Advance environmental appreciation and scientific literacy, allowing for science-based decisions that positively affect estuaries, watersheds, and coastal communities.

Biogeographic Regions and Boundaries of the National Estuarine Research Reserve System

NOAA has identified 11 distinct biogeographic regions and 29 subregions in the United States, each of which contains several types of estuarine ecosystems (15 C.F.R. Part 921, Appendix I and II). When complete, the system will contain examples of estuarine hydrologic and biological types characteristic of each biogeographic region. As of 2017, the system includes 29 reserves and one state in the process of designating a reserve.

Each reserve boundary will vary depending on the nature of the ecosystem. Boundaries must include an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation. Reserve boundaries encompass areas for which adequate state control has been or will be established by the managing entity over human activities occurring within the reserve. Reserve boundaries include a "core" area of key land and water encompassing resources representative of the total ecosystem, which if compromised could endanger the research objectives of the reserve, as well as a "buffer" area designed to protect the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. Buffer areas may also include areas necessary for facilities required for research and interpretation. Additionally, buffer areas are identified

to accommodate a shift of the core area as a result of biological, ecological, or geomorphological change that could be reasonably expected to occur. (15 C.F.R. Part 921.11 (c)(3))

National Estuarine Research Reserve Administrative Framework

The process for federal designation of a national estuarine research reserve has many steps and involves many individuals and organizations. While each reserve is a partnership program between NOAA and a coastal state, many entities collaborate to support the designation of a reserve. Other partners include federal and state agencies, nonprofit groups, universities, and members of the local community. For more information on the designation process, see coast.noaa.gov/nerrs.

Upon designation, the reserve implements the approved management plan and is eligible for NOAA financial assistance on a cost-share basis with the state. Management plans provide a vision and framework to guide reserve activities during a five-year period and enable the reserves and NOAA to track progress and realize opportunities for growth. Each management plan contains the reserve goals, objectives, and strategies supported by programs focused on research and monitoring, education and outreach, training, and stewardship. They also outline administration, public access, land acquisition, and facility plans and needs, as well as restoration and resource manipulation plans, if applicable.

Reserves are increasingly confronted with complex questions regarding new uses in or near reserves that may or may not be compatible with the reserve system's mission. A thoughtful and comprehensive management plan provides a foundation for addressing these challenges to protect and manage reserve resources wisely and ensure that the public and coastal decision makers value and protect coastal resources.

NOAA administers the reserve system and establishes standards for designating and operating reserves, provides support for reserve operations and system-wide programming, undertakes projects that benefit the reserve system, and integrates information from individual reserves and programs to support decision-making at the national level. Additionally, NOAA periodically evaluates reserves for compliance with federal requirements and with the individual reserve's federally approved management plan, as mandated under Section 312 of the Coastal Zone Management Act (15 C.F.R. Part 921.40).

NOAA currently provides leadership and support for three system-wide programs, including the System-Wide Monitoring Program, the K-12 Estuarine Education Program, and the Coastal Training Program, as well as a national program to support collaborative research in the reserve system. NOAA also provides support for initiatives focused on the reserve system's priorities.

Chapter 1 - INTRODUCTION TO THE RESERVE

1.1 History and Local Management of the Reserve

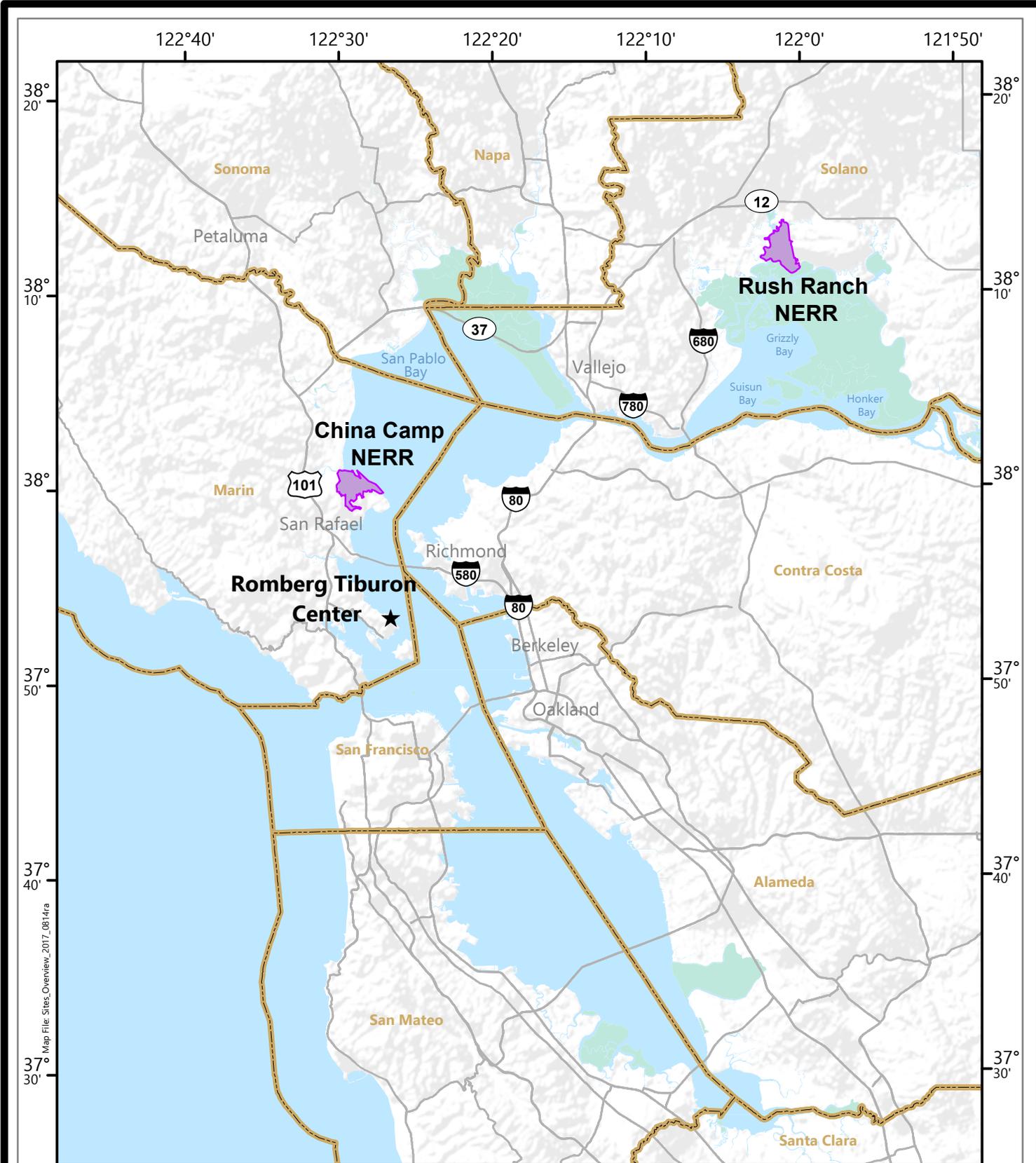
In the early 1990's, Dr. Roger Crawford (Geography Department, SF State) secured a small grant from NOAA to explore the potential for establishing a NERR on San Francisco Bay. The SFE was one of the first estuaries considered for NERR status but its size and complexity proved to be a daunting design challenge. Dr. Mike Vasey, at that time a lecturer and Coordinator of the Conservation Biology Program at SF State, was appointed by the Dean of the College of Science and Engineering (Dr. James Kelley) to lead the designation process.

Dr. Vasey assembled a team of local scientists to determine the conceptual design for the Reserve. They recommended that the Reserve be configured so that it would designate some of the last and best tidal wetland remnants in each of the key subregions making up the SFE, with the goal of providing reference sites to help inform future tidal wetland restoration in the SFE. Vasey then worked to integrate the various partners who would become part of the Reserve, including the US Fish and Wildlife Service (USFWS) in the South Bay (Baer and Greco Islands), then California Department of Fish and Game (now California Department of Fish and Wildlife - CDFW) in the Central Bay (Corte Madera Marsh), San Pablo Bay (China Camp State Park) and Petaluma Marsh (CDFW), Rush Ranch (SLT), Peytonia Slough, and Hill Slough (CDFW) and Browns Island in the Delta (East Bay Regional Parks District). After several years of effort, three sites were committed to be designated Reserve components: China Camp, Rush Ranch, and Browns Island. Browns Island was ultimately not included in the designation. This left China Camp representing the lower, salt marsh dominated estuary (San Pablo Bay, Central Bay, and South Bay) while Rush Ranch represents the upper, fresh-brackish estuary (Suisun Bay and Delta). SF State's RTC was identified as headquarters for Reserve staff, labs, offices, and teaching facilities.

After more than ten years of planning, these two field components (China Camp and Rush Ranch) were designated in August 2003. San Francisco State was named by the governor to act as the state lead agency along with NOAA as the federal lead agency.



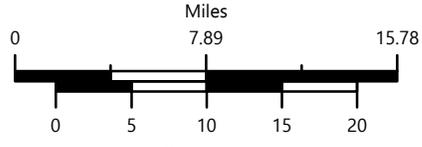
"Spider web on marsh": Michael Vasey



Data Sources: Roads, US Census TIGER Product 2013;
 Hillshade, USGS 2013; Coastline, National Hydrography Dataset 2017

Overview of San Francisco Bay Reserve

San Francisco Bay, CA



1:500,000 (1" = 7.89 miles at letter size)

Figure 2

1.2 Ecological Characteristics

The Reserve is strategically situated to represent subregions of the San Francisco Estuary (SFE). The SFE drains approximately 40% of the area of California (Sloan and Karachewski 2006). The upper portion of the SFE represents an historic inland lake occupying the Central Valley. During the Pleistocene, as sea level dropped several hundred meters, the lake cut a riverine drainage system through the present Suisun Bay, San Pablo Bay, and Central Bay region as far out as the Farallon Islands, approximately 26 miles west of the Golden Gate straight (Sloan and Karachewski, 2006). This system was well established by about one million years ago. During pluvial and inter-pluvial cycles in the Pleistocene, this river system was active when sea level was low and presumably became estuarine when sea-level rose and drowned the river during inter-pluvial cycles. Within a global climatic context, California's regional Mediterranean-type climate was well established, with wet winters and long dry summers, by approximately two million years ago (Jacobs et al. 2004). Presumably, many of the estuarine plants, animals, and microbes that inhabit the SFE today evolved adaptations to this Mediterranean-type climate during this time.

During the Holocene, sea-level rose rapidly from about 12,000 years before present (bp) to 6,000 years bp (Malamud-Roam 2007) and it has since slowed enough so that tidal wetlands and mudflat shoals have become well established downstream from the freshwater wetlands that constituted the Delta, the upper-most tidally-influenced part of the SFE and a remnant of the historical inland lake that once occupied the Central Valley. This delta represents the confluence of California's two major river systems, the Sacramento and the San Joaquin, and the historic river that drained the lake is now a tidally influenced embayment filling the former "California River" that once drained this region into the Gulf



"High tide China C amp marsh" Meandering channel at China Camp at high tide bordered by stands of native gum plant. Note the natural transition from marsh to upland woodlands. Photo: Michael Vasey.

of the Farallones. The South Bay subregion of the SFE is a subsided valley that drained into the Central Bay and functions hydrologically more like a lagoon than a drowned river (Sloan and Karachewski, 2006).

Modern tidal wetlands in the SFE are atypical for tidal wetlands in most other parts of the United States because of California's Mediterranean-type climate. Mediterranean-type climates typically have a distinct wet season (October through April) and a long dry season (May through September) during which very little rain falls (Cowling et al. 1996). In the saltier parts of the estuary, the result is that evaporation from the marsh plain causes soil salinity concentrations to become excessive. Relatively few halophytic wetland species can tolerate these conditions. One species in particular, pickleweed is very salt tolerant and tends to dominate salt marsh plains in the SFE. While tolerant of high salinity conditions, pickleweed is vulnerable to long periods of tidal inundation (Schile et al. 2011). It is likely that this contributes to its growth higher in the tidal frame than tidal wetlands found in non-Mediterranean-type climates.

Farther up the estuarine gradient, two large rivers empty into the SFE through Delta and the freshwater flows and tidal euhaline waters that come up from the mouth of the SFE (Golden Gate) meet and mix in Suisun Bay. These fresh to brackish tidal waters generate a more typical emergent marsh in areas of low topography and along channel edges dominated by species in such genera as tule, three-square bulrush, alkali bulrush, and cattail. Halophytic high marsh is still present in parts of the upper estuary but much reduced in area and there is a significantly larger number of plant species in these upper estuarine marshes (Atwater and Hedel 1976, Watson and Byrne 2009, Vasey et al. 2012). In the Delta, marshes are almost all freshwater and primarily influenced by wet season flows rather than tides.

Another key to tidal wetland sustainability is sediment supply. Sediments are needed for tidal wetlands to accrete and keep up with changes in sea-level over time. Historically, fresh water flows brought most of the SFE's sediment supply, however, much of the flow from the watershed of the SFE is now trapped behind dams and water is diverted to agricultural and urban interests. There is now a documented reduction of suspended sediment concentrations in freshwater flows entering the SFE (Schoellhamer 2011). Conversely, during the gold mining days in the late 1800's, millions of tons of sediment washed into the SFE due to hydraulic mining (Goals Project 1999). Today, the fine sediments trapped in shoals and small estuaries in the lower SFE are being redistributed in various

ways. One concern is that an increased rate of sea-level rise (SLR) and reduced sediment supply will negatively impact the inundation-sensitive pickleweed marsh plains in the lower SFE (Schile et al. 2014).

The central California coast is influenced by adjacent marine processes. Winds from the northwest in early spring typically drive surface waters off-shore and cold, nutrient-rich deep water upwells near shore. This cold water chills humid prevailing winds and generates coastal fog and marine stratus during the summer which is trapped in an inversion by high, warmer air masses moving offshore (Leipper 1994). The central California coast is also characterized by a series of low mountain ranges that trap coastal fog along the immediate coast and result in a dramatic temperature and moisture gradient from the shoreline to inland valleys (Johnstone and Dawson 2010). These mountain ranges are active tectonically along a series of transverse fault zones and geologically diverse. Over time, the eastern Pacific Ocean goes through oscillations such as El Nino cycles and the Pacific Decadal Oscillation. In part, these cycles drive climate fluctuations that take place on land such as years of heavy rainfall or long periods of drought.

The result of these large-scale physical processes is that the watershed of the SFE and the tidal wetlands it supports are highly variable but, in general, are characterized by hot and dry conditions during a long, rain-free summer, particularly in the interior, and cool, rainy winters particularly near the coast with coastal environments moderated by marine fog in the summer. The marine, estuarine, and terrestrial biota of coastal California is adapted to these unusual and relatively extreme climatic conditions. Partly as a result, California hosts an exceptionally high level of biological diversity and is considered a global "hot spot" (Meyers et al. 2000). Estuarine landscapes in central California are shaped by this rich diversity and the climatic and edaphic heterogeneity that characterizes the region. The SFE tidal wetlands contain an unusually high number of locally endemic plants, rodents, birds, fish, and other species. Given the massive loss of tidal wetlands in the SFE (~ 85%), many of these wetland and aquatic species have become threatened and endangered and are now given legal protection under state and federal laws (USFWS 2014). The SFE is also an extremely important wetland resource for migratory birds during the spring and fall. It also supports fisheries, such as migratory salmon and herring as well.

In summary, the ecological characteristics that are the focus of the Reserve relate to its tidal wetlands, adjacent

subtidal and deep bay waters, and uplands to which they are connected by perennial and seasonal flows as part of the various ecological landscapes that make up the SFE. Broadly speaking, the topography and tectonic processes that shape the SFE and its uplands, and the marine processes that connect the SFE to the Pacific Ocean, are all critical to the ecological sustainability of the SFE over time.

1.2.1 San Francisco Estuary

The San Francisco Bay Estuary (SFE) is the largest estuary in California. The drainage basin of the estuary's freshwater sources, the Sacramento and San Joaquin Rivers, encompasses approximately 1,600 square miles, drains more than 40% of the state (60,000 square miles - nearly half of the state's total runoff), provides drinking water to millions of Californians (approximately two-thirds of the state's population), and irrigates nearly 5 million acres of farmland. In the early 1800s, the Bay covered almost 700 square miles, and the Sacramento-San Joaquin River Delta was a network of 80 atoll-like islands, hundreds of miles of complex channels, and vast expanses of marsh (Atwater et al. 1979). Nearly a million fish passed through the estuary each year, and 69 million acre-feet of water ran from mountain headwaters toward the sea. Since that time, more than one billion cubic yards of sediment, deposited from hydraulic mining practices, have been deposited in the rivers and the Bay (Schoellhamer 2011). Nearly 750 square miles of tidal marsh have been filled, dams have been built that block runoff, and massive pumps and canals divert water headed towards the estuary to cities and farms around the state (San Francisco Estuary Project 2000). The estuary once supported 190,000 acres of highly productive tidal marsh, but now only 16,000 acres of this historic tidal marsh remain (Goals Project 1999).

The Reserve consists of two of the most intact of these remaining historic tidal marshes and adjacent habitats in the estuary which occur in two distinct Bay regions: Suisun Bay and Marsh (Rush Ranch) and San Pablo Bay (China Camp) (Ferner 2011a, Ferner 2011b, Ferner 2012). As historic wetlands, these habitats have been largely protected from development and alteration and are highly utilized as reference sites against which enhanced, restored, or created wetlands are evaluated (Goals Project 1999, May 1999, Simenstad et al. 1999, Simenstad et al. 2000). The two Reserve sites bracket a substantial portion of the salinity gradient within the estuary from the predominantly brackish marsh at Rush Ranch to the salt marsh of China Camp. Threatened, endangered, and rare species of plants and animals that occur within the Reserve boundaries include: Soft Bird's Beak, Suisun Marsh Aster, Suisun Thistle, Delta Tule Pea, Olympia Oyster, California Black Rail, California Ridgway Rail, Chinook Salmon, Steelhead Trout, Sacramento

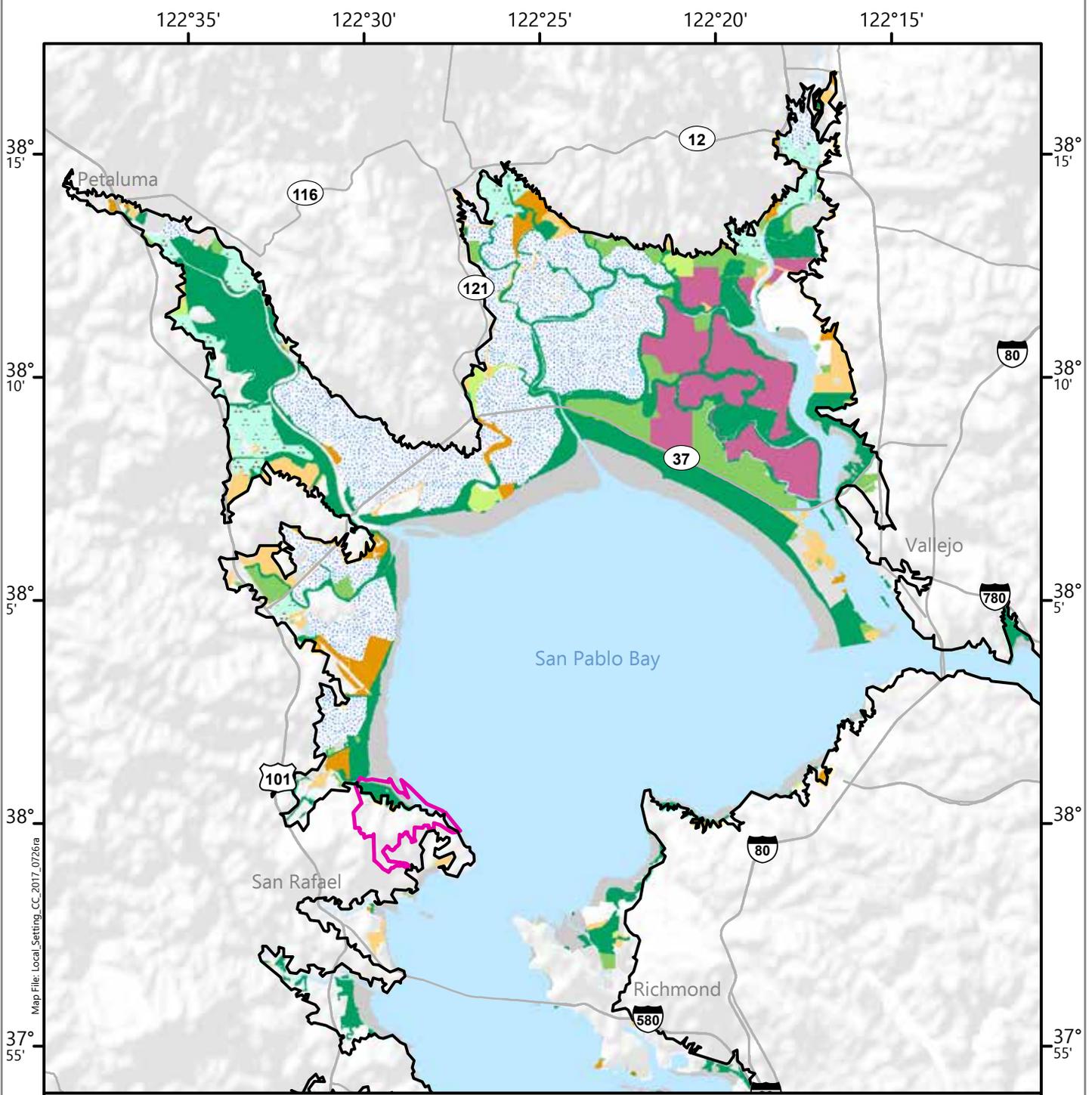
Splittail, Delta Smelt, and Salt Marsh Harvest Mouse. See Appendix E for more details regarding these species. More site-specific detail on environmental context is provided below.

1.2.2 China Camp State Park

China Camp is a 1,640-acre state park owned by California State Parks which is the lead agency for CEQA, provides support from district staff, and retains management of all the natural and cultural resources. FoCC is the park operator responsible for day-to-day operations. There is an operating agreement between FoCC and California State Parks that clearly defines the roles and responsibilities of the operator and California State Parks. It is located on the southwest shore of San Pablo Bay about 3 miles northeast of downtown San Rafael in Marin County. China Camp was designated as a California State Park in 1978, and a general plan for the property was completed in 1979. The park is bordered on the north by San Pablo Bay and along the northwestern point (Grove Point) by the marsh and flats along the mouth of Gallinas Creek. Along the western and southwestern edges, the park border runs along the ridgeline and is bounded by the San Pedro Mountain Open Space Preserve (Marin County) and the City of San Rafael Harry A. Barbier Memorial Park. The eastern end of the park abuts the McNears Beach County Park.

1.2.2.1 *Physiographic Features*

The Park protects 100 acres of wetlands (salt marsh, muted-tidal brackish marsh, and freshwater marsh), neighboring tidal mudflats, cobble beach and rocky shoreline, as well as 1,540 acres of surrounding uplands (including grasslands and oak woodlands). The hills of San Pablo Ridge slope up steeply from the Bay's shore, reaching a maximum elevation of about 1,000 feet. The muted-tidal brackish and freshwater marshes were historically part of the tidal salt marsh. However, North San Pedro Road now divides the marsh. Tidal flow into the marshes is partially restricted, and freshwater flow from the uplands is retained by the road; so the marshes on the landward side of the road are fresher and experience less tidal influence than the truly tidal salt marsh on the Bay-side of the road. The core tidal marshlands are representative transitional wetlands in San Francisco Bay and exhibit a pattern of vertical zonation from tidally-dominated low marsh to older, high-elevation marsh grading into freshwater marshes. The area of tidal marshlands consists of ancient marsh, as well as marsh that formed in the late 1800s due to accumulation of hydraulic mining debris from the Sierra Nevada. Rapid sediment accretion in these newly formed areas resulted in a steeper elevation gradient and straighter channels than in the more ancient, high-elevation marsh.



Data Sources: Land Cover, SFEI EcoAtlas 1998; Site Boundary, NERR 2017; Roads, US Census TIGER Product 2013; Hillshade, USGS 2013, Coastline, National Hydrography Dataset 2017

China Camp Environmental Setting

San Francisco Bay, CA

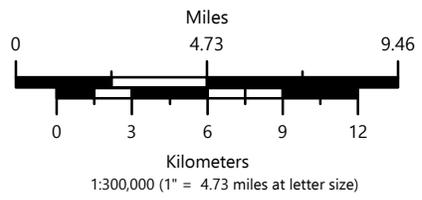
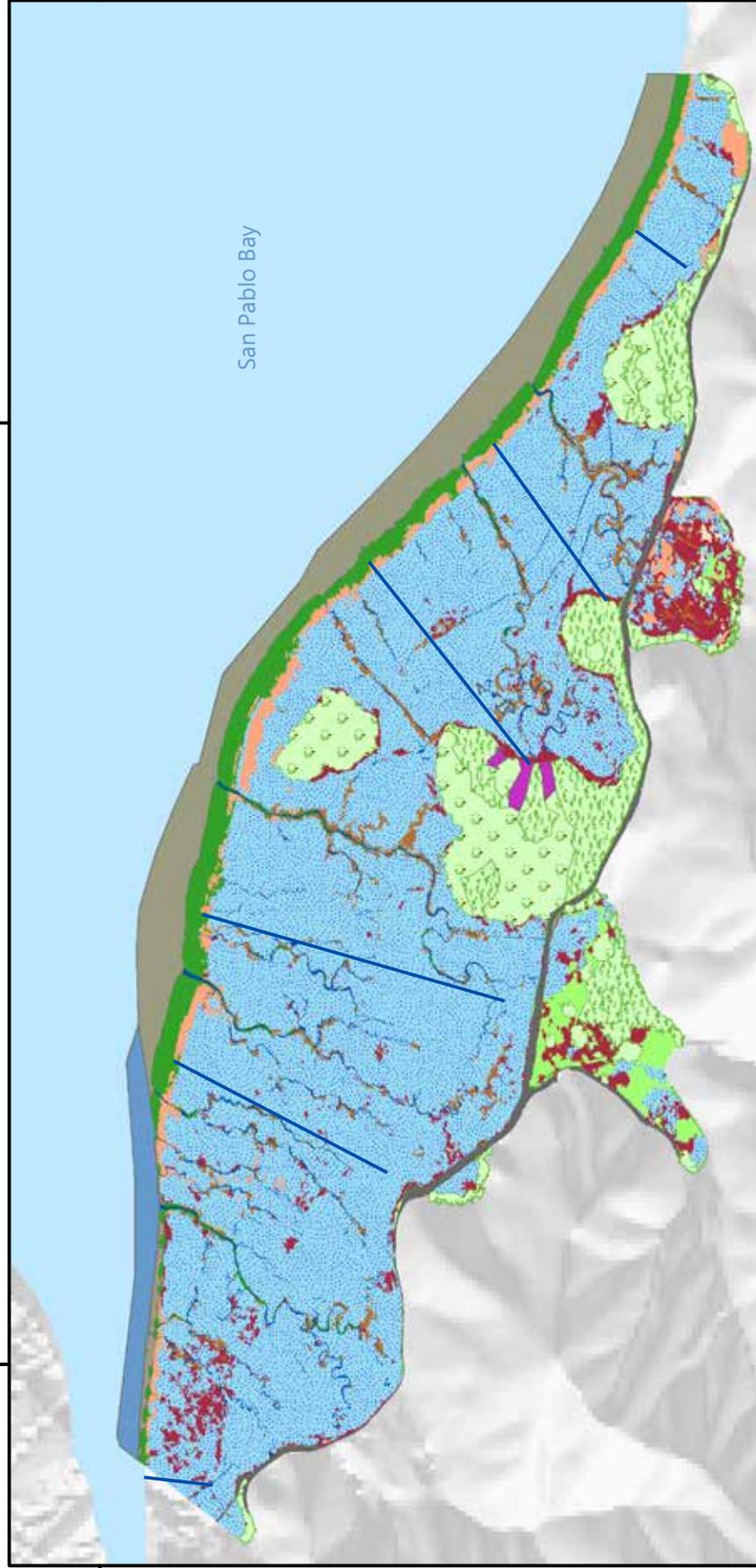


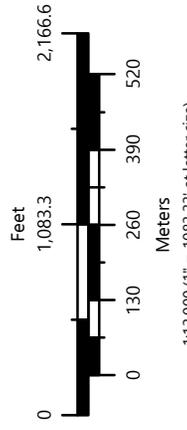
Figure 3

122°30' 122°29' 38° 38°



	Pickleweed (<i>Salicornia pacifica</i>)		Mudflat
	Saltgrass (<i>Distichlis spicata</i>)/ <i>Jaumea carnosa</i> mix		Subtidal habitat
	Alkali bulrush (<i>Bolboschoenus maritimus</i>)		Tidal slough
	Gumplant (<i>Grindelia stricta</i>)		Road or parking lot
	Cordgrass (<i>Spartina foliosa</i>)		Vegetation Transects
	Freshwater Species (e.g. <i>Typha</i> , <i>Carex</i> , <i>Juncus</i>)		
	Chaparral		
	Forbs and grassland		
	Oak woodland		
	Marsh panne		

Data Sources: Hillshade, USGS 2013; Coastline, National Hydrography Dataset 2017; Habitats and Transects, NERR 2016



China Camp Tidal Habitat
Marin County, CA

Figure 4

1.2.2.2 *Climate*

The climate of China Camp is controlled in large part by marine influences, as modified by San Pablo Ridge and the larger hills further west. The air temperature tends to be moderate, with typical variation between 40 to 80 degrees Fahrenheit. On average, there are more than 200 sunny days per year. The average annual rainfall is about 26 inches. Winds vary in intensity and direction depending on season and time of day.

1.2.2.3 *Hydrology*

The tidal marshlands are mostly above Mean High Water; and, therefore, they are not inundated by every high tide. Runoff from the adjacent hills has not been gauged, but the persistence of small strands of willows and other riparian vegetation at the bottom of some draws suggests perennial surface water or near-surface ground water influences. Where freshwater enters the tidal marshes are some of the last and best remnants of intact natural transition zones in the SFE (Baye 2012).

1.2.2.4 *Geology*

The bedrock of the hills is the Franciscan Melange, which is a complex assemblage of small and large rock types, dominated by silt stones and shales, and separated by zones of seismically sheered and crushed materials. Hard rock components can include sandstone, greenstone, chert, serpentine, and glaucophane schists. No serpentine is known to occur within this site.



“Dodder on pickleweed” Dodder is a common native plant parasite on pickleweed, often creating golden-orange patches on the marsh plain at China Camp. It typically does not kill the pickleweed but can reduce its dominance. Photo: Michael Vasey.

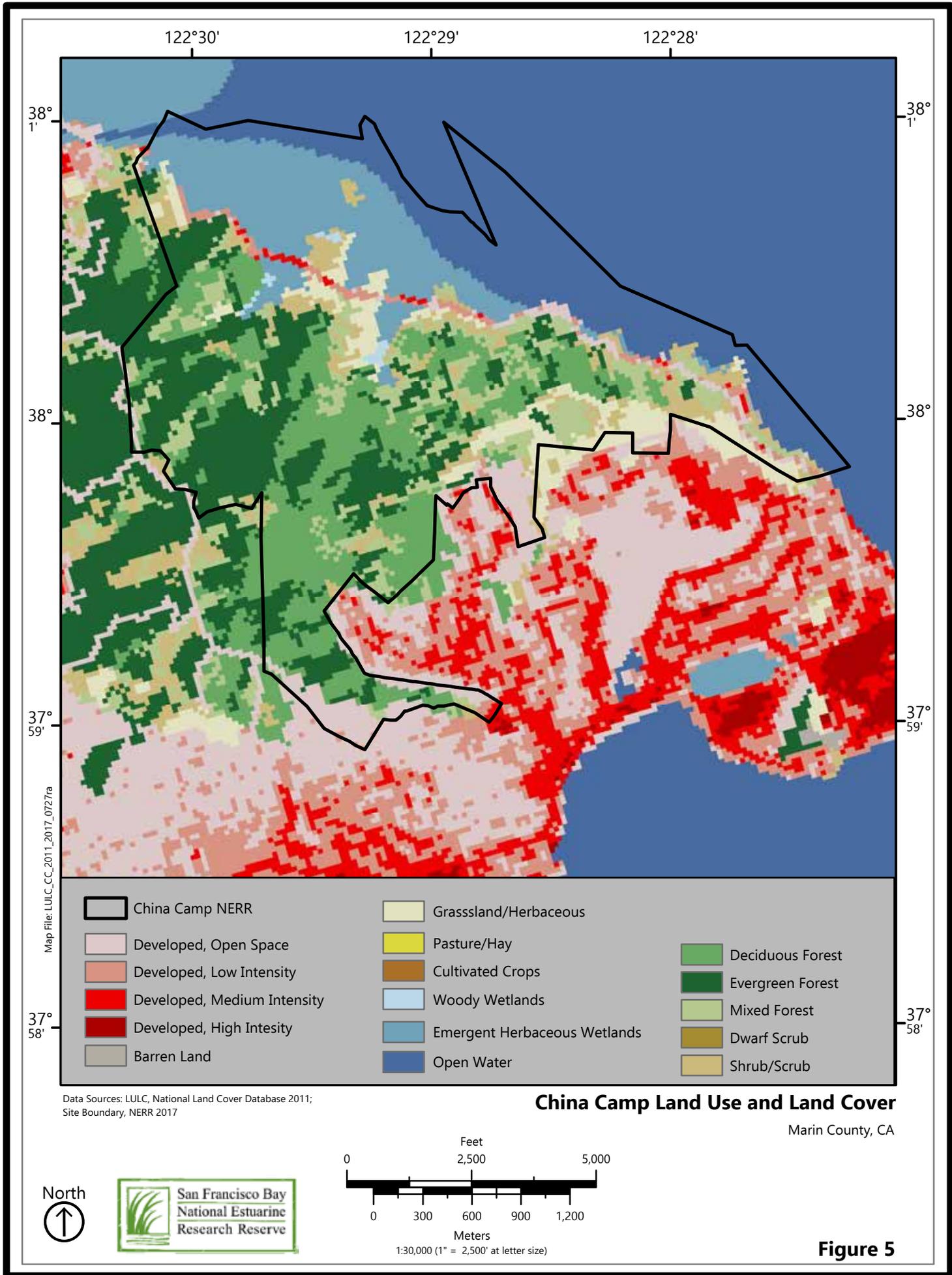


Figure 5

1.2.2.5 *Biological Resources*

The tidal marshlands at China Camp host several species that are listed as endangered by both the federal and the California State species protection laws: Ridgway's Rail, California Black Rail, and the Salt Marsh Harvest Mouse. The site also supports a variety of other species of special status or concern, including golden eagle, peregrine falcon, Northern Harrier, white-tailed kite, Short-Eared Owl, San Francisco Song Sparrow, and Soft Bird's-beak. A total of more than 140 species of birds, 26 species of mammals, 44 species of fish, and 15 species of reptiles and amphibians have been observed within the site (California State Parks 1979). The hills support at least three small groves of coast redwood, in addition to coastal shrub, oak woodlands, and isolated riparian stands. In a few places, controlled burning of hill slopes has encouraged the production of native bunch grasses. The association of coast live oak forest and tidal marshland is a particular characteristic of this site.

Although such associations were historically abundant along the western shore of San Pablo Bay, they are not common today, due to filling of tidal marshlands and the urbanization of adjacent hillsides.

There are no published reports on the species composition of the fish of China Camp tidal marshlands. However, surveys of the fish community in San Pablo Bay offshore from China Camp have been conducted and the USFWS attempts to sample fish by seining at the China Camp beach every other week year round, an effort that last year resulted in the catch of 12 fish species including one fall-run Chinook Salmon. For otter trawls and midwater trawls, the most common fish species are northern anchovy, Longfin Smelt, jacksmelet, Pacific herring, striped bass, American shad, starry flounder, shiner perch, and yellowfin goby (Herbold et al. 1992). The larger channels of the tidal marshlands of the site are likely to support juveniles of some of these species, in addition to staghorn sculpin, California bat ray, leopard shark, and brown smoothhound sharks.

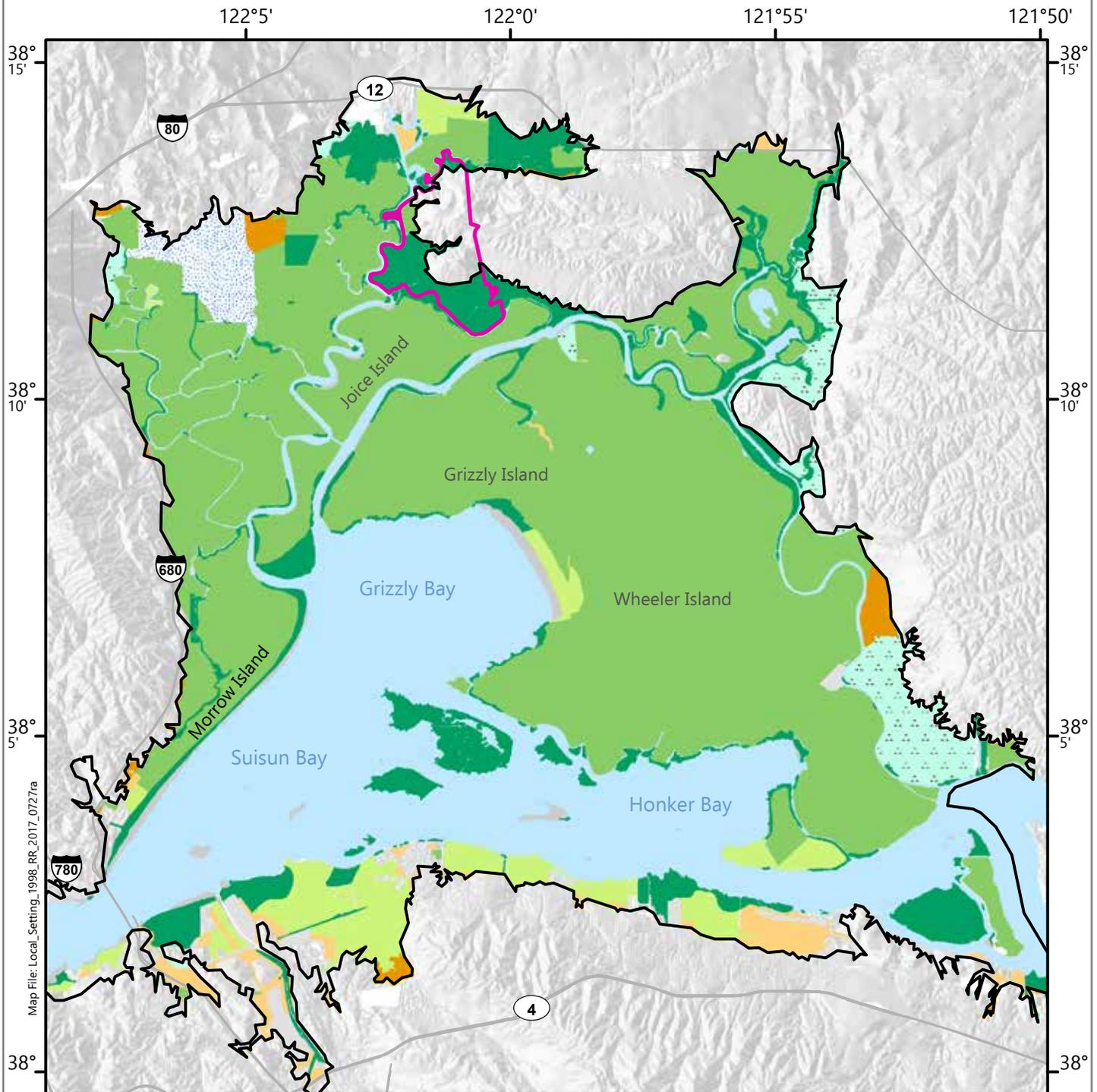
The plant community at China Camp is representative of that found in a mature middle marsh zone in the SFE. The marsh plain is dominated by pickleweed. The natural levees of the largest channel of the mature, high-elevation marshland typically support gum plant, yarrow, frankenia, and fat hen, in addition to pickleweed. Gum plant also inhabits the upland ecotone of the marshland as well as the channel margins. Slump blocks within the large channels support small patches of Pacific cordgrass as does the outer boundary between marsh and mudflat (Baye 2012).

1.2.3 *Rush Ranch Open Space Preserve*

Rush Ranch is a 2,070-acre site located on the northern margin of Suisun Marsh in Solano County. It consists of approximately 1,050 acres of brackish tidal wetlands (old high-elevation marsh), 950 acres of grassland (including the Ranch headquarters), seasonal systems, springs and ponds, and a 70-acre managed wetland. The Ranch was purchased in 1988 by the SLT through funding provided by the California State Coastal Conservancy. An Enhancement and Management Plan for this area was completed in 1989 (Wetland Research Associates Inc. 1990). In 2014, SLT approved the current Rush Ranch Management Plan (SLT 2014a). The Rush Ranch property is bordered by private lands and State wildlife areas. On the north and west lie the Hill Slough Wildlife Area (1,112 acres) and the Peytonia Slough Ecological Reserve (1,887 acres) and on the south and southeast is the Joice Island Wildlife Area (1,887 acres); all of these other properties are managed by the CDFW.

1.2.3.1 *Physiographic Features*

Rush Ranch protects the largest and least disturbed remnant of historic mid-brackish tidal marshlands in the Estuary. The marshes at Rush Ranch are part of the larger Suisun Marsh that encompasses some 85,000 acres of tidal marsh, managed wetlands, and waterways. It is the largest remaining wetland in San Francisco Bay and includes more than ten percent of California's remaining wetland acres. The marshlands at Rush Ranch extend from Suisun Slough to the base of the Potrero Hills, rising to a maximum elevation of about 300 feet. There is one small island, Goat Island, that is surrounded by tidal marshland. The headward reaches of the system are represented by remaining tidal marshlands of Peytonia Slough, which leads west from the upper part of Suisun Slough, and Hill Slough, which leads east. The Peytonia Slough marshlands include some undisturbed remnants of a broad ecotone between the brackish tidal marshlands and the low-gradient alluvial plane that extends southward from the Fairfield Hills. The Hill Slough marshlands extend eastward



Historic Bay	Farmed Bayland	Tidal Marsh	Diked Marsh
Rush Ranch NERR	Grazed Bayland	Muted Tidal Marsh	Ruderal
	Inactive Salt Pond	Managed Marsh	Tidal Flat

Data Sources: Land Cover, SFEI EcoAtlas 1998; Site Boundary, NERR 2017; Roads, US Census TIGER Product 2013; Hillshade, USGS 2013, Coastline, National Hydrography Dataset 2017

Rush Ranch Environmental Setting

Solano County, CA

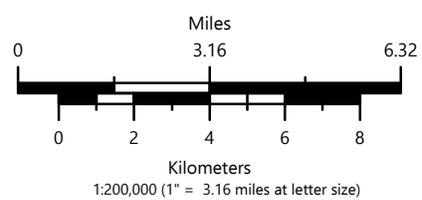
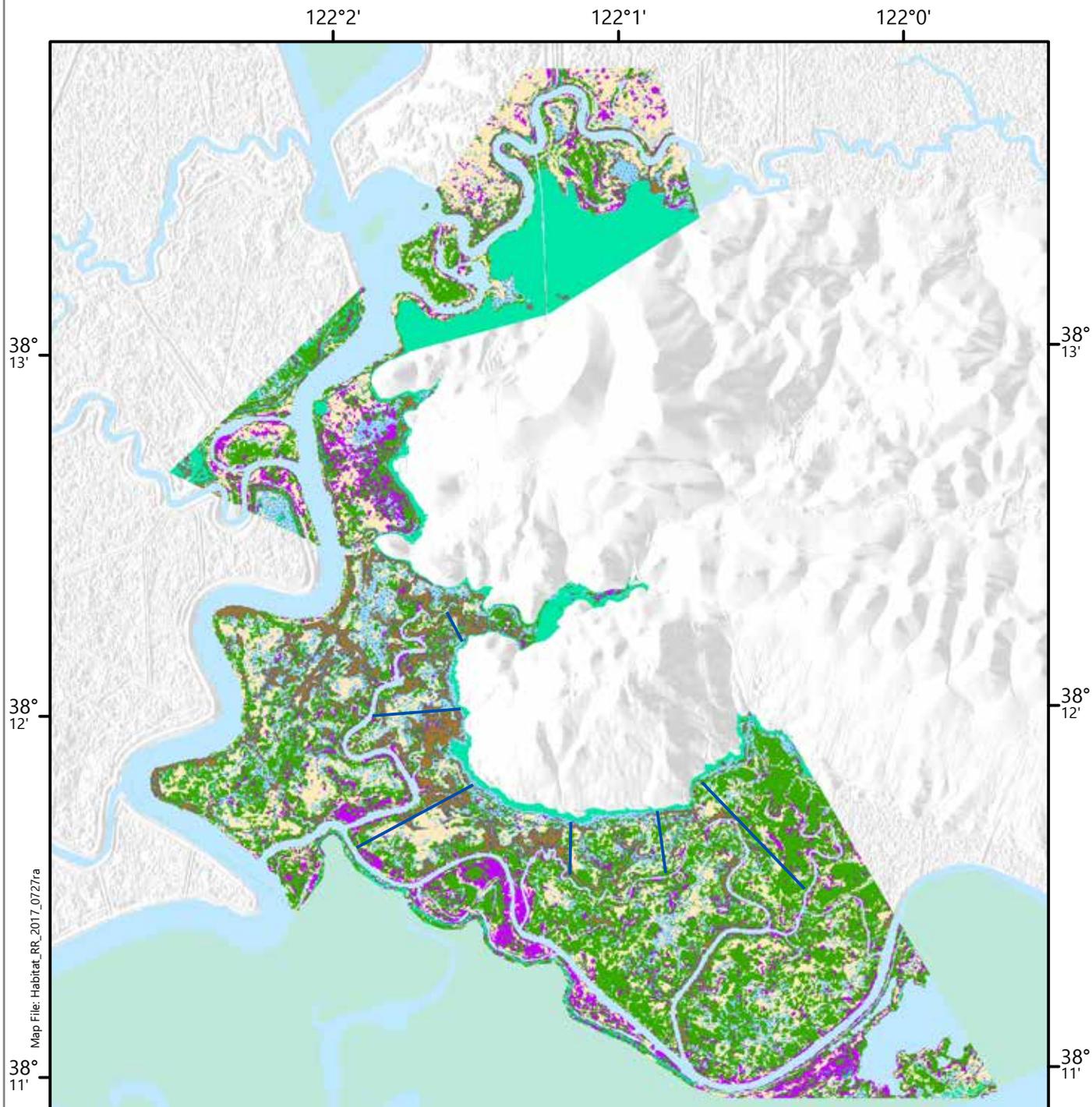


Figure 6



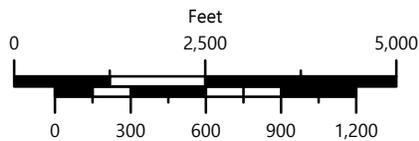
Map File: Habitat_RR_2017_0727ra

- | | | |
|----------------------|---|---|
| Vegetation Transects | Pickleweed (<i>Salicornia pacifica</i>) | Broadleaved Pepperweed (<i>Lepidium latifolium</i>) |
| Open Water | Bromus spp. | Common Tule (<i>Schoenoplectus acutus</i>) |
| Wetland | Baltic Rush (<i>Juncus balticus</i>) | Chairmaker's Bulrush (<i>Schoenoplectus americanus</i>) |

Data Sources: Habitat, NERR 2014; Hillshade, USGS NED 2010; Roads, US Census TIGER Product 2013; Coastline, National Hydrography Dataset 2017

Rush Ranch Tidal Wetland Habitat

Solano County, CA



Meters
1:30,000 (1" = 2,500' at letter size)

Figure 7

along the northern base of the Potrero Hills. Beyond the borders of Rush Ranch, the geography of the upland ecotones of Peytonia Slough and Hill Slough marshlands are distinctive as few other low-gradient planes with vernal pools intersect either saline or freshwater tidal marshlands (Wetland Research Associates 1990).

1.2.3.2 *Climate*

Average annual rainfall around Rush Ranch is only about 20 inches. Climate at the Suisun Marsh is strongly affected by both inland and coastal conditions. During summer, daytime convection in the Central Valley draws large volumes of marine air across the low areas of the California Coast Ranges. Afternoon winds that exceed 30 mph are common along the downstream reaches of Suisun Slough. Windiness tends to decrease with distance upstream due to the shielding effects of the inner Coast Range ridges north and west of Suisun City. However, the marine fog that forms along the coast during summer and invades the Bay Area, frequently extends inland as far as Suisun Slough, although it does not tend to persist beyond midday. Potential reduction of coastal fog(Johnstone and Dawson 2010) could impact these climate dynamics.

1.2.3.3 *Hydrology*

Most of the tidal marshlands of the Suisun Marsh are remnants of mature marshlands above the Mean High Water, and therefore are not inundated by every high tide. During autumn, when the high tides are low, the highest areas of the mature marshlands are not inundated during the neap tide cycles. The youthful marshlands that are developing along the immediate margins of Suisun Slough are inundated at least daily through the year. Hill Slough receives a minor amount of fluvial input from intermittent drainages of the north-facing slopes of the Potrero Hills. Peytonia Slough receives moderate fluvial inputs from Ledgewood Creek, a perennial stream that drains a small watershed north of Suisun City. First Mallard Slough at Rush Ranch receives minor freshwater inputs from Spring Branch Creek, which was historically



“Marsh at Rush Ranch” The tidal marsh landscape at Rush Ranch is dominated by three square bulrushes with rolling hills grading gently into the marsh. Note the prevalence of the invasive white-flowered pepperweed mixed with three square. Photo: Michael Vasey.

perennial but is now impounded within the Potrero Hills. An important aspect of the distinctive character of the Suisun Marsh is the lack of any major local freshwater influence. The most headward reaches of the Suisun Marsh terminate in low-gradient, poorly drained terrain. As a result, salinity does not decrease substantially with increasing distance upstream, away from the tidal source. During the dry seasons of drought years, the gradient may reverse, with lower salinities occurring downstream.

1.2.3.4 *Geology*

The Potrero Hills are a highly eroded anticlinal fold of sedimentary marine rocks. The axis of the fold trends east-west. An apron of eroded material extends around the hills and is intersected by much younger tidal marsh deposits. A few sandstone bedrock outcrops occur at the upland margin of the historical tidal marshlands.

1.2.3.5 *Biological Resources*

The Suisun Marsh is located in the zone of the estuary where the salinity regime is almost equally affected by marine influences, via the Golden Gate, and the freshwater influences of the Sacramento River and San Joaquin River. Spatial and temporal variability in salinity is extreme in this zone, due to seasonal and annual variability in local and regional rainfall. As a result of this variability, the brackish tidal marsh at Rush Ranch is exceptionally rich in vegetation and wildlife (Moyle 1976, Eaton 2001, Whitcraft et al. 2011, Watson and Byrne 2011, Vasey et al. 2012). Because of its special character, the marsh is protected by the Suisun Marsh Preservation Act, the Suisun Marsh Protection Plan, and the Suisun Marsh Local Protection Program.

Numerous sensitive species inhabit the Suisun Bay area. Threatened, endangered or rare plants and animals include: the Winter-Run Chinook Salmon, Delta Smelt, Sacramento Splittail, Ridgeway's Rail, California Black Rail, Burrowing Owl, California Least Tern, Salt Marsh Yellowthroat, Salt Marsh Song Sparrow, Suisun Shrew, Saltmarsh Harvest Mouse, California Tiger Salamander, Mason's Lilaeopsis, Suisun Marsh Aster, Suisun Thistle, Delta Tule Pea, Contra Costa Goldfields, and Soft Bird's Beak (Fiedler and Zebell 1993, Wetland Research Associates Inc. 1990, USFWS 1995, Eaton 2001). The Suisun Bay, in general, supports a great diversity and large numbers of waterfowl and shorebirds, as well as migratory passerines, due to the position of the Suisun Bay and the Pacific Flyway and also due to the conversion of the historical tidal marshlands to diked and intensively managed seasonal wetlands.



Rare native plant, Soft Birds Beak.
Photo: Aimee Good.

122°4'

122°2'

122°0'

121°58'

38° 14'

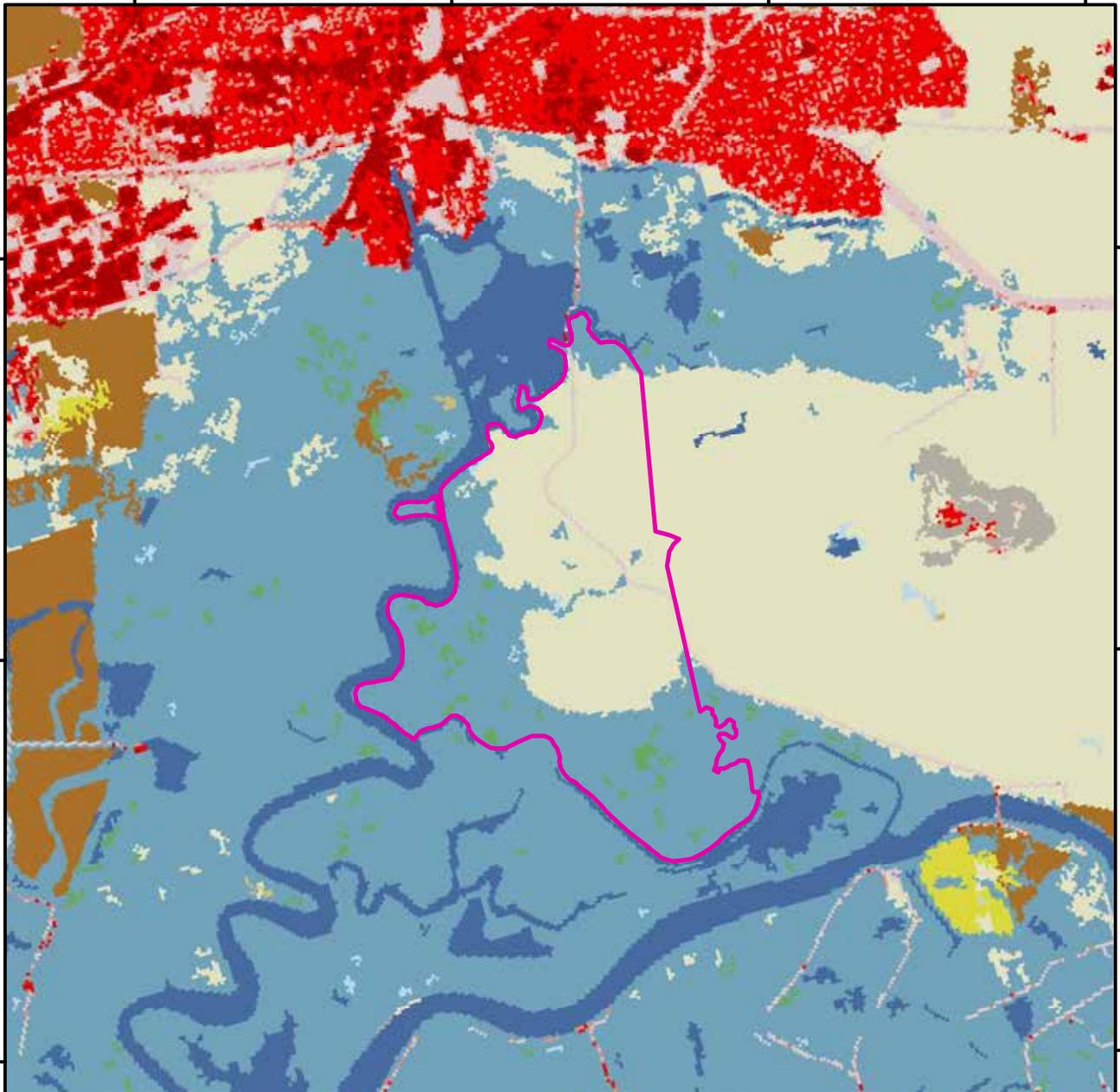
38° 14'

38° 12'

38° 12'

38° 10'

38° 10'



- | | | |
|-----------------------------|------------------------------|------------------|
| Rush Ranch NERR | Grassland/Herbaceous | Deciduous Forest |
| Developed, Open Space | Pasture/Hay | Evergreen Forest |
| Developed, Low Intensity | Cultivated Crops | Mixed Forest |
| Developed, Medium Intensity | Woody Wetlands | Dwarf Scrub |
| Developed, High Intensity | Emergent Herbaceous Wetlands | Shrub/Scrub |
| Barren Land | Open Water | |

Map File: LULC_RR_2011_2017_0728ra

Data Sources: LULC, National Land Cover Database 2011; Site Boundary, NERR 2017

Rush Ranch Land Use and Land Cover

Solano County, CA

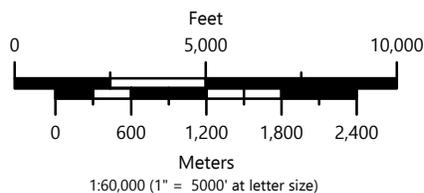


Figure 8

1.3 Social Attributes

Nine counties surround the SFE and make up the San Francisco Bay Area (Bay Area) (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma). These counties cover approximately 6,900 sq. miles, approximately four percent of the total area of California (163,700 sq. miles). Yet, as of 2016, there are an estimated 7.65 million people living in the Bay Area compared to 39.26 million people in California (Applied Development Economics 2016); i.e., about 20% of the total population of the state. Consequently, nearly one fifth of the population is located in less than five per cent of its total area. Further, the gross regional product (GRP) for the Bay Area in 2015 was approximately 722 billion dollars (ABAG 2015) compared to California GDP at approximately \$2.46 trillion dollars during the same year (i.e. about 29% of California's GDP) based upon a recent analysis by the World Bank (CCSCEa 2016). This World Bank study identified California as reaching the point where it now has become the sixth largest GDP in the world and the Bay Area alone ranks about 18th in the world based on this productivity index (CCSCEb 2016).

Although the Bay Area is clearly one of the global economic engines, this economy is distributed unequally. For example, median household income for Marin (\$96,580) and San Mateo (\$92,322) are relatively high whereas other counties, e.g. Solano (\$63,520) and Sonoma (\$61,029), are relatively low (SVIRS 2015). This reflects the difference between communities that are largely urban and dependent on health/social and professional/technical industries versus communities that are largely rural and dependent on agriculture and manufacturing (ABAG 2015).

According to the US Census Bureau, as of 2013, the ethnic diversity within the Bay Region was about 41.1% for Whites, 23.8% for Hispanics, 24.2% for Asians, and 6.2% for African-Americans and approximately 49.6% are male and 50.4% are female (SVIRS 2015). The Bay Area has a comparatively high per cent of people with college degrees (40%) compared to the rest of California (30%) (ABAG 2015). It also has an exceptionally large protected area under public management equaling approximately 1.2 million acres (Bay Area Open Space Council 2011).

Recent literature recognizes that the Bay Area is highly influenced by surrounding regions, such as the Sacramento Area, the San Joaquin Valley Area, and the Monterey Bay Area. Taken together, these four regions make up one 'megaregion', recognized as the Northern California Megaregion, one of eleven megaregions recognized around the nation (BAECI 2016). Since 2010, the Bay Area has accounted for three-quarters of the megaregional job growth. Conversely, because housing prices are so high in the Bay Area, this has resulted in a total net migration loss of 143,500 people into the other three areas making up the megaregion. This shift has caused increasing traffic congestion and air quality problems (BAECI 2016).

In summary, the nine Bay Area counties surrounding the SFE are relatively wealthy with a high cost of living, particularly in urbanized areas. The educational level of the populace is generally high and open space and parklands are well supported. The populace is relatively ethnically diverse. Yet, the wealth in the Bay Area is unequally distributed and rural and manufacturing communities tend to have lower standards of living (ABAG 2015). Further, as housing demand and affordability continues to exceed incomes, more and more working people are being forced to relocate out of the Bay Area and commute back to it for jobs (BAECI 2016).

1.3.1 China Camp

Although China Camp is surrounded almost entirely by open space or park land, the urban areas within the City of San Rafael are approximately 8 miles away, and a county road traverses through the Park. San Rafael, with a population of 58,819, is the largest city in Marin County. The City has a somewhat culturally diverse population: 58% White, 29% Hispanic, and 7% Asian (<https://datausa.io/profile/geo/san-rafael-ca/#economy>). San Rafael has a stronger, more vibrant Hispanic community than other areas within Marin County. The County's residents are fairly affluent, with Bay Area Census reporting a median household income of almost \$77,294 and the median home price over \$714,900, while 13.2% of residents live below the poverty level (<https://datausa.io/profile/geo/san-rafael-ca/#economy>). The school system is considered good, with many public and private elementary, middle, and high schools. Marin County traditionally boasts tremendous community support for environmental causes, and environmental awareness is high throughout the County. There has historically been great support for open space protection with very little new development being allowed.



1.3.2 Rush Ranch

The land surrounding Rush Ranch is mostly ranchland or former tidal wetlands converted to diked baylands. The largest nearby city is Fairfield. As of 2015, its population was 109,468, median household income was \$67,364, and median property value \$279,600 and ethnicity of the area is 33% White, Hispanic 29%, Asian 16%, and African-American 14% (<https://datausa.io/profile/geo/fairfield-ca/>). Closer to Rush Ranch is the community of Suisun City, less than 2 miles away up Suisun Sough. Suisun City is a historic waterfront town with significant areas of modern suburban development. As of 2015, its population was 28,867, median household income was \$66,452, and median property value \$229,100 while the ethnicity of the area is 26% White, 25% Hispanic, 21% African-American, and 19% Asian (<https://datausa.io/profile/geo/suisun-city-ca/>). Solano County has a mixed economy with strong, diverse agricultural interests (including ranching, orchards, and small and large farms) and a significant military presence due to the nearby Travis Air Force Base.



Above: "China Camp Heritage Day": The Friends of China Camp host an annual celebration of Chinese heritage at the historic fishing village during which the Reserve hosts an informative table informing guests of China Camp's tidal wetland ecology.

Below: The Suisun Thistle is federally listed as endangered with about 95% of its population at RR. Listed species impose important legal constraints on the use of Reserve sites by the public. Photos: Michael Vasey.

1.3.3 Comparative Socioeconomic Analysis

The location of the two Reserve sites represents different ends of the socioeconomic spectrum in the Bay Area. China Camp is situated in a relatively wealthy community which is dominated by Whites with a sizable minority of Hispanics in San Rafael. There is almost no agriculture in the area and no military presence. The surrounding landscape is dominated by commercial activities and residential districts. Conversely, Rush Ranch is situated in an agricultural landscape with an important military presence in the area. It presents a smaller median household income, much reduced property values, and greater ethnic diversity, possibly related to the military presence in the area. These different socioeconomic conditions at each Reserve site result in different kinds of challenges and opportunities for Reserve program development and these are well appreciated by Reserve staff and its partners. Further, staffing for the Reserve with its headquarters based in an even wealthier Marin County community (Tiburon) than San Rafael, creates important staff retention difficulties because of the high cost of living in Marin County.

1.4 Archaeological and Cultural Resources

Prior to the discovery of San Francisco Bay in 1769, the SFE landscape was a rich mosaic of wildlife, native vegetation, and approximately 30 small Native American tribes representing five different linguistic groups (Coast Miwok, Ohlone, Wappo, Patwin, and Bay Miwok). Native Americans actively managed the SFE landscape through a variety of techniques including fire, seed and bulb harvesting, fishing, hunting, and gathering other materials to meet their needs (Anderson 2005). By 1776, two missions were established in the region as well as the Presidio of San Francisco. The land management practices of the Native Americans declined as Spanish colonial influence increased. By the early 1800's, many tribes were disbanded and and, although still present and relatively cohesive, their land management practices subsided. The densest Native American populations occurred adjacent to the shores of the SFE (Milliken 1995) where they harvested tules for boats and housing and foraged fish, shellfish, and migratory birds for food resources. Shell mounds were located near the shore as well and represented important sites for gatherings, ceremonial dances, burials, and religious activities (Milliken 1995, Schneider 2016).

After Mexico seceded from Spain in 1821, the Bay Area became dominated by rancheros and grasslands were heavily impacted by cattle. Native grasslands and herbaceous fields were unintentionally transformed into non-native to non-native annual grasslands. Wildlife declined through hunting and other practices. It is likely that erosion of seasonal wetlands and streams impacted the SFE during this time. In 1846, the Bay Area became part of the Bear Flag Republic and was soon



"Old farm equipment at Rush Ranch": Rush Ranch displays historic ranch equipment and a functioning wind-driven well in the distance. Monthly tours of Rush Ranch during monthly "Get the Rush" events include an old-time black smith shop, an historic barn, and a Sears & Robuck "kit house" that now serves as a museum. Photo: Michael Vasey.

claimed by the United States. Gold was discovered in 1848 prompting the gold rush and by 1850 San Francisco's population increased from 1,000 to 25,000. California was admitted as a state in 1850. San Francisco was the first of many urban communities to reclaim tidal wetlands to add to their built environment (Booker 2013). Much of the eastern San Francisco bayshore was filled and extended to create downtown and industrial centers to the south. Urban expansion from privatization and filling of the wetland commons became the norm for many decades until the passage of the McAtteer-Petris Act in 1965 which resulted in the creation of the San Francisco Bay Conservation and Development Commission (BCDC).

Tidal wetlands were also lost in the 1800's by a move to reclaim tidal wetlands for

agriculture. Large levees were created to block tidal flows and farm inland sections of former wetlands. This practice began in the Delta and spread to other parts of the SFE including the Suisun, San Pablo Bay and South San Francisco Bay (Booker 2013). Another impact was the establishment of oyster farms in the South Bay in areas that are now active and former salt ponds. (Booker 2013). The collective impact of these tidal wetland reclamation activities was the loss of over 85% of tidal wetlands in the SFE and the reduction of the tidally influenced waters of the SFE to one-third of its former extent (Goals Project, 1999).

Since the founding of BCDC, the rate of shoreline development has significantly diminished and the use of the SFE as a recreational resource has greatly increased. Today, large areas of tidal wetland in the SFE are protected as public open space and managed by federal, state, local agencies, as well as non-profit groups. In the latter 20th Century, many military bases shut down and a number of these former military sites are now being converted to restored tidal wetlands and adjacent landscapes. The Reserve represents places that were exceptions to the rule of shoreline development. These have been “places of refuge” (Schneider 2015) where native upland and wetland habitats escaped prevailing trends and, as such, they represent some of the last and best historical and cultural remnants of the landscapes in the SFE.

1.4.1 China Camp

China Camp presents a rich archeological and cultural history. There have been several Native American shell mound sites discovered at China Camp (apparently located above the tidal marshes). These were occupied by Coast Miwok people. Recent archeological work at China Camp focused on three shell mounds that were situated near Miwok Meadows (Schneider 2010). These shell mounds were apparently occupied during the Late Holocene and into the Spanish colonial period. Schneider (2010) makes a compelling case that these shell mound sites were places of refuge for Coast Miwok who were baptized and later escaped or were given passes to leave missions (the Mission San Rafael Archangel occurs in the nearby City of San Rafael). Point San Pedro is rugged and fairly remote. It is hypothesized that the isolated nature of Point San Pedro, and its rich natural resources, allowed Coast Miwok people to continue to practice their culture and way of life. Interestingly, excavation of these mounds provides deep insight into native materials and species used by Coast Miwok, including the discovery of sea otter remains. Sea Otters were once common in the SFE until they were over hunted in the early 19th Century.

In 1869, a large portion of the former Rancho San Pedro was purchased by the McNear brothers from Sonoma County. These two businessmen began by establishing a 2500-acre dairy ranch and later a quarry and a brickyard. Chinese immigrants were present in Marin as early as 1855 and an influx of Chinese laborers after the railroads were completed in 1869 increased this population. Many Chinese worked at the brickyard located near the tip of Point San Pedro. In their off hours, they began fishing for shrimp as they had in their native region of China where



“China Camp pier”: Historic pier at the China Camp fishing village. Note the reconstructed Chinese shrimping vessel, the “Grace Quan”. One Reserve water quality monitoring station is situated at the end of the pier. Photo: Michael Vasey.

many had originated. Over time, a sizable shrimp fishing village was established in this area. By the 1880's, approximately 500 people occupied the shrimp fishing village known as China Camp. Similar to the Coast Miwok who sought shelter along the rugged, isolated shores of Point San Pedro, China Camp was also isolated and most easily accessed by boat. Living within the remote Chinese village may have protected residents from the rampant racism that permeated at the time. These sentiments eventually gave rise to the Chinese Exclusion Act of 1882, which forbade new Chinese immigrants. The village, pier, and a museum have largely been preserved since the park was acquired in 1976. Today, it is the last remnant of approximately two dozen Chinese shrimping villages that were situated along the shores of the SFE. Its acquisition followed a spirited conservation effort to prevent the site being developed by Chin Ho and his New York California Industrial Corporation. The Marin Conservation League played a key role in raising the funds to purchase the property as a public park. Chin Ho donated the 36-acre village site to be preserved as a memorial to Chinese-American history (<https://friendsofchinacamp.org/about-china-camp/history-of-china-camp/>).

1.4.2 Rush Ranch

Rush Ranch also hosts exceptional archeological and cultural attributes that complement its rich biological resources. Rush Ranch is located less than 16 km from the community of Rockville, Solano County, generally considered the site of Yulyul, the main village of the Suisunes tribe of southern Patwins. During prehistoric times, people occupied this area for at least 1,000 years, and more than likely up to 4,000 years. They lived on the Suisun plain near the marsh and constructed conical tule-thatched dwellings. Observations of the Spanish in 1810 described the Suisun plain as dotted with oaks. The Suisunes ground acorns, grass seeds, and other plant foods. They also hunted tule elk and grizzly bears and fished on salmon that came up into the sloughs. There is clear evidence of Patwin use of Rush Ranch during prehistoric times due to the presence of grinding rock mortars and middens near First Mallard Branch. Evidence of grinding rocks pushes out into the marsh transition zone. This site is considered one of the best Native American sites remaining in the Suisun Marsh region (pers. Comm., R. Bahktiary, UC Davis, PhD Archeology graduate student).



"Indian grinding rock": A rare grinding rock site is found near the tidal marsh at Rush Ranch. The Suisune people, a southern Patwin group, had a large village at Rockville, a small community not far from Rush Ranch.
Photo: Michael Vasey.

Rush Ranch also preserves buildings from the 19th Century when the property was a working ranch. Rush Ranch was acquired by Hiram Rush in 1852 and, after his death in 1869, his son, Benjamin Rush, continued to build up the ranch throughout his life. At one time, Rush Ranch consisted of 51,000 acres and was grazed by 3000 head of cattle, 1500 horses, and sheep. A large barn and blacksmith shop is still on the 2070-acre ranch property that remains. Benjamin Rush later became a state senator and sheriff of Solano County into the early 20th Century. While other Suisun Marsh properties were diked for agriculture from 1870-1920, and then later converted to duck clubs (Moyle et al. 2014), Rush Ranch continued to be operated as a ranch and it is one of the last remaining working ranches bordering the Suisun Marsh today.

1.4.3 Romberg Tiburon Center

Although RTC is not a designated component of the Reserve, it is a core partner of the Reserve and headquarters for the Reserve staff. It also presents an interesting cultural history that serves as a resource for Reserve-related educational and training programs. Due to its location on the eastern side of the rocky Tiburon Peninsula, the RTC location has one of the best accesses to deep water of any shoreline site in Marin County. This exceptional deep water led to its first known use in 1874 as a cod packing company. Cod was shipped to Tiburon from Alaska, processed, and then sent to the East Coast by rail for cod liver oil. In 1904, the site was acquired by the US Navy. It later became a coaling station for the Pacific Fleet during WWI. It remained as a navy station afterward and then became a naval facility dedicated to building submarine nets during WWII. In 1958, the navy facility was decommissioned and it became the NOAA NMFS Southwestern Fishery Center and a Minerals Management Technology Center. In 1978, the federal government closed the facility and sold it to San Francisco State University as a marine field station and center for environmental studies.

Many outstanding public facilities in the Bay Area today are the result of closed military bases that were originally situated on some of the most valuable real estate in the region (e.g., the Presidio in San Francisco). RTC is one of the beneficiaries of this phenomenon. Many historic structures (such as the renovated Ohrenschall Guest House built in 1904) are now important parts of the RTC campus and future renovation of a deep water pier is anticipated.

1.5 Threats and Stressors at China Camp

1.5.1 Natural and Anthropogenic Stressors

Natural stressors at China Camp are relatively few, however, there are natural events (such as excessive freshwater flows or droughts) that can result in stressful low-salinity conditions for different organisms; e.g., Olympia oysters (Cheng et al. 2016) and numerous soft-sediment invertebrates. High air temperatures are also important stressors on intertidal organisms, especially during midday low tides in the spring when fog cover is minimal. Most stressors primarily involve natural processes that are impacted by anthropogenic stressors. Anthropogenic stressors are several.

- The county road transects two of the major arms of tidal marsh at Back Ranch Meadow and Miwok Meadow. Reduced flows through small culverts under the road create muted conditions on the landward side of the marsh and prevent the marsh from draining during rain events. This decouples freshwater flows and sediment supplies from the watersheds behind these meadows and dams water behind the road causing water-logging behind the road.
- The road is negatively impacted by flooding and erosion, influencing traffic and parking along the road by park visitors.
- Sensitive wildlife, like Ridgway's Rails and Salt Marsh Harvest Mice, are blocked from moving across the road barrier.
- Generally, invasive species impacts are modest on the marsh but potential. Hybrid cordgrass has been detected in 2010 and 2016 but was quickly treated by the Invasive Spartina Project. Invasive European green crabs are common and abundant in the China Camp marsh but their impacts on other species are not well understood. An invasive gastropod (the Asian mudsnail) has been found nearby at Loch Lomond but is not yet present at China Camp. Most invasive species impacts are due to non-native plant and microbial species concentrated in park uplands.
- Natural upland erosion processes and erosion associated with park infrastructure can contribute sediment to the marsh, however this sediment does not freely access the bayward marsh because of the road.
- Another source of anthropogenic stressors is excessive nutrient and contaminant runoff through Gallinas Creek in the mouth of the creek and into nearby sloughs that run into China Camp.

- Research and monitoring activities could present a stressor to the tidal wetland ecosystem unless properly coordinated.

1.5.2 Climate Change Impacts

Direct climate change impacts are not immediately apparent in the tidal marshes, however changes in air temperature, water quality reduction in fog, estuarine acidification and frequency of storms are issues of concern that are expected to have documentable impacts in the near future. Accelerating sea-level rise is the most obvious threat to the persistence of the China Camp tidal marshes. Accretion modeling has demonstrated that if suspended sediment supply is low and rates of sea level rise are high, it is likely that tidal marshes will convert to mudflats by the end of the century (Schile et al. 2014). Creating marsh migration space by modifying the county road and enhancing sources of sediment are two potential short-term solutions; we will continue to seek other innovative solutions. Ultimately, to preserve tidal wetlands at China Camp in the long-term, rates of sea level rise will have to be slowed.

1.5.3 Reserve Sensitivity and Vulnerability to Climate Change

Tidal marsh ecosystems within China Camp are vulnerable to climate change (mainly sea level rise). Climate change may cause oscillating periods of drought and extreme rainfall in our region, which will likely impact benthic invertebrate populations. Greater periods of freshwater inundation will negatively affect oyster populations (Cheng et al 2016) and more research is needed on impacts to other organisms and systems. On the other hand, droughts will also impact organisms and systems; more research is needed to determine these impacts. Extreme events and sea level rise will likely impact historic Chinese Village and associated infrastructure. Camping facilities near Back Ranch Meadow and North San Pedro Road are already flooding at times and are highly vulnerable to increased sea level. The park headquarters structures are probably not vulnerable to sea-level rise at this time. China Camp may also be impacted by higher fire danger and ocean acidification.

1.5.4 Ecological and Social Sensitivity

It is likely that the greatest vulnerability of tidal wetlands is to increased sea level rise and low suspended sediment supply. So far, sediment supply seems adequate to keep up with sea-level rise but this could change as the rate of sea level rise increases. As explained elsewhere in this plan, North San Pedro Road affects the marsh's resilience to rising sea levels.

North San Pedro Road currently floods on extreme tides. If the road has to be closed due damage from this flooding, this will impact the local patterns of travel for the broader community surrounding China Camp and affect park access routes. The Reserve will continue to build partnerships with California State Parks, Friends of China Camp, and with County of Marin and our Gallinas Creek neighbors and engage in effective and constructive communications and partnerships with these entities about socially sensitive issues like the flooding of N. San Pedro Road.

1.6 Threats and Stressors at Rush Ranch

1.6.1 Natural and Anthropogenic Stressors

Anthropogenic stressors at Rush Ranch include introduced non-native species, roads, grazing, and visitation. An invasive plant, pepperweed, has spread quickly and extensively throughout the well-drained marsh plain (Whitcraft et al. 2011) and has impacted nutrient cycling, insect communities, and presumably competes with threatened native species such as Suisun Thistle and others. Feral pigs, an introduced animal, may impact the marsh plain through compaction and wallows, but data on the extent of this impact are currently lacking. There is a question as to whether their disturbance may favor some native plant species (through creation of recruitment opportunities) but this needs to be researched. Grizzly Island Road bisects Potrero Hill upland drainages from seasonal wetlands and tidal wetlands below the road. This impacts sediment supply, mobile species movements, and, to some degree, marsh migration opportunities in the

future. Uncontrolled grazing activities can potentially stress the marsh by adding nutrients into the system and increases speed of runoff. Human activity on the marsh plain, including use by researchers, can cause disturbance to reproducing populations of marsh birds and other impacts that are not yet well understood.

1.6.2 Climate Change Impacts

Climate change impacts include potential conversion of high tidal marsh to low tidal marsh over time, and eventually marsh loss if sea level rise rates continue to increase. Rush Ranch protects large areas of uplands that gradually slope into tidal wetland transition zones, so there is room for the tidal marshes to migrate. To achieve this, connections between upland drainages and tidal marsh need to be restored in some places; some of this restoration planning is already occurring and projects are funded and await permitting and implementation.

1.6.3 Reserve Sensitivity and Vulnerability to Climate Change

Reserve habitats are somewhat vulnerable to climate change but also naturally positioned to be relatively resilient in the future. Human structures on the ranch are not particularly vulnerable to sea-level rise. However, the Ranch's grazing operations, visitation, and ecological areas will be impacted by drought or extreme storms.

1.6.4 Ecological and Social Sensitivity

Ecological sensitivity is primarily related to control of invasive species and management strategies that address these concerns and, also, how grazing activities on Reserve grasslands is made compatible with tidal wetland resilience. This is an area that will require more focus and research.

Social sensitivity is centered on the need to integrate research, monitoring, and conservation of tidal wetlands into a more rural focus on management of grazed grasslands. To address this, staff keep open minds and focus on partnership building and open exchanges of information and views to ensure cooperative relationships between the Reserve and the Solano Land Trust. Research objectives are for future studies to identify best management practices for grazing on these lands.

1.6.5 Reserve Vulnerability

The Reserve is relatively resilient presuming good future management. It may need to work with Solano County to modify Grizzly Island Road to enhance connectivity between Potrero Hill uplands and tidal wetlands below.

1.7 Reserve Boundary

The present boundaries of the SF Bay NERR are co-terminus with the entire China Camp State Park and the entire Rush Ranch properties. China Camp is bordered on the north by San Pablo Bay, and along the northwestern point (Grove Point) by the marsh and flats at the mouth of Gallinas Creek. Along the western and southwestern edges, the park border runs along the ridgeline and is bounded by the San Pedro Mountain Open Space Preserve and the City of San Rafael Harry A. Barbier Memorial Park. The eastern end of the park abuts the McNears Beach County Park. The Rush Ranch property is bordered by a working ranch and wildlife areas. On the north and west lie the Hill Slough Wildlife Area (1,112 acres) and the Peytonia Slough Ecological Reserve (1,887 acres) and on the south and southeast is the Joice Island Wildlife Area (1,887 acres); all of these properties are managed by the California Department of Fish and Game.

1.7.1 Core and Buffer

As described at 15 CFR 921.11 (c)(3) (Appendix A), NOAA research reserve boundaries generally include two subcategories: key land and water areas, called "core areas," and a buffer zone. NOAA defines core areas as those containing critical estuarine ecological units for research purposes, encompassing "a full range of significant physical,

biological, and chemical factors contributing to the diversity of fauna, flora, and natural processes occurring within the estuary." A buffer zone is described as an area adjacent to or surrounding the core and on which the integrity of the core area depends. Buffer zones protect the core and provide additional protection for estuarine-dependent species, including those that are threatened or endangered. For this Reserve, the core areas are the inter-tidal areas (primarily tidally influenced wetlands, mudflats, and rocky shores) that occur within China Camp and Rush Ranch, totaling approximately 1,150 acres. The buffer zones comprise the areas that are not tidally influenced wetlands, totaling approximately 2,560 acres.

1.7.2 China Camp

In addition to being included in the California State Parks' primary mission, wetland preservation is also a mandated responsibility under the Keene-Nejedly California Wetlands Preservation Act of 1976 (Public Resources Code Div. 5, Ch. 7). The Act directs California State Parks, along with the Department of Fish and Game, to recognize opportunities for protecting wetlands within or adjacent to State Park System units, and to consider acquisition of wetlands in proximity to California State Parks. Adjacent properties that California State Parks may consider for acquisition include: the lands, wetlands and baylands along the northern park boundary near Gallinas Creek by Grove Point; and properties such as Boyd's Ranch and Buck's Landing immediately adjacent to the park.

The core focal areas of the Reserve are intertidal and subtidal habitats including muted marshes, fully tidal marshes, channels, mudflats, rocky shores, and beaches that are adjacent to upland areas of China Camp State Park. Riparian drainages and freshwater wetlands that drain into these peripheral intertidal habitats are key links to terrestrial uplands which are considered buffer areas from the perspective of the Reserve. All of these areas are protected by California State Parks with a high level of protection. Public trust areas are primarily open water in mudflat shoals adjacent to tidal wetlands. As sea-level rises, it could impact all of these habitats as described in the section on stressors.

Buffer areas at China Camp primarily consist of forested uplands. These forests are dominated by evergreen broadleaf trees such as California bay laurel, coast live oak and madrone. A number of deciduous trees are also part of this forest such as California black oak, valley oak, Oregon oak, and California buckeye. Coast redwood stands occur in ravines near the ridge crest. Lowland hills adjacent to tidal wetlands (e.g., Turtleback Hill) host patches of

native perennial grasslands, primarily dominated by purple needlegrass and shrubs such as toyon and manzanita.

1.7.3 Rush Ranch

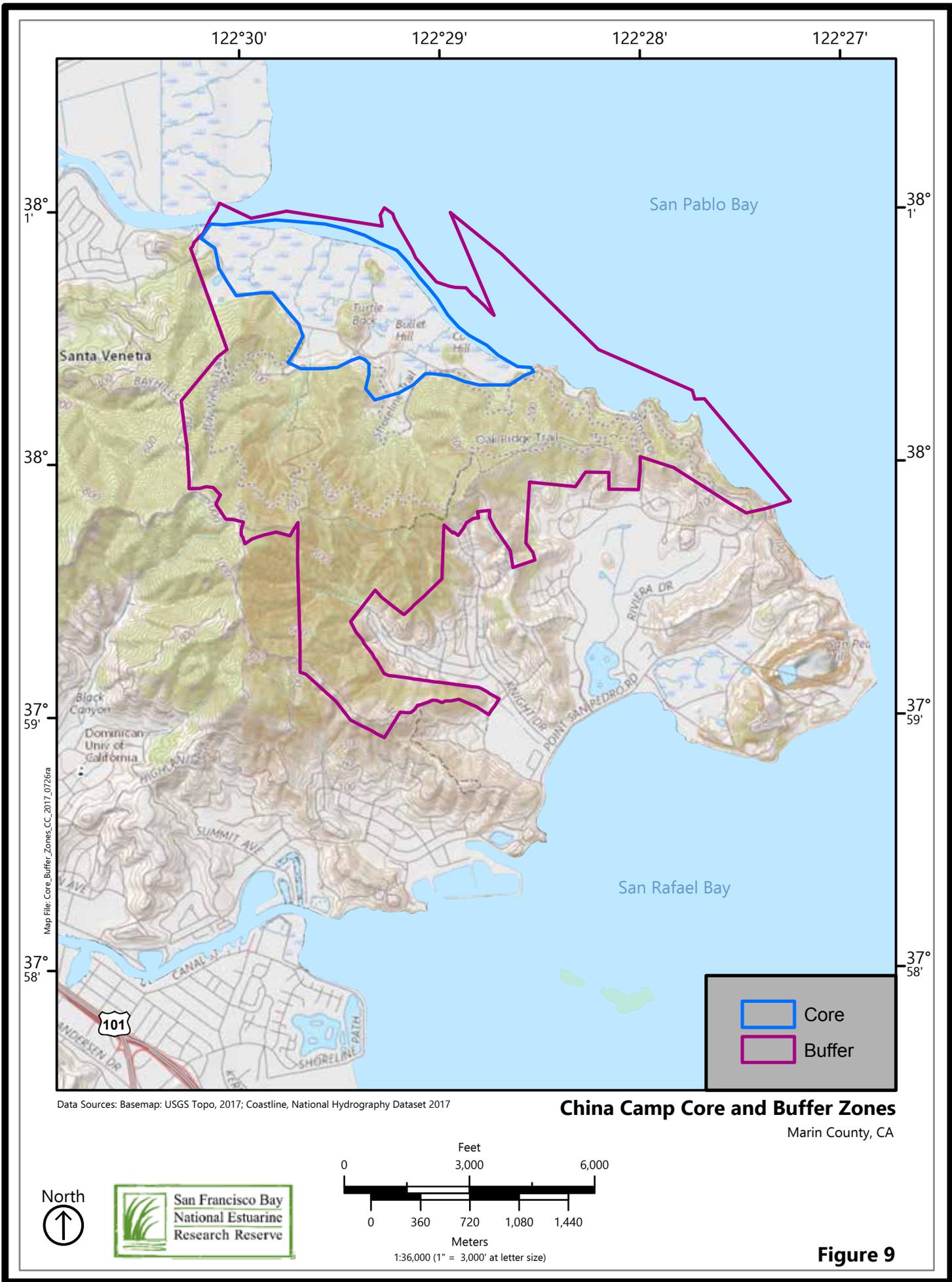
No inholdings exist at Rush Ranch, and much of the surrounding lands are in public ownership. The SLT Board has set priorities for acquisition of fee-title lands, including non-adjacent properties within the Suisun Marsh that may be acquired by the SLT or may be considered for inclusion in the Reserve. There are no immediate plans for acquisitions that will be added to Rush Ranch and such acquisitions are not identified in this Management Plan.

Similar to China Camp, the core focal areas of the Reserve (estuarine system) are intertidal and subtidal habitats including muted marshes, fully tidal marshes, channels, sloughs, and rocky shores and bluffs adjacent to sloughs that are adjacent to upland areas of Rush Ranch. Riparian drainages and freshwater wetlands that drain into these intertidal habitats are key links to terrestrial uplands and are considered buffer areas from the perspective of the Reserve (non-estuarine system). Public trust areas are primarily open water in sloughs adjacent to tidal wetlands. As sea-level rises, it could impact all of these habitats as described in the section on stressors.

Upland buffer areas surrounding Rush Ranch wetlands are dominated by annual grasslands composed primarily of non-native grasses such as wild oats, ripgut brome, soft chess, wall barley, and medusa head. Riparian drainages and freshwater wetlands are dominated by species such as Baltic rush, salt grass, alkali bulrush, broad-leaved cattail and other seasonal wetland herbaceous species. Introduction of some riparian species in formerly overgrazed seasonal drainages include red willow, arroyo willow, and blue oak on adjacent slopes. Seasonal streams flow down from grassland hills and there are some seasonal ponds created for watering livestock. The pond at Upper Spring Branch hosts a large population of the Tricolored Blackbird, a state sensitive species, and there was a recent sighting of a California Tiger Salamander at this site.

1.7.4 Land Ownership and Type

At China Camp, all of the land within the Reserve is owned in fee-title by the California State Department of Parks and Recreation. At Rush Ranch, the entire parcel is owned in fee-title by the SLT.



1.8 Potential Future Boundary Considerations

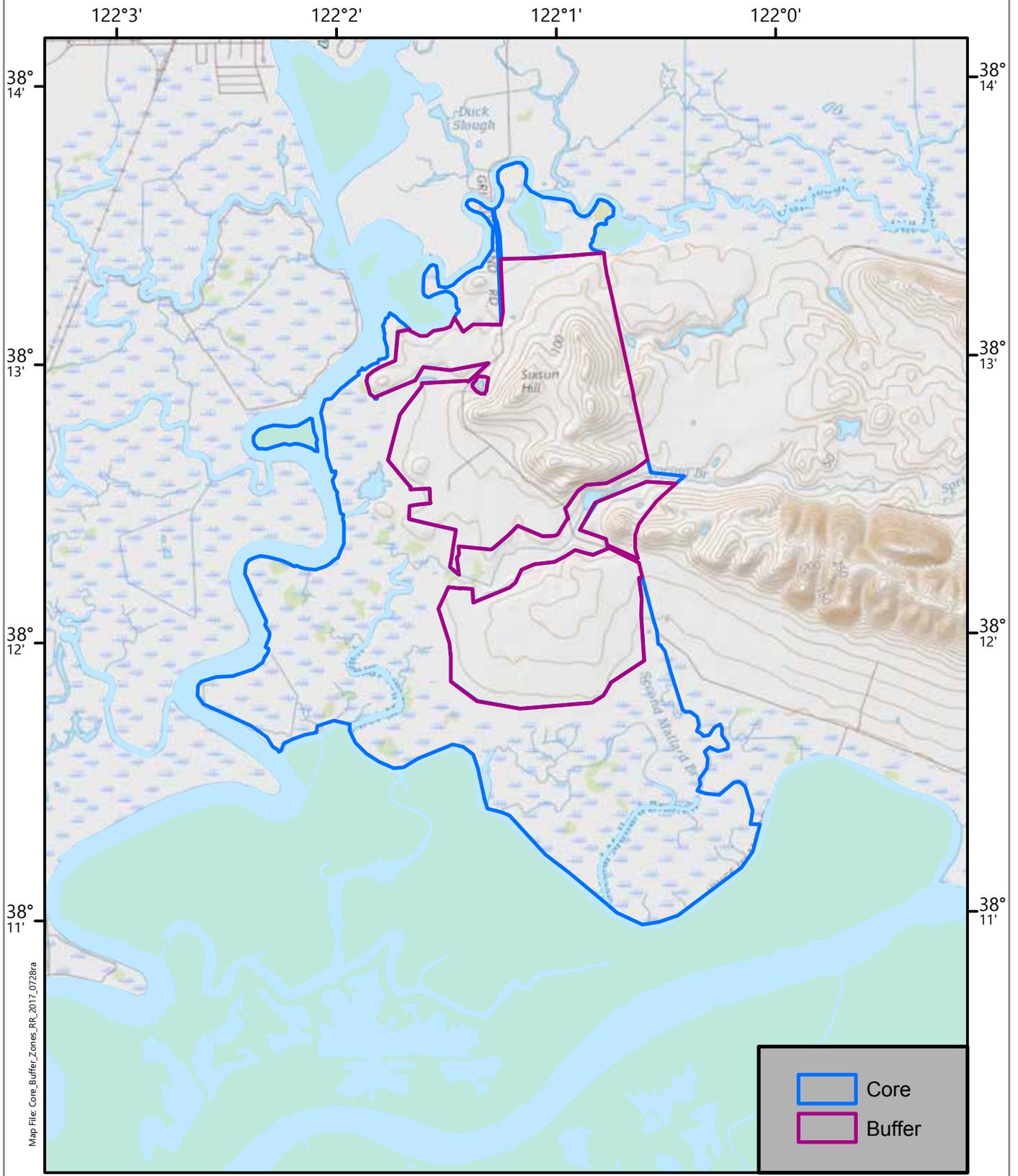
In the Land Acquisition Plan (Chapter 11), we clearly state that in the period covered by this five-year Management Plan (2017-2022), we do not anticipate any changes to the boundary of the reserve. There are two areas that we would like to explore for future boundary expansion considerations.

In the case of China Camp, the Reserve could be expanded (at some point beyond 2022) to include adjacent wetlands that are owned and managed by the County of Marin and California State Lands. Expanding the boundary to include these properties would significantly enhance the Reserve's opportunity to engage with the Gallinas Creek community and add almost 500 acres of tidal wetlands to the Reserve. It would further add an important land management and planning partner (i.e., the County of Marin).

The second boundary expansion involves partnering with the Richardson Bay Audubon Center (Audubon Center), the Smithsonian MarineGEO program, and RTC. The Reserve is already engaged in a partnership with these parties at the Richardson Bay Audubon Center and Sanctuary in Tiburon and is actively involved in research and monitoring in the Richardson Bay Important Bird Area Sanctuary (900 acres). Including this additional component into the Reserve would add important habitat diversity (eelgrass beds, native oyster habitat, and beaches) to the Reserve which is important for shoreline resilience and green infrastructure. All of the habitat that would be added would be considered Core.



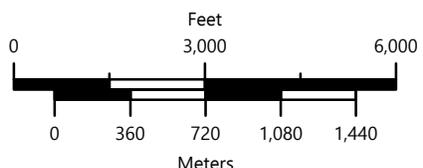
Accommodation space at Rush Ranch. Photo: Michael Vasey.



Data Sources: Basemap: USGS Topo, 2017; Coastline, National Hydrography Dataset 2017

Rush Ranch Core and Buffer Zones

Solano County, CA



1:36,000 (1" = 3,000' at letter size)

Figure 10

Chapter 2 - STRATEGIC PLAN: ADAPTIVE MANAGEMENT THROUGH ISSUE-BASED PLANNING

2.1 Reserve Vision

We envision ecologically vibrant and resilient estuaries cherished and supported by their surrounding communities.

2.2 Reserve Mission

Our mission is to increase place-based scientific understanding and conservation of Reserve sites through collaboration with our partners and to extend this knowledge broadly to inform regional and national coastal decision-making and improve science literacy.

2.3 Reserve Coastal Management Issues

1. Need for improved capacity to prepare, respond to and recover from changing environmental conditions and unpredictable extreme events (Coastal Resilience)
2. Need for timely, actionable information to make informed choices about effective management decision-making that supports the conservation and restoration of the estuary (Coastal Intelligence)
3. Need for broader engagement of diverse audiences to support estuarine conservation and stewardship activities

2.4 Reserve Niche

The Reserve is unique in the San Francisco Estuary by combining place-based long-term scientific assessment and research with education and coastal training programs that draw upon and extend beyond the outputs from the two Reserve sites, with the capacity to integrate science across disciplines and audiences. Foundational to our success is the strength of our signatory partnerships and collaboration with a wide range of entities and programs in the Estuary and the NERRS national network.

2.5 Management Plan Goals and Objectives

The Reserve has identified 3 goals and their associated objectives, described in the following sections.

2.5.1 GOAL 1: Increase and improve scientific knowledge of the SFE ecosystem

Objective 1: Full implementation of of System-Wide Monitoring Program (SWMP) elements enhances capacity to collect monitoring data by 2019.

Actions to support Objective 1:

- Identify gaps, unmet needs, and the approximate costs associated with each
- Develop plan for prioritizing and addressing identified gaps and needs
- Finish “build-out” of SWMP elements by filling those gaps and needs
- Develop plan for replacing pilings and other SWMP infrastructure over time
- Develop plan for sustaining core SWMP monitoring staff and operating resources

Objective 2: Expanded SWMP program enhances understanding of changes to reserve habitats and ecosystem processes.

Actions to support Objective 2:

- Expand SWMP to include full Sentinel Site Application Module 1 (SSAM-1) monitoring (NERRS 2016) at both Reserve sites
- Authorize the operational monitoring stations in Richardson Bay as secondary SWMP stations
- Expand benthic invertebrate monitoring at China Camp and consider expansion at Rush Ranch
- Develop actionable plan for updating Reserve-scale habitat maps, including regular change analysis
- Develop plan for more comprehensive and complementary site-based monitoring and research, with a focus on ecology and the relationships between drivers and ecosystem process, structure and function

Objective 3: Reserve staff enhance annual dissemination of research by students and scientists working at the Reserve.

Actions to support Objective 3:

- Develop and publish on website annual summaries of SWMP data highlights and an overview of research projects occurring in the Reserve
- Advertise to a variety of scientists the need for research on ecosystem structure, function, and process by working across sectors and with site partners
- Encourage and facilitate sharing of data and related publications among site resource managers and scientists working in the Reserve
- Assist site resource managers with reviewing, prioritizing, authorizing and overseeing site-based projects
- Assist scientists working in the Reserve by facilitating access and providing scientific feedback before, during and after projects

Objective 4: Data and knowledge of Reserve sites are interpreted within a regional and national context by the end of 2021.

Actions to support Objective 4:

- Build capacity and resources to store, maintain, and share geospatial data to the extent that staff skills, capacity and sufficient funding are available
- Develop brief annual research summaries that relate Reserve-based studies to broader issues for the benefit of site managers and other audiences
- Summarize new knowledge obtained since publication of the Reserve site profile
- Develop training workshops that attract regional practitioners and decision-makers to the Reserve sites
- Use citizen science to increase monitoring capacity and document phenomena like marsh flooding, restoration actions, etc.
- Promote regional and national use of the Reserve as sentinel sites for climate change effects and adaptation strategies and as reference areas for restoration and adaptive management (see also Objective 8)

2.5.2 GOAL 2: Expand understanding, practice and application of estuarine and coastal science

Objective 5: Scientific knowledge and skills are provided to teachers, students, visitors, scientists, resource managers, and other coastal decision-makers on an annual basis.

Actions to support Objective 5:

- Provide professional development for teachers through workshops, classroom support, and creation of lesson plans
- Publish science stories, data summaries, and lesson plans on the Reserve's website and in other outlets (including partners' newsletters)
- Co-lead Tidal Marsh Docent Program at Rush Ranch, including leading monthly Science Discovery Labs
- Lead CTP trainings focused on issues prioritized by Reserve site resource managers
- Work collaboratively with the Bay Area Remote Sensing Working Group, SF State, and NOAA to develop remote sensing capacity and products to assess geomorphic, vegetation, and wildlife change over time at the Reserve and similar sites to the extent that staff skills, capacity and sufficient funding are available
- Provide technical support for regional projects as staff capacity and skills allow, such as by assisting with research design for adaptive management projects

Objective 6: Teachers, students, volunteers, and visitors are involved in annual long-term monitoring through citizen science at the Reserve sites and beyond

Actions to support Objective 6:

- Organize and lead teacher workshops that encourage student-led monitoring activities during the school year
- Establish and maintain citizen science monitoring at the Reserve sites, including projects that contribute to programs like the USA National Phenology Network, Digital Earth Watch network Picture Posts, and California King Tides Project
- Seek opportunities to strengthen partnerships with existing long-term monitoring programs, such as the USA National Phenology Network and The GLOBE Program

Objective 7: A community of people is created and sustained that uses, learns from, and/or contributes to Reserve projects and programs by the end of 2023

Actions to support Objective 7:

- Highlight Reserve projects and programs through public presentations, scientific conferences, CTP workshops and teacher professional development workshops to increase the number of people reached
- Inform education and CTP workshop participants and volunteers about the Reserve's goals and actions so that they feel like part of the Reserve team
- Communicate about Reserve projects and programs on the Reserve's website, blog, Facebook page, partner newsletters, and other communication outlets to continue engagement between events/workshops
- Create opportunities for volunteers to increase involvement across sectors, e.g. for Tidal Marsh Docents to participate in research

Objective 8: Extramural funding for Reserve research, monitoring, education and stewardship is increased at Reserve sites and the broader SFE by the end of 2023

Actions to support Objective 8:

- Advertise to scientists, restoration practitioners, and other coastal decision makers the value of utilizing the Reserve (and potentially other restoring and mature marshes) to function as 'sentinel sites' to provide baseline information to inform ecological forecasting and wetland restoration project decision-making
- Identify opportunities and synergies for program development and fundraising in collaboration with SF State, RTC, land-owning partners, and other groups
- Through collaboration and partnership development, encourage long-term agency funding support for Reserve participation in monitoring of regional wetlands, living shorelines and other estuarine conservation and restoration projects
- Develop proposals for competitive extramural funding opportunities to support research, monitoring, stewardship and education projects that leverage the intrinsic value and data density of the Reserve sites and expertise of Reserve staff

2.5.3 GOAL 3: Promote public appreciation and support for stewardship of the SFE

Objective 9: The Reserve's visibility, image and impact is enhanced by the end of 2023

Actions to support Objective 9:

- Bring new community members into the Reserve and NERR System through promoting Reserve programs and activities at public presentations and meetings (see also Objective 7)
- Increase number of people reached through public education programming
- Continue participation at annual Reserve site Open House events
- Increase use of the Reserve blog and social media for all Reserve programs
- Increase use of the Reserve website to advertise and distribute data stories, research and monitoring summaries, pictures, videos, reports and presentations (see also Objective 7)
- Cultivate new and existing partnerships that support the Reserve's mission
- Develop a unified graphic style for the Reserve to use in communication products

Objective 10: Annual stewardship activities that organize, support, and/or lead to hands-on visitor participation in resource protection at the Reserve sites are increased.

Actions to support Objective 10:

- Identify and advertise opportunities to restore or enhance degraded or altered habitats within and adjacent to the Reserve sites
- Sustain and enhance communities of volunteers that participate in stewardship and/or citizen science activities at the Reserve sites (see also Objective 6)
- Improve volunteer recruitment and coordination by collaborating with land-owning partners and signatory partners
- Offer annual CTP-led field trips to educate land managers on current stewardship issues at Reserve sites and throughout the SFE

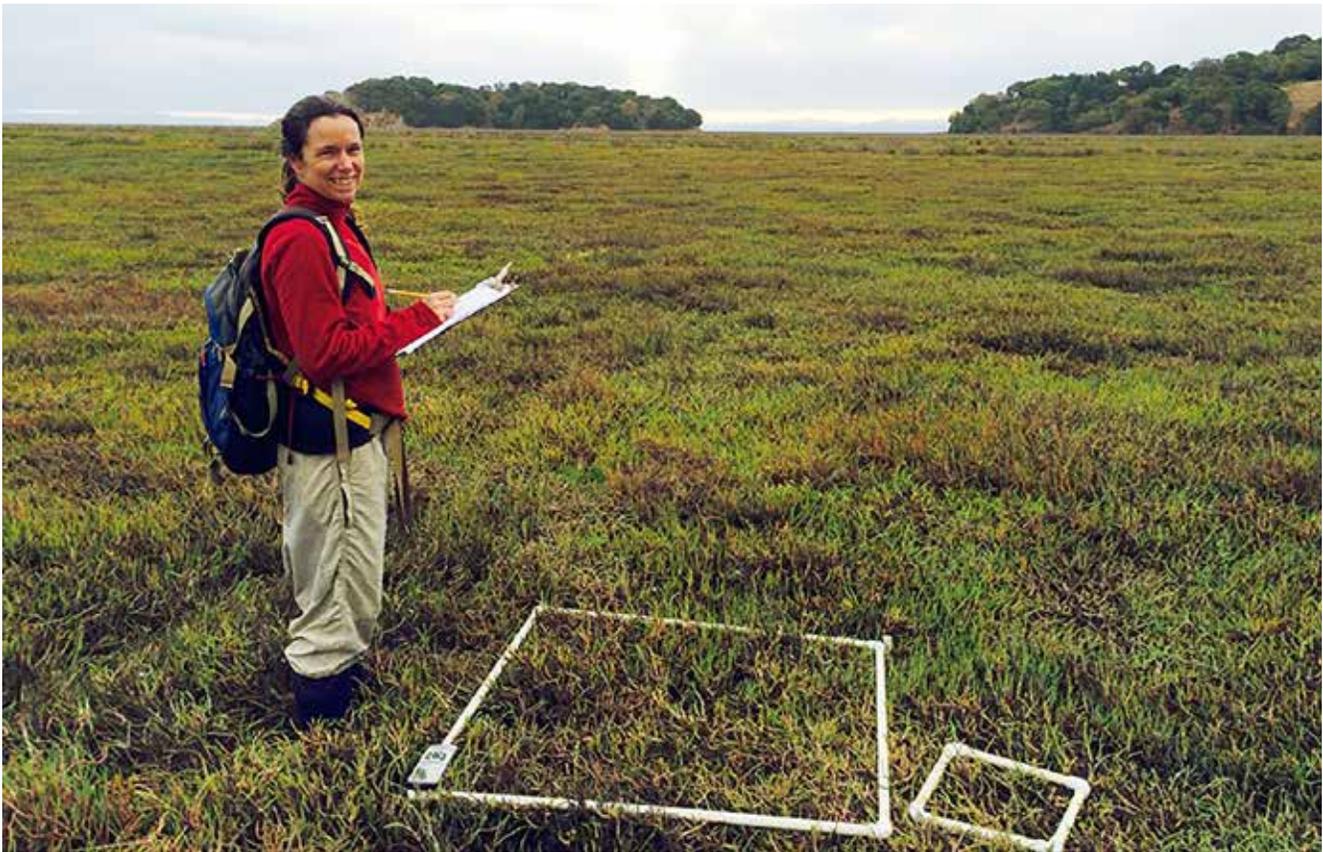
CHAPTER 3 - RESEARCH AND MONITORING PROGRAM

3.1 National Research and Monitoring Program

The National Estuarine Research Reserve System's mission provides that reserves are protected and managed to afford opportunities for long-term research. Research at each reserve is designed to fulfill the reserve system goals as defined in the regulations (15 C.F.R Part 921(b)).

To sustain these system goals, the 2018-2023 Reserve System Strategic Plan outlines research objectives to maintain and expand biophysical and socio-economic monitoring to track environmental change, increase the use of collaborative research to address decision-maker needs, and ensure that scientific, education, and management audiences can use the data and tools developed by the system.

Research is supported through the National Estuarine Research Reserve System Science Collaborative, a program that focuses on integrating science into the management of coastal natural resources. The program integrates and applies the principles of collaborative research, information and technology transfer, and adaptive management with the goal of developing and applying science-based tools to detect, prevent, and reverse the impacts of coastal pollution and habitat degradation in a changing environment. The program is designed to enhance the reserve system's ability to support decisions related to coastal resources through collaborative approaches that engage the people who produce science and technology with those who need it. In so doing, the Science Collaborative seeks to make the process of linking science to coastal management decisions, practices, and policies more efficient, timely, and effective and share best practices and examples for how this can be done.



Sarah Ferner performs vegetation monitoring survey at China Camp. Photo: Michael Vasey.

3.2 National System-Wide Monitoring Program

Environmental monitoring is supported through the System-Wide Monitoring Program (SWMP), which provides standardized data on national estuarine environmental trends while allowing the flexibility to assess coastal management issues of regional or local concern. The System-Wide Monitoring Program Plan describes SWMP and its role in supporting the National Estuarine Research Reserve System's mission and strategic goals, details the existing capacity, and outlines an implementation and development plan for the program. SWMP monitors short-term variability and long-term changes in water quality, biological systems, sea level and lake level change impacts on coastal habitats, and land use and land cover characteristics of estuaries and estuarine ecosystems for the purpose of informing effective coastal zone management. The program is designed to enhance the value and support the vision of the reserves as a system of national reference sites and focuses on three ecosystem characteristics:

1. **Abiotic Characteristics:** Abiotic measurements are taken using standard protocols, parameters, and approaches that describe the physical environment, including weather, water quality, and hydrological conditions. The monitoring program currently provides data on water temperature, specific conductivity, pH, turbidity, salinity, concentration of dissolved oxygen, and water depth. Meteorological data include air temperature, relative humidity, barometric pressure, wind speed, wind direction, rainfall, and photosynthetically active radiation (PAR). In addition, the program collects monthly nutrient and chlorophyll a samples at all stations and monthly diel samples at one SWMP data logger station. Data are Federal Geographic Data Committee compliant and available via the Reserve System Centralized Data Management Office.
2. **Biotic Characteristics:** Reserves are focusing on monitoring habitats and biodiversity.
3. **Watershed and Land-use Classifications:** The reserve system is examining the link between watershed land use and coastal habitat quality by tracking and evaluating changes in coastal habitats and watershed land use and land cover. This element is guided by the *Reserve System Habitat Mapping and Change Plan*.

Building on these foundational elements, the Reserve System is developing a network of sentinel sites and the capacity to assess the impact of sea level/lake level changes and inundation on the diverse set of coastal vegetative habitats represented in the system. Reserves are implementing a suite of activities, as described in the 2012 Reserve System Sentinel Site Guidance Document, to assess the relationship between vegetative communities (marsh, mangrove and submerged aquatic vegetation) and sea level. Reserves are adding surface elevation tables and monitoring pore water chemistry along vegetation monitoring transects and linking their System-Wide Monitoring Program to a network of specialized spatial infrastructure to allow precise measurement of local sea level and lake level changes and subsequent impacts to key habitats. The Reserve System is working in partnership with NOAA's National Geodetic Survey and the Center for Operational Oceanographic Products and Services to support the development of sentinel sites.

3.3 Reserve Research and Monitoring Program Context

The Reserve Research and Monitoring (R&M) Program is focused primarily at China Camp and Rush Ranch through implementation of the System-Wide Monitoring Program (SWMP). Additional effort is focused on estuarine areas immediately adjacent to the Reserve sites through expanded vegetation mapping around both sites, measurement of suspended sediment concentrations in nearby waters, oyster monitoring along the Marin County shoreline south of China Camp. In certain cases, program activities have covered more of the estuary including co-located monitoring of water-quality and weather in Richardson Bay, annual monitoring of regional oyster populations around the estuary, and externally-funded tidal wetland restoration projects such as Sears Point in Sonoma County. The Reserve's R&M Program also occasionally collaborates on projects in coastal waters that both influence and are affected by the San Francisco Estuary, and that focus may expand in future years. On a national scale, the R&M Program also contributes to a variety of NERRS-wide initiatives including assessments of tidal marsh carbon-cycling and susceptibility to sea-level rise, data syntheses comparing different coasts and biogeographic regions, and committees and initiatives that work to develop nationally standardized protocols and projects.

The R&M Program continued implementation of SWMP during the last management plan period, producing long-term and ongoing datasets on water quality, nutrients and chlorophyll *a*, weather, marsh vegetation, marsh accretion, and benthic invertebrates (primarily oysters). Those data have led to informative products including a technical report assessing the potential for nutrient impairment in Suisun Marsh, a book chapter promoting the value of NERRS long-term monitoring in tidal marshes, and several peer-reviewed manuscripts and technical reports relating oyster performance and survival to environmental stressors. Other program activities and publications have contributed information on sediment transport into and out of tidal marshes, responses of invertebrate larvae to levels of turbulent mixing characteristic of coastal habitats, and the usefulness of remote sensing for improving digital elevation models and ecological forecasts of marsh responses to sea-level rise.

The primary target audiences for this program are the Reserve site owners and resource managers, permitting and regulatory agencies, regional conservation partnerships, restoration planners and practitioners, and estuarine and marine scientists, educators and students. All of these audiences are reached through online posting of SWMP data (<http://nerrdata.org>) as well as blog posts and various updates to the Reserve's website and social media. Other approaches for reaching these audiences include publishing peer-reviewed publications and technical reports, presenting in classrooms and at regional and national conferences, participating in partner meetings and working groups, and collaborating on grant proposals, externally funded projects, and other lab and field activities.

The SFE is surrounded by a diverse and thriving research community, fueled in large part by high-performing academic institutions such as Stanford University, the Universities of California and San Francisco State University, and also augmented by numerous other universities, colleges, federal and state agencies, consulting firms, and non-profit organizations. The estuary also is a destination for international scientists and a target for piloting coastal management practices and comparing coastal processes at a national scale. There are many professional scientists currently working in the region on estuarine and marine topics, and many of these researchers have included the Reserve or nearby sites in their studies. For each Reserve site we typically receive between 10-20 research permit applications per year, and a much larger number of subtidal and intertidal projects are undertaken each year in other parts of the estuary. Yet, despite the diverse and abundant group of researchers in the area, many topics of vital interest to coastal management remain relatively underexplored and numerous gaps in basic data and applied knowledge still need to be filled. The potential for data sharing and leveraging of past and ongoing studies brings added value to the Reserve, and this research history and

momentum will continue to be a draw for future science in and around the Reserve sites.



Dr. Matt Ferner, Research Coordinator at the Reserve, processes a water quality sample at the Gallinas Creek monitoring site at China Camp. Photo: Michael Vasey.

The R&M Program will address priority issues and questions based on the needs of local site managers and regulatory agencies as conveyed through planning documents and in-person meetings, and as outlined within the Science Goal of the NERRS Strategic Plan and the Reserve's overarching Goals and Objectives presented above. The overarching research issue for the R&M Program is the need to better understand the causes and consequences of short-term variability and long-term trends in environmental drivers, especially those drivers measured at the Reserve's core SWMP stations. How do water quality and weather vary along the estuarine salinity gradient and over time, and particularly in response to predominantly wet vs. dry years? What are the implications of these

changes for sediment supply to tidal marshes and subsequent marsh accretion? How do changes in environmental drivers affect biological responses by marsh vegetation, phytoplankton, native fishes and oysters, and other species? These questions are highly relevant for coastal management needs related to enhancing wetland resilience to sea-level rise, tidal wetland restoration, improving water quality, protecting shorelines, conserving sensitive species, and controlling invasive species and a variety of human impacts. These issues and questions also are aligned with the Science Goal of the NERRS Strategic Plan, which calls on NERRS research, data and tools to be applied to improve the scientific understanding of estuaries and their watersheds.

3.4 Research and Monitoring Program Capacity

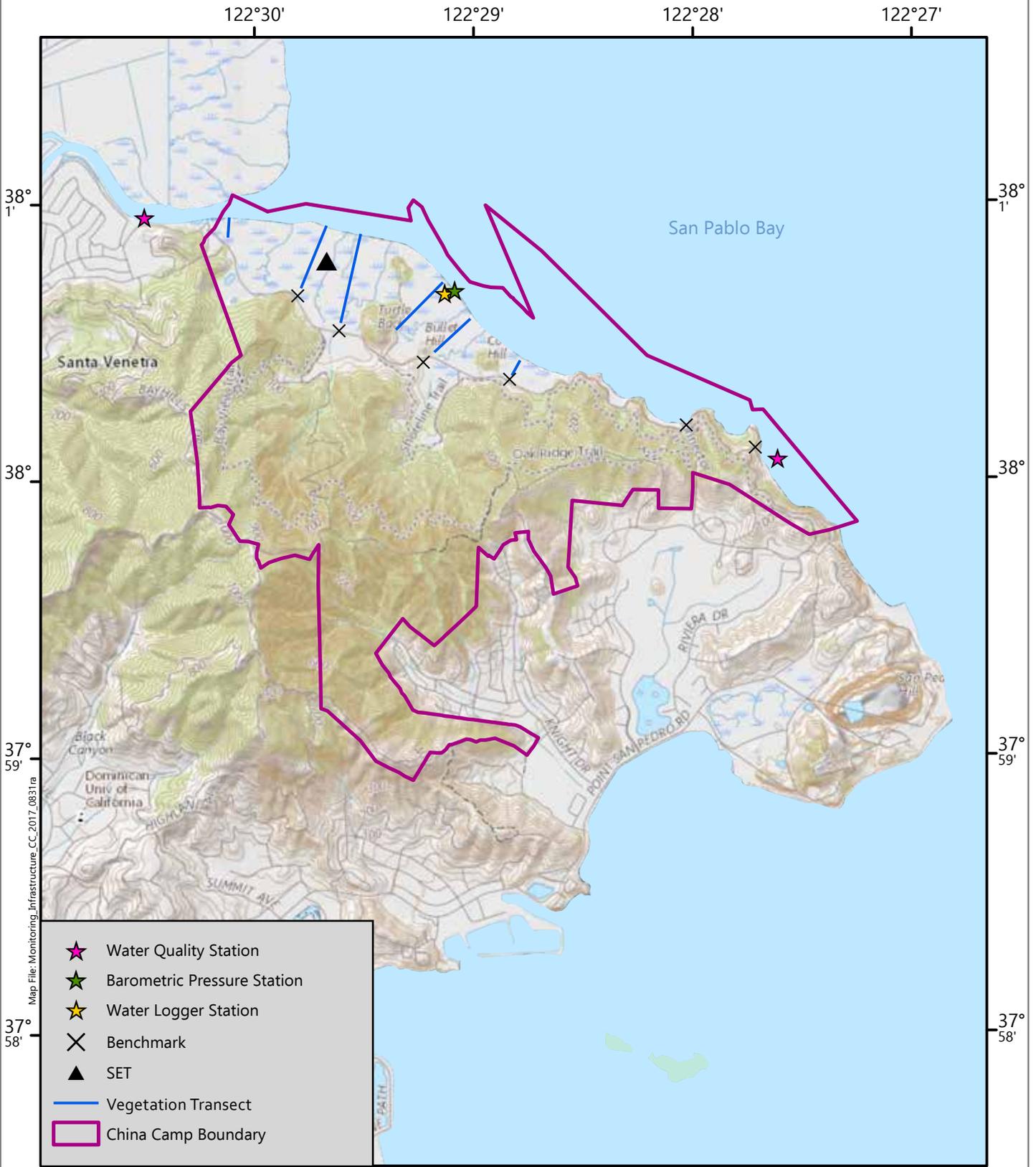
Currently the R&M Program is managed by the Reserve's Research Director with support from 1 full-time research technician who oversees SWMP logistics, data management and related projects, and a part-time (75%) research technician who implements monthly SWMP data collection and oversees all equipment installation and maintenance, including telemetry and other technical requirements of the program. Reserve staff from other programs (administration, education, coastal training, stewardship) also regularly assist with monthly SWMP data collection and annual SWMP activities like vegetation and oyster monitoring, as do a fluctuating number of students, interns and volunteers.

Most R&M Program activities take place at the Reserve sites, with support from facilities like the small laboratory space in the Rush Ranch Nature Center and the fishing pier at China Camp. Monitoring infrastructure at the sites includes surface elevation tables installed in the tidal marsh and large marine pilings that support water quality sondes, solar panels and telemetry equipment. The Reserve's main laboratory is at SF State's Romberg Tiburon Center for Environmental Studies, where the research technicians calibrate and repair instruments, process most water samples, and stage new installations and field outings. Additional facilities at SF State such as staff offices, meeting rooms, computers, printers and email servers facilitate necessary work of the program. Travel to Reserve sites is only possible because of access to RTC trucks, boats, and the SF State staff support necessary for maintaining those resources.

The R&M Program will continue working most closely with the Reserve's signatory partners at SF State, California State Parks and the Solano Land Trust. At SF State those partners include scientists and staff based at RTC, the Institute for Geographic Information Science (IGISc), the Biology Department and Earth and Climate Sciences Department in the College of Science & Engineering (CoSE), and the Office of Research and Sponsored Programs (ORSP). At California State Parks those partners include the Superintendent and Natural Resource Program staff of the Bay Area District, which includes China Camp. At the SLT those partners include the Stewardship Director and staff based at Rush Ranch. All these partners are truly essential for continued success of the Reserve's R&M Program. Additional core partners of the program include researchers from the University of San Francisco, the Universities of California at Davis and Berkeley, the USGS and the Smithsonian Environmental Research Center (SERC). Other partners that collaborate and interface with the program on specific projects include researchers and resource managers from a variety of other universities, NOAA, the California State Coastal Conservancy, BCDC, and non-profit groups including Point Blue Conservation Science, Audubon California and the San Francisco Estuary Institute (SFEI).

3.5 Research and Monitoring Program Delivery

The Reserve's primary strategy for continuing to implement system-wide and national programs is to retain current staff expertise and minimize staff turnover. Past experience has shown that staff turnover can compromise quality and consistency of SWMP data, reduce productivity during understaffed periods and new training periods, and increase costs of maintaining requisite infrastructure and equipment for the program. A key component of the staff retention strategy is to regularly offer modest salary increases in line with cost-of-living increases in the region, even during years when such increases are not mandated by SF State. Because the cost of living is extremely high around San Francisco relative to the rest of the country, maintaining this strategy over time will require extramural fundraising through grants, contracts, and potentially also through future donor contributions. Another component of this strategy is to continue staff training and professional development in order to increase the efficiency of program implementation and to utilize new resources and monitoring approaches (e.g., incorporation of optical backscatter sensors, remote sensing and GIS technologies).



Map File: Monitoring_Infrastructure_CC_2017_0831ra

Data Sources: SET, Site Boundary, Monitoring Stations, Vegetation Transects, NERR 2017; Benchmarks, USGS 2017; Basemap, USGS Topo 2017

China Camp Monitoring Infrastructure

Marin County, CA

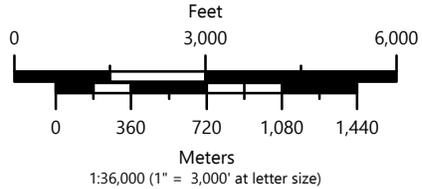


Figure 11

A second strategy for sustaining local implementation of NERRS programs and priorities is to foster productive collaboration with partners, students and volunteers. As noted above, partnerships are an important part of our operations and they are especially critical for maintaining SWMP and for pursuing additional initiatives such as projects sponsored by the NERRS Science Collaborative. For example, we have partnered with researchers from USGS to implement sentinel site monitoring at both Reserve sites and have collaborated with a broad range of local partners and multiple other NERRs to complete four different projects funded by the NERRS Science Collaborative. We also strive to promote and expand our collaborative partnerships through publicity on the Reserve's website and by participating in regional, state and national conferences. Finally, Reserve staff increases the program's capacity to implement national initiatives by participating in annual NERRS meetings, sector meetings and the Technician Training Workshop.

3.5.1 Support for Additional Local and Regional Monitoring and Research

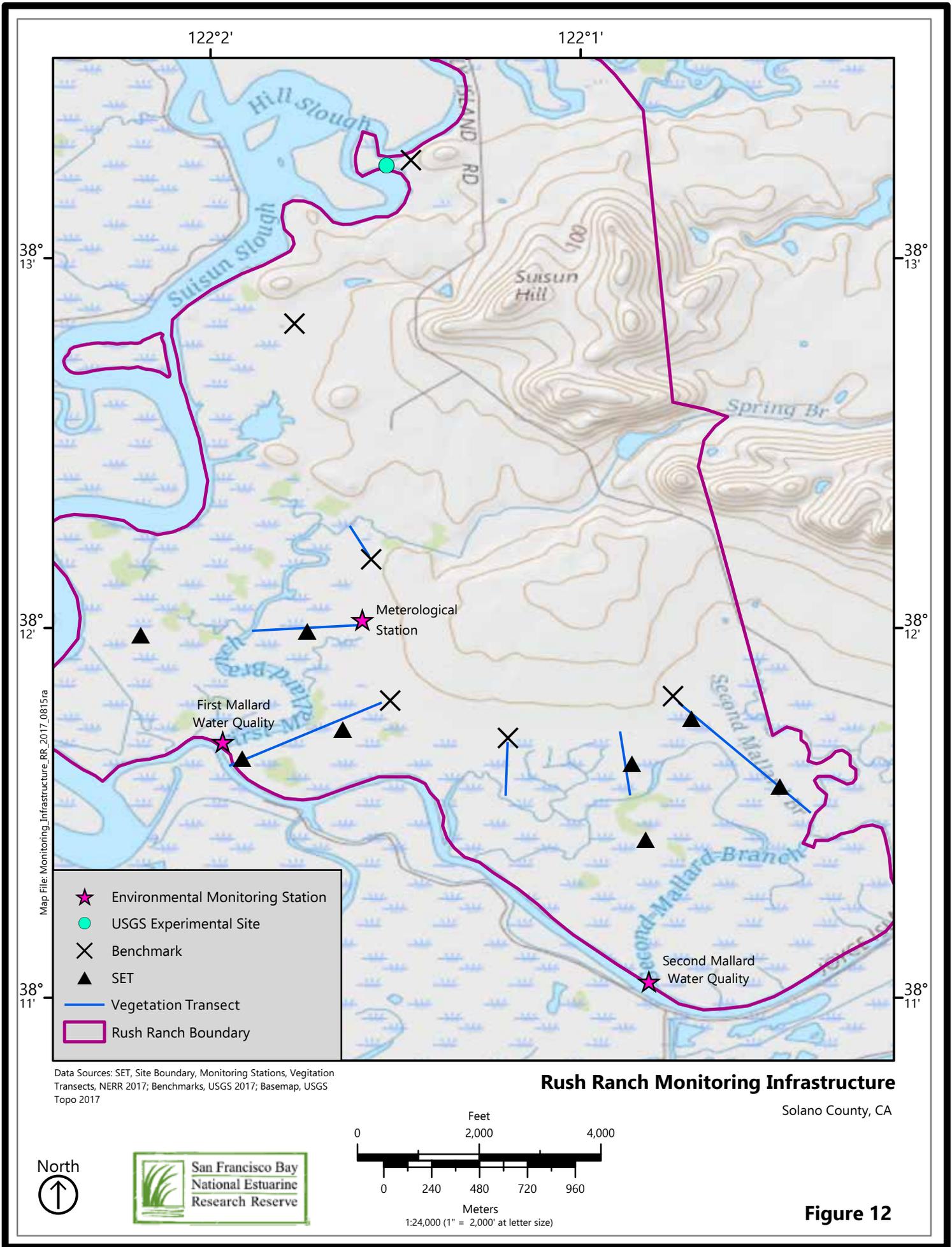
As with implementation of our core SWMP activities, one strategy for implementing additional local and regional monitoring and research is through partnerships. Such efforts are typically supported by external grants and contracts, and in some cases we have been able to leverage the ongoing availability of SWMP data to obtain additional funding. One key partnership that has enabled new local monitoring and research is our collaboration with SERC and the Smithsonian's MarineGEO program. Through that collaboration, we have expanded our monthly monitoring to include a new water-quality monitoring station collocated with a newly refurbished weather station in Richardson Bay, which is a biologically diverse sub-embayment near the mouth of the estuary. Those data will form the basis for future decades of comparative research and monitoring by MarineGEO, Audubon California, RTC, others and us. In addition to Reserve-based implementation of local and regional monitoring and research, pressing ecological questions and management needs that require the attention of other parties are promoted to external researchers and supported through permit review/ approval and research coordination.

Regional monitoring in the SFE has gained recent attention. The May 2016 Comprehensive Conservation and Management Plan for the San Francisco Estuary (SF Estuary Partnership 2016) Action 2 is to develop a Regional Wetlands Monitoring Program and it identifies the Reserve as one of five key partners in establishing and implementing that program. Efforts are underway by those five partners and other regional entities to set the foundation for such a program.

3.5.2 Support for Other Functions at Reserve

Other functions at the Reserve that are supported by the R&M Program include fundraising, outreach and partnership development. The R&M Program activities are clear expressions of the value of having a "research reserve", and as such the program is often highlighted in cross-sector proposals, public events, and regional and national partner meetings. Data-based case studies drawn from the program can be discussed, debated, and refined for purposes of raising funds to supplement the Reserve's annual operating grant, communicating the commitment of the Reserve to place-based science, and enticing partner organizations to invest in or collaborate with the Reserve on a range of initiatives. Staff time devoted to such functions is valued and seen as intrinsically necessary for success of the Reserve.

The Reserve's R&M Program provides data and interpretation to the education, stewardship and coastal training sectors to inform their programmatic efforts and also for broader dissemination through social media, blog posts, interviews, tabling events and presentations. Staff in the R&M Program also regularly contribute to activities of other sectors, including exhibit design, behind the scenes troubleshooting, field trips, classroom demonstrations and teacher workshops. External scientists and resource managers who interact with the R&M Program often are referred to other Reserve programs to capitalize on new opportunities for outreach, training or stewardship. All sectors in the Reserve also work collaboratively on messaging, outreach, and technical support via review of communication materials. Staff in the R&M Program respond to needs of other sectors by prioritizing topics for new proposals and by developing targeted data summaries or other communication materials to help provide a framework for other sectors to construct complementary projects around. Additionally, the R&M Program provides opportunities for other Reserve staff to get involved in research and monitoring in ways that increase their skills and knowledge and ultimately lead to other complementary programmatic actions, such as development of education or stewardship funding proposals, refinement of educational presentations, or expansion of programs within those other sectors.



3.5.3 Evaluation of Reserve Research and Monitoring Program

Currently, the Reserve evaluates success of SWMP through completion and submission of monthly, quarterly, and annual datasets and metadata, followed by national review, revision and approval of those data and metadata per standards set forth by the NERR System. Fundraising and expansion of the R&M Program is assessed through submission of grant proposals, receipt of funding awards, and initiation of sustainable new monitoring and research activities. In addition to posting of science projects and products on the NOAA/NERRS Research and Monitoring Database, publication of peer-reviewed journal articles, book chapters and technical reports is another strategy for evaluating the success of the program, as the science included in those products has been deemed worthy of publication by the scientific community. To a lesser degree, delivery of posters and oral presentations serve as another means to evaluate the program and is at least a necessary component of making demonstrable progress. Direct requests for scientific information and feedback on program accomplishments from site partners and resource managers also helps to inform and incentivize R&M Program activities. In addition, annual performance evaluations completed for R&M Program staff are used to assess progress and take concrete steps towards increasing productivity and efficiency.

Over the next five years, R&M Program staff will work closely with natural resource managers at both Reserve sites to ensure that the most pressing information needs are being addressed and that the research and monitoring data produced by the program is understood and applied appropriately. The R&M Program Advisory Committee will be reformed in 2018 and will include voluntary regional or national experts in a variety of relevant fields including climate science, meteorology, physical, chemical and biological oceanography, restoration ecology, and social science. The committee will meet once annually to review and inform program planning and annual work plans, and will be available for individual consultations as needs arise. Furthermore, each January, about halfway through the fiscal year, R&M program staff will collectively evaluate the tasks set forth in that year's operating grant, gauging progress to date and refining work plans for the second half of the fiscal year. Immediately following that mid-year check, the next year's operating grant proposal will be developed to strategically complement and build upon recent successes and lessons learned. And in future years, the Reserve's formal 312 performance measures and other NERRS standards may change, and the program will need to adapt to those changes in appropriate and sustainable ways.

Major outcomes that we aim to achieve within the next five years are:

- Increased understanding of long-term trends and short-term variability in water quality, weather, and wetland responses to sea-level rise at the Reserve sites;
- Increased understanding of the ecology and ecosystem processes inherent to the Reserve;
- Designation of two secondary SWMP stations (one water-quality and one weather station) in Richardson Bay in collaboration with Smithsonian's MarineGEO and others;
- Completion of a comprehensive and sustainable operations plan for the R&M Program, including updated strategies for staff retention, infrastructure maintenance, and program expansion; and
- Implementation of NOAA and NERRS protocols and initiatives that both support and are supported by SF Bay NERR (e.g., sentinel site monitoring, national data syntheses).
- Data will be made available to the public through the NERRS Central Data Management Office (<http://cdmo.baruch.sc.edu/>)

Research and monitoring contributions that we aim to deliver to both scientific and management communities include:

- Site-based SWMP data that are both reliable and understandable (e.g., with appropriate metadata), including basic data products like habitat maps and summary graphs available from the NERRS Centralized Data Management Office at <http://nerrdata.org> and other websites;
- Long-term monitoring infrastructure in tidal wetlands at the Reserve sites, including surface elevation tables, water-level loggers and permanent monitoring plots;

- As funding permits, participation in the development of regional monitoring programs that support tidal marsh restoration projects
- Collaboration with other NERRs on the west coast and nationally to support and promote the value of comparative data based on standardized long-term research and monitoring;
- Conference presentations (oral and poster) and peer-reviewed data products including journal articles, technical reports, and interpretive materials;
- Case studies or examples of project connections between research, education and stewardship (e.g., through cross-sectoral communication products, trainings, or collaborative projects);
- Site-based research symposia and/or journal special issues to bring together regionally scientists and decision makers and to promote knowledge sharing and collaboration; and
- Advisory support of research and monitoring at Reserve sites, as well as regionally and nationally through participation in committees, review panels, teaching, advising and mentoring.

3.6 Research and Monitoring Program Needs and Opportunities

Signatory partners of the Reserve have articulated priority research needs at both the site level and regionally. At China Camp, the principal research needs center around ecological impacts of North San Pedro Road., which bisects the tidal marsh and exacerbates local flooding by restricting tidal flow and storm water runoff. The paved roadway and aging culverts beneath it are rapidly deteriorating and, along with expanding car pullouts, are crumbling into adjacent tidal marsh on the bay side and brackish/ruderal marsh on the upland side. California State Parks staff that oversee conservation and natural resource management at China Camp have identified the need to understand hydrology, sedimentation and vegetation patterns on both sides of the road during dry and wet seasons and also as a function of tidal conditions. Establishing baseline conditions for these critical habitat-maintaining processes is necessary for subsequent assessment and understanding of potential impacts of removing or modifying the road, as well as for understanding how a range of ecosystem states and management scenarios will be affected by future rates of sea-level rise. Another stakeholder need at China Camp is to understand potential impacts (positive and negative) of subtidal eelgrass restoration on local patterns of sediment transport and deposition, especially in the context of sediment delivery from subtidal waters across intertidal mudflats and onto the historic tidal marsh plain.

At Rush Ranch, the principal research needs include understanding cumulative impacts of invasive perennial pepperweed and the appropriateness and efficacy of potential treatment and control methods. Another pressing need is contemporary mapping of the distribution and abundance of sensitive (federally and state listed) plant and animal species, as well as scientific assessment of the responses of those species to a variety of conservation and management practices at the site. Additional prioritized needs at Rush Ranch include assessing the benefits and impacts of habitat restoration projects at the site, understanding the population dynamics, distribution and impacts of feral pigs in the tidal marsh, and understanding the importance of the tidal marsh for carbon cycling and provisioning of food subsidies for native fishes.

Regionally, BCDC has prioritized the need for greater understanding of sediment supply to tidal marshes, the resulting accretion in those habitats, and corresponding resilience of shorelines and tidal marshes in response to anticipated changes in sediment supply and rates of sea-level rise. These informational needs complement a wide range of related priority issues identified in regional planning documents such as the recently released Baylands Ecosystem Habitat Goals Science Update (<http://baylandsgoals.org/science-update-2015/>) and the San Francisco Bay Subtidal Habitat Goals Report (<http://www.sfbaysubtidal.org/report.html>).

The R&M Program already has begun pursuing some of these research needs and is well positioned to generate meaningful insights within the next five years. At China Camp, the program has collected repeat measurements of sediment supply and corresponding accretion in the tidal marsh, and sentinel site monitoring infrastructure that is

planned to be installed at that site will provide more detailed information on water levels and sediment elevations on either side of North San Pedro Road. Information about the potential for positive and/or negative impacts of eelgrass restoration on sediment delivery to the tidal marsh at China Camp will rely on initiation of eelgrass restoration projects and accompanying ecological studies by other scientists in the region.

At Rush Ranch, the first baseline habitat map for the site (submitted to NOAA in 2016) and a variety of complementary and higher resolution mapping efforts (by the Reserve's Stewardship Coordinator in collaboration with the SLT) have clarified current distributions of key plant species in the marsh, including perennial pepperweed. However, additional information is still needed on ecological effects of invasive species (including feral pigs) as well as tradeoffs among various control methods, and the R&M Program does not currently have the capacity to meet those needs. Instead, those needs will be publicized on the Reserve's website and advertised to targeted researchers both regionally and nationally in an attempt to attract the necessary research attention by known experts in the field along with graduate students in their labs. Similarly, current distributions of most special status species (e.g., Ridgway's Rails, Black Rails, Salt Marsh Harvest Mouse, plants and some native fishes) are not documented and would require external expertise to fulfill the stated research needs. The R&M Program will collaborate with the SLT and Stewardship Program to request appropriate surveys by staff from groups like the USFWS and Point Blue Conservation Science, which are well positioned to collect the needed information about those species. Assessing potential impacts of conservation and management actions targeting those species can occur only after the current abundance and distribution of those species are known, and follow-up investigations will be encouraged by soliciting the attention of appropriate experts after baseline information has been gathered. Studies of carbon cycling are already in progress both in the tidal marsh and surrounding subtidal creeks, and a study of tidal marsh provisioning of food subsidies for native fishes is planned to begin in 2017 with R&M Program staff working to support the principal investigators from University of California at Davis (UC Davis). Monitoring the benefits and impacts of tidal marsh restoration projects at Rush Ranch will involve some ongoing monitoring via SWMP and also new data collection as specified in the external awards funding those restoration projects. Staff of the R&M Program will assist with some of those efforts

as possible, although new part-time or seasonal technicians will need to be hired in order to comply with the monitoring required by the project funders.

A variety of programmatic efforts will be used to address regional needs for information about sediment dynamics and shoreline resilience. The R&M Program in particular will continue collecting sentinel site data at both Reserve sites and more detailed data on sediment delivery and transport into, across, and out of the marsh at China Camp. Vegetation monitoring, and especially tracking of horizontal shifts in the boundaries of transitional ecotones, also will provide useful data for assessing tidal marsh responses to changing sediment supply and sea-level rise. Future collaborative opportunities should arise for high-resolution remote sensing of regional marshes, relatively accurate elevation mapping of these low-relief habitats, and modeling efforts designed to evaluate the susceptibility and/or resilience of tidal marshes to changing conditions. The cumulative insights generated through all these integrated efforts capitalize on the capacity and mission of the Reserve and also directly apply to the most pressing management needs identified for the region.

The primary limitation of the R&M Program is the small number of staff that can be consistently supported with annual operating funds, especially given the rising costs of living in the region. Over the past eight years, technician support for the program has been maintained at between 1.75 to 2 full-time positions including paid graduate student support. Additional work from occasional interns and volunteers also has helped maintain SWMP, but availability of paid staff and trained volunteers still falls short of what is needed for full implementation of program activities, especially given the increase in program scope in recent years and the high workload on existing staff. Despite the obvious benefits of recruiting outside funding support for special projects, an associated challenge is planning for the fluctuating benefits and obligations that accompany that external funding. Short-term, project-based funding can enable the hiring of more staff, but then maintaining those staff positions becomes a challenge as budgets run out and projects end. Moreover, during periods when the program can support only 1.75 full-time staff, nearly all of that staff time is committed to core SWMP activities alone. The resulting shortage of staff time limits the capacity of the program to accept periodically available small amounts of external funding, even when those short-term projects align with Reserve priorities.

Another important fiscal limitation is the modest budget available for program supplies and equipment. Despite

recent support of OCM for sondes and sentinel site infrastructure, this limitation applies to the entire NERR System and has been the topic of considerable discussion and debate at both the regional and national level. Out of budgetary necessity, our supply budget for SWMP has decreased by almost 50% over the past five years while at the same time the costs of purchasing and maintaining sondes has increased and is expected to rise further as reserves continue replacing their expiring sondes with the newer, more available model. A related limitation of our operating budget is the small amount of funding available for local travel, which in the past has not accounted for boat fees currently necessary for maintaining SWMP (as previously those fees were deducted from the SWMP budget for supplies and services). As boat fees increase and if SF State begins imposing daily fees for vehicle use, as is currently intended, travel costs for the R&M Program will become more limiting.

Fieldwork at the Reserve sites is limited to some degree by typical factors such as tidal flooding and site access, but one additional challenge is the seasonal closure of tidal marshes within the Reserve for all but the most site-relevant research and monitoring activities. Both sites are home to a number of special status species, and human activities in the marsh during reproductive seasons of spring and summer can result in accidental take of certain species like Ridgway's Rails and California Black Rails. Therefore, most fieldwork in the marsh is limited to the fall and winter months despite only marginally favorable daytime low tides during those seasons. Negotiating the ongoing and necessary balance between protecting sensitive species and making use of the Reserve sites for research and monitoring is an underlying theme of the NERR System overall, and is one of the many good reasons to foster cross-sector collaboration and open communication between scientists and natural resource managers.

The small number of sites included in the Reserve limits regional relevance of the R&M Program. China Camp and Rush Ranch, although exemplary sites in their respective sub regions, only represent two points along a continuum of salinity regimes and tidal habitats within the estuary. Additional sites would allow broader comparisons across geographic and environmental gradients, even if those additional sites only had a subset of the long-term data currently collected by the program. Comparing data from Reserve sites to those collected in other areas already is and will remain a strong focus of the program, but the official designation of new Reserve sites within the SFE would enable more coordinated effort across

sites and provide leverage for future opportunities. Such consideration should be given when developing future Management Plans.

The Reserve is fortunate to have access to a wide variety of opportunities to strengthen and expand the R&M Program. The success of previous programmatic activities provides a lot to build upon, including the foundation of long-term monitoring equipment, standardized protocols, novel experiments, and resulting data that the program has advanced to date. Meaningful collaboration with the Reserve's signatory partners is expanding, particularly at RTC and IGISc. Site partnerships are thriving as well, including active initiatives underway with both California State Parks and the SLT. Other key institutional, agency and non-profit partnerships also continue to bring added value to the R&M Program.

Regionally, there is growing scientific and management interest in Reserve sites and the natural resource issues being examined therein. That interest has led to more awareness of what can be gained from coordinated research and monitoring, and as a result high-quality science that addresses key management needs is increasingly being proposed at and around both Reserve sites. Collectively, the R&M Program along with other Reserve programs and collaborators are contributing to regional initiatives and citizen based efforts to improve health and quality of the estuary. Future collaborations and outreach will promote the estuary as an example of how to effectively couple estuarine science and management with broad support and involvement from educators, students and the public.

One overarching opportunity for the R&M Program is also an incentive behind the program: contributing the data needed to monitor and assess environmental challenges facing the estuary. Pressing challenges include annual changes in freshwater runoff and sediment supply to the estuary, increasing temperatures and decreasing pH of coastal waters, change in patterns of land-use, accelerating sea-level rise, invasive species, habitat restoration, management of special status species and more. By combining long-term monitoring with focused investigations, the R&M Program can provide data necessary for understanding and solving these many challenges. As with all the opportunities noted above, one requirement for success will be linking program expansion with tangible mechanisms for securing the funds necessary for that expansion.

CHAPTER 4 - EDUCATION PROGRAM

4.1 National Education Program

The National Estuarine Research Reserve System's mission includes an emphasis on education, interpretation, and outreach. Education at each reserve is designed to fulfill the reserve system goals as defined in the regulations (15 C.F.R Part 921(b)).

To sustain these system goals, the 2017-2022 Reserve System Strategic Plan outlines education objectives to increase coastal residents' and visitors' awareness and ability to improve stewardship of estuaries, coastal watersheds, and their communities; improve educators' and students' understanding and use of the reserve system and NOAA resources for place-based and inquiry-based learning; and grow and motivate the next generation of coastal professionals through access to programs and facilities that facilitate research, resource management, and educational opportunities.

Reserves conduct formal and informal education activities, as well as outreach activities that target culturally diverse audiences of educators and students, environmental professionals, resource users, and the public. Education and public programs, interpretive exhibits, and community outreach programs integrate elements of reserve system science, research, and monitoring activities and ensure a systematic, multi-faceted, and locally focused approach to fostering stewardship.

The reserve system is committed to providing tomorrow's leaders with the knowledge and understanding of our nation's oceans and coasts to be responsible stewards. To fulfill this commitment, the reserve system has created the K-12 Estuarine Education Program (KEEP) to increase the estuary literacy of students, teachers, and the public. KEEP helps students and teachers learn about essential coastal and estuarine concepts, develop data literacy skills, and strengthen their critical-thinking, team-building, and problem-solving skills. K-12 and professional development programs for teachers include the use of established coastal and estuarine science curricula aligned with state and national science education standards and frequently involves both on-site and in-school follow-up activities. Community education and outreach is another priority for the reserve system. Community education programs foster behavioral change to promote resource conservation. These programs work with audiences whose choices directly impact the integrity of our estuaries and their associated watersheds.

4.2 Reserve Education Program

4.2.1 Background and Integrated Approach

The watershed of the San Francisco Estuary encompasses roughly 40% of the state of California. Nine counties make up the San Francisco Bay Area, which is home to more than 7 million people. Because of the large population size and vast geographical scale, the Reserve focuses its education resources at Reserve sites and in the counties in which those sites are located (Marin County for China Camp and Romberg Tiburon Center, and Solano Counties for Rush Ranch: see Figure 3). However, specific programs often reach audiences throughout the Bay Area, such as workshops for teachers, and many of the program materials are useful regionally and nationally, such as lesson plans.

In 2011, the EC led the Reserve's K-12 education program through a Market Analysis and Needs Assessment, as outlined by national K-12 Estuarine Education Program guidelines. The results of these assessments have driven K-12 education program development. In particular, we have focused on the following findings from the Needs Assessment:

1. The Reserve was better positioned to support teachers from Marin County than from Solano County because they had more flexibility in their curriculum and more access to resources (like natural habitats adjacent to their school) that are helpful when incorporating Reserve lessons and research into their work. In contrast, teachers in Solano County were restricted in what they were able to teach and had limited access to natural habitats to study.
2. Most local teachers were not using NOAA and/or NERRS resources, like Estuaries 101 or SWMP data, so there was an opportunity for the San Francisco Bay NERR to promote the use of these resources through teacher professional development or other avenues.
3. Marin County high school science teachers were very interested in opportunities to conduct authentic water-quality monitoring with their students.

Recent changes in education standards towards Common Core and Next Generation Science Standards have created new opportunities that were not present in 2011. The EC has kept up with changes by evaluating existing education programs, participating in regional environmental education meetings and trainings, pilot testing ideas, and taking every opportunity to talk with local teachers. In particular, there are three key changes the Reserve is responding to:

1. The Reserve expects teachers from Solano County to have more flexibility in their curriculum, and more ability to incorporate Reserve science into their classrooms under the new standards.
2. There is increasing demand from elementary educators for professional development in science, math, and engineering.
3. There is more interest in students developing science skills and practices.

Whichever way educational reform moves in the next five years, the Reserve's education programs will continue to support each of the three goals laid out in this Management Plan. The content taught in education programs is cross-sectoral and is therefore tightly integrated with the Reserve's priorities, and aspects of that content change as research, stewardship, and coastal training programs focus changes. The activities within the Reserve, for example the research team's focus on oyster monitoring or the impending restorations at Rush Ranch, can drive education program content in new directions, while the basic structure of the programs can stay the same.

Following this basic structure, the education program supports research, training, and stewardship programs by aligning program content to active areas of research and stewardship. For example, the EC leads interpretive walks during the highest high tides each year and uses the tidal flooding as an opportunity to teach about climate change and sea level rise. The walks incorporate Sentinel Sites and other marsh resilience research. They also build community support for topics that are important for stewardship of the site – like raising N. San Pedro Road.

For this model of flexible content that is inherently cross-sectoral to be effective, the EC needs to be engaged with ongoing research, stewardship, and restoration activities at the sites. To facilitate that inclusion, the EC assists research

program and other scientists with SWMP and other fieldwork. In addition, the Research Coordinator regularly shares proposals, anecdotes, and data from ongoing projects so the EC can stay informed and excited about those projects. The RC also shares newly published work of relevance to NERR education. The Research Technicians regularly help with many aspects of the education program, such as setting up experiments for education events, assisting with data analysis and interpretation, helping to teach, and much more. The engagement with stewardship activities and research activities managed by Reserve affiliates needs to be strengthened, through the EC participating in field work and the inclusion of the EC in stewardship planning and discussions.

4.2.2 Target Audiences

The primary target audience for our K-12 program is classroom teachers. Teachers were selected as the primary target audience because: (1) teaching teachers is the most effective use of limited staff time, (2) the Reserve has expertise in translating science and facilitating student research that is fairly unique among PD providers in the region, and (3) the local education market for professional development (PD) is not as saturated as the market for student field trip programs. Some of our programs have reached teachers from across the Bay Area (e.g. Coastal Science Explorations with NOAA and NatureBridge in 2015), while others have targeted teachers from specific counties (like iTEAMS, also in 2015). In the first 10 years of the Reserve, the professional development programs were aimed primarily at high school teachers. The K-12 Needs Assessment affirmed this focus on high school science teachers, but also noted a potential opportunity with elementary school teachers. New science standards have created a stronger demand from middle and elementary school teachers, and our most recent professional development programs have focused on those audiences.

The estuarine education market in the Bay Area offers plentiful opportunities for excellent student field trip programs, including field trips to our Reserve sites. At Rush Ranch, estuary science field trips are led by Resource Conservation District, several Universities, and on an ad-hoc basis by the Reserve/SLT Tidal Marsh Docents. At China Camp, WildCare, Vilda Foundation, Friends of China Camp docents, and others lead field trip programs. The Reserve staff therefore only occasionally led field trip programs, and those are typically for specialized high school classes or college (post-secondary) classes.

An analysis of performance measurement data from fiscal years 2011-2016 (the years covered by the previous Management Plan) demonstrate a sustained commitment to the target audiences described above, and to in-depth programming for teachers (as evidenced by relatively high number of contact hours per teacher): see Education Figures 13 and 14.

4.2.3 Public Outreach

The Reserve considers outreach programs to be those that facilitate short interactions with many people and are therefore suited to raising awareness of the Reserve around the San Francisco Bay Area, but not deep instruction. The primary public outreach programs the Reserve participates in are annual open houses at Rush Ranch, China Camp, and the Romberg Tiburon Center. We focus outreach time primarily on these events because:

1. Our participation helps our partners to have successful events. For example, our participation at Ranch Day at Rush Ranch adds a science component that may attract additional families to an event that is primarily focused on cultural history.
2. Audiences at these events are likely to have some connection to the site already, or an interest in building a connection, so they may be interested in the NERR. For example, a recreational swimmer may visit the NERR exhibit at Heritage Day at China Camp, learn about the SWMP data, and then become regular user of that data.

Across the three open house events, we reach over 1,000 people annually.

Relative Contact Hours between NERR Education Coordinator Across K-16 Audiences (Average of FY11-16)

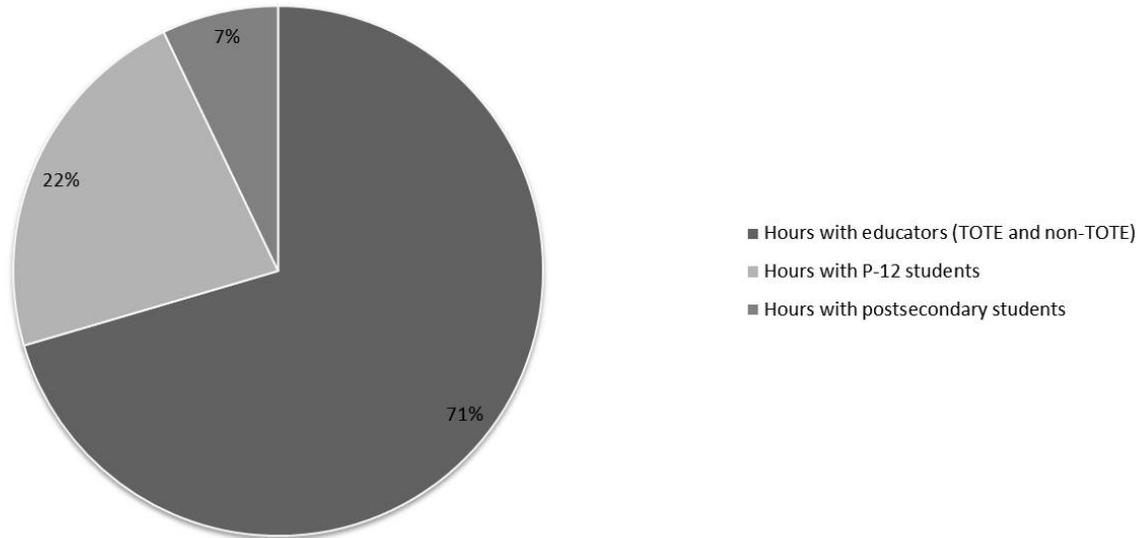


Figure 13. Relative percent of contact hours across audiences for fiscal year 2011-2016 data, as reported to NOAA. The average actual contact hours across fiscal years 2011-2016 were: 774 for educators, 246 for K-12 students, and 78 for post-secondary students.

Relative Numbers of People Reached by Education Coordinator Across Audiences (Average of FY11-16)

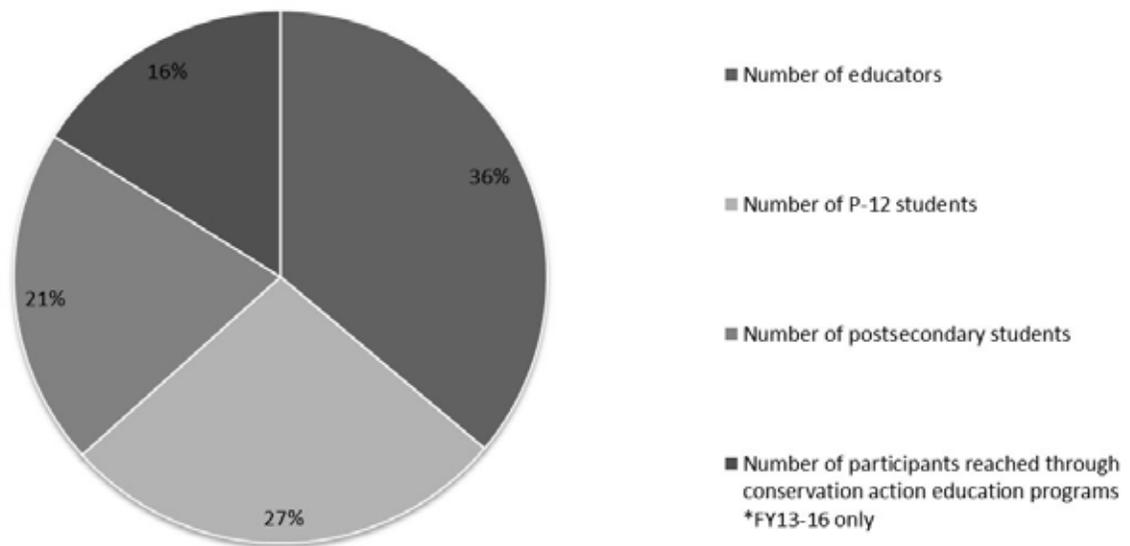


Figure 14. Relative percent numbers of people reached across audiences for fiscal year 2011-2016 data, as reported to NOAA. The average actual numbers for fiscal years 2011-2016 were: 77 for educators, 58 for K-12 students, 44 for post-secondary students, and 34 for conservation action education programs.

“Build a Buoy”: Elementary school teachers test ocean observing stations they designed and built in a wave tank. The activity integrates NOAA science with new engineering standards. Photo by Sarah Ferner



4.2.4 Community and Public Education

The Reserve leads several more in-depth education programs for public audiences, most significantly the Tidal Marsh Docent Program in partnership with Solano Land Trust. Other public education activities include: leading interpretive walks at the Reserve sites, establishing citizen science projects at the Reserve sites, creating interpretive exhibits, and writing blogs and newsletter articles (for the Reserve, RTC, SLT, and others). In each of these cases the audience is people who have some connection to a Reserve program, partner program, or to the site already. Their connection may be significant, like that of a Tidal Marsh Docent, or loose, like that of a member of the Solano Land Trust who has not visited Rush Ranch. We focus the education programs on people with some existing connection to support our partners and maximize effectiveness of our programs. Some public education programs are intended to create behavior change (like king tide walks) while others are primarily about increasing science literacy and support (like Science Discovery Labs).

4.2.5 Education Program Capacity

The education program is currently limited to one paid staff member, the Education Coordinator, as it has been since the Reserve was established. The EC works in partnership with educators from other organizations, including those representing Solano Land Trust, Friends of China Camp, California State Parks, and the Romberg Tiburon Center. Volunteer docents also assist greatly with education at Rush Ranch, allowing us to reach many more people than we would otherwise.

The education program works out of RTC, China Camp, and Rush Ranch, and uses facilities at each site.

The Education Program has access to the RTC facilities, including a spectacular office with phone and high-speed Internet access, teaching and research labs, classroom and workshop space, and guesthouse. The EC has also amassed many teaching supplies and materials needed to teach about estuarine science, from bags of rocks to HOBO temperature loggers, most of which are stored at RTC.

The Reserve has full access to a small laboratory and large classroom at the Rush Ranch Nature Center, as well as trails, exhibits, and outdoor teaching spaces at Rush Ranch. There is also storage space for Science Discovery Lab and other docent-related education materials.

Facilities are more limited at China Camp, but the Reserve has access to trails, cultural and natural history exhibits, protected sandy beach, cultural history museum, and picnic tables. China Camp Beach allows for easy, safe access to estuarine water and life.

As evidenced by facilities use, we could not do our work without cooperation from the core partners that make up the Reserve: SLT, California State Parks, and SF State (including RTC and the Department of Education). Our Education Programs also work closely with FoCC, other NERRs, and NOAA National Marine Sanctuaries. We have also worked with other groups on a project-by-project basis, including: Dominican University, Solano Community College, Exploratorium, NatureBridge, Richardson Bay Audubon Center and Sanctuary, and others.

4.2.6 Education Program Delivery

The K-12 Education Programs align with KEEP. Our past Teachers on the Estuary (TOTE) workshop met national guidelines, but didn't have the Reserve-specific focus of TOTEs done without as many partners. Beginning in 2016, the Reserve will implement TOTE programs at one or more Reserve sites that will more closely match the unified national model of TOTE. We will also continue to explore partnership opportunities that improve the quality and effectiveness of our professional development workshops.

The content of the Education Programs changes as research foci change in response to new environmental concerns, management needs, and funding opportunities. This flexibility in content allows our programs to remain on the cutting edge of science, which is a key factor in the attractiveness of programs to teachers and the public. It also means that we are able to align with NERRS Science Collaborative grants, when appropriate, and with NERRS initiatives. For example, the original education program content was heavily focused on wetland restoration, whereas new content is more focused on climate change and sea level rise. The EC sought out additional training through participation in the National Network for Ocean and Climate Change Interpreters (NNOCCI) to improve her own ability to teach about climate change. With more recent build-out of sentinel site monitoring in the San Francisco Bay NERR, the EC has incorporated more information about long-term monitoring into programming and created opportunities for visitors to take part in that monitoring through Nature's Notebook and other citizen science initiatives. A key to the success of this approach is the EC remaining involved with research and stewardship activities within the Reserve.

"Discovery Day": Reserve Education Coordinator Sarah Ferner talks with visitors about oysters and salinity at the Romberg Tiburon Center's Discovery Day. Photo: Wil Matthews.



4.2.7 K-12 Education Program Activities

1. Professional development for teachers, including TOTE and non-TOTE workshops at the Reserve and with partners beyond sites
2. Adapting, collecting, and sharing lesson plans
3. Supporting teachers in implementing lessons plans
4. Sustaining engagement with teachers by writing science summaries and stories for the blog
5. Evaluation of programming and creation of success stories
6. Writing grants to fund additional education staff, support partner staff, provide materials, and off-set costs typically covered by the operations grant

4.2.8 Public Education Program Activities

1. Tidal Marsh Docents at Rush Ranch (consideration of expansion to China Camp and/or Richardson Bay)
2. Interpretive programs led by the EC
3. Interpretive programs, including Science Discovery Labs and Marsh Walks, led by docents
4. Citizen science opportunities – including Nature’s Notebook, King Tide Photo Monitoring, and Picture Post
5. Sustaining engagement with docents and visitors by writing science summaries and stories for the blog
6. Reaching new audiences and supporting our partners by continuing to write articles for their newsletters
7. Outreach at three open houses each year (one each at Rush Ranch, China Camp, and RTC)
8. Creating new NERR post card to replace or supplement Reserve brochure
9. Exhibits, if needed
10. Evaluation of programming and creation of success stories

Additional details about the program activities can be found in the K-12 and Public Education Logic Models.

4.2.9 Evaluation and Outcomes

The Reserve evaluates all significant programs event by event. For example, the participants in the TOTE workshop at Rush Ranch in 2016 took an informal evaluation mid-workshop and turned in formal evaluations at the conclusion. The mid-workshop evaluation asks for feedback on pacing of the workshop so far, on activities that were helpful or not, and other questions that can be used to shape the content of the next day. The final evaluation asks questions to shape follow-up with those teachers as well as inform future workshops, like: ranking of confidence in teaching the content before and after the workshop, sharing one way the teachers expects to integrate the content in their teaching, and remaining barriers or concerns about implementation. Results from evaluations and quotes are often shared in annual progress reports. For example, in the TOTE mentioned above, 100% of participants reported that they were satisfied or extremely satisfied with the quality of the content, quality of instruction, and whether the workshop met their needs.

NOAA has recently changed evaluation requirements, asking for more detailed evaluation results for teacher professional development and stewardship programs, in particular. As a result of these new requirements, the EC implemented the Reserve’s first lagging evaluation; evaluations were sent in January 2016 to all teachers who participated in a summer 2015 workshop (as required by new NOAA reporting guidelines). We will continue to adapt to the new requirements and to strengthen our ability to capture and tell success stories for local and national use. Total program numbers are also reported to San Francisco State University as part of RTC’s Annual Report.

Under this new Management Plan, more emphasis will be placed on sharing successes of our programs internally with our

partners (through emails, conversations, and posting on Facebook or our blog), externally by writing about successes and sharing those in partner newsletters and with SF State, and reporting to NOAA following the new guidelines that include narratives and additional evaluation metrics.

The Education Program Advisory Committee will be reformed in 2018 and will include colleagues from our partner organizations (SF State, FoCC,, and SLT) as well as other regional experts in estuarine science or science education. The committee will meet once annually to review and inform program planning and annual work plans, and will be available for individual consultations as needs arise.

K-12 Education Program Outcomes Include:

1. Teachers using NERRS lessons, data, and science (as measured through formal evaluation)
2. Teachers implementing research, monitoring, and stewardship projects with students (as measured through formal evaluation)
3. Teachers returning to the Reserve for resources, updates, and to sign up for more trainings (as noted by EC when one-on-one conversations occur and through tallying of e-newsletter and website hits on articles and pages directed at teachers)
4. Evaluations and summaries that show our success (as measured through submission of success stories and publication of blog posts)

Public Education Program Outcomes Include:

1. Increased recognition of the Reserve and site partner(s) by docents and participants (as observed by Reserve staff anecdotally)
2. Increased understanding of methods + practice of science by docents and participants (docent understanding measured through formal evaluation)
3. Increased commitment to stewardship of estuary, as shown by participation in stewardship or citizen science activities (as measured through formal evaluation)
4. Docents and visitors seeking opportunities for additional involvement with NERR + site partner (as measured through tallying of e-newsletter and website hits on articles and pages directed at docents or advertising events for those audiences, and through numbers of people participating in events)

Additional details about the program activities can be found in the K-12 and Public Education Logic Models.

4.2.10 Education Future Needs, Opportunities, and Limitations

Our education program is primarily limited by staff; with just one educator, it is difficult to accomplish all the important education we would like to do. In the past, this need has been partially met by working collaboratively with many partners. In this 5 years, we will explore more defined partnerships with RTC and SF State to fill education staffing needs through partnerships rather than new positions or through low-cost solutions like graduate student assistants or interns. The education program has tended to follow grant opportunities and direct requests. In the next five years, the program will be focused on creating a more defined, interconnected, and stable set of programs following the logic models and cross-sector priorities established in this Management Plan. In particular, we see the following needs and opportunities.

4.2.10.1 K-12 Education Program

The needs of teachers that the Reserve is well positioned to assist with include professional development around incorporating science, research and monitoring into classroom studies and assistance meeting Next Generation Science

Standards, especially Practices of Science. The SLT has also identified that they would like to cooperate on professional development trainings for teachers, to meet their goal of serving as a catalyst for education. RTC has also identified this as an area of strength and future growth. The collaboration with our partners, the NERR can meet the needs of teachers stated in #1 above. The EC will need to continue to seek out Next Generation Science Standards professional development trainings for her to meet this need most effectively.

We also see a need at both Rush Ranch and China Camp to provide information about research and science happening at the sites to educators leading field trips programs there. The NERR may be able to assist our partners in meeting this need, if it is a high priority for SLT and/or California State Parks.

4.2.10.2 Public Education Program

At Rush Ranch, there is a need for local, hands-on science opportunities for the public. We have begun to address this need through Science Discovery Labs, a program that also supports the Tidal Marsh Docent Program by offering more opportunities to teach (and different types of teaching).

There are needs for education and interpretation at China Camp, including: changing visitor behavior to better protect the marsh (e.g. parking along North San Pedro Road), additional opportunities to involve visitors in or inform them about research and monitoring, and assisting California State Parks and Friends of China Camp with coordination of other groups using the Park. The Reserve can assist with some education needs at China Camp, but will depend on State Parks to help prioritize those needs.



"Marine Debris Exhibit": A visitor learns how she and her family can protect the marsh from ocean trash while visiting China Camp. This exhibit was funded by NOAA's Marine Debris Program. Photo: Sarah Ferner

Table 1. K-12 Education Program Logic Model

Audience: Classroom teachers, primarily from the Bay Area					
Overall goal is to assist teachers in leading authentic science studies, using the San Francisco Estuary and watershed as an example or context.					
Objectives	Resources	Activities	Outputs	Short-term Outcomes	Mid/Long Outcomes
*Teachers will incorporate content, lessons, data into class	*EC's knowledge and involvement with research	*Plan and lead TOTE and non-TOTE PD workshops	*Lesson plans and resources collected on NERR website	*Teachers teach more estuarine or watershed science or long-term monitoring	*Increased science literacy of students and teachers
*Teachers will report satisfaction with training	*EC time *Web assistant (or EC time) to post and maintain links	*Provide in-class modeling + help *Recruitment *Application development and review	*Teacher application for participation in TOTE *Teacher stipend awards for TOTE	*Teachers implement research or stewardship projects	*Increased confidence in designing and leading student research or data analysis
*Teachers will report increased confidence in NGSS skills	*RC, Tech, SC, and others time *NOAA/NERR data	*Development and review *EC involvement with research	*List of research and stewardship project ideas *NERR support in class and field visits	*Teachers know how NERR lessons and content relate to NGSS	*Increased confidence in ability to teach NGSS
*Teachers will report intention to refer colleagues	*SF State Ed Dept. *EI01	*Development of project ideas *Adapt and post lessons	*NERR teaching TOTE and non-TOTE workshops	*Teachers have increased understanding of ecology and threats to SFE	*Increased commitment of students and teachers to stewardship of estuary, as demonstrated by participation in stewardship or citizen science activities
*Teachers will know where to look for more information from NOAA/NERR	*Existing NERR resources and articles *coast.noaa.gov/estuaries	*Write blogs with science summaries and data *Maintain recommended resource lists	*Other resources collected on website *Blog and partner newsletter articles	*Teachers use lessons, data, and science stories from NERR trainings in class	*Long-term participation of teachers in NERR, e.g. through attending follow-up trainings or seeking out more significant involvement
*Teachers will participate in follow-up activities (e.g. read blog, class support, additional training, etc.)	*Web tracking stats *\$ for attractive workshops *SLT media outreach	*Write and submit grants *Maintain teacher email list *Adapt and vet evaluations *Write press releases	*Curated resource list and updated reading list *Grant(s) to support additional staff *Updated teacher email list *Evaluations *Press releases *Success stories	*Teachers recognize NOAA/NERR as source of training *Teachers receive and read blog and other follow-up communications *Teachers share within and beyond own schools *Teachers complete post and lagging evaluations	*NERR builds stronger connections with local schools *Teachers report increased use of NOAA/NERR resources and new skills beyond scope of training (e.g. in teaching other topics)
*Teachers will implement research/stewardship projects	*SLT, RTC staff time? *Teacher email list	*Write and solicit stories		*Local coverage of training in news, school or partner newsletters	*NERR has portfolio of success stories

Table 2. San Francisco Bay NERR Public Education Program Logic Model

Audience: Visitors and other people with existing interest in one or more of San Francisco Bay NERR's programs or places					
Overall goal is improve science literacy and estuarine stewardship of the NERR community.					
Objectives	Resources	Activities	Outputs	Short-term Outcomes	Mid/Long Outcomes
*Docents will have strong NERR/SLT identity	*EC's knowledge and involvement with research	*Plan + lead docent training at RR	*Science discovery lab kits	*Increased knowledge of specific research or restoration project	*Increased perception of Reserve sites as places of science research
*Effective docents will remain with the program	*EC time	*Docent support at RR	*Interpretive tools	*Increased knowledge of interconnection between personal and community actions and health of estuary/site	*Increased understanding of methods and practice of science
*Docents will lead accurate and enjoyable programs	*RC, Tech, SC, and others time	*Docent and EC led Disco Labs and walks at RR	*Docent training materials	*Increased knowledge of ways visitor can steward/protect SFE	*Increased commitment to stewardship of estuary, as demonstrated by participation in stewardship or citizen science activities
*Docents will seek out continued involvement with NERR (read blog, attend events, etc.)	*SLT staff time	*Citizen Science at RR + CC	*Docent-created interpretive tools	*Practice doing science	* Increased recognition of NERR
*Participants will report satisfaction with event	*\$ for materials (hats, cards, name tags, etc.)	*EC engaged with research + stewardship	*NERR post card and banner	*Recognition of NERR and core partner	*Increased understanding of ecological importance of estuary and human interconnectedness
*Participants will report increased science knowledge or skill	*\$ for disco lab kits	*Write blogs with science summaries and data	*Blog	*Docents feel confident in ability to lead programs	*Some visitors move towards long-term participation NERR, e.g. through docent program or citizen science
*Participants will return for more programs	*Past docent training materials	*Maintain recommended resource lists	*Evaluations	*Existing docents remain active with program	*Docents seek opportunities for additional involvement with NERR
*Participants will know they attended NERR/SLT event	*Web hit tracker	*Create evaluations	*Press releases	*Docents complete evaluations	*NERR has portfolio of success stories
		*Write press releases (or SLT)	*Success stories	*Increased interest in docent program	
		*Write and solicit success stories		*Local coverage of programs in news or partner newsletter	
		*Create NERR post card and banner			
		*Purchase NERR hats, name tags			
		*Add docents to email list			

CHAPTER 5 –WETLAND SCIENCE AND COASTAL TRAINING PROGRAM

5.1 National Coastal Training Program

The reserve system has a responsibility to educate coastal decision makers and supports the reserve system goals, as defined in the regulations (15 C.F.R. Part 921(b)).

To sustain these system goals, the 2018-2023 Reserve System Strategic Plan outlines coastal training objectives to ensure that coastal decision-makers and environmental professionals understand and effectively apply science-based tools, information, and planning approaches that support resilient estuaries and coastal communities.

The Coastal Training Program provides up-to-date scientific information and skill-building opportunities to coastal decision-makers responsible for making decisions affecting coastal resources. The target decision-maker groups vary according to reserve priorities, but generally include groups such as local elected or appointed officials, managers of both public and private lands, natural resource managers, coastal and community planners, and coastal business owners and operators. They may also include groups such as farmers, watershed councils, professional associations, recreation enthusiasts, researchers, and more.

Reserves are uniquely positioned to deliver pertinent information to local and regional decision-makers given their place-based nature. Coastal Training Program coordinators know the local people, places, and science and are able to skillfully convene training participants and experts to address coastal management issues. Training programs are built upon solid and strategic program documents, including an analysis of the training market and assessment of audience needs. Coordinators then work with the results to identify how their program can best address local and reserve system priority issues.

Partnerships are integral to the success of the program. Reserves work closely with state coastal management programs, Sea Grant Programs, and a host of local partners in determining key coastal resource issues, target audiences, and expertise to deliver relevant and accessible programs.

5.2 Reserve Coastal Training Program Context

The San Francisco Bay Area is home to diverse populations, a booming economy and fragile ecosystems, all of which contribute significantly to the culture, values and politics of communities situated here. The Reserve sites are situated within a highly urbanized estuary that is the 5th most populous metropolitan area in the United States. Over seven million people reside in the Bay Area, and it encompasses 101 cities and towns, including San Francisco, San Jose and Oakland, and nine counties. In addition, the San Francisco Bay Area has incredible ecological richness in close proximity to its urban core. Approximately 90 percent of California's remaining wetlands are located in the San Francisco Bay Area. Climate change is creating pressing challenges for both the fragile and highly impacted ecosystems across the region as well as for communities as they grow and plan for the future.

The Reserve's Coastal Training Program (CTP) engages directly with communities and organizations to provide cost-effective, high-quality learning opportunities to coastal professionals that align closely with the geographic and management context of the San Francisco Bay. Trainings range in topic, depth and audience, from sensitive species trainings for natural resource and land managers to restoration monitoring techniques for researchers, consultants and regulators. In addition, CTP programs align with Reserve wide priority issues; coastal intelligence, coastal resilience and engaging diverse audiences, and incorporates these issues in all planning. Training programs and technical assistance products are developed to address the greater San Francisco Bay Area's pressing ecosystem and community issues and are designed to foster open, multidisciplinary communication and real-world problem solving.

We have recently merged the current CTP with the RTC Wetland Science Program (WSP). The former assistant manager at the reserve who was also the WSP coordinator has taken on the full-time role of CTPC. The newly merged program will

now be called the Wetland Science and Coastal Training Program (WSCTP). Management and funding for the CTPC will be shared between RM and RTC Director, Karina Nielsen. The goal of merging the programs is to build on the strengths of the two programs, increase visibility, expand the audiences, as well as to have a closer focus on our sites as well as maintain a regional support role. By sharing the funding of the position, both NERR & RTC can meet their outreach goals without duplication of effort. The Wetland Science and CTP Coordinator engages directly on site-related issues while remaining connected to regional partners and pressing management issues. For simplicity sake, we will hereafter identify the Wetland Science and CTP Coordinator as the CTPC.

5.3 Coastal Training Program Capacity Staff and Facilities

Since the last management plan was completed in December 2010, a number of formal and informal needs assessments were conducted, both individually and in conjunction with the Elkhorn Slough NERR CTP as well as with other partners. In addition, CTP workshops are evaluated to assess the effectiveness of the training experience, as well as to understand evolving training needs of workshop participants. These needs assessments and evaluations provide an important view into the training and technical assistance needs of CTP audiences.

One full-time Coastal Training Program Coordinator (CTPC) currently staffs the program. The CTPC plans, develops, organizes, and runs all trainings for coastal decision makers hosted by the Reserve. In addition, the CTPC regularly provides technical assistance to other sector programs and to partners. Office space is provided at RTC in Tiburon, CA. In addition to office space, the Reserve has conference rooms, research laboratory and additional office space for interns. The RTC campus also includes the Bay Conference Center and Ohrenshall Guest House that provides training facilities and accommodations for trainers and participants. Facilities are also available at the Rush Ranch component of the Reserve, including a classroom and guesthouse for trainers and participants.

An evolving role for the WSCTP is technical assistance. As defined by the CTP Performance Monitoring Manual, technical assistance represents a broad range of activities including meeting facilitation, providing survey and evaluation assistance, assisting partners with grant writing, assisting state agencies with plan revisions, assisting natural resource managers with implementation of best management practices, developing GIS products, assisting land trusts/watershed councils with strategic/action planning, creation of publications or websites for use by coastal decision makers, assistance writing comprehensive plans, ordinances, etc., and serving in advisory or leadership role on a committee/watershed group. The WSCTP is expanding its programmatic capacity in these areas.

5.4 Existing and Anticipated Partners

The Reserve has developed partnerships that benefit every aspect of the Reserve and these partnerships are essential for the success of WSCTP. Partners play a variety of critical roles for the Program, including: defining training priorities, collaborative development on training or technical assistance content (e.g., training materials, websites, reports), etc. developing grant proposals, advising on WSCTP-related projects, linking partners and leveraging relevant work, providing access to additional target audiences, providing subject expertise, or contributing additional resources or funding. In return, these developing partnerships benefit from the training design, product development, facilitation, and logistical expertise of WSCTP staff. Partners are vital to the success of WSCTP, and our thriving partnerships keep the program relevant to our mutually shared core audiences. The new CTPC plans to work closely with the Oakland office of OCM and meet with them informally on a quarterly basis.

The WSCTP Advisory Committee was established several years ago and membership is comprised of the Reserve signatory partners, as well as other organizations with which WSCTP staff have well-established working relationships that have contributed to the success of many past training programs and technical assistance products. The CTPC stays in regular contact with Advisory Committee members to update them of upcoming trainings and WSCTP - related projects, get feedback, brainstorm future ideas and to work as a sounding board and feedback mechanism for keeping WSCTP responsive and in tune with Bay Area audience needs. The table below provides names and representatives for the WSCTP Advisory Committee, as well as a brief description of the types of collaborations.



WSCP students performing their delineation practicum at Ring Mountain Open Space. Photo: Aimee Good.

5.5 Wetland Science and Coastal Training Program Advisory Committee

Table 3. Wetland Science and Coastal Training Program Advisory Committee

Organization and Role	Contact Name
<p><u>San Francisco Bay Conservation and Development Commission</u></p> <p>CTP engages with BCDC on coastal resilience and planning issues for the San Francisco Bay. BCDC staff attend and speak regularly at CTP trainings, and we engage closely on technical assistance.</p>	Adam Fullerton
<p><u>California State Parks</u></p> <p>As the land management partner for China Camp, CTP works with California State Parks to train land managers, scientists, field technicians and partners on stewardship-related issues.</p>	Cyndy Shafer
<p><u>Elkhorn Slough NERR Coastal Training Program</u></p> <p>SF Bay and Elkhorn Slough CTPs work together on a majority of trainings, to support outreach, training development and technical assistance. The two programs work to cover the broad range of training and technical assistance needs for the region by working collaboratively as well as developing grant proposals and completing needs assessments.</p>	TBD
<p><u>NOAA Office for Coastal Management</u></p> <p>CTP works with NOAA OCM to translate local tools, data and resources for coastal decision makers. There is a long and lively history of collaboration addressing innovative engagement practices, climate resiliency and sea level rise preparedness, green infrastructure, and process skills.</p>	Becky Lunde
<p><u>SF State/Romberg Tiburon Center</u></p> <p>There is an exciting nexus to translate emerging research from the Romberg Tiburon Center to CTP audience. CTP is working to forge a closer partnership through the merger with the Wetlands Science Program, the shared coordinator position and by engaging with researchers and the Director at RTC.</p>	Kathy Boyer
<p><u>Solano Land Trust</u></p> <p>As the land management partner for Rush Ranch, CTP works with Solano Land Trust to train land managers, scientists, field technicians and partners on stewardship-related issues.</p>	TBD

5.5.1 Non advisory partners

The WSCTP actively pursues additional partnerships. CTP has a history of working with these organizations in a similar capacity as with Advisory Committee members, and these partners should be considered for addition to the Advisory Committee in future revisions of the CTP Program Strategy. This list includes:

- California Coastal Commission
- California Coastal Conservancy
- San Francisco Estuary Partnership
- Greater Farallones National Marine Sanctuary & Association

- The Bay Institute
- San Francisco Estuary Institute
- SF Bay and Outer Coast Sentinel Site Cooperative

The Reserve WSCTP strives to collaborate regionally with the two other NERRs in California: the Elkhorn Slough NERR and the Tijuana River NERR. Each Reserve serves the needs of local audiences, but CTP Coordinators have found overlap in audience needs across the state. The newly appointed CTPC will be mentored by and work closely with both CTPC's from ESNERR and TRNERR. When relevant, these programs will deliver trainings together, support larger scale CTP collaborative efforts and share information and resources across Reserves.

5.6 Coastal Training Program Delivery

The WSCTP will implement and align with local, system-wide and national programs and priorities through a number of avenues. Program priorities are defined in close coordination with program staff, specifically the Reserve Manager. The *Coastal Training Program Strategy 2013-2018* serves as a core guiding document for the program as it bridges the previous and updated Management Plans. The primary activities of WSCTP are characterized according to the Performance Monitoring Manual as training and technical assistance.

Trainings: Trainings represent a core aspect of WSCTP. Trainings are often developed in close collaboration with partners, and extensive evaluation and needs assessments are conducted to identify training needs, formats, appropriate cost, preferred location, and preferred presenters. Results from needs assessments show that preferred workshop formats are field-based or classroom style formats. The WSCTP strives to serve audience needs by providing a mix of these formats. Training techniques regularly incorporated into WSCTP events include small group report outs, roundtable discussions, brainstorming sessions, utilization of visual aids, participatory exercises, panel discussions and formal presentations. As appropriate, Reserve and partner scientists communicate and disseminate relevant scientific results to stakeholders at WSCTP workshops. Workshops are typically delivered in 1-3 day formats, with a mix of indoor and field experiences provided. In the next 5 years, the goal is to integrate more closely with topics relevant to research and stewardship at our reserve sites as well.

Technical Assistance: The WSCTP engages with all Reserve sectors on technical assistance by leveraging CTPC skills as well as Reserve staff expertise for team building, strategic planning, grant development and project coordination. As mentioned previously, WSCTP is expanding its programmatic capacity in this area in close coordination with the Advisory Committee.

The WSCTP regularly incorporates NERRS system-wide programs, national programs, and priorities, as well as cross-sector perspectives and audiences into workshops and technical assistance. For example, the CTPC participates in NERRS Science Collaborative proposals, both as applicant as well as support, facilitates Research Sector meetings when appropriate, and has lead the effort to develop the SF Estuary Geospatial working group which highlights NERRS led remote sensing work. Depending on the workshop content, Reserve staff participate, present information, or support facilitation. This includes the incorporation of system-wide monitoring program data when possible.

5.7 Anticipated impacts and outcomes

Developing more robust programmatic and technology infrastructures will improve and expand program delivery capabilities. As its core mission, the WSCTP will continue to provide decision makers with access to the most up-to-date science in the format that is best for that audience, whether that format is field-based training, printed materials, facilitated discussions, online modules, or classroom-style workshops. CTP events will range from 4 hours to as long as a week and involve anywhere from 10 to 100+ participants. Training topics will continue to change and evolve along with

needs at our sites and in our region. At least 25% of programming will be new or redesigned trainings on an annual basis. Repeat topics will have had at least a 75% approval rating.

Training and workshop outreach is conducted through multiple avenues. These include: SF Bay NERR website, email outreach, social media, Reserve newsletter, individual outreach to partners, and leveraging outreach efforts in conjunction with the Elkhorn Slough NERR CTP. The WSCTP uses MailChimp and EventBrite as platforms for marketing and outreach via email and web to audiences. These services provide the benefit of being able to track responses, people following the WSCTP email list, and to keep our subscription list lively and up-to-date. Finally, Reserve WSCTP shares email outreach with its partner, Elkhorn Slough CTP. Through sharing email contacts, both programs are able to expand their reach and support each other's work. WSCTP partners also support event outreach through posting upcoming events on websites and email newsletters. When relevant, the CTPC also provides outreach for upcoming trainings and other events at meetings, conferences and other forums. Finally, the Reserve website was specifically designed with an events management function that provides a calendar of events and keeps the WSCTP Events Page current. Outreach will continue to expand and reach new audience members. The Reserve's email list will gain at least 30 new members/year.

Monitoring and evaluation are ongoing to ensure that the WSCTP is effective in its selection of topics, audiences, and delivery methods. The CTPC, often in collaboration with Elkhorn Slough NERR CTP, conducts the majority of program evaluation efforts. In addition, NOAA OCM provides valuable expertise on this topic that is often utilized, and the program reports their evaluation data to them. Achievement of short-term outcomes will be measured through participant evaluation surveys and other assessment techniques. Achievement of mid- and long-term outcomes will be measured through focus groups and interviews six months or more after participation, longitudinal research, and external program evaluation. Blog posts as well as weekly Facebook posts keep audience engaged in latest offerings and goings on with the WSCTP. In addition, the CTPC will ensure ongoing reporting to the National Performance Measure Database.

5.8 Coastal Training Future Needs and Opportunities

As previously mentioned, WSCTP regularly conducts needs assessments to determine primary training topics for the region. A vibrant training provider market already exists in the Greater Bay Area. These training providers range from environmental nonprofits working with rural community leaders, to state regulatory programs providing city planners with non-point source pollution prevention tools, to university extension programs offering certification in a range of coastal management-related professions.

Despite these myriad offerings, market analyses (available on the Reserve website) indicate that there is a niche for the CTP in providing low-cost, timely, scientifically sound and relevant programming that has been developed to meet the specific information needs of various professional sectors. The priority issues and objectives identified in the Coastal Training Program Strategy 2013-2018 are listed below. There is some overlap in these topic areas, due to the cross-disciplinary and ecosystem-based approach taken by the Coordinator. The primary gap is time and money, with only one staff member the capacity to increase the number of trainings is limited. If the success of recent trainings continues the hope is to be able to support additional staff to manage logistics, allowing the CTPC to focus on continued programmatic development.

5.9 Priority Coastal Issue #1: Climate Change, Sea Level Rise and Coastal Hazards

Some of the thematic areas covered by climate change-focused WSCTP workshops include: Tools, data and techniques for integrating social, scientific and technical information into climate change planning processes, including understanding local climate change science and impacts; Vulnerability assessment frameworks and adaptation strategies; Strategies for effective community engagement and communication, including conflict management, stakeholder engagement and community involvement; Analyzing, interpreting and applying scientific information to land use decisions; Providing support for "soft skills" capacity building such as project planning, program evaluation and management plan development.

5.10 Priority Coastal Issue #2: Habitat Protection and Restoration

Hosting high-quality workshops and providing technical assistance on a broad array of topics related to habitat protection and restoration is a high priority for WSCTP. Training topics are identified through regular communication with the WSCTP Advisory Committee; formal and informal needs assessments, and feedback from other key partners. Some of the thematic areas covered by these workshops include: Interpreting and implementing laws and regulations including permit streamlining across agencies and regulatory compliance; Ecosystem management techniques for addressing species-specific concerns, specifically invasive species management, and best practices for threatened and endangered species; Habitat restoration techniques, including restoration of native plants and shorelines with a special focus on wetlands; Funding habitat restoration; Linking habitat restoration with climate adaptation strategies to leverage support and funding (combining green infrastructure and habitat projects); Conservation planning; Land acquisition strategies; Water supply.

Many of the topics and themes covered by this priority coastal issue overlap with the climate change issue. The WSCTP finds that an interesting training nexus for the program is training on tidal marsh restoration and climate change – including emerging restoration techniques, marsh response to climate change, and design consideration related to sea level rise. There is significant staff capacity on these topics areas, and a cross-sectoral approach to integrate expertise, knowledge and feedback is highly preferred.

5.11 Core Program Objectives

The core program objectives were developed for the Coastal Training Program Strategy. They will be re-assessed during the next planning phase of that document and based on the evolving role of CTPC. The core objectives were developed in close coordination with NOAA OCM program administrators to reflect measurable outcomes for the program. They are listed here as a resource and context for the program.

- **Objective 1:** For each WSCTP training event over the next five years, 80% of participants in training indicate intent to apply natural and social science-based information in coastal decision-making.
- **Objective 2:** The WSCTP will provide technical assistance and at least five training workshops per year on priority coastal issues to target audiences during the strategic planning period of 2013-2018.
- **Objective 3:** For each WSCTP training event over the next five years, at least 90% of the participating coastal decision-makers will report that their knowledge of priority coastal issues has increased as a result of attending the training event.

In addition, all trainings are evaluated by participants, recorded in the performance measures database and reviewed in detail by CTPC. All work is also reviewed and debriefs done after all trainings to call on weaknesses as well as strengths to work towards improvement.

The WSCTP is ever evolving and with the new leadership and direction we expect positive change and improved reach.

CHAPTER 6 – STEWARDSHIP PROGRAM

6.1 Overview of the National Program

A core mission of the National Reserve System is to protect and conserve the more than 1.3 million acres of coastal and estuarine habitat within reserves and to facilitate improved stewardship of coastal habitats outside reserve boundaries. Stewardship refers to the responsible management of coastal resources using the best available science, data, and information to make informed management decisions. The fundamental goal of stewardship is to ensure the long-term viability and resiliency of natural and cultural resources through restoration, conservation, and maintenance of reserve resources and ecosystems. More broadly, stewardship involves activities associated with responsible ecosystems management based on adaptive science-based strategies. These goals are accomplished through assessments, direct protection of land resources, science and technical assistance, and community engagement. Because of the diversity of stewardship needs within the NERR system, stewardship goals and activities vary across the 28 reserve system. Resources found within the national reserve system are equally diverse, requiring site-specific and locally informed approaches to accomplish stewardship goals.

Stewardship activities typically include the following core activities:

- Development of natural resource and management plans
- Biological monitoring
- Invasive species management
- Public outreach
- Habitat restoration
- Applied research
- GIS habitat mapping and remote sensing

The stewardship program plans for and responds directly to environmental stressors within and around reserve sites by providing information, resources, and adaptive management strategies that account for land-use changes, climate change impacts, and ecological trends at the regional and national scale. Land management strategies, including the development and application of applied scientific activities, are integrated through the Stewardship Program to account for ecological stressors. Mitigation strategies are implemented when necessary, which may include several approaches ranging from habitat restoration to potential land acquisition strategies.

6.2 Reserve Stewardship Program

At the Reserve, stewardship activities are provided by the staff of California State Parks and FoCC volunteers for China Camp and by the SLT for Rush Ranch, as each of these partners are land owning, managing and operating entities. Given that the Reserve does not have land management responsibility nor authority, its primary role is to inform management activities through science-based knowledge and recommendations. The current Reserve Stewardship Program was implemented in 2014 with the hiring of a Stewardship Coordinator (SC) working jointly for the Reserve and one of its core land managing partners, SLT. This joint position allowed for greater communication and collaboration between SLT and the Reserve and enhanced the Reserve's ability to implement Stewardship activities by working across organizational boundaries. The SC recently resigned, but the Reserve intends to continue supporting a similar position. The Stewardship Program focuses primarily on implementation of science-based resource management as directed by broader programmatic and Reserve goals outlined in the Reserve management plan.

Engaging regional stakeholders, researchers, and agencies is also a fundamental component of the Stewardship Program,

in conjunction with and coordinated by the Reserve Research and Monitoring Program. Recent efforts which have broadened and expanded Stewardship Program partnerships include research partnerships with USGS, UC Berkeley and the Natural Resource Conservation Service (NRCS). These partnerships have expanded the Reserve's capacity for data collection and analysis, provided additional funding opportunities, and increased the Reserve's science capacity—in particular science and research efforts focused on marsh biogeochemistry and carbon sequestration.

Further, geospatial science is major focus of the Stewardship Program with significant efforts directed towards increasing partnerships and collaborations with researchers engaged with geospatial research in coastal and estuarine systems. The former SC also led the SF Estuary Geospatial Workgroup--a consortium of researchers, resource management professionals, scientists, and GIS professionals active in geospatial technology and science. This effort is closely linked with the development of the Sentinel Site Program and system-wide monitoring programs, and supports the Reserve more generally by providing technical and logistical support in GIS while building GIS capacity within the Reserve. The Reserve remains committed to supporting the Geospatial Workgroup, with the CTPC assuming a key leadership role in the group.

6.3 Stewardship Program Philosophy

Effective stewardship efforts address a diverse set of ecological, cultural, and economic factors inherent in conservation landscapes. Landscape scale stewardship and conservation actions are presented with a unique set of challenges directly related to the spatial scale of a conservation landscape and to the degree of ecosystem fragmentation. Climate change impacts also pose significant threats to conservation resources and at the same time threaten the viability of commercial enterprises that rely on functionally connected ecosystems. These challenges are compounded by regulatory and socio-political constraints which complicate the organization and distribution of resources, implementation of stewardship activities, and restrict the possibility of integrated conservation actions that are critical for successful resource (natural and otherwise) management.

Overcoming these challenges requires a distributed approach to stewardship and conservation. For this reason, the Stewardship Program implements several network based leadership strategies that provide multiple pathways to support the implementation of solutions that address each of these fundamental conservation challenges.

Network leadership is primarily relational—in contrast to organizational leadership approaches, which are typically top-down approaches. Relational networks support consensus and collaboration—two fundamental components of effective stewardship. The necessity for consensus building and collaboration is heightened when managing landscape scale efforts typical of Reserve Stewardship Program activities—as these types of efforts require coordination of diverse stakeholders and cross-organizational partnerships. Facilitation of multiple priorities is also a requirement of effective landscape scale stewardship and conservation. As a direct result, the Stewardship Program has adopted network leadership approaches in place of organizational leadership approaches given their emphasis on diverse partnerships and relationship building.

6.4 Stewardship Program Focus

- Reserve staff supports stewardship efforts by focusing on:
- Geographic information systems and habitat mapping (Rush Ranch and China Camp),
- Invasive species management of upland grasslands (Rush Ranch),
- Conservation of protected and otherwise sensitive native species (Rush Ranch and China Camp)
- Managing visitor use (Rush Ranch, China Camp permit recommendations)
- Science-based restoration and management guidance.

As identified through discussions with SLT, the priorities of the stewardship program at Rush Ranch are:

- Maintain an economically viable and ecologically sustainable grazing operation, consistent with purposes of a National Estuarine Research Reserve;
- Provide meaningful opportunities for education, public access, and scientific research;
- Protect high-quality habitats and biodiversity;
- Restore degraded sites;
- Re-establish the physical processes necessary to maintain the natural ecosystem within the context of agricultural, educational, and research goals; and
- Use adaptive management to respond to change over time.

The mission of the California State Parks is to provide for the health, inspiration, and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation. Thus, as identified through discussions with California State Parks, the priorities of the stewardship program at China Camp are:

- Management of natural resources by developing strategies for specific concerns such as the interface between wildlife and urban areas, trail erosion, and invasive species (e.g., fungal pathogens);
- Protection of the cultural resources of the China Camp Village and Miwok archeological resources;
- Provide meaningful opportunities for education, public access, and scientific research;
- Protect high quality habitats and biodiversity; and
- Use adaptive management to respond to change over time.

Lessons learned from stewardship activities within the Reserve are shared with the broader regional management community through the Reserve's CTP and direct communication between researchers and managers.



Dr. Kirk Waters and Jared Lewis, former Reserve Stewardship Coordinator, use the latest RTK instruments to conduct baseline vegetation sampling to inform a specially funded NOAA project to test UAV remote sensing technology for vegetation mapping at Rush Ranch. Photo: Michael Vasey.

6.5 Stewardship Program Activities

The former SC established the following activities:

The SC was active in working with Reserve research and monitoring staff, as well as with Reserve staff, to update Reserve Habitat Mapping layers for both Rush Ranch and China Camp.

The SC worked with the SLT Stewardship Director to develop an “Invasive Species and Biodiversity Conservation Management Plan” that we hope will be added to the Rush Ranch Management Plan as an appendix. This plan combines actions to both control invasive plant and animal species at Rush Ranch but to accomplish this task in the context of necessary actions to protect and conserve sensitive and protected plant and animal species. Protected species are such an important part of the Rush Ranch landscape that invasive species control virtually cannot be approached without taking this approach. This plan element promises to be an important template for taking this holistic approach to invasive species management.

- Mapping and monitoring using aerial and unmanned aerial systems (UAS) imagery. All UAS activity is carefully permitted and approved by NOAA.
- Working with citizen volunteers on seasonal wetland restoration activities including planting natives and weed removal in uplands (not tidal wetlands at this time).
- Assisting visiting researchers and their staff with field oriented activities such as maintaining the eddy covariance flux tower near First Mallard Slough at Rush Ranch.
- Engaging with the education and coastal training programs to integrate imagery, issues, and citizen participation in stewardship related activities, particularly at Rush Ranch.

The Reserve staff expect the activities to continue with support from staff and volunteers of the Reserve and SLT, and a new SC. Over time, we hope to get more engaged with California State Parks in their stewardship activities at China Camp.



The CTP program coordinated with OCM to host a workshop on vertical control technology taught by members of the National Geodetic Survey. Representatives from several Reserves attended as well as local scientists from organizations such as USGS. Here, Dr. Phillippe Hensel explains the fine points of establishing a base station from a known elevational benchmark to Research Technicians Anna Deck and Alex Wick. Photo: Michael Vasey.

“Advanced Delineation Soils”, WSCTP leading a 2-day advanced delineation training to examine hydric soils. Photo: Aimee Good.

CHAPTER 7 - ADMINISTRATIVE PLAN

The Administrative Plan provides an overview of the organizational and administrative framework that governs management of the Reserve, addresses the roles and responsibilities of staff, as well as identifying strategic partnerships and advisory committees.

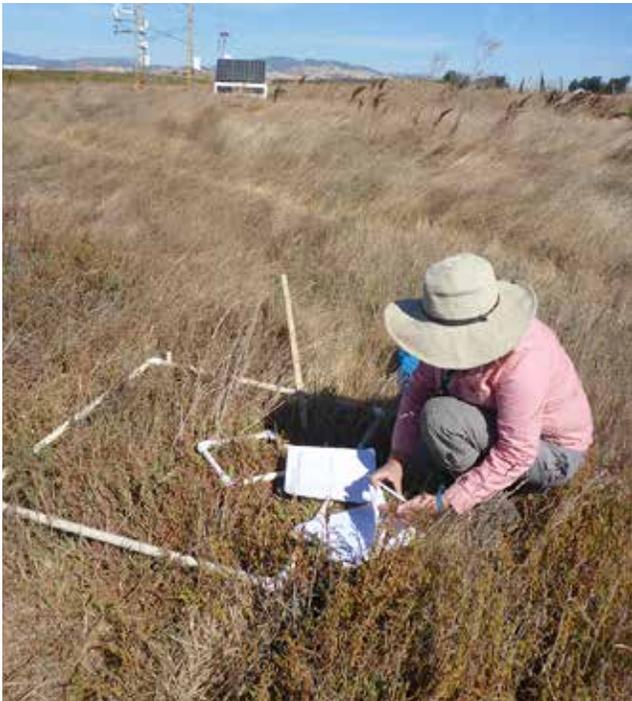
7.1 Organization Framework and Management Authorities

A state, commonwealth, or territory and the federal government cooperate in operation of each NERR. Primarily the Office for Coastal Management (OCM), National Ocean Service, NOAA, represents the federal interest. NOAA's mission includes management of the nation's coastal resources and promotion of global stewardship of the world's oceans and atmosphere through science and service. OCM coordinates the NERRS nationally and administers financial awards to individual Reserves.

The NERR System operates as a federal/state partnership. Although the management of a reserve, including development of site-specific policies and programs, is a state's responsibility, NOAA provides overall system policies and guidelines; cooperates with and assists the states in selecting, designating, and operating Reserves; and reviews Reserve programs regularly. The purpose of the NOAA review is to ensure that a state is complying with federal NERR System goals, approved work plans, and Reserve management plans. The primary mechanisms used by NOAA to assist the state, as well as NOAA responsibilities pertaining to reviews are discussed below.

Upon designation, NOAA staff, in particular the Site Liaison assigned to the Reserve, communicates directly and regularly with the Reserve staff. Communication builds a level of trust between federal and Reserve staff and familiarizes both OCM and state personnel with reserve management procedures and policies. This cooperative approach is needed for a reserve to be successful. Both oral and written communication is necessary and site visits are advisable.

Another component of NOAA oversight is its reserve funding program. NOAA provides different categories of grant funding to a reserve and works with reserve staff to ensure that funds are spent on projects and in areas where the most benefit can be achieved. Semi-annual grant progress reports and a final grant report are required. NOAA personnel carefully review the grant reports and associated communications to ensure compliance with program policies and specific grant conditions.



WSCTP coordinator Aimee Good helping with our annual vegetation monitoring at Rush Ranch. Photo: Anna Deck.

Pursuant to the Coastal Zone Management Act (CZMA) enabling legislation (Sections 312 and 315), OCM must periodically conduct performance evaluations of the operation and management of each reserve while federal financial assistance continues. These reviews are a mechanism for identifying, discussing, and resolving concerns with reserve operation.

The state interest is usually represented through one or more state agencies, typically agencies charged with education, environmental, research, wildlife, or coastal management responsibilities. The state agency administers reserve personnel and day-to-day reserve management.

The state partner for the Reserve is SF State. The Reserve is classified as a 'Center' within the College of Science and Engineering (CoSE). The Director/Manager of the Reserve is classified as an administrator (MPP), reports directly to the Dean of CoSE, and sits with Department Chairs and Administrators of other Centers on the CoSE Science Council. Employees of the Reserve are employees of SF State and are paid by the NOAA operations grant or through the University cost share.

The Reserve headquarters is housed at RTC in Tiburon. SF State provides several services for the Reserve at RTC including office space, lab space, IT support, hardware, software, photocopies, internet access, and maintenance support. RTC also supports Reserve fieldwork by maintaining a fleet of vessels of various sizes and a motor pool with different vehicles available for Reserve staff use. The Director of the Reserve and Research Coordinator participate as RTC Principle Investigators and the Director coordinates directly with the Director of RTC (who also reports to the Dean of CoSE). The Reserve Director also sits on the RTC Advisory Board. The Reserve Director, the RTC Director, and the Director of the Smithsonian Environmental Research Center work together to build and maintain a strong partnership among these three organizations.

Facilities at the Reserve components are owned, operated, and maintained by two land managing entities (California State Parks and SLT). These land managers also are responsible for trail access, land use permits, and other related land use activities. The Reserve works with staff and volunteers at China Camp and Rush Ranch to conduct educational programs and site stewardship activities. Research and monitoring at the two components is supported by the Reserve working closely to advise the land managing staff. For example, research permits are issued by the land managers based upon review and recommendations by the Research Coordinator. The Reserve Director is primarily responsible for coordinating Reserve policies and allowed activities with the directors of California State Parks and SLT.



Marsh Gumplant.
Photo: Aimee Good.

The Reserve is also strongly linked to NOAA within the SFE. In particular, the Reserve is closely connected to its signatory partner the BCDC, the NOAA coastal zone managing agency within the SFE, and the local Office for Coastal Management (OCM) in Oakland, CA. The Reserve is also one of the core members of the San Francisco Bay and Outer Coast Sentinel Site Cooperative. This NOAA organization, one of five Sentinel Site Cooperatives in the country, extends the scope of the Reserve to include a more regional focus.

The Reserve is served by three volunteer organizations and a growing partnership with the Smithsonian Environmental Research Center (SERC) and the new Smithsonian Marine-GEO global coastal monitoring effort. At China Camp, Friends of China Camp currently operate the Park, and at Rush Ranch, the Rush Ranch Educational Council hosts numerous activities including NERR supported docent hikes. The third volunteer organization, the RTC Advisory Board, is currently being re-organized but is geared to improving facilities, research, and education at RTC in ways that benefit the Reserve and educational mission of SF State.

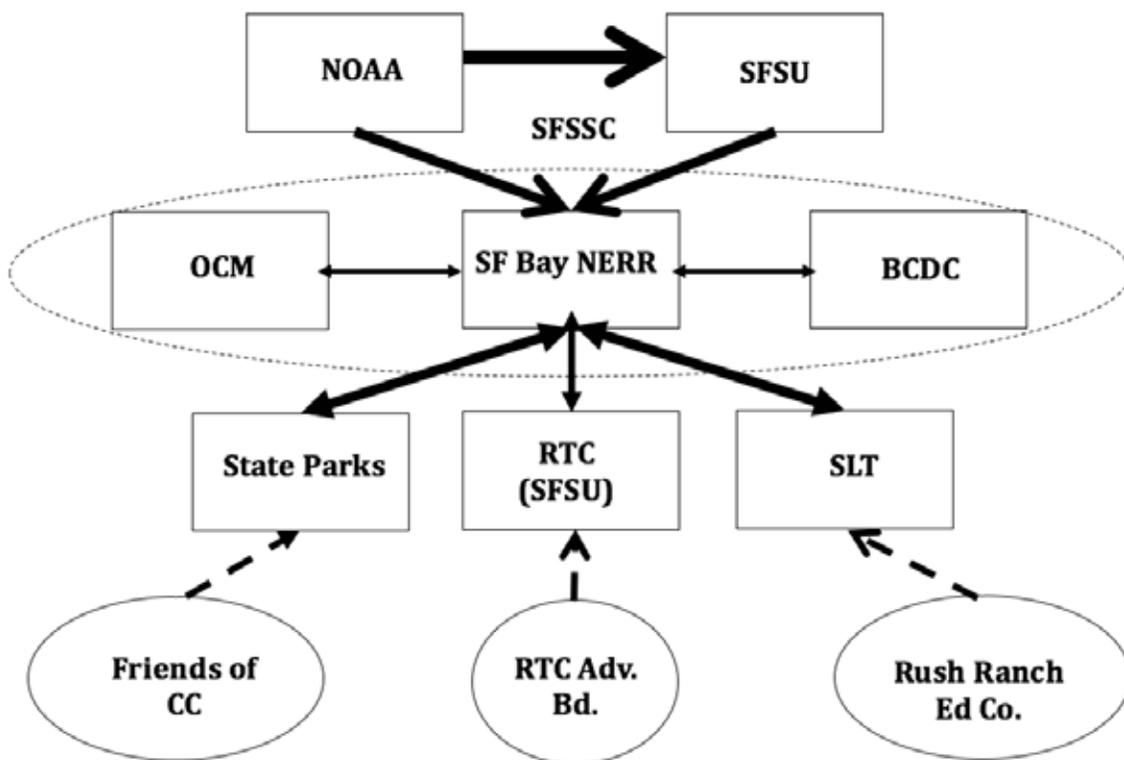


Figure 15. Reserve Organizational Framework within the Region. Solid arrows depict direct, programmatic relationships. Double ended arrows represent reciprocal relationships. Thickness of the arrows indicates strength of relationship. NOAA – National Oceanic and Atmospheric Administration; OCM – Office for Coastal Management; NERRS – National Estuarine Research Reserve System; SF State – San Francisco State University; SFSSC – Sentinel Site Cooperative; SF Bay NERR – Reserve; BCDC – San Francisco Bay Conservation and Development Commission; California State Parks – California Department of Parks and Recreation; RTC – Romberg Tiburon Center for Environmental Studies; SLT – Solano Land Trust; Friends of CC – Friends of China Camp (non-profit); RTC Adv. Board. – RTC Advisory Board; Rush Ranch Ed Co. – Rush Ranch Educational Council (volunteers).

7.2 Current Staff and Needs

Reserve staff is primarily composed of employees of SF State and generally reflects required or preferred positions in the NERR System (NERRS). Required positions include a Reserve Manager (RM), Research Coordinator (RC), and Education Coordinator (EC). In the University system, the RM is classified as an administrator (MPP) and is given the title of Director, similar to administrators that lead other Centers within CoSE. The RM is also the Principal Investigator (PI) for the NERRS Operation Grant.

The RC represents the Research and Monitoring Sector within the NERRS. The RC oversees the required System-wide Monitoring Program (SWMP) and coordinates research for the Reserve. He supervises two Research Technicians (RTs) whose primary focus is to operate the SWMP. The senior RT has been with the Reserve for several years and brings exceptional several skills to the position including lab management experience, deep familiarity with the requirements of the Central Data Management Operation (CDMO), analytical skills, and expertise in Olympic oyster ecology and monitoring. The more recently hired RT is an expert at maintaining and calibrating scientific instruments. He also has extensive experience in Marine Operations and is partly funded by RTC to work with Marine Operations on various projects.

The EC represents the Education Sector and operates through creative partnerships with other organizations in the region to translate NERRS science to the broader Reserve community, including teachers, students, and visitors to the sites. She works closely with SLT, California State Parks, and FoCC, and many other partners, to support science education opportunities at the Reserve sites and beyond. The EC has been present at the Reserve since just after it was designated. She therefore represents an important source of staff continuity and institutional memory for the Reserve.

The CTPC is now the Wetland Science and Coastal Training Program Coordinator. This is a newly created shared position with the RTC and is the result of a merger between the RTC Wetland Science Program and NERR CTP program. The Wetland Science program along with our CTP program was conceived in 2005 and was working in parallel to provide professional development trainings. The new program can expand training offerings as well as expand the reach regionally to decision makers as well as practitioners. The CTPC will also be jointly funded by RTC and Federal NERR funds.

Through another partnership arrangement, in 2014 we were able to fill our SC position working half time for the Reserve and half time for SLT. This arrangement helped strengthen stewardship at Rush Ranch, as well as the partnership between SLT and the Reserve. The SC also strengthened our partnership with the Institute for Geographic Information Sciences (IGISc) on the main campus of SF State and brought needed capacity in the geospatial realm. The Reserve intends to continue supporting the Stewardship Coordinator position, despite the current position vacancy.

We have also created a Coastal Resilience Specialist (CRS) position that is funded by the College of Science and Engineering through Reimbursed Release Time (RRT). An experienced wetland scientist currently holds the position. He is adjunct faculty in the Earth and Climate Science Department on campus and has been granted PI status for NERR and related grants. This individual has contacts throughout the SFE region and has been instrumental in working with us on a variety of external funding proposals. This position is focused on moving us toward realizing our Sentinel Site goals and objectives, among other activities. The position may be maintained over time but funding is uniquely tailored to this individual.

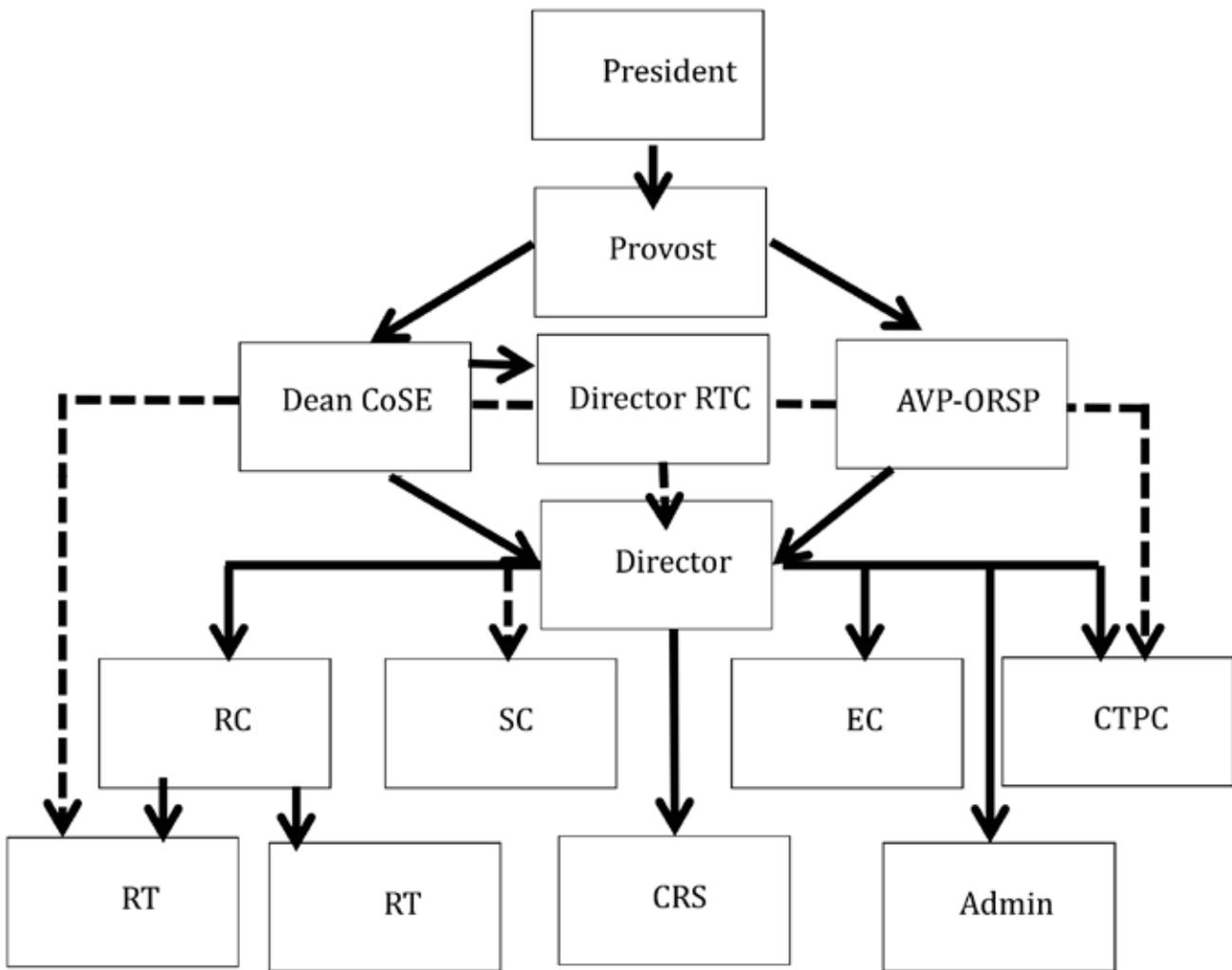


Figure 16. Reserve Organizational Framework within SF State. Dashed arrows represent co-funded positions. Key to acronyms: CoSE (College of Science and Engineering), RTC (Romberg Tiburon Center for Environmental Studies), AVP (Associate Vice President), ORSP (Office for Research and Sponsored Programs), Director is also Reserve Manager (RM), RC (Research Coordinator), SC (Stewardship Coordinator), EC (Education Coordinator), CTPC (Coastal Training Program Coordinator), RT (Research Technician), CRS (Coastal Resilience Specialist), Admin (Administrative Coordinator). One RT and the CTPC are partly funded by RTC and the SC is partly funded by Solano Land Trust.

7.3 Strategic Partnerships

Our core partners (California State Parks, SLT, RTC, BCDC, NOAA OCM, and SF State) are fundamental to our existence. The Reserve also depends on numerous other strategic partnerships. Many of these are identified in the sectoral RC, EC, and CTPC descriptions. Certain strategic partners, however, are identified in this section because of their administrative linkage to the Reserve and/or Reserve projects. These partners, like the partners mentioned in the sectoral descriptions, are key to the success of the Reserve in achieving its long-term regional and local mission.

SF Bay and Outer Coast Sentinel Site Cooperative

The SF Bay and Outer Coast Sentinel Site Cooperative (SFSCC) is one of five regional NOAA sentinel site cooperatives in the nation. The SFSCC brings together five core NOAA organizations – the Reserve, NOAA’s Office for Coastal Management, BCDC, NOAA’s Greater Farallones National Marine Sanctuary, and California Sea Grant – to help the SFE region address concrete problems people in the region are facing, like improving resilience to sea level rise. The SFSCC has a full time coordinator who is co-mentored by the Reserve Director. The SFSCC provides a broader regional context for the Reserve which is key to its effectiveness in the extensive SFE region.

San Francisco Estuary Partnership

The San Francisco Estuary Partnership (SFEP) was established by the EPA in 1988 and is a collaboration of local, state, and federal agencies, non-governmental organizations, academia and business leaders whose work is guided by the implementation and development of the “Estuary Blueprint”. The Estuary Blueprint – also known as the Comprehensive Conservation Management Plan (CCMP) -is now in its second edition (CCMP 2016). The CCMP specifies Goals, Actions, Owners, and Collaborative Partners committed to working on Actions. The Reserve Director is on the CCMP Implementation Committee and the Reserve “owns” two Actions (2 and 11) and is a “collaborative partner” in eight Actions (5,8,9,12,14,28,29, and 31).

San Francisco Bay Joint Venture

The San Francisco Bay Joint Venture (SFBJV) was established by the U.S. Fish and Wildlife Service and is a partnership between public agencies, environmental organizations, the business community, local governments, and landowners. They work cooperatively to protect, restore, increase, and enhance wetlands throughout the SFE and its’ watershed. The Reserve Director serves on the Science Committee and is co-chair of the Monitoring and Evaluation sub-committee, while the CTPC and Coastal Resilience Specialist are members of the Conservation Delivery Committee.

California Coastal Conservancy

The Coastal Conservancy is a State agency established in 1976 to protect and improve natural lands and waterways, help people get to and enjoy the outdoors, and sustain local economies along the length of California’s coast and around San Francisco Bay. It is also part of the State CZM Program. The Coastal Conservancy leads several projects that the Reserve is involved with, has funded the Reserve to conduct research and education projects, and was integral in the protection and enhancement of Rush Ranch.

Smithsonian Institution

The Smithsonian Institution (SI) is the world’s largest museum, education, and research complex. The Reserve partners with two programs within SI: Marine Global Earth Observatory (MarineGEO) and the Smithsonian Environmental Research Center (SERC). The Reserve and MarineGEO co-sponsor a water quality and weather station located within the Richardson Bay Audubon Center and Sanctuary. The Reserve hopes to expand on this project to build innovative links between the NERRS SWMP program and MarineGEO biodiversity studies. SERC has an Invasions Lab that his housed at RTC. The Reserve, SERC, and RTC collaborate to lead oyster research in the SFE, with a focus on integrating communities in research. SERC, the Reserve, and RTC work closely together

to advance the goal of making the RTC a center of excellence for estuary and ocean research, education, and policy.

San Francisco Estuary Institute

The San Francisco Estuary Institute (SFEI)'s staff of fifty scientists and experts provide data, technology and tools that empower government, civic and business leaders to create cost-effective solutions for complex environmental issues through three primary programs: Clean Water, Resilient Landscapes, and Environmental Informatics. SFEI is leading establishment of a regional tidal wetland monitoring program, in which the Reserve is likely to play a prominent role.

U.S. Geological Survey

The U.S. Geological Survey (USGS) is a prominent federal applied science institution in the San Francisco Estuary. Researchers from five local offices (in Sacramento, Dixon, Vacaville, Menlo Park, and Santa Cruz) have contributed research expertise and equipment to Reserve research, monitoring, and land management activities. The Reserve is collaborating with USGS on a NOAA-funded sea-level rise study at Rush Ranch, an acoustic sensitive rail monitoring project at Rush Ranch, a carbon flux study at Rush Ranch, water-level and sediment monitoring studies at China Camp, habitat mapping at Rush Ranch, and several other projects. Through sharing of resources and expertise, the USGS partnership contributes to the overall effective administration of Reserve programs.

Point Blue Conservation Science

Point Blue Conservation Science is a non-profit whose mission is to conserve birds, other wildlife and ecosystems through science, partnerships, and outreach. The Reserve partners with Point Blue in many projects and relies on their expertise and data on bird populations at Rush Ranch and China Camp. They are active participants in the SFBJV and other planning, research, and monitoring activities that take place in the SFE.

San Pablo Bay National Wildlife Refuge

The San Pablo Bay National Wildlife Refuge is a key land manager in the northern San Pablo Bay region involved in large-scale tidal wetland restoration and endangered species recovery. The Reserve has begun working with the Refuge in connection with the Sears Point tidal wetland restoration project that is now part of the San Pablo Bay National Wildlife Refuge. We anticipate that the Reserve will be growing its partnership with the Refuge over the next several years as we collaborate on implementing a pilot monitoring program at Sears Point.

Sonoma Land Trust

The Sonoma Land Trust is a prominent non-profit land trust that primarily focuses on land acquisition and land management activities in the Sonoma County region. They acquired Sears Point and obtained the funding to implement a state-of-the-art tidal wetland restoration project involving about 1,000 acres. The Reserve is developing a close partnership with the Sonoma Land Trust in monitoring this site over the next five years for both permit requirements and as a pilot site to demonstrate adaptive management and lessons-learned monitoring in conjunction with SFEP, SFEI, and the SFBJV as we attempt to develop of a regional tidal wetland monitoring plan.

County of Marin

The County of Marin owns land adjacent to China Camp State Park. We are hoping to work more closely with them over the next several years on providing assistance for resolving critical flood, wetland restoration, and sediment issues in lower Gallinas Creek and protecting and restoring tidal marshes near China Camp. Plans are to focus a thin-layer sediment addition project at Bothin Marsh, a Marin County property, and we are currently working with them on an ecosystem services project focused on lower Gallinas Creek.

Suisun Resource Conservation District

The Suisun Resource Conservation District (SRCD) provides the landowners technical assistance in permitting, water control, and habitat management to ensure the wetland and wildlife values of the Suisun Marsh are sustained and enhanced. They are a key partner in the protection and restoration of tidal marshes at and near Rush Ranch. Our Coastal Resilience Specialist and Research and Monitoring technical staff are now working on an important research project assessing the effects of low dissolved oxygen on water quality adjacent to Rush Ranch and within the Suisun Marsh.

Delta Stewardship Council

The Delta Stewardship Council was created to advance the state's coequal goals for the Delta – a more reliable statewide water supply and a healthy and protected ecosystem, both achieved in a manner that protects and enhances the unique characteristics of the Delta as an evolving place. The Delta Stewardship Council includes the Delta Science Program (discussed in Chapter 8).



During a visit to the Reserve, OCM Program Liaison Michael Migliori joins Reserve staff and SLT staff on a boat tour of Rush Ranch. From left to right, Bernard Warzecha (NERR), Steve Kohlmann (SLT), Matt Ferner (NERR), Heidi Nutters (NERR), Nicole Byrd-Braddock (SLT), Aimee Good (NERR) and Michael Migliori (OCM). Photo: Michael Vasey.

Advisory Committees

The SF Bay NERR Management Advisory Board (MAB) is a non-voting advisory body supported by Reserve staff that works together to facilitate coordination and cooperation among member agencies, aid implementation of the Plan, and promote the work of the Reserve through developing and supporting agreements that recognize the complex network of interests at the Reserve sites and how to best support them. Members include each of the Reserve site land managing agencies, BCDC, SF State and ex officio membership by NOAA.

The Advisory Board's principal responsibilities are: (a) to aid with implementation of the Plan and promote adherence to the broader policies of the Reserve and support for its programs by involved agencies, (b) to promote interagency cooperation to advance the mission of the Reserve concurrent with the fulfillment of the respective missions of the agencies and organizations, (c) to assist with periodic reviews of the Reserve and progress on implementation of the Plan, (d) to assist with identifying and obtaining funding, and (e) to assist with revision and updating of the Plan at least every five years. The Board meets annually with additional meetings as needed.

Currently, the MAB consists of six representatives from, respectively, California State Parks (District Superintendent), Vince Anibale, the Solano Land Trust (Executive Director), Nicole Byrd Braddock, RTC (Director, also representing SF State), Karina Nielsen, BCDC (Deputy Director), Steve Goldbeck, OCM (West Coast Regional Director), Rebecca Smyth, and Friends of China Camp (Executive Director) Martin Lowenstein and Board Chair (Ed Lai). There are no term limits for the MAB and meetings of this group are advisory only, by invitation, and not publicly scheduled.

7.4 Objectives and Actions

The objectives and actions of the Administration Plan are designed to support and guide the Reserve to address coastal management issues in the region (need for coastal resilience, coastal intelligence, and engagement with diverse audiences to promote estuarine conservation) and to achieve the vision, mission, goals, objectives and actions articulated in the Reserve's Strategic Plan. Specifically, these objectives and actions will serve to (1) increase and improve scientific knowledge of the SFE ecosystem; (2) expand understanding, practice, and application of estuarine and coastal social and natural science; and (3) promote public appreciation and support for stewardship of the SFE.

Objective 1 – Prepare and submit an annual funding proposal to NOAA on a timely basis.

Actions to support Objective 1

- a) Manager will coordinate with staff to develop proposed funding priorities and budget for upcoming fiscal year
- b) Manager will meet with Dean to review budget and get SF State approval for funding request.
- c) Manager and staff will prepare proposal and budget in CAMMP format for submission to Grants.gov.
- d) Manager and staff will work with ORSP to submit CAMMP document to Grants.gov on a timely basis.

Objective 2 – Meet reporting, staff training, and evaluation requirements in a timely and responsive manner that keeps the Reserve in good standing with NOAA and SF State.

Actions to support Objective 2

- a) Manager will coordinate with staff to produce required progress reports and submit them to ORSP so that they can submit to Grants.gov in a timely manner.
- b) Manager will coordinate with staff to identify opportunities for optional staff training and to enrich staff experience and expertise while insuring that required staff training is conducted in a timely manner.
- c) Manager and supervisors will conduct timely staff evaluations and facilitate staff advancement when warranted. Manager will oversee and be responsible for all staff evaluations, including evaluations conducted by supervisors
- d) Manager and administrative staff will be responsible for interfacing with ORSP and Dean for all personnel advancement and other actions.

Objective 3 – Maintain core staff positions and use creative means to expand staff capacity for the Reserve so that it can accomplish its goals.

Actions to support Objective 3

- a) Continue to support core staff positions with operations grant funding and find ways, when appropriate, to share staff responsibilities and funding with key partners when it is in everyone's advantage to do so.
- b) Seek additional staff expertise through external funding opportunities and affiliations with adjunct faculty and researchers supportive of the Reserve.
- c) Engage students and volunteers in projects and services that can provide them with rich experiences

working with and for the Reserve while also helping to perform vital functions for Reserve operations.

Objective 4 – Support a collaborative work environment involving staff, stakeholders, partners, volunteers, and other supporters of the Reserve.

Actions to support Objective 4

- a) Keep all participants in Reserve activities informed via email and other communication media.
- b) Meet as a staff in person at least once per month
- c) Manager to meet with staff once per week or as needed
- d) Support active participation of staff and affiliated partners at public events sponsored by our partners

Objective 5 – Maintain and strengthen partnerships (California State Parks, FoCC, SLT, and RTC) so that place-based activities, resource protection, and public appreciation of Reserve sites can be sustained.

Actions to support Objective 5

- a) Coordinate semi-annual or as needed meetings between manager, staff, and core partners at Management Advisory Board meetings.
- b) Manager and staff to work closely and keep partners informed of Reserve activities in the area of research, monitoring, education, training, and stewardship.
- c) Maintain advisory services to land managing partners regarding permit applications and proposed management activities on Reserve core and buffer lands.
- d) Encourage responsible visitation and education programs that engage the public and continue to protect sensitive biological and habitat resources.

Objective 6 – Promote Reserve representation in regional organizations that focus on estuarine stewardship, actionable science, monitoring, resilience, public education, and coastal training.

Actions to support Objective 6

- a) Manager and other core staff will actively and strategically participate in regional organizations such as San Francisco Estuary Partnership, San Francisco Bay Joint Venture, the Sentinel Site Cooperative, and others.
- b) Manager will work with the Coastal Resilience Specialist to help engage and influence regional partners on large-scale estuarine issues.
- c) The Coastal Resilience Specialist will help develop external funding proposals to respond to regional opportunities to engage the Reserve in activities that will promote its goals for the estuary.
- d) Manager and Coastal Resilience Specialist will work with partners and collaborators identified in the CCMP to advance establishment of a regional wetlands monitoring program.

Objective 7 – Support efforts to promote tidal wetland restoration activities that help to recover the ecological well-being of the San Francisco Estuary

Actions to support Objective 7

- a) Manager, Research Coordinator, and Coastal Resilience Specialist will identify ecological restoration projects to provide monitoring support, both within components and outside component boundaries, assuming sufficient funding is provided to apply Reserve resources to help monitor these projects.

Objective 8 – Build partnership with Romberg Tiburon Center (RTC) to support the education and training of SF State students and share other resources while promoting Reserve interests.

Actions to support Objective 8

- a) Manager and staff shall participate to the extent possible in RTC events, on appropriate committees, and in seeking joint funding opportunities.
- b) Manager and staff will explore opportunities to contribute to the educational mission of RTC through guest teaching, participation on committees, and providing internship opportunities where and when appropriate.
- c) Manager and staff will contribute to building the partnership between RTC, the Smithsonian Environmental Research Center, and the Reserve as opportunities arise.
- d) Manager will participate on the RTC Advisory Board.



Sentinel Site Cooperative Dr. Jenna Judge and Dr. Chris Janousek decommissioning a research project using 'marsh organs' to test the tolerance of Baltic rush to different levels of inundation at Rush Ranch. This project was funded by NOAA's National Centers for Coastal Ocean Science in Silver Spring, MD. The San Francisco Bay and Outer Coast Sentinel Site Cooperative is active in building regional partnerships focused on coastal resilience. Photo: Michael Vasey.

7.5 Volunteer Plan

The Reserve supports volunteer activities at both designated components and in partnership with RTC. Volunteer coordination is largely organized by the Solano Land Trust at Rush Ranch and collaboratively by the Friends of China Camp and California State Parks at China Camp. RTC is currently working with Reserve staff to support a volunteer organization that is shifting sponsorship from Richardson Bay Audubon Center and Sanctuary to RTC.

We will develop a Volunteer Plan that outlines Reserve involvement in these volunteer programs by 2020.

7.6 Vessel and Vehicle Plan

Vessels and vehicles that support the Reserve's research and monitoring activities are housed at RTC. Vessels are overseen by SF State's Marine Operations, and RTC also oversees vehicles. The fleet includes a number of vessels that range from large boats with onboard equipment (e.g., the R/V *Questuary*) to a number of whalers that provide a good platform for visiting Reserve water quality monitoring stations and transporting personnel and equipment to various parts of the marsh. These vessels, trailers, and RTC vehicles are available for use by the Reserve through scheduling. All drivers of SF State vehicles must have defensive driver's training certificates and vessel operators must have MOTC training certificates. All vessels follow Coast Guard recommendations and the Small Boat Safety Association safety recommendations. The RTC Marine Operations program provides the MOTC training free to the Reserve staff.

RTC provides insurance for and maintains all vessels and vehicles. The Marine Operations program at RTC also houses a certified dive-training program.

The Reserve pays rental fees for vessel use (\$250 per day).. The Reserve is researching the possible acquisition of a vessel that could become part of the RTC fleet but would not incur rental charges. It is also possible that the Reserve will need to acquire a vehicle in the future if RTC begins to charge for vehicle use.

7.7 Communications Plan

7.7.1 Goal

Create a more unified message for San Francisco Bay NERR that is communicated by all staff and partners clearly and frequently so that the communities of people we work with recognize San Francisco Bay NERR and its accomplishments.

7.7.2 Target Audiences

The target audience for our communications plan is people we work with in the very broadest sense. In defining our target audience as such, we are strategically focusing our messaging on people who have some interest in the Reserve already, rather than trying to communicate everything to everyone. The target audience includes: staff of our partners, including staff from SF State's Office of Research and Sponsored Programs, Romberg Tiburon Center, Solano Land Trust, China Camp State Park, and many more; visitors to the Reserve sites and RTC; teachers and students that attend our programs or programs about marshes or science led by partner groups at the Reserve; educators from other estuary education organizations; docents and volunteers for the NERR, SLT, and FoCC;; scientists working in the Reserve or in similar habitats; land managers working at our Reserve sites or in similar habitats; wetland restoration practitioners; and undergraduate and graduate students working within related fields.

7.7.3 Consistent Messaging

A key action of our new Communications Plan is developing a consistent message. The EC will lead the staff through this process. Once implemented, the core staff of San Francisco Bay NERR will tell its audiences a consistent story of

the NERR, so that “what is the NERR?” is a question we answer in the same manner across both people and time. Staff members can revisit and improve upon the story collectively, but not make significant changes without discussion and approval of the Reserve Director.

7.7.4 Materials

The Reserve’s brochure is ready for retirement. It will be replaced by a set of post cards developed by the EC that include a photograph of research happening within the Reserve, a very brief description of the NERR (consistent with short message above), and a link to our website. The expectation will be that all staff carry and distribute post cards whenever they are working. When funds are available, the NERR will create stickers, hats, mugs, and pencils to further distribute our name and website.

7.7.5 Branding

During this Management Plan, the Reserve will seek funds to hire, or work with SF State to coordinate with, a graphic designer to create style guidelines for the NERR, including consistent logo(s), letterhead, presentation template, e-news template, business cards, and banners for our buildings and event displays. If possible, the Reserve will overhaul the website to match the new branding style.

7.7.6 Writing

San Francisco Bay NERR, like the NERRS as a whole, is increasing the communication of our successes. We will do this by submitting success stories to NOAA in the approved format and sharing those success stories with SF State, California State Parks, Friends of China Camp, and Solano Land Trust. We will also work locally with our partners to write articles in their newsletters, including Solano Land Trust’s Vistas and eVistas, Romberg Tiburon Center’s Bayside (where we have a regular column in “NERR Notes”), and Friends of China Camp’s electronic newsletter. We will also continue to create a quarterly “NERR News” e-newsletter primarily made up of blog posts and including topics from across our sectors. We will increase the frequency and diversity of blog posts, with increased focus on sharing publications, highlights from active research projects, and data analysis.

7.7.7 Social Media

San Francisco Bay NERR is active on Facebook, with one or more posts each week. The posts are cross-sectoral, with contributions from CTPC, Research Technicians, and Education Coordinator, as well as sharing of posts by NOAA and other colleagues. We will continue this frequency of posting. Many of the NERR staff are also active on LinkedIn, where they can connect with colleagues from NOAA and SF State.

CHAPTER 8 - RESOURCE PROTECTION PLAN

The fundamental goal of resource protection is to ensure the long-term viability and resiliency of ecosystems through restoration, conservation and maintenance of critical natural resources. This Resource Protection Plan describes the authorities that protect the Reserve, allowable and unallowable uses in accordance with those authorities, uses requiring a permit, and surveillance and enforcement strategies to ensure appropriate use of the Reserve. The Reserve does not create regulations, nor does it alter any regulatory review process or traditional uses such as overnight camping, hiking, fishing, or marine transportation within, or adjacent to, the Reserve sites. Regulation enforcement and permitting is the responsibility of Reserve land managing partners with input and guidance provided by Reserve staff. This plan also outlines specific resource protection challenges identified for each site and relates those challenges back to the Reserve's overarching Goals and Objectives described above.

8.1 Management and Statutory Authorities

The protection of the Reserve relies on federal, state, and local management and regulatory authorities. The combined total of 3,710 acres within the SF Bay NERR are managed by the California State Parks (China Camp) and Solano Land Trust (Rush Ranch). Those organizations manage activities occurring on their lands and rely on existing regulations to guide management decisions consistent with the purpose of the SF Bay NERR designation. As such, there is a significant level of resource protection in place at both sites. Several federal, state and local agencies, described below, have regulatory authority over the uplands, wetlands, and submerged lands within the boundaries of the Reserve. Many of the applicable California State statutes in the Public Resources Code can be accessed at <http://codes.findlaw.com/ca/public-resources-code/> and the California Code of Regulations (CCR) can be found at <http://ccr.oal.ca.gov/>.

8.1.1 Federal

8.1.1.1 *Environmental Protection Agency*

The U.S. Environmental Protection Agency has enforcement and commenting authority for the Federal wetland permitting program and the Clean Air Act (42 U.S.C. §§ 7401 et seq.) and Clean Water Act (33 U.S.C. §§ 1251 et seq.), among other regulatory responsibilities.

8.1.1.2 *National Marine Fisheries Service*

The National Marine Fisheries Service (NMFS) is responsible for identifying essential fish habitats for federally regulated fish species and carrying out provisions of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801 et seq.). Under the Endangered Species Act (16 U.S.C. §§ 1531 et seq.), NMFS helps protect threatened and endangered species such as the Winter Run Chinook Salmon. In addition, NMFS is responsible for marine mammal protection under the Marine Mammal Protection Act (16 U.S.C. §§ 1361 et seq.). NMFS may make recommendations to the U.S. Army Corps of Engineers on wetland permits under the Clean Water Act (33 U.S.C. §§ 1251 et seq.).

8.1.1.3 *U.S. Army Corps of Engineers*

The U.S. Army Corps of Engineers is responsible for administration of the Federal wetland permitting programs for tidal and non-tidal wetlands within the SF Bay NERR and on adjacent waters and wetlands throughout the San Francisco Bay area; thus their permitting authority affects activities in wetlands, such as restoration, at the Reserve sites. The Corps has a range of responsibilities, including maintenance of certain navigable waters, flood risk management, environmental protection, ecosystem restoration, and emergency preparedness and response. They are a member organization of the Dredged Materials Management Office. The Corps has regulatory jurisdiction over the Reserve sites, primarily under the following three authorities: (1) Section 404 of the Clean Water Act for the discharge of dredged or fill material in waters of

the United States (33 U.S.C. § 1344; (2) Section 10 of the Rivers and Harbors Act for working in navigable waters (33 U.S.C. § 403); and (3) Section 14 of the Rivers and Harbors Act of 1899 (33 U.S.C. § 408) for the alteration of a Federal project (to include sea wall, jetty, dike, levee, wharf, pier, or other work).

8.1.1.4 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service has authority over taxa listed in accordance with the Endangered Species Act (16 U.S.C. §§ 1531 et seq.), which include the Ridgway's Rail (common at China Camp), Salt Marsh Harvest Mouse (present at both Reserve sites), Soft Bird's Beak, and the Suisun Thistle. Rush Ranch harbors the largest known population of the Suisun Thistle and also a small population of Soft Bird's Beak, including an experimental reintroduced population. The USFWS is consulted in advance of marsh restoration activities and other significant management actions at both sites.

8.1.2 State

8.1.2.1 Delta Stewardship Council

The Delta Stewardship Council is an independent state agency created by the Delta Reform Act (Senate Bill 1 (2010)) tasked with pursuing the coequal goals of providing a more reliable water supply for California while at the same time protecting, restoring and enhancing the Sacramento-San Joaquin Delta ecosystem. The Council consists of seven members with diverse expertise providing a broad statewide perspective. Of the Council members, one is the Chair of the Delta Protection Commission, while the remaining six are appointed: four by the Governor, one by the Senate, and one by the Assembly. The Delta Science Program, formerly the CALFED Bay-Delta Ecosystem Restoration Program, reports to the Delta Stewardship Council. Its mission is "to provide the best possible scientific information for water and environmental decision-making in the Bay-Delta system" (<http://deltacouncil.ca.gov/>). They accomplish this through supporting research on the Bay-Delta system; synthesizing scientific



Margot Buchbinder, MA student at RTC studying marsh mounds at the Sears Point restoration project, and Karen Backe, also an MA student at RTC but working for USGS, assist the Reserve in evaluating elevations for Pacific cordgrass recruitment at Sears Point. The Coastal Conservancy-funded Invasive Spartina project is considering using Sears Point as one of its active restoration sites, which potentially could bring thousands of native Pacific cordgrass plugs to help speed along the restoration trajectory at this site.

Julian Meisler, Wetlands Program Manager for Sonoma Land Trust, and Ryan Anderson, RTC graduate student, re-establish photo monitoring points at the Sears Point restoration site. A four-year history of photo monitoring at Sears Point has captured pre, during, and post construction images of this project and will be used to help track large-scale changes over time Photos: Michael Vasey.

information; facilitating independent peer review of plans, programs and products; coordinating agencies to promote science-based adaptive management; and communicating science.

8.1.2.2 California Department of Fish and Wildlife

The California Department of Fish and Wildlife, and the California Fish and Wildlife Commission have ultimate responsibility and authority for management of the fish and wildlife resources of California (Title 14 §§ 1.04-886.6 of the California Fish and Game Code). Division 3, Chapter 1.5 provides the regulations implementing California Endangered Species Act.

8.1.2.3 California Department of Parks and Recreation

The California Department of Parks and Recreation (California State Parks) is a signatory Copartner in the Reserve that manages the Reserve site of China Camp State Park, a 1,640-acre property in Marin County, California. The mission of the California State Parks is “to provide for the health, inspiration, and education of the people of California by helping to preserve the State’s extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation” (<https://www.parks.ca.gov/>). The Department manages more than 280 park units and is authorized under Division 3 of Title 14 (the California Code of Regulations).

8.1.2.4 California State Department of Water Resources

The State Department of Water Resources (DWR) is part of the California Natural Resources Agency. It is responsible for the State’s management and regulation of water use. DWR was formed in 1956 to build and operate the State Water Project. The focus of the agency is on water supply and flood control, however, it is also heavily involved in mitigation and restoration projects involving aquatic species. As such, it has jurisdiction over flows from the watershed of the SFE into the Delta. This, in turn, impacts salinity regimes in the Suisun Marsh region. It is primarily in the context of its role of balancing water supply pressures and conservation of natural resources in the upper SFE (Delta and Suisun) that practices of DWR are relevant to the SF Bay NERR.

8.1.2.5 California State Lands Commission

The California State Lands Commission (Commission) manages approximately 4.5 million acres of land in public trust for the people of California. The State holds these lands in public trust for all the people of the State for water related commerce, navigation, fisheries, recreation, and open space. Within these State owned lands lie many wetlands. The Commission manages the use of the State-owned wetlands through leases for use or development by public agencies and private parties. For example, the Commission has leased wetlands around the San Francisco Bay to the California Department of Fish and Wildlife and the U.S. Fish and Wildlife Service for wetlands habitat management and restoration. Private parties may also apply to lease lands for wetlands or habitat purposes for environmental mitigation.

In its role as Trustee of the Kapiloff Land Bank Fund, the Commission has participated in acquiring wetlands for the inclusion in habitat management projects. The Commission has jurisdiction and control over State-owned lands pursuant to Division 6 of the California Public Resources Code (§ 6000). These lands include: a three-mile-wide section of tidal and submerged land adjacent to the coast and offshore islands, including bays, estuaries, and lagoons; the waters and underlying beds of more than 120 rivers, lakes, streams, and sloughs; and 585,000 acres of school lands granted to the State by the Federal Government to support public education.

8.1.2.6 California State Water Resources Control Board

The State Water Resources Control Board (SRCWB) was established in 1967 by the legislature. It joined nine Regional Water Quality Control Boards, including the San Francisco Bay Regional Water Quality Control Board (SFB RWQCB), in implementing and enforcing California’s landmark Porter-Cologne Water Quality Control Act (Porter-Cologne Act) of 1969, foundational legislation leading to the federal Clean Water Act of 1972 (33 U.S.C. §§ 1251 et seq.). The State Water

Board is a regulatory agency that focuses on water quality. It has regulatory authority to implement some elements of the Federal Clean Water Act within California (e.g., the NPDES program and the dredge/fill permits). Recognizing that the CZMA did not specifically mention water quality, in 1990, Congress amended CZMA Section 306(d)(16) (16 USC § 1455[d][16]) and added Section 6217 (16 USC § 1455b) to focus on non-point source (NPS) pollution problems and the protection of coastal waters. Coastal Zone Act Reauthorization Amendments (CZARA) Section 6217 requires state coastal zone management agencies, in coordination with state and local water quality agencies, to develop and implement management measures to restore and protect coastal waters from adverse impacts of NPS pollution. Similarly, Coastal Zone Management Act Section 306(d)(16) requires that state coastal zone management programs contain enforceable policies and mechanisms to implement applicable requirements of CZARA section 6217. To achieve these goals, states were directed to coordinate and integrate their existing coastal zone management and water quality plans and programs, including the states' NPS management plans. These provisions are directly relevant to the SF Bay NERR focus on water quality and on wetland restoration projects on and near SF Bay NERR sites.

The State of California recognized the biological importance of the Sacramento-San Joaquin Delta and Suisun Marsh and passed a series of laws and regulations designed to protect it. Water Rights Decision 1485 (D-1485), adopted by the SWRCB (through authority under California Code Title 23 §§ 640-4007 et seq.) in 1978, was enacted to protect water quality in the delta and Suisun Marsh. Element 7 of D-1485 required the California Department of Water Resources (through authority under California Code Title 23 §§ 220-649.6 et seq. and §§ 640-4007 et seq.) and the U.S. Bureau of Reclamation to develop a plan to ensure compliance with water quality standards. In addition, Elements 4 and 7 of D-1485 required development of a monitoring plan to measure various physical, chemical, and biological parameters in the marsh. Decision 1485 was amended in 1995 by SWRCB Order WR 95-6 to make it more consistent with the SWRCB Water Quality Control Plan. In late 1999, the State Water Resources Control Board adopted Decision 1641. This Decision implements flow objectives for the Bay-Delta Estuary, approves a petition to change points of diversion of the Central Valley Project and the State Water Project in the Southern Delta, and approves a petition to change places of use and purposes of use of the Central Valley Project. See the main website for more information: <http://www.swrcb.ca.gov/>. Collectively, these decisions provide protection of the water quality and quantity of the Reserve sites of the SF Bay NERR.

8.1.2.7 San Francisco Bay Conservation and Development Commission

The San Francisco Bay Conservation and Development Commission (BCDC) is a signatory partner for the Reserve and the coastal zone agency with regulatory jurisdiction in the nine-county Bay Area. In 1965 the California State Legislature passed the McAteer-Petris Act creating the first coastal management agency in the United States, the 27-member Bay Conservation and Development Commission. BCDC is a state agency with the responsibility for comprehensively managing the protection and use of San Francisco Bay and its shoreline and the Suisun Marsh. BCDC carries out this responsibility under the provisions of the McAteer-Petris Act (California Government Code §§ 66600-66694) and the provisions of the San Francisco Bay Plan (Bay Plan) and the Suisun Marsh Preservation Act (California Public Resources Code §§ 29000-29612); the Suisun Marsh Protection Plan, and the Suisun Marsh Local Protection Program; and the Federal Coastal Zone Management Act of 1972, as amended (16 U.S.C. §§ 1451 et seq.). All persons, organizations, and local and state governmental agencies must secure a permit from BCDC for filling, dredging and dredge sediment disposal, shoreline projects, Suisun Marsh projects, other related projects, and Federal projects within its jurisdiction including Reserve sites. All Federal funding must be generally consistent with BCDC's coastal management program for the San Francisco Estuary. Permits are issued or denied and Federal consistency is determined based on whether the proposed project is consistent with the enforceable policies of BCDC's federally-approved coastal management program. BCDC's coastal management program defines the BCDC segment of the California coastal zone as being coextensive with BCDC jurisdiction under state law, incorporates the McAteer-Petris Act, the Suisun Marsh Preservation Act, certain other state laws, and various BCDC plans. The Suisun Marsh Protection Plan discusses policies for Environment, Water Supply and Quality, Natural Gas Resources, Utilities, Facilities and Transportation, Recreation and Access, Water-related Industry, and Marsh and Upland Resource Management. Documents relating to BCDC's mission can be obtained from their website at <http://www.bcdc.ca.gov/>.

8.1.3 Local

8.1.3.1 *County Sheriff Offices*

The respective County Sheriff's Office (Marin County for China Camp and Solano County for Rush Ranch) has general jurisdiction over lands, laws, and regulations pertaining to Reserve component sites.

8.1.3.2 *Resource Conservation Districts*

Resource Conservation Districts (RCDs) are government entities that provide technical assistance and tools to manage and protect land and water resources. Under Division 9 (§§ 9001-9978) of the California Public Resources Code, the counties of Solano and Marin have both formed RCDs. The text of Division 9 can be found at the website for California State legislative information at <http://www.leginfo.ca.gov/> or at the website for the California Code of Regulations: <http://ccr.oal.ca.gov/>. These RCDs collectively work to conduct: watershed planning and management, water conservation, water quality protection and enhancement, agricultural land conservation, soil and water management on non-agricultural lands, wildlife habitat enhancement, wetland conservation, recreational land restoration, irrigation management, conservation education, forest stewardship and urban resource conservation.

In 1977, California State Assembly Bill 1717 established the Suisun Marsh Preservation Act. This act:

- Designated the respective responsibilities of local government agencies and districts with respect to the preservation of the Suisun Marsh. This includes the Solano Resource Conservation District (SRCD).
- Provided for the preparation and implementation of a local protection program by designated local government agencies and districts having jurisdiction over the marsh.
- Added provisions relating to the responsibility of the SRCD over water management practices in the marsh.
- Provided for reimbursement of local governmental costs mandated by the bill.
- Gave SRCD the power to issue regulations requiring compliance with any water management plan or program for privately owned lands in the marsh.

Division 19 of the Public Resources Code outlines general provisions of the Suisun Marsh Protection Plan intended to promote the orderly and long-range conservation, use, and management of the Suisun Marsh.

8.1.3.3 *Solano Land Trust*

The Solano Land Trust (SLT) is a signatory partner of the SF Bay NERR program that protects natural areas and agricultural lands in Solano County through a combination of outright ownership and easements. Rush Ranch Open Space Preserve (Rush Ranch), designated as a Reserve site, is a 2,070-acre property located in Solano County within the area covered by the Suisun Marsh Preservation Act. The SLT is a private non-profit, public benefit corporation dedicated to the preservation of agricultural lands, open space, and wetlands within Solano County. Preservation is accomplished through acquisition, donation, or purchase of land and conservation easements, public education and land management. To date, Solano Land Trust has permanently protected 22,161 acres of natural areas and agricultural lands while also providing stewardship of the diverse and important habitats and species on those properties, including many that are threatened and endangered.

CHAPTER 9 - PUBLIC ACCESS AND VISITOR USE PLAN

9.1 China Camp State Park

9.1.1 Current Public Access

9.1.1.1 Hours

Open to the public during daylight hours (changes seasonally).

9.1.1.2 Target Audiences

California Department of Parks and Recreation estimates that over 500,000 people a year visit China Camp. The community of people who visit, use, and love China Camp is diverse and includes many locals who visit regularly. Programming is provided for a wide variety of audiences, including bikers, hikers, naturalists, families, campers, and visitors interested in cultural history. There is no mechanism to count visitors to China Camp, nor have there been any carrying capacity studies.

9.1.1.3 Access Points

There are multiple public access points from along North San Pedro Road, from adjacent neighborhoods and properties, and from the water (see map, Fig. 21). Because of the many access points, there is no way to physically close the Park. However, visitors are informed that the Park is closed dusk to dawn and gates to specific areas are closed from dusk until 8 am. There are day use and parking fees, with annual passes and group rentals available. Occasional road closures due to flooding of North San Pedro Road limit access and prevents vehicular ingress and egress from residential communities on the south side of Point San Pedro.

9.1.1.4 Facilities

Facilities within China Camp State Park include approximately 15 miles of trails for hiking, bicycling, and equestrian use; staging areas at trail heads; restrooms at staging areas; a campground; picnic areas; China Camp Village; and the Ranger Station. Seven picnic areas are available and are located along the shoreline at Buckeye Point, Weber Point, Bullhead Flat, China Camp Point, and China Camp Beach, and within the interior of the Park at Miwok Meadows and Bach Ranch Meadows. Many of these areas include lawns, picnic tables, running water, restrooms, and barbecues and can be reserved. Facilities at the China Camp Village include a cultural history museum, covered picnic area, café, and historical houses, structures, and machinery. The Ranger Station includes a small nature center that was created by Friends of China Camp. Facilities within the Park are accessible for people with disabilities.

9.1.1.5 Trails

The 15 miles of trails within China Camp traverse the ridgeline, wind through dense forests, and parallel the shoreline. One highlight of the Park's beautiful and very popular trail system is Turtle Back Hill Trail. This trail is a 0.75-mile loop that offers views of the San Francisco Bay as it passes across open grasslands, along the edges of the salt marsh, and through oak-bay woodland. Turtle Back Hill Trail is accessible to people in wheelchairs and people with limited vision, and features interpretive exhibits with tactile panels. Dogs are not allowed on the trails.

9.1.1.6 Allowable activities

Hiking, biking, fishing, boating, swimming, camping, and picnicking are all allowable. See map (Figure 17) for details.

9.1.2 Public Access Challenges

China Camp has significant public access challenges because of the high number of visitors, the need to protect significant archeological, cultural and natural resources, and the permeability of the Park borders.

9.1.2.1 *North San Pedro Road*

North San Pedro Road bisects two significant salt marshes within the Park and presents several inter-related public access challenges, including: (1) the road floods during extreme high tides, which presents an access challenge and public safety issue, as well as potential negative environmental impacts; (2) visitors park on the shoulder of the road, which is causing the shoulder to widen into the adjacent marsh and occasionally results in vehicles driving into the marsh; (3) FoCC, faces a loss of visitor use fees associated with parking on North San Pedro Road shoulder; and (4) Visitors using the road occasionally dump trash along it.

9.1.2.2 *Interpretation*

The Park has challenges that relate to interpretation, including fulfilling a shared desire from California State Parks, FoCC, and the NERR to offer more natural history programming and to have space to offer educational events during evenings or inclement weather. A secondary challenge to this is recruiting, training, and maintaining a volunteer base to lead or support programming. An underlying program is lack of staff time.

Citizen Science: California State Parks, FoCC, and the NERR would like to increase effective ways to engage visitors with science (including actually doing science), but this presents a resource protection challenge and another demand on staff time.

9.1.2.3 *Trails*

California State Parks and FoCC face an on-going challenge of maintaining existing trail infrastructure and preventing (or restoring) illegal social trails from being built.

9.1.3 Public Access Opportunities and the Visitor Experience

There are opportunities to improve visitor experience while continuing to protect natural resources within the Park.

9.1.3.1 *North San Pedro Road*

Issues surrounding North San Pedro Road are the most significant public access challenges the NERR is involved with at China Camp. Climate change will continue to exacerbate the problem, and innovative solutions will need to be developed. An honest and thoughtful dialogue with visitors will be necessary to find those solutions, as they may change the visitor experience at the Park. Addressing the challenges facing North San Pedro Road meets objectives 8 and 10 in this Management Plan. For example, a short-term action that addresses this challenge and supports objective 10 could include completing small restoration projects outside of the County right-of-way to narrow the width of the shoulder (leaving it wide enough to safely park on). Longer term and larger scale efforts to improve the road will require extramural funding (objective 8).

9.1.3.2 *Interpretation*

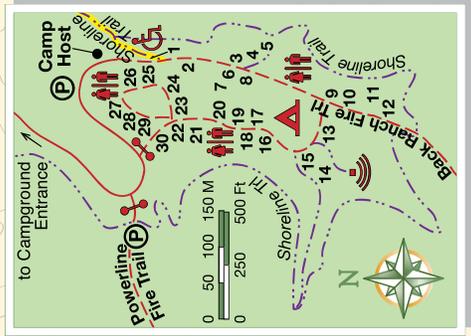
Supporting and increasing interpretation, through staff leading interpretive programming and/or supporting volunteer-led programming, is important to all of the partners at China Camp (including the NERR). Goals 2 and 3 of this Management Plan include many objectives and actions that support this intention. The primary interpretive theme the NERR emphasizes in interpretation is that China Camp was included with NERRS because of the large protected tidal marsh with a mostly protected and undeveloped transition zone and relatively natural tidal channel structure. We also communicate about the importance of the site to scientific research, and how long-term monitoring and research are used to improve management within and beyond China Camp.

This park receives support in part from a nonprofit organization. For further information, contact:
 Friends of China Camp
 (415) 488-5161 • friendsofchinacamp.org

China Camp State Park



to Civic Center, 101 (3.0 Miles)
 Sunny Oaks Dr
 No Parking
 Bay Hills Dr
 Scettini Fire Rd
 PRIVATE PROPERTY
 Campground Entrance
 to San Rafael, 101 (3.5 Miles)



9.1.3.3 *Citizen Science*

The Reserve will support existing (Nature's Notebook and King Tide Photo Initiative) and expand or develop new citizen science projects, if they can be done without negatively impacting natural resources. In keeping with interpretative themes, citizen science projects will be about long-term monitoring or related to restoration projects.

9.1.3.4 *Trails*

The Reserve will support our partners in their trail projects, and offer more of a leadership role where trail challenges intersect with our areas of expertise or where research coordination is needed.

9.2 **Rush Ranch**

9.2.1 **Current Public Access**

9.2.1.1 *Hours*

Open to the public during daylight hours (changes seasonally)

9.2.1.2 *Target Audiences*

Solano Land Trust estimates that thousands of people visit the Ranch each year. Large events, like Ranch Day, attract high numbers of users (up to 1,000 across the day), but most days host many fewer. Rush Ranch visitors include birders and naturalists, school groups (often associated with field trips from Resource Conservation District or Rush Ranch Educational Council), participants in scheduled programs (including NERR supported events like 'Get the Rush' and those of partner, Access Adventure), and casual visitors who come to explore cultural history or relax in nature. Solano Land Trust strives to welcome diverse community of people to all of their sites, with an emphasis on attracting people from Solano County. There is currently no mechanism to count visitors to Rush Ranch, nor have there been any carrying capacity studies.

9.2.1.3 *Access Points*

The primary access point to Rush Ranch is the headquarters area (where the Nature Center is located); it is located a short distance down a gravel driveway leading from Grizzly Island Road (approximately three miles from Fairfield, CA; see Fig. 20). Access to Suisun Hill Trail is located at the gate to the driveway, while the other trails depart from the headquarters area. Concentrating parking and use in this area allows for increased security and encourages visitors to interact with interpretive exhibits.

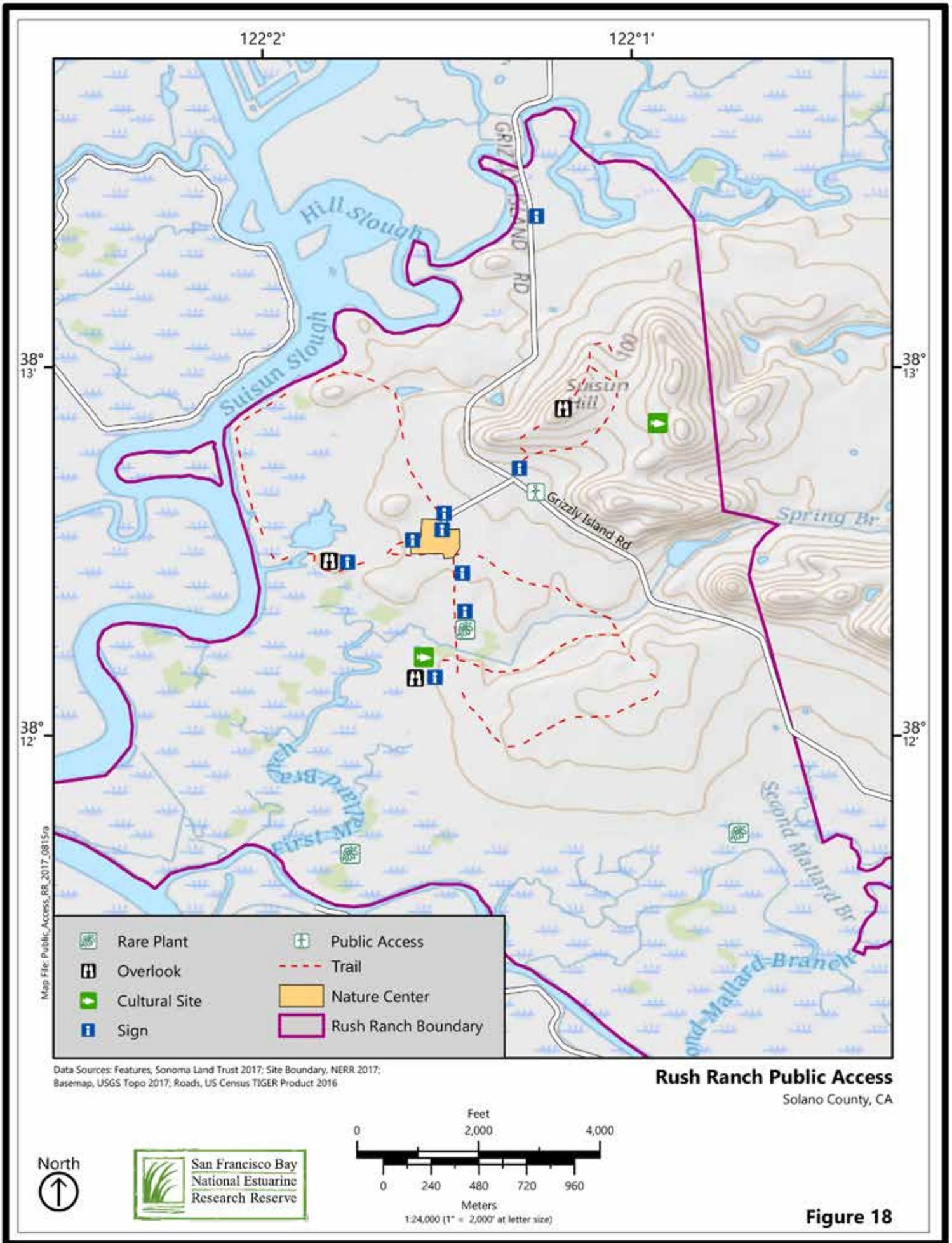
9.2.1.4 *Facilities*

Rush Ranch includes an unpaved parking area, historical and modern ranch buildings, Nature Center, guest quarters for visiting scientists, a residence, and a system of three well-maintained trails. Rush Ranch is open to the public during daylight hours 7 days a week, and has regular events for the public, especially on the third Saturday of the month (Get the Rush), and during an annual open house (Ranch Day).

Allowable activities: Hiking, picnicking, group camping with permission.

9.2.1.5 *Trails*

The Marsh Trail begins behind the Nature Center. The relatively flat trail has several loop options, ranging from less than a mile to just over 2 miles long. The trail passes by a replica of a type of home the Patwin people may have built in this area, through grasslands and along the edge of tidal marsh, and is a great place to see birds.



South Pasture Trail leaves from near the Blacksmith Shop and antique farm equipment. The trail offers a good view into a marsh channel, and an easy opportunity to see a large Native American grinding rock. Longer loop options are available, but may be difficult to follow through active pastures.

Suisun Hill Trail begins through the gate across from the Rush Ranch entrance on Grizzly Island Road. It is the only trail that allows dogs at Rush Ranch; they must be leashed. The trail climbs 500 feet to an overlook with expansive views of the marsh and the western hills of Solano County and Mount Diablo. The trails offer great opportunities to see raptors.

9.2.2 Public Access Challenges

Rush Ranch has experienced increased visitation since the last NERR Management Plan and is now also hosts' daily office space for SLT and SLT/NERR staff. The increased uses, and funding for restoration of two areas, have brought new public access challenges (and opportunities).

9.2.2.1 *Power and Water*

NOAA invested significant money in Rush Ranch to construct a Nature Center, associated buildings and infrastructure, including solar panels and a water filtration system. The facility is entirely off the grid and has successfully attracted new visitors and users to Rush Ranch. Upgrades to power and water were identified as the most important public access challenge at Rush Ranch.

9.2.2.2 *Parking*

Rush Ranch has a single public entrance point located on the west side of Grizzly Island Road. A gravel parking lot of approximately 17,000 SF accommodates approximately 20 standard sized vehicles, and is available for public use year-round. The driveway and all weather parking areas are gravel. Current parking facilities are not adequate on most days when schools and visitor groups are present. To accommodate the increased visitor levels at Rush Ranch it is necessary to expand the gravel parking area, to construct a bus roundabout to increase all weather vehicle capacity to a total of 30-40 vehicles, and improve vehicle and pedestrian circulation at the ranch headquarters. The County requires ADA compliant pathways from parking areas to public restrooms at the Nature Center.

9.2.2.3 *Trails Maintenance and Design*

The restoration of Goat Island Marsh presents new visitor use challenges because the restoration plan calls for removal of the levee on which the Marsh Trail is built. The portion of the trail that is on the levee is the best opportunity for visitors to be close to Suisun Slough. It also provides a level, long trail for visitors wanting a longer hike. However, currently the levee that the trail follows is failing, and the trail is occasionally impassable or unsafe. With completion of the Goat Island Marsh restoration, the Marsh Trail on the outer levee will be permanently closed.

9.2.3 Public Access Opportunities and the Visitor Experience

9.2.3.1 *Goat Island Marsh Restoration*

The restoration of Goat Island Marsh also presents opportunities for improved access, especially to the waters of Suisun Slough. Some iterations of the restoration plan include new public access features to mitigate the loss of this trail, including construction of a boardwalk and observation platform. A platform could allow groups or classes to collect water samples, provide a place to install new instrumentation (like water quality sensors) for education and research, and give visitors a chance to see the marsh and slough up close. The NERR will work with SLT and other partners to encourage public access features are included in restoration plans.

9.2.3.2 *Spring Branch Creek*

The restoration of flow to Upper Spring Branch Creek similarly presents access opportunities. Although restoration plans do not currently call for public access features, there may be opportunities to allow for access to the tidal channel for water sampling or observation.

Actions related to both of the public access opportunities described above could allow for on-going citizen science monitoring related to the restorations and create more ways to involve students and teachers in research, as supported by Goal 2 of this Management Plan.

The primary interpretive theme the Reserve emphasizes in interpretation is that Rush Ranch was included as part of the Reserve because of the large protected tidal marsh, undeveloped transition zone between the marsh and uplands, and the relatively natural tidal channel structure; we summarize this as “locally loved, nationally famous”. We also communicate about the importance of the site to scientific research, and how long-term monitoring and research are used to improve management within and beyond Rush Ranch.



Tidal marsh plain at China Camp showing the fall color of pickleweed, the dominant plant species in the high marsh. Photo: Michael Vasey

CHAPTER 10 - FACILITY DEVELOPMENT AND IMPROVEMENT PLAN

10.1 Purpose of Facilities and Construction Philosophies

The Reserve facilities, and associated stressors and future needs, at RTC, China Camp, and Rush Ranch are described. The Reserve is committed to following the guidelines presented in "Planning for Sustainable Facilities" in Appendix 10 of the NERRS Management Plan Guidance document. Thus, to reduce the impact of facilities and construction activities on the Reserve's natural resources, any new facilities and remodeling will include sustainable design, construction concepts, and materials wherever possible. Likewise, damage from construction activity will be mitigated wherever possible; and disturbance from construction activity will not impact on-site wetland systems. The design of Reserve facilities, the construction methods used, and the materials chosen for building can serve as education tools for sustainability and low impact development; therefore, information and exhibits will be established on-site to educate visitors about sustainable buildings and materials, along with related topics such as reducing carbon emissions, the use of solar energy, and permeable surfaces. Additionally, all future Reserve facilities improvements or additions will be built to be resilient to climate change.

10.2 Romberg Tiburon Center

10.2.1 Description of Current Facilities

As a campus of SF State, RTC is the only university estuarine and ocean science center on the shores of San Francisco Bay. It has a rich cultural history (see Section 1.4.3) that is reflected by several historic and contemporary structures that currently occupy its dramatic 53-acre landscape. The Reserve occupies a prominent place among this academic community.

10.2.1.1 RTC BUILDING 36

Dedicated Spaces

- Research and SWMP laboratory with workstations and capacity for dry lab activities.
- Research Coordinator principal investigator office (window).
- Reserve Manager office (with window; approximately 216 square feet).
- South wing of second floor, configured with seven offices, a shared seminar room (capacity 16), and a large room (approximately 500 square feet) that serves as the location of the combined NERR-RTC library.

Shared Spaces

- Keck teaching laboratory (capacity 20).
- IT classroom (capacity 15).
- Atrium for exhibits and displays.
- Other common use facilities, including kitchen, commons room, and restrooms.

10.2.1.2 RTC BUILDING 39

Dedicated Spaces

- The second floor, including usage of the former RTC administrative area, with offices and open area, to be

configured for Reserve and RTC Education and Outreach needs.

- The former “principal investigator wing” provides offices for Reserve EC, Reserve CTP Coordinator, visiting colleagues, and a room for Reserve supply storage.

Shared Spaces

- Shared use of Information Technology classroom (second floor; capacity 20) and lecture classroom (first floor; capacity 20).
- Shared storage area adjacent to Information Technology classroom.
- Shared spaces including lobby, kitchen, and restrooms.

10.2.1.3 Bay Conference Center at RTC

SF Bay NERR has access to the Bay Conference Center for larger meetings as needed at no cost. The Bay Conference Center’s facilities include a 140-seat main hall for large meetings or lectures, two meeting rooms seating from 10-60 people, and a comfortable lounge with fireplace. Free parking and outdoor picnic areas are available.

10.2.1.4 Other facilities at RTC

- RTC Building 50 - Storage needs for equipment and gear are provided here, including space for a canoe and approximately 300 square feet of shelf space.
- RTC Building 49 - Primarily used by the Reserve for its maintenance workshop. Includes a lathe, mill, drill press, band saw, table saw, etc. These tools are essential for construction and repair of monitoring stations and other hardware modifications needed to sustain SWMP over time.
- Ohrenschall Guest House - Full kitchen for guests, comfortable living area, individual rooms with bathrooms or shared bathrooms on upper floor. This site is available to host workshop organizers and attendees, visiting scientists, and NOAA program specialists and staff for a modest fee.

*10.2.1.5 RTC Shared Use Facilities (*use fees charged)*

- Research Pier
- Small Boat Launch
- Gene Laboratory*
- Elemental Analysis Laboratory*
- Flow Cytometer*
- Turner 10 AU Fluorometer*
- Baywater System*

10.2.1.6 Main Campus

An office with a desk and a phone is provided on the main campus. This space is shared among NERR staff and the RTC Director for workdays on the main campus. Space is assigned on an as-available basis each semester.

10.2.2 Facility Challenges and Gaps

SF State is sponsoring a master planning process that will provide a vision for the RTC site and its existing buildings. The Reserve program Director and staff will participate in the master planning process. More comprehensive assessment of challenges and gaps for Reserve-related facilities will be possible when the master plan is completed. Meanwhile, the following elements have been identified that are relevant to this planning document and that are expected to be important challenges and gaps for Reserve headquarters at RTC into the future.

Status of Building 36 (location of Reserve lab, office and meeting space): The status of this building is satisfactory.

Status of Building 39: This building requires upgrades. It needs to be modified to be brought into compliance with the American's with Disabilities Act. Until that time, it cannot be used as for public events, such as educational programs or as an outreach center. The building is also a candidate for installation of a solar power system to reduce its carbon footprint.

Status of Buildings 49 and 50. These buildings have recently been identified as needing substantial retrofitting for continued use. The CSU and SF State have collectively allocated \$2.6M to start addressing these needs. We anticipate additional funds will be made available in subsequent years. Minor renovations have recently been made to repair emergency exits and fire escape stairways and allow for continued occupancy and allow current uses to be sustained.

The Bay Conference Center is an excellent venue for meetings and trainings. Repairs are needed for the solar power system's inverter and will be completed in the coming year. The building requires some seismic retrofitting that the CSU has committed some funding to complete.

10.2.3 Planned Facilities

SF State is currently working on a major fund raising campaign. Facilities at RTC are targeted for both construction and upgrades. Reserve research, education, and training activities will benefit from these new facilities. New facilities in the planning stages are as follows:

- Wetlands research greenhouse facility, with environmental controls; flow through baywater; freshwater and seawater
- Aquatic research facility with environmental controls; flow through baywater, seawater and freshwater; and a flume laboratory.
- Temporary housing for small groups of; visiting scientists and graduate students (~10-20) Longer-term graduate student housing (10-20). Shared kitchen, dining area and commons for residents and visitors. Buildings 49 or 50, after they are retrofitted, may be considered for renovation.
- A new Science Education and Visitor Center. SF State has partnered with PG&E in a design challenge contest where students and professionals will contribute designs for this facility to meet CA's goals for all new construction to be net zero energy (NZE) by 2020 and 2030 for residential and commercial construction, respectively. The winning designs will be considered as the basis of a fundraising campaign to build the facility.

10.2.4 Facilities Upgrades

There are a number of facility upgrades that would be of great value to the Reserve.

- The parking facilities on both the upper (Building 39 and BCC) and lower (Building 36) campus need to be repaired or replaced. The upper campus parking area may be well suited to being replaced with a water permeable paving surface.
- The addition of solar power to Building 39 and repair of the solar inverter for the BCC would make the Reserve headquarters more sustainable.

- ADA accessibility upgrades to Building 39 (ramps, lifts, bathrooms)
- The Reserve and RTC need a public and K-12 education space at RTC where visitors could participate in and learn about research in a safe environment away from the working labs. We have long envisioned turning the lower floor of Building 39 into a coastal and estuarine education center. This would require significant improvements, including making the building ADA compliant.
- Guest quarters able to house at least 20 adults comfortably, with semi-private sleeping areas and communal gathering space, would greatly assist with Teachers on the Estuary workshops and other education, training and research programs
- Aquatic Research Center for NERR-related experimental research

10.2.5 Climate and Non-Climate Stressors

NOAA's Digital Coast Sea Level Rise Viewer shows portions of RTC flooding with a 6-foot rise in water level. Building 36 is just beyond the area predicted 6-foot flood area. However, Building 39 is situated on a hill well beyond current sea level rise projections. RTC's shoreline is primarily protected by a hard seawall; RTC and the Reserve would like to restore the shoreline to a more natural system that is more resilient to rising water levels. All structures on the site are potentially vulnerable to fire, but modern sprinkler systems and alarms are installed and regularly maintained in Buildings 36 and 39.

10.3 China Camp State Park

10.3.1 Description of Current Facilities

The park offers 15 miles of hiking, biking, and equestrian trails, as well as a museum describing the cultural history of the site. Back Ranch Meadows Campground has walk-in sites for tent-camping only. China Camp has three reserve able picnic areas with barbecues: Buckeye Point and Weber Point are day use areas with views of the water and are suitable for groups of 50 people or less; Miwok Meadows Picnic Area is larger (for groups up to 200 people) and is located in a grassy meadow among Oak and Bay woodlands. There are also non-reservable picnic tables throughout the park, including areas with numerous tables at China Camp Point and near the beach at the historic Chinese village.

The park has facilities for visitor center at the historic village, ranger station, administrative headquarters, staff housing, and a maintenance shop. Presently the Reserve has no constructed facilities at China Camp, other than the modifications made to the pier at the fishing village to install SWMP equipment. The Reserve collaborated with California State Parks using NOAA construction funds to install interpretive signage at three areas within the park (most of which was refreshed in 2016). Through a grant from NOAA's Marine Debris Program, an additional interpretive sign was added in 2016. Additional needs include installation of a new piling, access platform, and instrumentation mooring to allow future relocation of the SWMP equipment (presently on the China Camp village pier) to deeper water. Education needs include classroom or lecture space protected from the elements for Reserve, California State Parks, and FoCC, to use for educational programming.

10.3.2 Facility Challenges and Gaps

There is a need for better Reserve educational and visitor facilities to facilitate teaching classes and workshops at China Camp. The FoCC, and California State Parks have proposed an outdoor classroom, and the Reserve is supportive of this proposal or of a more comprehensive Nature Center that includes an indoor classroom. There is a great desire for a large and modern visitor center for China Camp although finding a suitable site for such a facility will be a challenge.

10.3.3 Planned Facilities

- Outdoor Classroom – Preliminary plans are already developed for this joint California State Parks, Friends of China Camp, and Reserve facility. It would be located at the Park headquarters near Bullhead Flat.
- Improvements could be made to the visitor center in the historic village. For example, the facility is being used for presentations but lacks comfortable seating and dedicated A/V equipment.

10.3.4 Envisioned Facilities

- Visitor and education center – This would ideally be a major facility that would share space for California State Parks, Friends of China Camp, the Reserve, and possibly the County of Marin.

10.3.5 Climate and Non-Climate Stressors

The historic village and pier at China Camp are threatened by sea level rise. They are historic structures and any efforts to protect them would need to involve many partners and careful planning. With the exception of the SWMP station on the Pier, there are no Reserve-funded facilities that are threatened by climate change.



China Camp village is an excellent outdoor meeting space and, at the end of the pier, it harbors a very informative museum that documents the history of this historic Chinese shrimp community. Today, out of 26 former Chinese shrimp villages along San Francisco Bay, only China Camp remains relatively intact. Photo: Michael Vasey.

10.4 Rush Ranch Open Space Preserve

10.4.1 Description of Current Facilities

NOAA investments totaling approximately \$800,000 provided funding that, with augmentation by other SLT funding sources, was used to build the “Rush Ranch Nature Center” that offers space for meeting and events, a small Reserve laboratory, a small kitchen, offices, restrooms, and a foyer with interpretive exhibits. An adjacent building includes Guest

Quarters for visiting scientists and others plus a 3-bedroom, 2-bath Caretaker's Residence. A landscaped patio in front of the Rush Ranch Nature Center offers additional outdoor gathering space.

Through an additional NOAA construction grant, interpretive exhibits were installed on the exterior walls and in the foyer of the Nature Center. The interactive exhibits include two beautiful murals, maps of the trails and estuary, and exhibits that highlight the three major habitats at Rush Ranch and the animals and plants that live in them.

10.4.2 Facility Challenges and Gaps

Power and Water: Upgrades to power and water were identified as the most important public access challenge at Rush Ranch. These are extensive and include new battery banks and accessories, new solar panels, new water filtration system, and much more.

Parking: Upgrade parking facilities to support increased visitor ship, especially school busses, including expanding year-round parking, creating a turnaround circle, and creating an ADA-compliant walkway to connect parking with headquarters area

Drainage: With increased visitor infrastructure, impacts to adjacent habitats from runoff and storm water drainage must be minimized. A storm water management system is needed to reduce potential discharge from the visitor services and to reduce water accumulation and soil saturation and to minimize the potential for pollutant discharge into sensitive marsh habitats.

Guesthouse/Researcher's Quarters: County Zoning requires that bathroom and kitchen facilities are ADA compliant before full use can be permitted. In addition, all emergency and non-emergency ingress/egress pathways must be ADA compliant.

Trails Maintenance and Design: The restoration of Goat Island Marsh presents new visitor use challenges because the restoration plan calls for removal of the levee on which the Marsh Trail is built.

- Improve trail to Goat Island marsh (decomposed granite, vehicle accessible for maintenance and mobility-impaired users. Construct an elevated wildlife-viewing platform and boardwalk at the planned southern terminal end of the Goat Island levee (near the current southern gate) with ramp and other visitor amenities (benches, interpretive panels, shade structure).
- Construct a trail to an overlook site near the Rush Landing location to provide trail users with an interpretive focal point (benches, panels, kiosk) at the north end of Goat Island marsh.

10.4.3 Planned Facilities

The SLT has a conceptual design and site plan for the Ranch headquarters. The site plan aims to re-establish safe and reliable energy and drinking water supplies, improve circulation and accessibility, expand capacity within the existing footprint, orient visitors to the site, improve the flow of vehicle and foot traffic, improve access for people with disabilities, protect historical structures, improve public safety, and increase parking availability for normal daily usage. The County pursuant to an Initial Study –Mitigated Negative Declaration (ISMND) under CEQA, has approved all improvements.

10.4.3.1 Interpretive facilities and trails

SLT and the Reserve will work together to design and construct interpretive nature trail and public access facilities in conjunction with implementation of tidal marsh restoration projects (lower Spring Branch Creek and Goat Island Marsh). The purpose of these improvements is to provide a safe and attractive visitor experience for users in close proximity to the Ranch headquarters, create gathering areas to facilitate instructional and recreational use, concentrate visitor use for the purpose of resource protection, and offset the loss of public access resulting from closure of the levee-portion of the

Marsh Trail around Goat Island Marsh. The project will be installed in accordance with the implementation of the habitat restoration projects.

The proposed interpretive nature trail and facilities at Goat Island Marsh will provide concentrated public access to the lower portion of Goat Island Marsh to reduce dispersed impacts elsewhere at the restoration site. The trail will require realignment of existing fence lines and footpaths between the Ranch headquarters and Goat Island Marsh and will include construction of a boardwalk, wildlife viewing platform, an all-weather interpretive nature trail, interpretive exhibits.

In addition, part of the Spring Branch Creek restoration plan contains constructing up to 2000 feet of interpretive trail (36" width) consisting of hard packed native soil in the grassland between the Ranch headquarters and Spring Branch Creek, a spur trail up to 150 feet to an interpretive sign and 12 x 8 foot platform (96 SF) in grasslands on north bank of lower Spring Branch Creek for public educational access, and interpretive signs along the interpretive trail in the grasslands portion of the South Pasture Trail north and south of Spring Branch Creek.

Finally, a staging area and footpath expansion is needed for visitors to the East Hills and Suisun Hill Trail. This involves constructing a 4000 square foot staging area and an expanded footpath up to two miles in the East Hills to provide longer hiking opportunities. Footpaths may include gated access to crosswalks on Grizzly Island Road to connect with trails in the South Pasture. Improvements also include signage and other traffic safety features, benches and interpretive signage at scenic overlooks and other areas of interest. The planned East Hills visitor improvements provide safe access for visitor use, and also support rotational grazing by facilitating handling and herding of cattle among pastures and across Grizzly Island Road.

10.4.3.2 *Facilities Upgrades*

Rush Ranch has a number of important upgrades to its facilities that will be key to keeping Rush Ranch operational in the future.

- **Energy:** a 10 kW solar array with battery storage, a defunct 2.5 kW wind turbine, and a 48kW propane-powered backup generator power The Nature Center and headquarters area. The system is inadequately sized, has outdated technology and does not reliably provide renewable power for the current demand. Additional solar panels (6 kW), new back-up batteries and modern controllers/inverters are needed to meet increased demand for reliable power. In addition, the current wind-turbine needs to be repaired or replaced. Finally, the current propane-operated generator is oversized, causing wasteful propane consumption. Right-sizing the entire electrical system is one of the highest priorities and prerequisites for continued public access and operation of Rush Ranch.
- **Drinking water** at Rush Ranch is pumped from an on-site well into two 8,000-gallon tanks, with 5,000 gallons held in reserve for fire and emergencies. The drinking water source is a 1930's era hand-dug shallow well that has silted in and is not reliable anymore (Doshier and Gregson Well Report, on file with SLT). A new well is needed to allow continued access to sufficient quantities of fresh water, preferably located in a location that is less susceptible to seawater intrusion. Drinking water is purified with a multi-tiered purification process with an ozone generator, reverse osmosis through a filtration system, and ultraviolet irradiation. This system is ailing due to its age and outdated technology and has caused numerous interruptions to the water supply. The adequate supply and safety of drinking water is crucial for all users at Rush Ranch, including the activities of NERR scientists, SLT staff and educators.
- **Current parking facilities** are not adequate on most days when schools and visitor groups are present. To accommodate the increased visitor levels at Rush Ranch it is necessary to expand the gravel parking area, and construct a bus roundabout to increase all weather vehicle capacity to a total of 30-40 vehicles, and improve vehicle and pedestrian circulation at the ranch headquarters. The increase in all-weather parking spaces would be accomplished by converting some of the existing supplemental parking spaces to all weather spaces. Existing trees would be maintained where possible, except individual eucalyptus trees that are determined to pose a potential safety hazard may be replaced with more suitable species or at a more suitable location. The County

requires an ADA compliant pathway from parking to restroom facilities at the Nature Center and ADA-compliant bathroom, kitchen and ingress/egress at the guesthouse as permit conditions.

- With increased visitor infrastructure, impacts to adjacent habitats from runoff and storm water drainage must be minimized. It is therefore necessary to establish a storm water management system to reduce potential discharge from the visitor services area as a whole, to reduce water accumulation and soil saturation in areas of moderate to heavy public use and to minimize the potential for pollutant discharge into sensitive marsh habitats. Drainage improvements will include (a) redirecting Source Flows (from Grizzly Island Road and the Rush Ranch Driveway), (b) re-aligning drainage ditches to direct flow away from heavy use area, reduce storm water accumulation within public access areas, travel corridors and work areas, and minimize potential for discharge of pollutants and (c) implementing a buffer strip/infiltration area and pretreatment constructed wetland basin to capture and filter surface water flows from the corrals.

10.4.4 Climate and Non-Climate Stressors

Rush Ranch facilities are not vulnerable to sea level rise. They are vulnerable to drought, especially given the reliance on well water, as well as wild fire.

10.5 Exhibits

If new education facilities are constructed at China Camp or RTC, extensive exhibits will be needed to enhance the educational value of those facilities and ensure the NERR message is interpreted even when staff is not present. New exhibits will also be necessary with the restoration projects at Rush Ranch.



The visitor center, meeting room, Reserve lab, office, and guest lodging facility were largely funded by NOAA and provide an excellent facility shared by SLT and the Reserve. The facility is “off-the-grid” and relies upon wind power, solar power, and well water, all of which will need upgrading in the years to come. Photo: Michael Vasey.

CHAPTER 11 – LAND ACQUISITION PLAN

11.1 Land Acquisition Plan

Relatively few historic tidal wetlands remain in the SFE and almost all of these are in public ownership. This situation in large measure drove the original mission of the Reserve to identify and establish partnerships with public land managing institutions that harbor some of the last and best representatives of these tidal wetland landscapes, both in the lower estuary (San Francisco and San Pablo Bay) and in the upper estuary (Suisun Bay) (see Chapter 1). A major purpose of the Reserve is to utilize well-protected historic estuarine ecosystems at Rush Ranch and China Camp as reference sites to inform the stewardship and restoration of estuarine ecosystems elsewhere in the SFE.

There are other protected estuarine habitats that align with the priorities of the Reserve whose eventual inclusion in the Reserve could strengthen the Reserve’s mission. For the five-year time-frame covered by this Management Plan, however, we do not intend to propose additional boundary expansions nor formal inclusion of land managing partners that boundary expansion would entail during the time frame of this revised management plan.



Sea-level rise and diminished suspended sediment supply are predicted to shift low marsh dominated by Pacific cordgrass inland to displace the high marsh plain currently dominated by pickleweed. Annual vegetation surveys are tracking the potential for these kinds of shifts. Photo: Michael Vasey.

CHAPTER 12 - RESOURCE MANIPULATION PLAN

12.1 Rush Ranch Grazing Operations

12.1.1 Grazing Operations Description

The Reserve is currently engaged in one resource manipulation activity at its Rush Ranch component: cattle grazing. Grazing occurs exclusively in the upland buffer area in approximately 950 acres of upland grassland habitat (Rush Ranch Grazing Plan 2014). Before protection by the SLT, the lands of Rush Ranch, including the tidal wetlands, were grazed. Grazing today is limited to upland grasslands. Grazing is connected with the Reserve's goals in that it: (1) provides a place for research-based studies of best-practices in grazing and (2) provides income to the Solano Land Trust to finance its land managing operation. Priorities for the Reserve are to insure that the grazing regime practiced at Rush Ranch is sustainable, maintains the integrity of ecological resources in grassland ecosystems, including sensitive species, and protects seasonal wetlands and flow regimes that help support tidal wetlands nourished by these flows.

The Reserve had the opportunity to work with SLT in developing and reviewing its Grazing Plan (2014), which has become part of the Rush Ranch Management Plan (2014). The plan stresses adaptive management for the grazing regime depending on spring rains which, data has demonstrated, is the best predictor of the amount of forage available in a given year. Herds of cattle are rotated frequently to prevent excessive grazing in any one pasture. Protected zones adjacent to tidal wetlands and seasonal wetlands are grazed infrequently and for short periods to minimize impacts on adjacent wetlands. The potential benefits of this resource manipulation for the Reserve include: reduction of thatch and promotion of upland grass and forb diversity, improvements in soil health, and enhancement of water holding capacity of uplands. The scale of these manipulations is widespread over the hills and slopes that constitute uplands that surround the core tidal wetlands. The SLT contracts with a livestock operator to manage the operation. No local, state, or federal authorities apply. A baseline of approximately 900 AUM (Animal Units per Month) are allowed to graze the area from October through April (the growing season) although the number of AUM is scaled to growing conditions each year (as determined by the amount of precipitation from March 1 through April 30). Consequently, during dry years, the AUM allowed is reduced.

12.1.2 Non-Climate and Climate Stressors

One advantage of the grazing regime taking place at Rush Ranch is that it provides the opportunity to engage in research that is considered of great importance to land management and carbon sequestration in California. Recent studies have suggested that adding compost to grazed grasslands can improve carbon sequestration, water holding capacity, and plant diversity in grazed grassland soils (Silver et al. 2010; Ryals et al. 2016). The SLT obtained funding from the V. Kann Rasmussen Foundation to conduct a replicated study of grassland soil and vegetation response to compost additions in both grazed and ungrazed plots. SLT and a San Francisco State University graduate student advised by Dr. V. Thomas Parker, a community ecologist, are conducting the study.

In general, climate factors could negatively impact grazed grasslands, particularly if there is a prolonged drought. The adaptive management approach to rotational grazing and herd size is a positive response to this future scenario. Another important response involves restoration of Upper and Lower Spring Branch seasonal wetlands as well as Suisun Hill Hollow. Restoration of these seasonal wetland habitats will hopefully improve flows to core tidal wetlands and also provide migration space for tidal wetlands as sea level rises. These features should enhance resilience of the tidal wetlands potentially impacted by resource manipulation in the event of climate uncertainty.

12.1.3 Current and Potential Partners

Partners involved with developing the Rush Ranch Grazing Plan, State Natural Resource Conservation District representatives, and the Elkhorn Slough NERR Coastal Training Program. In conjunction with the 'Carbon Farming' grant above, we are working with the Carbon Cycle Institute, USGS, and San Francisco State University.

12.1.4 Permitting Approval Requirements

There are no permit requirements for this resource manipulation activity.

12.1.5 Impacts of Resource Manipulation Activities

We are mindful of the potential negative impacts of grazing at Rush Ranch and are both observing and studying these impacts. The grasslands themselves offer habitat for many plant, animal, and microbial species that occur at the Reserve. These grassland habitats are adequately monitored at this time. Much is being learned through research focused on the major seasonal streams flowing down into the tidal wetlands from the grassland uplands. One lesson is that limits on grazing in these seasonal wetlands are necessary. Monitoring of restored seasonal streams will provide insights on how streambeds recover and how species inhabiting these ecosystems respond when grazing is removed. The adaptive management plan is specifically designed to control the impact of grazing on grasslands and to promote an appropriate level of grassland biomass to support grassland species through rotation and management of numbers of livestock grazing at any one time. The Reserve Stewardship Coordinator is engaged in this monitoring activity that involves citizen science and remote sensing imagery (including the use of UAS operated by the Reserve staff).

The deployment of Reserve water quality monitoring stations at Rush Ranch was designed in part to test the impacts of upland drainage on the marsh. One station is situated in First Mallard Slough where upland drainage from grazed grasslands is seasonally pronounced, the other in Second Mallard Slough which gets much less upland drainage. Although discrete monthly water samples at these two stations indicate consistently higher nutrient concentrations in First Mallard compared with Second Mallard, the persistence of these differences throughout the dry season suggests that the pattern may be driven in large part by external factors not related to land management at Rush Ranch. For example, compared with Second Mallard, the First Mallard station is closer to nearby managed wetlands and wastewater treatment plants, both of which discharge effluent into nearby tidal sloughs and may disproportionately affect water quality at First Mallard even when local runoff is nonexistent. Beginning in Summer 2017, the Reserve will begin collecting preliminary data within the tidal sloughs around First Mallard and Second Mallard to explore the possibility of regional influences on water quality and to enable in the future a more thorough examination of land-use impacts. In addition to possible effects of nutrient loading on aquatic food webs and marsh plant productivity, the increased nutrients in First Mallard may be affecting the invasive perennial pepperweed that is abundant in that area of the tidal marsh, but this speculative connection would need to be more carefully researched.



Through the VK Rasmussen Foundation, the SLT obtained funding to study the effects of “carbon farming” on Rush Ranch grazing lands. A SF State graduate student in Community Ecology (Mizael Seminatore) is working on his MA for this project. A meeting of the principal participants occurred in Spring, 2017. From left to right participants included Dr. Jeff Creque, Mizael, an unidentified participant from NRCS, Dr. Frank Casey from USGS, Jared Lewis (Stewardship Coordinator) and Dr. Steve Kohlmann, former Stewardship Director at the SLT. Photo: Michael Vasey.

CHAPTER 13 - RESTORATION MANAGEMENT PLAN

There currently are no plans for restoration at China Camp. At Rush Ranch, four projects are planned, three of which are funded for restoration at Rush Ranch during the five-year planning horizon.

13.1 Rush Ranch Restoration Projects Overview

Restoration projects at Rush Ranch are the responsibility of the Solano Land Trust which has obtained funding for plans, permits, and implementation of these projects. The major role of the Reserve is to comment on the projects and to assist Rush Ranch with long term research and monitoring that will enhance the scientific value of these sites. Figure 19 shows the locations of the four restoration projects at Rush Ranch. These projects include interrelated habitat restoration and improvement projects designed to restore and enhance the core conservation values and public benefits associated with the Rush Ranch NERR. The following four restoration projects will restore natural fluvial and tidal processes within Rush Ranch:

- Goat Island Marsh Tidal Restoration Project
- Suisun Hill Hollow Enhancement Project
- Lower Spring Branch Creek Tidal Marsh and Active Alluvial Fan Restoration Project
- Upper Spring Branch Creek Enhancement Project

The purpose of these projects is to restore connectivity across the estuarine, alluvial, and terrestrial landscape to the maximum extent feasible and to enhance the educational and recreational experience of visitors within the constraints of site partner goals and management objectives. Restoration will be implemented in cooperation with partners, technical experts, regulatory agencies, and other stakeholders.

13.1.1 Goat Island Marsh Tidal Restoration Project

The proposed project will restore unrestricted tidal flows to Goat Island Marsh, currently a diked, muted marsh with broken tide gates. Proposed actions include excavating a breach in the levee and constructing a tidal channel, lowering the remainder of the perimeter levee, closing the levee portion of the Marsh Trail, expanding marsh ponds, and revegetating the levee excavation site and marsh-terrestrial ecotone. A wildlife viewing platform and interpretive trail will be constructed concurrently with the project to provide alternate public access, as specified above. This restoration project is not yet funded.

13.1.2 Suisun Hill Hollow Enhancement Project.

This project will restore hydrologic and hydraulic connectivity between upland, fluvial, and estuarine habitats in Suisun Hill Hollow and Goat Island Marsh, enhance seasonal wetland habitats and reconnect ecological processes between the tidal and fluvial system. Proposed actions include installing off-channel stock water facilities and gates for livestock, installing exclusion fences to protect seasonal wetlands, lowering artificial berms and re-grading impoundment sites to create seasonal wetland complexes, implementing vegetation management actions to encourage native wetland plants and discourage weeds, installing low-water crossing to maintain public access across the site. The project is funded by California Department of Fish and Wildlife. Design is complete and permit applications are currently being processed by SLT.

13.1.3 Lower Spring Branch Creek Tidal Marsh and Seasonal Wetland Enhancement Project

This project will improve hydrologic and hydraulic connectivity between upland, fluvial, and estuarine habitats along the seasonal creek system and facilitate landward tidal marsh migration as sea level rises. Proposed actions include

redesigning the berm and resizing culverts at the distal end of Spring Branch Creek, re-grading channels, berms, and ditches within the project site, restoring native vegetation, and designating service roads to provide vehicle access to the South Pasture from Grizzly Island Road. This project is intended to have important benefits for educational activities which the Reserve will conduct. It is funded by California Department of Fish and Wildlife. Design is complete and permit applications are currently being processed by SLT.

13.1.4 Upper Spring Branch Creek Seasonal Wetland Enhancement Project.

This project is in its final implementation phase and includes the erection of additional livestock fences to control livestock access, additional water source development for cattle outside the wetlands area, and the maintenance/repair of the existing spillway and pond to provide sufficient water for wetlands, maintain open water and the existing emergent vegetation suitable to support the currently existing breeding colony of tri-colored blackbirds and California Tiger Salamander breeding populations. The Upper Spring Branch project involved only repairs and maintenance activities to existing impoundment features without any grading for wetland creation anywhere in the Secondary Marsh Zone. Extensive plantings with site-adapted native shrubs and herbaceous plants is ongoing to complement and enhance the habitat value of this important wetland site. This project was designed and mostly implemented under two funding mechanisms, namely a mitigation project from Caltrans, the state transportation agency, and a small grant from the National Fish and Wildlife Foundation.

13.2 Factoring Climate and Non-Climate Stressors into Restoration Planning

These four restoration projects are all designed with climate change in mind. Suisun Hill Hollow, Lower Spring Branch Creek, and Upper Spring Branch Creek are designed specifically to enhance flows from upland seasonal wetlands into tidal wetlands, thus increasing sediment delivery and species' opportunities to move up and down these drainages. The connectivity between these seasonal drainages and tidal wetlands creates improved connectivity and opportunity for marsh migration in the face of sea-level rise. The Goat Island project specifically restores a former managed diked wetland to a tidal wetland. It creates additional habitat for tidal wetland species at Rush Ranch including opportunities for aquatic species to expand into this habitat. Non-climate stressors include potential invasive plants. These issues have been addressed as part of the plan. Included are extensive native plant restoration additions and future monitoring plans.

13.3 Determining Restoration Priorities

All four restoration projects were identified by a project funded by the Coastal Conservancy several years ago. It was recognized then that Goat Island Marsh was an ideal restoration site that could serve as a model for tidal wetland restoration in the Suisun Marsh region. The other three projects were highlighted because of their value in enhancing connectivity and ecological processes between uplands and tidal wetlands.

13.4 Priority Restoration Planning

The Goat Island Marsh project has not yet been funded and the Reserve is working on funding for future monitoring of this site. Also, the Reserve may be able to help fund an educational viewing platform and interpretive site that will be used by our education program for education delivery to a broad audience. The tidal wetland sentinel site program under way, the SWMP program, and habitat mapping program should be very valuable for reference / restoration comparative purposes. This includes the use of tidal benchmarks to accurately track sedimentation and marsh accretion over time at Goat Island Marsh as well as Suisun Hill Hollow and Lower Spring Branch Creek. The SWMP program will provide the capacity to compare impacts of the restoration on First Mallard Branch slough (which connects to Lower Spring Branch Creek) to the non-impacted Second Mallard Branch SWMP station. Suisun Hill Hollow will connect up to Suisun Slough for the first time in over a century as it enters the Goat Island tidal wetland restoration that will be tidally connected to Suisun Slough.

122°2'

122°1'

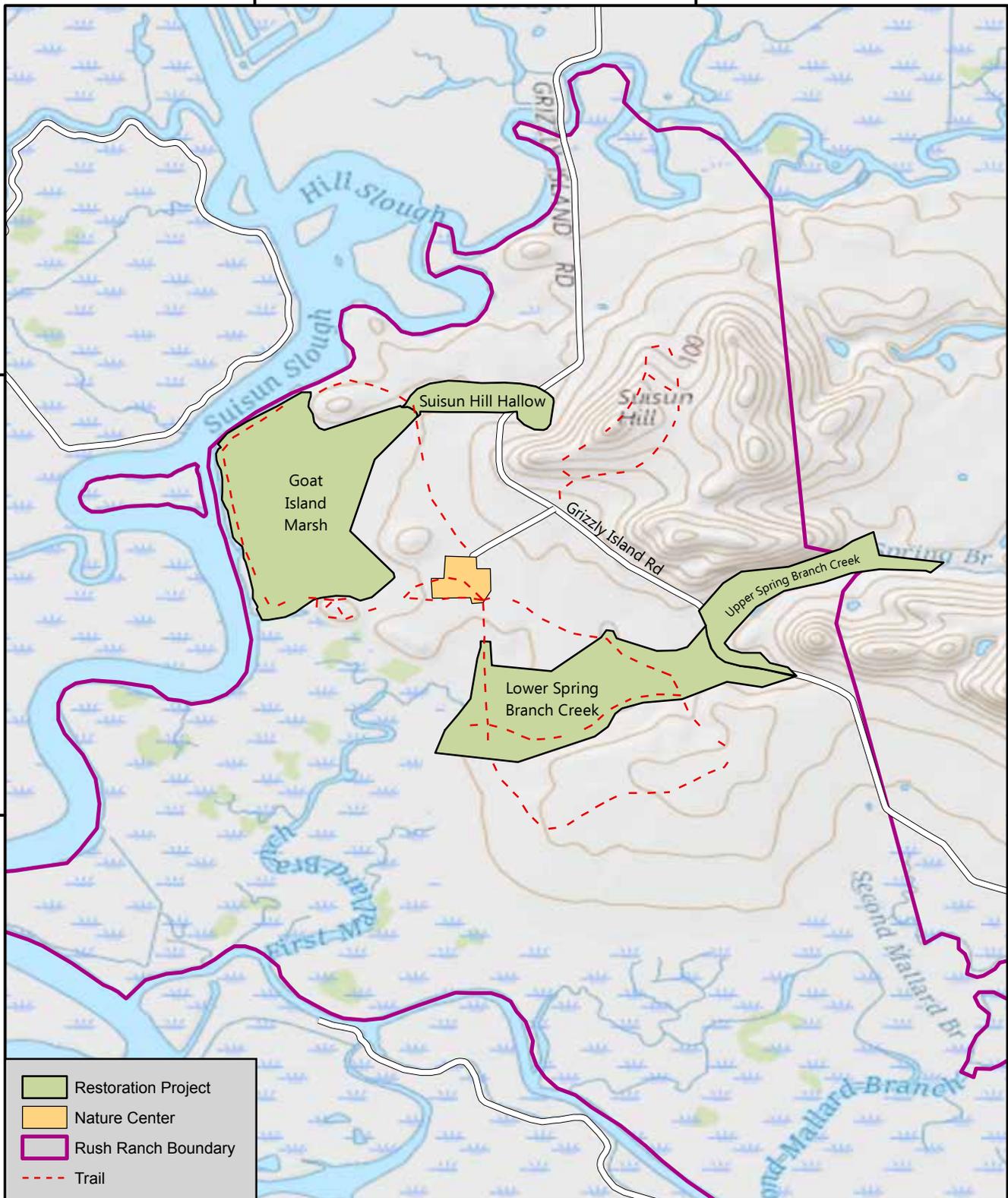
38° 13'

38° 13'

38° 12'

38° 12'

Map File: Restoration_Projects_RR_2017_0815.ra



Data Sources: Features and Site Boundary, NERR 2017; Basemap, USGS Topo 2017; Roads, US Census TIGER Product 2016

Rush Ranch Restoration Projects

Solano County, CA

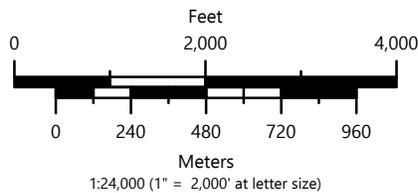


Figure 19

Funding for Lower Spring Branch and Suisun Hill Hollow was provided through a Proposition One grant from the California Department of Fish and Wildlife which, unfortunately, did not support significant funding for monitoring. However, our Stewardship Coordinator (part-time with SLT) will be involved in these two projects, as is the Coastal Resilience Specialist affiliated with the Reserve. Therefore, we anticipate that we will get the opportunity to engage in future monitoring and management activities associated with these projects. Since they involve seasonal wetland restoration projects, however, they are not part of our core tidal wetland activity.

13.5 Monitoring and Evaluation Strategies

As mentioned above, the Reserve has not had the opportunity to prepare the long term monitoring program for any of these projects because funds obtained for the projects did not provide for significant monitoring and the plans for the project were prepared by the SLT. However, to the extent possible, the Reserve will participate in creating a long term monitoring program for all four sites and will work with Reserve staff and joint SLT/Reserve staff to integrate Reserve science into the long term implementation of the project.



Rush Ranch's trails offer spectacular opportunities to see birds. Photo: Erika Zambello.

REFERENCES

- ABAG (Association of Bay Area Governments). 2015. San Francisco Bay Area State of the Region: Economy, population, housing. <http://reports.abag.ca.gov/sotr/2015/index.php>
- Anderson, K., 2005. Tending the wild: Native American knowledge and the management of California's natural resources. Univ of California Press.
- Applied Economic Analysis. 2016. Socioeconomic analysis of Proposed Rule 12-16. Report prepared for the Bay Area Quality Management District. http://www.baaqmd.gov/~media/dotgov/files/rules/regulation-12-rule-16/documents/20170531_socio_1216-pdf.pdf?la=zh-tw
- Atwater, B.F. and Hedel, C.W., 1976. Distribution of seed plants with respect to tide levels and water salinity in the natural tidal marshes of the northern San Francisco Bay estuary, California (No. 76-389). US Geological Survey.
- Atwater, B.F., Conrad, S.G., Dowden, J.N., Hedel, C.W., MacDonald, R.L. and Savage, W., 1979. History, landforms, and vegetation of the estuary's tidal marshes. AAAS Pacific Division, San Francisco.
- BACEI (Bay Area Council Economic Institute). 2016. The Northern California Megaregion: Innovative, connected, and growing. http://www.bayareaeconomy.org/files/pdf/The_Northern_California_Megaregion_2016c.pdf.
- Bay Area Open Space Council 2011. The Conservation Lands Network: San Francisco Bay Area Upland Habitat Goals Project Report. Berkeley, CA.
- BCDC (San Francisco Bay Conservation and Development Commission). 1976. Suisun Marsh Protection Plan. San Francisco. 46 pp. Available at: http://www.bcdc.ca.gov/laws_plans/laws/suisun_marsh.shtml
- _____. 1977. Suisun Marsh Protection Plan Supplement. San Francisco.
- _____. 2001. Staff Report: Public access and wildlife compatibility. San Francisco. 114 pp including appendices. Available at http://www.bcdc.ca.gov/pdf/planning/reports/public_access_wildlife.pdf
- _____. 2008. San Francisco Bay Plan. San Francisco. 114 pp including appendices. Available at http://www.bcdc.ca.gov/laws_plans/plans/sfbay_plan.shtml
- Baye PR 2012. Tidal marsh vegetation of China Camp, San Pablo Bay, California. San Francisco Estuary and Watershed Science, 10(2).
- Booker M. 2013. Down by the Bay: San Francisco's history between the tides. UC Press. Pp 1-259.
- California State Parks. 1979. China Camp State Park General Plan. Petaluma, CA. 104 pp.
- CCMP. 2016. Comprehensive Conservation and Management Plan for the San Francisco Estuary (Estuary Blueprint). San Francisco Estuary Partnership.
- CCSCEa (Center for Continuing Studies of the California Economy). 2016. California leaps to the world's 6th largest economy: Leads all states in growth in 2015. <http://www.ccsce.com/PDF/Numbers-July-2016-CA-Economy-Rankings-2015.pdf>
- CCSCEb (Center for Continuing Studies of the California Economy). 2016. The Bay Area led broad regional GDP growth surge in 2015. http://www.bayareaeconomy.org/files/pdf/2015_California_Regional_Economy_Rankings.pdf
- Cheng BS, Chang AL, Deck A, Ferner MC. 2016 Atmospheric rivers and the mass mortality of wild oysters: insight into an extreme future? Proc. R. Soc. B 283: 20161462.
- Conomos, T.J., Leviton, A.E., Berson, M. and American Association for the Advancement of Science, 1979. San Francisco

Bay, the urbanized estuary; investigations into the natural history of San Francisco Bay and Delta with reference to the influence of man;(papers presented at a symposium), San Francisco, Calif., Jun 13, 1977.

- Cowling, R.M., Rundel, P.W., Lamont, B.B., Arroyo, M.K. and Arianoutsou, M., 1996. Plant diversity in Mediterranean-climate regions. *Trends in Ecology & Evolution*, 11(9), pp.362-366.
- Eaton J. 2001. A Slough Runs Through It: Solano County's Rush Ranch Reserve. *Bay Nature* 1:8-1
- Ferner MC. 2011a (ed). Special Issue, Part 1: Tidal wetlands in the San Francisco Bay National Estuarine Research Reserve. *San Francisco Estuary and Watershed Science* 9(3).
- Ferner MC. 2011b. A profile of the San Francisco Bay National Estuarine Research Reserve. *SF Bay National Estuarine Research Reserve*. Pp. 345.
- Ferner MC. 2012 (ed). Part II, Conclusion: Ecology and Regional Context of Tidal Wetlands in the San Francisco Bay National Estuarine Research Reserve. *San Francisco Estuary and Watershed Science* 10(2).
- Fiedler, P and Zebell, R. 1993. Final Report. Restoration and recovery of Mason's lilaepsis: Phase I. Report submitted October 28, 1993, to the Shell Oil Litigation Settlement Trustee Committee and the Endangered Plant Program, Natural Heritage Division, California Department of Fish and Game. 47pp. plus Appendix A.
- Goals Project. 1999. Baylands Ecosystem Habitat Goals. A report of recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental protection Agency, San Francisco, CA and SF Bay Regional Water Quality Control Board, Oakland, CA. 209 pp with five appendices. Also available at www.sfei.org.
- Goals Project. 2015. The Baylands and Climate Change: What We Can Do. Baylands Ecosystem Habitat Goals Science Update 2015 prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. California State Coastal Conservancy, Oakland, CA.
- Herbold B, Jassby, AD, Moyle, PB. 1992. Status and trends report on aquatic resources in the San Francisco Estuary. 240 pp.
- Jacobs, DK, Haney TA, Louie DK. 2004. Genes, diversity, and geologic process along the Pacific Coast. *Annual Review of Earth Planet Science* 32: 601-652.
- Johnstone, JA. and Dawson, TE., 2010. Climatic context and ecological implications of summer fog decline in the coast redwood region. *Proceedings of the National Academy of Sciences*, 107: 4533-4538.
- Leipper, DF., 1994. Fog on the US west coast: A review. *Bulletin of the American Meteorological Society*, 75: 229-240.
- Malamud-Roam F, Dettinger M, Ingram BL, Hughes MK, Florsheim J. 2007. Holocene climates and connections between the San Francisco Bay estuary and its watershed: a review. *San Francisco Estuary and Watershed Science* 5(1).
- May MD. 1999. Vegetation and salinity changes over the last 2000 years at two islands in the northern San Francisco Estuary, California. Master Thesis. University of California, Berkeley.
- Meyers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403:853-858
- Moyle PB. 1976. *Inland Fishes of California*. University of California Press, Berkeley. National Oceanic and Atmospheric Administration. 2002.
- Moyle PB, Lund JR, Bennett WA, Fleenor WE. 2010. Habitat variability and complexity in the upper San Francisco Estuary, *San Francisco Estuary Watershed Science* 8(3).
- National Oceanic and Atmospheric Administration. 2008. San Francisco Bay National Estuarine Research Reserve Final Evaluation Findings. 22 pp with 5 appendices.

- Ryals, R, Hartman MD, Parton,WJ, DeLonge, MS, Silver, WL., 2015. Long-term climate change mitigation potential with organic matter management on grasslands. *Ecological Applications* 25: 531-545.
- San Francisco Estuary Project. 2000. State of the Estuary 2000: Restoration primer. San Francisco Estuary Project (now San Francisco Estuary Partnership). Oakland, CA. 776 pp.
- Saumweber W, Lerberg S, Dionne M, Wasson K, Cornu C, Bundy M, Garfield N. 2010. Establishing the NERRS as Sentinel Sites for Coastal Ecosystem Response to a Changing Climate. NERRS Strategic Proposal.
- Schile, LM., Callaway JC, Parker VT, Vasey, MC., 2011. Salinity and inundation influence productivity of the halophytic plant *Sarcocornia pacifica*. *Wetlands*, 31: 1165-1174.
- Schile LM., Callaway JC, Morris JT, Stralberg, D, Parker VT, Kelly M. 2014. Modeling tidal marsh distribution with sea-level rise: Evaluating the role of vegetation, sediment, and upland habitat in marsh resiliency. *PloS one*, 9(2), p.e88760.
- Schneider, TD. 2010. Placing refuge: Shell mounds and the archaeology of colonial encounters in the San Francisco Bay Area, California. PhD. Thesis, Anthropology, UC Berkeley, CA.
- Schneider, TD. 2015. Placing refuge and the archaeology of indigenous hinterlands in colonial California. *American Antiquity*80: 695-713.
- SLT (Solano Land Trust). 2014a. Rush Ranch Grazing Plan. Available upon request from the Solano Land Trust. <http://www.solanolandtrust.org/Index.aspx>
- SLT (Solano Land Trust). 2014b. Rush Ranch Management Plan. Available upon request from the Solano Land Trust. <http://www.solanolandtrust.org/Index.aspx>
- SVIRS (Silicon Valley Institute for Regional Studies). 2015. Income inequality in the San Francisco Bay Area. <https://jointventure.org/images/stories/pdf/income-inequality-2015-06.pdf>
- Silver, W., Ryals R, Eviner V., 2010. Soil carbon pools in California's annual grassland ecosystems. *Rangeland Ecology & Management*, 63: 128-136.
- Simenstad C, Toft J, Higgins H, Cordell J, Orr M, Williams P, Grimaldo L, Hymanson Z, Reed D. 1999. Preliminary results from the Sacramento-San Joaquin Delta breached levee wetland study (BREACH). *IEP Newsletter*, 12:15-21.
- Simenstad C, Toft J, Higgins H, Cordell J, Orr M, Williams P, Grimaldo L, Hymanson Z, Reed D. 2000. Sacramento/San Joaquin Delta breached levee wetland study (BREACH). Preliminary report to CALFED. 51 pp. Available at <http://depts.washington.edu/calfed/breachii.htm> or from C. Simenstad. Univ. WA. School of Fisheries, Seattle, WA.
- Sloan, D and Karachewski, J. 2006 *Geology of the San Francisco Bay region*. UC Press. 360 pp.
- Solano County, 2010. Solano County: The Official Guidebook 2008. <http://www.co.solano.ca.us/civica/filebank/blobdload.asp?BlobID=6269>
- US Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Water Resources, and California Department of Fish and Wildlife. 2011. Final Environmental Impact Statement/ Environmental Impact Report for the Suisun Marsh Habitat Management, Preservation, and Restoration Plan. USBR, Sacramento, CA.
- USFWS (US Fish and Wildlife Service). 1995. Sacramento-San Joaquin Delta Native Fishes Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon. Available at http://ecos.fws.gov/docs/recovery_plan/961126.pdf
- USFWS (U.S. Fish and Wildlife Service). 2013. Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California. Sacramento, California. xviii + 605 pp.

- Vasey, MC, Parker VT, Callaway JC., Herbert ER, Schile LM. 2012. Tidal wetland vegetation in the San Francisco Bay-Delta estuary. *San Francisco Estuary and Watershed Science*, 10(2).
- Watson, EB, Byrne, R, 2009. Abundance and diversity of tidal marsh plants along the salinity gradient of the San Francisco Estuary: implications for global change ecology. *Plant Ecology* 205:113.
- Whitcraft CR, Grewell BJ, Baye, PR. 2011. Estuarine Vegetation at Rush Ranch Open Space Preserve, San Francisco Bay National Estuarine Research Reserve, California. *San Francisco Estuary and Watershed Science*, 9(3).
- Wetland Research Associates Inc., 1990. Final Rush Ranch Enhancement and Management Plan. Report prepared for the Solano County Farmlands and Open Space Foundation, Fairfield, CA. 128 pp. plus appendices. Wetland Research Associates, San Rafael, CA. Available from: CA State Coastal Conservancy, Oakland, CA

APPENDIX A

National Estuarine Research Reserve System Regulations

Code of Federal Regulations

Title 15, Volume 3, Revised as of January 1, 2003
From the U.S. Government Printing Office via GPO Access
[CITE: 15CFR921]

TITLE 15--COMMERCE AND FOREIGN TRADE

CHAPTER IX--NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION,
DEPARTMENT OF COMMERCE

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REGULATIONS

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Authority: Section 315 of the Coastal Zone Management Act, as amended (16 U.S.C. 1461).

Source: 58 FR 38215, July 15, 1993, unless otherwise noted.

Sec. 921.1 Mission, goals and general provisions.

(a) The mission of the National Estuarine Research Reserve Program is the establishment and management, through Federal-state cooperation, of a national system (National Estuarine Research Reserve System or System) of estuarine research reserves (National Estuarine Research Reserves or Reserves) representative of the various regions and estuarine types in the United States. National Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.

(b) The goals of the Program are to:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
2. Address coastal management issues identified as significant through coordinated estuarine research within the System;
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
4. Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and
5. Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

(c) National Estuarine Research Reserves shall be open to the public to the extent permitted under state and Federal law. Multiple uses are allowed to the degree compatible with each Reserve's overall purpose as provided in the management plan (see Sec. 921.13) and consistent with paragraphs (a) and (b) of this section. Use levels are set by the state where the Reserve is located and analyzed in the management plan. The Reserve management plan shall describe the uses and establish priorities among these uses. The plan shall identify uses requiring a state permit, as well as areas where uses are encouraged or prohibited. Consistent with resource protection and research objectives, public access and use may be restricted to certain areas or components within a Reserve.

(d) Habitat manipulation for research purposes is allowed consistent with the following limitations. Manipulative research activities must be specified in the management plan, be consistent with the mission and goals of the program (see paragraphs (a) and (b) of this section) and the goals and objectives set forth in the Reserve's management plan, and be limited in nature and extent to the minimum manipulative activity necessary to accomplish the stated research objective. Manipulative research activities with a significant or long-term impact on Reserve resources require the prior approval of the state and the National Oceanic and Atmospheric Administration (NOAA). Manipulative research activities which can reasonably be expected to have a significant adverse impact on the estuarine resources and habitat of a Reserve, such that the activities themselves or their resulting short- and long-term consequences compromise the representative character and integrity of a Reserve, are prohibited. Habitat manipulation for resource management purposes is prohibited except as specifically approved by NOAA as: (1) A

restoration activity consistent with paragraph (e) of this section; or (2) an activity necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant Federal or state authority (e.g., threatened/endangered species or significant historical or cultural resources) or if the manipulative activity is a long-term pre-existing use (i.e., has occurred prior to designation) occurring in a buffer area. If habitat manipulation is determined to be necessary for the protection of public health, the preservation of sensitive resources, or if the manipulation is a long-term pre-existing use in a buffer area, then these activities shall be specified in the Reserve management plan in accordance with Sec. 921.13(a)(10) and shall be limited to the reasonable alternative which has the least adverse and shortest term impact on the representative and ecological integrity of the Reserve.

(e) Under the Act an area may be designated as an estuarine Reserve only if the area is a representative estuarine ecosystem that is suitable for long-term research. Many estuarine areas have undergone some ecological change as a result of human activities (e.g., hydrological changes, intentional/unintentional species composition changes--introduced and exotic species). In those areas proposed or designated as National Estuarine Research Reserves, such changes may have diminished the representative character and integrity of the site. Although restoration of degraded areas is not a primary purpose of the System, such activities may be permitted to improve the representative character and integrity of a Reserve. Restoration activities must be carefully planned and approved by NOAA through the Reserve management plan. Historical research may be necessary to determine the "natural" representative state of an estuarine area (i.e., an estuarine ecosystem minimally affected by human activity or influence). Frequently, restoration of a degraded estuarine area will provide an excellent opportunity for management oriented research.

(f) NOAA may provide financial assistance to coastal states, not to exceed, per Reserve, 50 percent of all actual costs or \$5 million whichever amount is less, to assist in the acquisition of land and waters, or interests therein. NOAA may provide financial assistance to coastal states not to exceed 70 percent of all actual costs for the management and operation of, the development and construction of facilities, and the conduct of educational or interpretive activities concerning Reserves (see subpart I). NOAA may provide financial assistance to any coastal state or public or private person, not to exceed 70 percent of all actual costs, to support research and monitoring within a Reserve. Notwithstanding any financial assistance limits established by this Part, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. Predesignation, acquisition and development, operation and management, special research and monitoring, and special education and interpretation awards are available under the National Estuarine Reserve Program. Predesignation awards are for site selection/feasibility, draft management plan preparation and conduct of basic characterization studies. Acquisition and development awards are intended primarily for acquisition of interests in land, facility construction and to develop and/or upgrade research, monitoring and education programs. Operation and management awards

provide funds to assist in implementing, operating and managing the administrative, and basic research, monitoring and education programs, outlined in the Reserve management plan. Special research and monitoring awards provide funds to conduct estuarine research and monitoring projects with the System. Special educational and interpretive awards provide funds to conduct estuarine educational and interpretive projects within the System.

(g) Lands already in protected status managed by other Federal agencies, state or local governments, or private organizations may be included within National Estuarine Research Reserves only if the managing entity commits to long-term management consistent with paragraphs (d) and (e) of this section in the Reserve management plan. Federal lands already in protected status may not comprise a majority of the key land and water areas of a Reserve (see Sec. 921.11(c)(3)).

(h) To assist the states in carrying out the Program's goals in an effective manner, NOAA will coordinate a research and education information exchange throughout the National Estuarine Research Reserve System. As part of this role, NOAA will ensure that information and ideas from one Reserve are made available to others in the System. The network will enable Reserves to exchange information and research data with each other, with universities engaged in estuarine research, and with Federal, state, and local agencies. NOAA's objective is a system- wide program of research and monitoring capable of addressing the management issues that affect long-term productivity of our Nation's estuaries.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.2 Definitions

(a) Act means the Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.

(b) Assistant Administrator means the Assistant Administrator for Ocean Services and Coastal Zone Management or delegee.

(c) Coastal state means a state of the United States, in or bordering on, the Atlantic, Pacific, or Arctic Ocean, the Gulf of Mexico, Long Island Sound, or one or more of the Great Lakes. For the purposes of these regulations the term also includes Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Marianas Islands, the Trust Territories of the Pacific Islands, and American Samoa (see 16 U.S.C. 1453(4)).

(d) State agency means an instrumentality of a coastal state to whom the coastal state has delegated the authority and responsibility for the creation and/or management/operation of a National Estuarine Research Reserve. Factors indicative of this authority may include the power to receive and expend funds on behalf of the Reserve, acquire and sell or convey real and personal property interests, adopt rules for the protection of the Reserve, enforce rules applicable to the Reserve, or develop and implement research and education programs for the reserve. For the purposes of these regulations, the terms "coastal state" and "State agency" shall be synonymous.

(e) Estuary means that part of a river or stream or other body of water having unimpaired connection with the open sea, where the sea water is measurably diluted with fresh water derived from land drainage. The term also includes estuary-type areas with measurable freshwater influence and having unimpaired connections with the open sea, and estuary-type areas of the Great Lakes and their connecting waters (see 16 U.S.C. 1453(7)).

(f) National Estuarine Research Reserve means an area that is a representative estuarine ecosystem suitable for long-term research, which may include all of the key land and water portion of an estuary, and adjacent transitional areas and uplands constituting to the extent feasible a natural unit, and which is set aside as a natural field laboratory to provide long-term opportunities for research, education, and interpretation on the ecological relationships within the area (see 16 U.S.C. 1453(8)) and meets the requirements of 16 U.S.C. 1461(b). This includes those areas designated as National Estuarine Sanctuaries or Reserves under section 315 of the Act prior to enactment of the Coastal Zone Act Reauthorization Amendments of 1990 and each area subsequently designated as a National Estuarine Research Reserve.

Sec. 921.3 National Estuarine Research Reserve System Biogeographic Classification Scheme and Estuarine Typologies.

(a) National Estuarine Research Reserves are chosen to reflect regional differences and to include a variety of ecosystem types. A biogeographic classification scheme based on regional variations in the nation's coastal zone has been developed. The biogeographic classification scheme is used to ensure that the National Estuarine Research Reserve System includes at least one site from each region. The estuarine typology system is utilized to ensure that sites in the System reflect the wide range of estuarine types within the United States.

(b) The biogeographic classification scheme, presented in appendix I, contains 29 regions. Figure 1 graphically depicts the biogeographic regions of the United States.

(c) The typology system is presented in appendix II..

Sec. 921.4 Relationship to other provisions of the Coastal Zone Management Act, and to the Marine Protection, Research and Sanctuaries Act.

(a) The National Estuarine Research Reserve System is intended to provide information to state agencies and other entities involved in addressing coastal management issues. Any coastal state, including those that do not have approved coastal management programs under section 306 of the Act, is eligible for an award under the National Estuarine Research Reserve Program (see Sec. 921.2(c)).

(b) For purposes of consistency review by states with a federally approved coastal management program, the designation of a National Estuarine Research Reserve is deemed to be a Federal activity, which, if directly affecting the state's coastal zone, must be undertaken in a manner consistent to the maximum extent practicable with the approved state coastal management program as provided by section 1456(c)(1) of the Act, and implementing regulations at 15 CFR part 930, subpart C. In accordance with section 1456(c)(1) of the Act and the applicable regulations NOAA will be responsible for certifying that designation of the Reserve is consistent with the state's approved coastal management program. The state must concur with or object to the certification. It is recommended that the lead state agency for Reserve designation consult, at the earliest practicable time, with the appropriate state officials concerning the consistency of a proposed National Estuarine Research Reserve.

(c) The National Estuarine Research Reserve Program will be administered in close coordination with the National Marine Sanctuary Program (Title III of the Marine Protection, Research and Sanctuaries Act, as amended, 16 U.S.C. 1431-1445), also administered by NOAA. Title III authorizes the Secretary of Commerce to designate discrete areas of the marine environment as National Marine Sanctuaries to protect or restore such areas for their conservation, recreational, ecological, historical, research,

educational or esthetic values. National Marine Sanctuaries and Estuarine Research Reserves may not overlap, but may be adjacent.

Sec. 921.10 General.

(a) A coastal state may apply for Federal financial assistance for the purpose of site selection, preparation of documents specified in Sec. 921.13 (draft management plan (DMP) and environmental impact statement (EIS)), and the conduct of limited basic characterization studies. The total Federal share of this assistance may not exceed \$100,000. Federal financial assistance for preacquisition activities under Sec. 921.11 and Sec. 921.12 is subject to the total \$5 million for which each Reserve is eligible for land acquisition. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more coastal states, each state is eligible for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Each separate National Estuarine Research Reserve is eligible for the full complement of funding. Financial assistance application procedures are specified in subpart I.

(b) In developing a Reserve program, a state may choose to develop a multiple-site Reserve reflecting a diversity of habitats in a single biogeographic region. A multiple-site Reserve allows the state to develop complementary research and educational programs within the individual components of its multi-site Reserve. Multiple-site Reserves are treated as one Reserve in terms of financial assistance and development of an overall management framework and plan. Each individual site of a proposed multiple-site Reserve shall be evaluated both separately under Sec. 921.11(c) and collectively as part of the site selection process. A coastal state may propose to establish a multiple-site Reserve at the time of the initial site selection, or at any point in the development or operation of the Reserve. If the state decides to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award is made for a single site, the proposal is subject to the requirements set forth in Sec. 921.33(b). However, a state may not propose to add one or more sites to an already designated Reserve if the operation and management of such Reserve has been found deficient and uncorrected or the research conducted is not consistent with the Estuarine Research Guidelines referenced in Sec. 921.51. In addition, Federal funds for the acquisition of a multiple-site Reserve remain limited to \$5,000,000 (see Sec. 921.20). The funding for operation of a multiple-site Reserve is limited to the maximum allowed for any one Reserve per year (see Sec. 921.32(c)) and preacquisition funds are limited to \$100,000 per Reserve. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available.

[58 FR 38215, July 15, 1993, as amended at 63 FR 26717, May 14, 1998].

Sec. 921.11 Site selection and feasibility.

(a) A coastal state may use Federal funds to establish and implement a site selection process which is approved by NOAA.

(b) In addition to the requirements set forth in subpart I, a request for Federal funds for site selection must contain the following programmatic information:

1. A description of the proposed site selection process and how it will be implemented in conformance with the biogeographic classification scheme and typology (Sec. 921.3);
2. An identification of the site selection agency and the potential management agency; and
3. A description of how public participation will be incorporated into the process (see Sec. 921.11(d)).

(c) As part of the site selection process, the state and NOAA shall evaluate and select the final site(s). NOAA has final authority in approving such sites. Site selection shall be guided by the following principles:

1. The site's contribution to the biogeographical and typological balance of the National Estuarine Research Reserve System. NOAA will give priority consideration to proposals to establish Reserves in biogeographic regions or subregions or incorporating types that are not represented in the system. (see the biogeographic classification scheme and typology set forth in Sec. 921.3 and appendices I and II);
2. The site's ecological characteristics, including its biological productivity, diversity of flora and fauna, and capacity to attract a broad range of research and educational interests. The proposed site must be a representative estuarine ecosystem and should, to the maximum extent possible, be an estuarine ecosystem minimally affected by human activity or influence (see Sec. 921.1(e)).
3. Assurance that the site's boundaries encompass an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation. Boundary size will vary greatly depending on the nature of the ecosystem. Reserve boundaries must encompass the area within which adequate control has or will be established by the managing entity over human activities occurring within the Reserve. Generally, Reserve boundaries will encompass two areas: Key land and water areas (or "core area") and a buffer zone. Key land and water areas and a buffer zone will likely require significantly different levels of control (see Sec. 921.13(a)(7)). The term "key land and water areas" refers to that core area within the Reserve that is so vital to the functioning of the estuarine ecosystem that it must be under a level of control sufficient to

ensure the long-term viability of the Reserve for research on natural processes. Key land and water areas, which comprise the core area, are those ecological units of a natural estuarine system which preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary. The determination of which land and water areas are "key" to a particular Reserve must be based on specific scientific knowledge of the area. A basic principle to follow when deciding upon key land and water areas is that they should encompass resources representative of the total ecosystem, and which if compromised could endanger the research objectives of the Reserve. The term buffer zone refers to an area adjacent to or surrounding key land and water areas and essential to their integrity. Buffer zones protect the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. When determined appropriate by the state and approved by NOAA, the buffer zone may also include an area necessary for facilities required for research and interpretation. Additionally, buffer zones should be established sufficient to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur. National Estuarine Research Reserves may include existing Federal or state lands already in a protected status where mutual benefit can be enhanced. However, NOAA will not approve a site for potential National Estuarine Research Reserve status that is dependent primarily upon the inclusion of currently protected Federal lands in order to meet the requirements for Reserve status (such as key land and water areas). Such lands generally will be included within a Reserve to serve as a buffer or for other ancillary purposes; and may be included, subject to NOAA approval, as a limited portion of the core area;

4. The site's suitability for long-term estuarine research, including ecological factors and proximity to existing research facilities and educational institutions;
5. The site's compatibility with existing and potential land and water uses in contiguous areas as well as approved coastal and estuarine management plans; and
6. The site's importance to education and interpretive efforts, consistent with the need for continued protection of the natural system.

(d) Early in the site selection process the state must seek the views of affected landowners, local governments, other state and Federal agencies and other parties who are interested in the area(s) being considered for selection as a potential National Estuarine Research Reserve. After the local government(s) and affected landowner(s) have been contacted, at least one public meeting shall be held in the vicinity of the proposed site. Notice of such a meeting, including the time, place, and relevant subject matter, shall be announced by the state through the area's principal newspaper at least 15 days prior to the date of the meeting and by NOAA in the Federal Register.

(e) A state request for NOAA approval of a proposed site (or sites in the case of a multi-site Reserve) must contain a description of the proposed site(s) in relationship to each of the site selection principals (Sec. 921.11(c)) and the following information:

1. An analysis of the proposed site(s) based on the biogeographical scheme/typology discussed in Sec. 921.3 and set forth in appendices I and II;
2. A description of the proposed site(s) and its (their) major resources, including location, proposed boundaries, and adjacent land uses. Maps are required;
3. A description of the public participation process used by the state to solicit the views of interested parties, a summary of comments, and, if interstate issues are involved, documentation that the Governor(s) of the other affected state(s) has been contacted. Copies of all correspondence, including contact letters to all affected landowners must be appended;
4. A list of all sites considered and a brief statement of the reasons why a site was not preferred; and
5. A nomination of the proposed site(s) for designation as a National Estuarine Research Reserve by the Governor of the coastal state in which the state is located.

(f) A state proposing to reactivate an inactive site, previously approved by NOAA for development as an Estuarine Sanctuary or Reserve, may apply for those funds remaining, if any, provided for site selection and feasibility (Sec. 921.11a)) to determine the feasibility of reactivation. This feasibility study must comply with the requirements set forth in Sec. 921.11 (c) through (e).

Sec. 921.12 Post site selection.

(a) At the time of the coastal state's request for NOAA approval of a proposed site, the state may submit a request for funds to develop the draft management plan and for preparation of the EIS. At this time, the state may also submit a request for the remainder of the predesignation funds to perform a limited basic characterization of the physical, chemical and biological characteristics of the site approved by NOAA necessary for providing EIS information to NOAA. The state's request for these post site selection funds must be accompanied by the information specified in subpart I and, for draft management plan development and EIS information collection, the following programmatic information:

1. A draft management plan outline (see Sec. 921.13(a) below); and
2. An outline of a draft memorandum of understanding (MOU) between the state and NOAA detailing the Federal-state role in Reserve management during the initial period of Federal funding and expressing the state's long-term commitment to operate and manage the Reserve.

(b) The state is eligible to use the funds referenced in Sec. 921.12(a) after the proposed site is approved by NOAA under the terms of Sec. 921.11.

Sec. 921.13 Management plan and environmental impact statement development.

(a) After NOAA approves the state's proposed site and application for funds submitted pursuant to Sec. 921.12, the state may begin draft management plan development and the collection of information necessary for the preparation by NOAA of an EIS. The state shall develop a draft management plan, including an MOU. The plan shall set out in detail:

1. Reserve goals and objectives, management issues, and strategies or actions for meeting the goals and objectives;
2. An administrative plan including staff roles in administration, research, education/interpretation, and surveillance and enforcement;
3. A research plan, including a monitoring design;
4. An education/interpretive plan;
5. A plan for public access to the Reserve;
6. A construction plan, including a proposed construction schedule, general descriptions of proposed developments and general cost estimates. Information should be provided for proposed minor construction projects in sufficient detail to allow these projects to begin in the initial phase of acquisition and development. A categorical exclusion, environmental assessment, or EIS may be required prior to construction;
7. (i) An acquisition plan identifying the ecologically key land and water areas of the Reserve, ranking these areas according to their relative importance, and including a strategy for establishing adequate long-term state control over these areas sufficient to provide protection for Reserve resources to ensure a stable environment for research. This plan must include an identification of ownership within the proposed Reserve boundaries, including land already in the public domain; the method(s) of acquisition which the state proposes to use--acquisition (including less-than-fee simple options) to establish adequate long-term state control; an estimate of the fair market value of any property interest--which is proposed for acquisition; a schedule estimating the time required to complete the process of establishing adequate state control of the proposed research reserve; and a discussion of any anticipated problems. In selecting a preferred method(s) for establishing adequate state control over areas within the proposed boundaries of the Reserve, the state shall perform the following steps for each parcel determined to be part of the key land and water areas (control over which is necessary to protect the integrity of the Reserve for research purposes), and for those parcels required for research and interpretive support facilities or buffer purposes:
 - (A) Determine, with appropriate justification, the minimum level of control(s) required [e.g., management agreement, regulation, less-than-fee simple property interest (e.g., conservation easement), fee simple property acquisition, or a combination of these approaches]. This does not preclude the future necessity of increasing the level of state control;
 - (B) Identify the level of existing state control(s);
 - (C) Identify the level of additional state control(s), if any, necessary to meet the

minimum requirements identified in paragraph (a)(7)(i)(A) of this section;
(D) Examine all reasonable alternatives for attaining the level of control identified in paragraph (a)(7)(i)(C) of this section, and perform a cost analysis of each; and
(E) Rank, in order of cost, the methods (including acquisition) identified in paragraph (a)(7)(i)(D) of this section.

(ii) An assessment of the relative cost-effectiveness of control alternatives shall include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method(s) for establishing adequate state control over each parcel examined under the process described above, the state shall give priority consideration to the least costly method(s) of attaining the minimum level of long-term control required. Generally, with the possible exception of buffer areas required for support facilities, the level of control(s) required for buffer areas will be considerably less than that required for key land and water areas. This acquisition plan, after receiving the approval of NOAA, shall serve as a guide for negotiations with landowners. A final boundary for the reserve shall be delineated as a part of the final management plan;

8. A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the research reserve, and a strategy for research reserve surveillance and enforcement of such use restrictions, including appropriate government enforcement agencies;
9. If applicable, a restoration plan describing those portions of the site that may require habitat modification to restore natural conditions;
10. If applicable, a resource manipulation plan, describing those portions of the Reserve buffer in which long-term pre-existing (prior to designation) manipulation for reasons not related to research or restoration is occurring. The plan shall explain in detail the nature of such activities, shall justify why such manipulation should be permitted to continue within the reserve buffer; and shall describe possible effects of this manipulation on key land and water areas and their resources;
11. A proposed memorandum of understanding (MOU) between the state and NOAA regarding the Federal-state relationship during the establishment and development of the National Estuarine Research Reserve, and expressing a long-term commitment by the state to maintain and manage the Reserve in accordance with section 315 of the Act, 16 U.S.C. 1461, and applicable regulations. In conjunction with the MOU, and where possible under state law, the state will consider taking appropriate administrative or legislative action to ensure the long-term protection and operation of the National Estuarine Research Reserve. If other MOUs are necessary (such as with a Federal agency, another state agency or private organization), drafts of such MOUs must be included in the plan. All necessary MOU's shall be signed prior to Reserve designation; and

12. If the state has a federally approved coastal management program, a certification that the National Estuarine Research Reserve is consistent to the maximum extent practicable with that program. See Secs. 921.4(b) and 921.30(b).

(b) Regarding the preparation of an EIS under the National Environmental Policy Act on a National Estuarine Research Reserve proposal, the state and NOAA shall collect all necessary information concerning the socioeconomic and environmental impacts associated with implementing the draft management plan and feasible alternatives to the plan. Based on this information, the state will draft and provide NOAA with a preliminary EIS.

(c) Early in the development of the draft management plan and the draft EIS, the state and NOAA shall hold a scoping meeting (pursuant to NEPA) in the area or areas most affected to solicit public and government comments on the significant issues related to the proposed action. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the meeting. The state shall be responsible for publishing a similar notice in the local media.

(d) NOAA will publish a Federal Register notice of intent to prepare a draft EIS. After the draft EIS is prepared and filed with the Environmental Protection Agency (EPA), a Notice of Availability of the draft EIS will appear in the Federal Register. Not less than 30 days after publication of the notice, NOAA will hold at least one public hearing in the area or areas most affected by the proposed national estuarine research reserve. The hearing will be held no sooner than 15 days after appropriate notice of the meeting has been given in the principal news media by the state and in the Federal Register by NOAA. After a 45-day comment period, a final EIS will be prepared by the state and NOAA.

Sec. 921.20 General.

The acquisition and development period is separated into two major phases. After NOAA approval of the site, draft management plan and draft MOU, and completion of the final EIS, a coastal state is eligible for an initial acquisition and development award(s). In this initial phase, the state should work to meet the criteria required for formal research reserve designation; e.g., establishing adequate state control over the key land and water areas as specified in the draft management plan and preparing the final management plan. These requirements are specified in Sec. 921.30. Minor construction in accordance with the draft management plan may also be conducted during this initial phase. The initial acquisition and development phase is expected to last no longer than three years. If necessary, a longer time period may be negotiated between the state and NOAA. After Reserve designation, a state is eligible for a supplemental acquisition and development award(s) in accordance with Sec. 921.31. In this post-designation acquisition and development phase, funds may be used in accordance with the final management plan to construct research and educational facilities, complete any remaining land acquisition, for program development, and for restorative activities identified in the final management

plan. In any case, the amount of Federal financial assistance provided to a coastal state with respect to the acquisition of lands and waters, or interests therein, for any one National Estuarine Research Reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein or \$5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.21 Initial acquisition and development awards.

(a) Assistance is provided to aid the recipient prior to designation in:

1. Acquiring a fee simple or less-than-fee simple real property interest in land and water areas to be included in the Reserve boundaries (see Sec. 921.13(a)(7); Sec. 921.30(d));
2. Minor construction, as provided in paragraphs (b) and (c) of this section;
3. Preparing the final management plan; and
4. Initial management costs, e.g., for implementing the NOAA approved draft management plan, hiring a Reserve manager and other staff as necessary and for other management-related activities. Application procedures are specified in subpart I.

(b) The expenditure of Federal and state funds on major construction activities is not allowed during the initial acquisition and development phase. The preparation of architectural and engineering plans, including specifications, for any proposed construction, or for proposed restorative activities, is permitted. In addition, minor construction activities, consistent with paragraph (c) of this section also are allowed. The NOAA-approved draft management plan must, however, include a construction plan and a public access plan before any award funds can be spent on construction activities.

(c) Only minor construction activities that aid in implementing portions of the management plan (such as boat ramps and nature trails) are permitted during the initial acquisition and development phase. No more than five (5) percent of the initial acquisition and development award may be expended on such activities. NOAA must make a specific determination, based on the final EIS, that the construction activity will not be detrimental to the environment.

(d) Except as specifically provided in paragraphs (a) through (c) of this section, construction projects, to be funded in whole or in part under an acquisition and development award(s), may not be initiated until the Reserve receives formal designation (see Sec. 921.30). This requirement has been adopted to ensure that substantial progress

in establishing adequate state control over key land and water areas has been made and that a final management plan is completed before major sums are spent on construction. Once substantial progress in establishing adequate state control/acquisition has been made, as defined by the state in the management plan, other activities guided by the final management plan may begin with NOAA's approval.

(e) For any real property acquired in whole or part with Federal funds for the Reserve, the state shall execute suitable title documents to include substantially the following provisions, or otherwise append the following provisions in a manner acceptable under applicable state law to the official land record(s):

1. Title to the property conveyed by this deed shall vest in the [recipient of the award granted pursuant to section 315 of the Act, 16 U.S.C. 1461 or other NOAA approved state agency] subject to the condition that the designation of the [name of National Estuarine Reserve] is not withdrawn and the property remains part of the federally designated [name of National Estuarine Research Reserve]; and
2. In the event that the property is no longer included as part of the Reserve, or if the designation of the Reserve of which it is part is withdrawn, then NOAA or its successor agency, after full and reasonable consultation with the State, may exercise the following rights regarding the disposition of the property:
 - (i) The recipient may retain title after paying the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the current fair market value of the property;
 - (ii) If the recipient does not elect to retain title, the Federal Government may either direct the recipient to sell the property and pay the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the proceeds from the sale (after deducting actual and reasonable selling and repair or renovation expenses, if any, from the sale proceeds), or direct the recipient to transfer title to the Federal Government. If directed to transfer title to the Federal Government, the recipient shall be entitled to compensation computed by applying the recipient's percentage of participation in the cost of the original project to the current fair market value of the property; and
 - (iii) Fair market value of the property must be determined by an independent appraiser and certified by a responsible official of the state, as provided by Department of Commerce regulations at 15 CFR part 24, and Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally assisted programs at 15 CFR part 11.

(f) Upon instruction by NOAA, provisions analogous to those of Sec. 921.21(e) shall be included in the documentation underlying less-than-fee-simple interests acquired in whole or part with Federal funds.

(g) Federal funds or non-Federal matching share funds shall not be spent to acquire a real property interest in which the state will own the land concurrently with another entity unless the property interest has been identified as a part of an acquisition strategy

pursuant to Sec. 921.13(7) which has been approved by NOAA prior to the effective date of these regulations.

(h) Prior to submitting the final management plan to NOAA for review and approval, the state shall hold a public meeting to receive comment on the plan in the area affected by the estuarine research reserve. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the public meeting. The state shall be responsible for having a similar notice published in the local newspaper(s).

Sec. 921.30 Designation of National Estuarine Research Reserves.

(a) The Under Secretary may designate an area proposed for designation by the Governor of the state in which it is located, as a National Estuarine Research Reserve if the Under Secretary finds:

1. The area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
2. Key land and water areas of the proposed Reserve, as identified in the management plan, are under adequate state control sufficient to provide long-term protection for reserve resources to ensure a stable environment for research;
3. Designation of the area as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation;
4. A final management plan has been approved by NOAA;
5. An MOU has been signed between the state and NOAA ensuring a long-term commitment by the state to the effective operation and implementation of the area as a National Estuarine Research Reserve;
6. All MOU's necessary for reserve management (i.e., with relevant Federal, state, and local agencies and/or private organizations) have been signed; and
7. The coastal state in which the area is located has complied with the requirements of subpart B.

(b) NOAA will determine whether the designation of a National Estuarine Research Reserve in a state with a federally approved coastal zone management program directly affects the coastal zone. If the designation is found to directly affect the coastal zone, NOAA will make a consistency determination pursuant to Sec. 307(c)(1) of the Act, 16 U.S.C. 1456, and 15 CFR part 930, subpart C. See Sec. 921.4(b). The results of this consistency determination will be published in the Federal Register when the notice of designation is published. See Sec. 921.30(c).

(c) NOAA will publish the notice of designation of a National Estuarine Research Reserve in the Federal Register. The state shall be responsible for having a similar notice published in the local media.

(d) The term state control in Sec. 921.30(a)(3) does not necessarily require that key land and water areas be owned by the state in fee simple. Acquisition of less-than-fee simple interests e.g., conservation easements) and utilization of existing state regulatory measures are encouraged where the state can demonstrate that these interests and measures assure adequate long-term state control consistent with the purposes of the research reserve (see also Secs. 921.13(a)(7); 921.21(g)). Should the state later elect to purchase an interest in such lands using NOAA funds, adequate justification as to the need for such acquisition must be provided to NOAA.

Sec. 921.31 Supplemental acquisition and development awards.

After National Estuarine Research Reserve designation, and as specified in the approved management plan, a coastal state may request a supplemental acquisition and/or development award(s) for acquiring additional property interests identified in the management plan as necessary to strengthen protection of key land and water areas and to enhance long-term protection of the area for research and education, for facility and exhibit construction, for restorative activities identified in the approved management plan, for administrative purposes related to acquisition and/or facility construction and to develop and/or upgrade research, monitoring and education/interpretive programs. Federal financial assistance provided to a National Estuarine Research Reserve for supplemental development costs directly associated with facility construction (i.e., major construction activities) may not exceed 70 percent of the total project cost, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. NOAA must make a specific determination that the construction activity will not be detrimental to the environment. Acquisition awards for the acquisition of lands or waters, or interests therein, for any one reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein of \$5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more states, each state is eligible independently for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Application procedures are specified in subpart I. Land acquisition must follow the procedures specified in Secs. 921.13(a)(7), 921.21(e) and (f) and 921.81.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.32 Operation and management: Implementation of the management plan.

(a) After the Reserve is formally designated, a coastal state is eligible to receive Federal funds to assist the state in the operation and management of the Reserve including the management of research, monitoring, education, and interpretive programs. The purpose of this Federally funded operation and management phase is to implement the approved final management plan and to take the necessary steps to ensure the continued effective operation of the Reserve.

(b) State operation and management of the Reserves shall be consistent with the mission, and shall further the goals of the National Estuarine Research Reserve program (see Sec. 921.1).

(c) Federal funds are available for the operation and management of the Reserve. Federal funds provided pursuant to this section may not exceed 70 percent of the total cost of operating and managing the Reserve for any one year, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. In the case of a biogeographic region (see Appendix I) shared by two or more states, each state is eligible for Federal financial assistance to establish a separate Reserve within their respective portion of the shared biogeographic region (see Sec. 921.10).

(d) Operation and management funds are subject to the following limitations:

1. Eligible coastal state agencies may apply for up to the maximum share available per Reserve for that fiscal year. Share amounts will be announced annually by letter from the Sanctuary and Reserves Division to all participating states. This letter will be provided as soon as practicable following approval of the Federal budget for that fiscal year.
2. No more than ten percent of the total amount (state and Federal shares) of each operation and management award may be used for construction-type activities.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12541, Mar. 17, 1997].

Sec. 921.33 Boundary changes, amendments to the management plan, and addition of multiple-site components.

(a) Changes in the boundary of a Reserve and major changes to the final management plan, including state laws or regulations promulgated specifically for the Reserve, may be made only after written approval by NOAA. NOAA may require public notice, including notice in the Federal Register and an opportunity for public comment before approving a boundary or management plan change. Changes in the boundary of a Reserve involving the acquisition of properties not listed in the management plan or final EIS require public notice and the opportunity for comment; in certain cases, a categorical exclusion, an environmental assessment and possibly an environmental impact statement may be

required. NOAA will place a notice in the Federal Register of any proposed changes in Reserve boundaries or proposed major changes to the final management plan. The state shall be responsible for publishing an equivalent notice in the local media. See also requirements of Secs. 921.4(b) and 921.13(a)(11).

(b) As discussed in Sec. 921.10(b), a state may choose to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award for a single site has been made. NOAA will publish notice of the proposed new site including an invitation for comments from the public in the Federal Register. The state shall be responsible for publishing an equivalent notice in the local newspaper(s). An EIS, if required, shall be prepared in accordance with section Sec. 921.13 and shall include an administrative framework for the multiple-site Reserve and a description of the complementary research and educational programs within the Reserve. If NOAA determines, based on the scope of the project and the issues associated with the additional site(s), that an environmental assessment is sufficient to establish a multiple-site Reserve, then the state shall develop a revised management plan which, concerning the additional component, incorporates each of the elements described in Sec. 921.13(a). The revised management plan shall address goals and objectives for all components of the multi-site Reserve and the additional component's relationship to the original site(s).

(c) The state shall revise the management plan for a Reserve at least every five years, or more often if necessary. Management plan revisions are subject to (a) above.

(d) NOAA will approve boundary changes, amendments to management plans, or the addition of multiple-site components, by notice in the Federal Register. If necessary NOAA will revise the designation document (findings) for the site.

Sec. 921.40 Ongoing oversight and evaluations of designated National Estuarine Research Reserves.

(a) The Sanctuaries and Reserve Division shall conduct, in accordance with section 312 of the Act and procedures set forth in 15 CFR part 928, ongoing oversight and evaluations of Reserves. Interim sanctions may be imposed in accordance with regulations promulgated under 15 CFR part 928.

(b) The Assistant Administrator may consider the following indicators of non-adherence in determining whether to invoke interim sanctions:

1. Inadequate implementation of required staff roles in administration, research, education/interpretation, and surveillance and enforcement. Indicators of inadequate implementation could include: No Reserve Manager, or no staff or insufficient staff to carry out the required functions.
2. Inadequate implementation of the required research plan, including the monitoring design. Indicators of inadequate implementation could include: Not

- carrying out research or monitoring that is required by the plan, or carrying out research or monitoring that is inconsistent with the plan.
3. Inadequate implementation of the required education/interpretation plan. Indicators of inadequate implementation could include: Not carrying out education or interpretation that is required by the plan, or carrying out education/interpretation that is inconsistent with the plan.
 4. Inadequate implementation of public access to the Reserve. Indicators of inadequate implementation of public access could include: Not providing necessary access, giving full consideration to the need to keep some areas off limits to the public in order to protect fragile resources.
 5. Inadequate implementation of facility development plan. Indicators of inadequate implementation could include: Not taking action to propose and budget for necessary facilities, or not undertaking necessary construction in a timely manner when funds are available.
 6. Inadequate implementation of acquisition plan. Indicators of inadequate implementation could include: Not pursuing an aggressive acquisition program with all available funds for that purpose, not requesting promptly additional funds when necessary, and evidence that adequate long-term state control has not been established over some core or buffer areas, thus jeopardizing the ability to protect the Reserve site and resources from offsite impacts.
 7. Inadequate implementation of Reserve protection plan. Indicators of inadequate implementation could include: Evidence of non-compliance with Reserve restrictions, insufficient surveillance and enforcement to assure that restrictions on use of the Reserve are adhered to, or evidence that Reserve resources are being damaged or destroyed as a result of the above.
 8. Failure to carry out the terms of the signed Memorandum of Understanding (MOU) between the state and NOAA, which establishes a long-term state commitment to maintain and manage the Reserve in accordance with section 315 of the Act. Indicators of failure could include: State action to allow incompatible uses of state-controlled lands or waters in the Reserve, failure of the state to bear its fair share of costs associated with long-term operation and management of the Reserve, or failure to initiate timely updates of the MOU when necessary.

Sec. 921.41 Withdrawal of designation.

The Assistant Administrator may withdraw designation of an estuarine area as a National Estuarine Research Reserve pursuant to and in accordance with the procedures of section 312 and 315 of the Act and regulations promulgated thereunder.

APPENDIX B

**Agreement Concerning Cooperative Management of
the San Francisco Bay National Estuarine Research Reserve**

Memorandum of Understanding
AGREEMENT CONCERNING COOPERATIVE MANAGEMENT OF
THE SAN FRANCISCO BAY NATIONAL ESTUARINE RESEARCH RESERVE

This Memorandum serves as an expression of intent among four parties-in-interest ("parties"): Solano Land Trust; California Department of Parks and Recreation (collectively referred to as "the land management parties"); San Francisco State University ("SFSU"), the state lead agency; and the San Francisco Bay Conservation and Development Commission ("the Commission").

Witnesseth:

WHEREAS, the State of California has received a grant from the United States Secretary of Commerce for the development and operation of certain portions of the San Francisco Bay Estuary (see Appended List) as the San Francisco Bay National Estuarine Research Reserve (the Reserve), and

WHEREAS, the purpose of this grant is to create new opportunities for coordinated San Francisco Bay estuarine resource management, research, monitoring, stewardship, and public education (the Program), and

WHEREAS, such Program has wide public support, as evidenced by the implementation of the Comprehensive Conservation and Management Plan for the San Francisco Bay Estuary, and the Baylands Ecosystem Habitat Goals Project and

WHEREAS, the parties have evidenced support for such a Program through their approval of the 1992 Site Nomination Proposal for the San Francisco Bay National Estuarine Research Reserve,

NOW THEREFORE, in consideration of the mutual benefits to be derived from implementing this Program, the parties agree to the following:

1. The lands described in the Appended List, which are and will remain independently owned and administered by the respective owners and lessees, are hereby designated as sites to be cooperatively managed by the land management parties, based in part on the advice of the Commission, as the San Francisco Bay National Estuarine Research Reserve in accordance with the provisions of this MOU.
2. There shall be a reserve management plan for the reserve ("reserve management plan") that provides a framework for conducting a specified Program on Reserve sites. Revisions of the reserve management plan shall be developed by the reserve staff and shall be subject to approval by a management advisory board that will include representatives of the parties. The reserve management plan shall be reviewed periodically and revised as specified by NOAA and the management advisory board.

3. A primary purpose of the Program is to provide funding, staff, and other resources and guidance that will assist reserve land management parties to develop site-specific activities that are consistent with the reserve management plan. This Program will focus on identifying and conserving sensitive ecological resources, promoting on-site research and long-term monitoring, engaging local communities in stewardship activities that support the conservation of sensitive reserve resources, and acting as a regional educational resource that serves the public of the San Francisco Bay and Delta region.

4. The parties agree, so far as it consistent with their respective governing laws, policies, regulations and available resources, to support the preparation and implementation of the reserve management plan.

5. The uses of reserve lands shall be compatible with the Program and its purpose as expressed in the reserve management plan.

6. Management Structure

a. There shall be a management advisory board that will include one member from each of the parties that shall review the recommendations of reserve staff and that shall represent the parties. The advisory board will be a non-voting advisory body and will be supported by reserve staff. The management advisory board shall review the reserve management plan periodically and shall advise SFSU regarding the adequacy of staff implementation of the reserve management plan. A representative of NOAA shall serve as an ex-officio representative on the management advisory board.

b. SFSU shall implement the program by hiring and directing reserve staff, supervising and coordinating implementation of the provisions of the reserve management plan, and by receiving and acting upon the recommendations of the management advisory board and participating site managers. The reserve staff will be directly responsible for program coordination with agency representatives having proprietary control over reserve sites.

c. The Commission will assist in developing an advisory structure that provides the management advisory board with an appropriate linkage to the broader community so that its direction of the reserve reflects the concerns and ideas of this regional constituency.

7. No projects shall be carried out on reserve lands without the approval of the party having proprietary control over such lands. Such party shall maintain all facilities built on lands that the party controls in furtherance of a project, and shall cooperate with reserve staff in carrying out the approved program.

8. The reserve staff, management advisory board and appropriate advisory participants shall confer regularly to ensure coordination between the Program and the broader goals and mandates of regional coastal management programs that affect the San Francisco Bay

Estuary. To the extent feasible, as necessary, and in accordance with the laws and regulations affecting and guiding the respective parties, the parties will coordinate resource management and manipulation, public entry and use of the properties, enforcement, development and operation of the Properties in accordance with the provisions of this MOU.

9. This Memorandum shall not be construed to preclude additional transfers of property among the parties, nor to preclude additions of appropriate lands to reserve sites.

10. The land management parties agree to reasonably commit their respective available resources towards achieving the objectives of this MOU, but no party shall be obligated to provide or expend any funds, staff, equipment or other resources over and above what such party is normally authorized in connection with the management and operation of its respective lands and what is necessary to meet the State match requirement.

11. This Memorandum shall continue in perpetuity so long as the Program is funded and has not been terminated; additional participants may join by unanimous approval of the parties, and this Memorandum may be amended or terminated by majority vote of the parties at any time. Nothing in this Memorandum shall preclude the unilateral withdrawal of any of the parties. Any party may terminate its participation under the MOU by providing sixty (60) days written notice to each of the other parties. In such an eventuality, it is understood that the lands of the withdrawing party would be withdrawn from reserve designation, and it is further understood that the federal Office of Management and Budget would take appropriate action with respect to repayment of grant funds as may be indicated by its regulations.

12. All parties agree, to the extent permitted by their respective governing laws, that they will cooperate with the Program so that it can achieve its mission to provide opportunities for long-term research, education, and interpretation. This will help the parties promote and recover the ecological health of the San Francisco Estuary and to create a more sustainable regional environment for future generations.

13. The parties shall neither be construed as partners nor an agent of the other by reason of this MOU nor be given any power to bind any other party to any obligation or liability. No provision of this MOU shall be interpreted to mean that a party assumes any responsibility for liability or claims of third parties on lands of another party.

14 Counterparts: The MOU may be executed in counterparts with each counterpart, when taken all together, constituting a full and complete binding document.

15. Severability: Should any provision of this MOU be found to be invalid as to any party, such invalidity shall not affect the remainder of the MOU and it shall be enforceable as if the invalid provision were never included.

16 Existing law: This MOU does not supercede or modify existing statutory authority or direction of the parties and the parties will continue to administer their respective lands and programs or otherwise work within existing statutory authority. Decisions made pursuant to this MOU shall not be binding on a party unless the party's representative has the authority to bind the agency regarding the specific decision or the agency ratifies the decision.

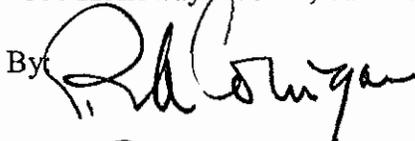
17. Applicable law: Enforcement of the provisions of this MOU shall be in accordance with the laws of the State of California and appropriate local jurisdictions. It is the intent of the parties that the provisions of the MOU be interpreted in the broadest manner so as to give effect to the purposes of the MOU. However, no party shall be required to participate in a cooperative activity that it, in good faith, believes is not consistent with its underlying statutory, regulatory, budget authority or the policies of its respective entity.

18. Notices: Notices shall be given to each of the other parties in writing by first-class mail or personal delivery at the addresses shown below.

Signed,

San Francisco State University
1600 Holloway Avenue, San Francisco CA 94132

By:



Date:

July 3, 2003

Title:

President

Romberg Tiburon Center
San Francisco State University
3152 Paradise Drive
Tiburon CA 94920-1205

By:



Date:

July 3, 2003

Title:

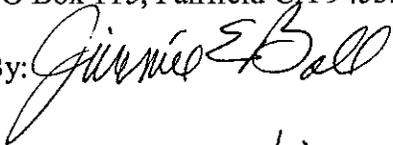
Director

California Department of Parks and Recreation
Marin District Headquarters
7665 Redwood Blvd, Suite 150, Novato, CA 94945.

By:  Date: JULY 3, 2003

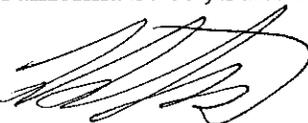
Title: General Manager

Solano Land Trust
PO Box 115, Fairfield CA 94533

By:  Date: July 1, 2003

Title: Executive Director

San Francisco Bay Conservation and Development Commission
50 California Street, Suite 2600, San Francisco CA 94111

By:  Date: JUNE 20, 2003

Title: EXECUTIVE DIRECTOR

Appended List of Properties included in the San Francisco Bay National Estuarine
Research Reserve:

China Camp State Park, California Department of Parks & Recreation

Rush Ranch Open Space Preserve, Solano Land Trust

APPENDIX C

**Memorandum of Understanding between
San Francisco State and National Oceanic and Atmospheric Administration**

Memorandum of Agreement
Between the
National Oceanic and Atmospheric Administration
And the
San Francisco State University
Detailing the state-federal roles in the
Management of the San Francisco Bay National Estuarine Research Reserve

This Memorandum of Agreement states the provisions for the cooperative management of the San Francisco Bay National Estuarine Research Reserve in the state of California, between San Francisco State University and the National Oceanic and Atmospheric Administration's Office for Coastal Management. This Memorandum of Agreement supersedes the previous Memorandum of Understanding between NOAA and San Francisco State University regarding the San Francisco Bay National Estuarine Research Reserve made on July 28, 2003.

I. BACKGROUND

- A. The state of California has determined that the waters and related coastal habitats of San Francisco Bay provide unique opportunities for study of natural and human processes to contribute to the science of estuarine ecosystem processes, enhance environmental education opportunities, and provide scientific information for effective coastal zone management in the state of California.
- B. The state of California has determined that the resources of the San Francisco Bay National Estuarine Research Reserve and the values they represent to the citizens of California and the United States will benefit from the management of these resources as part of the National Estuarine Research Reserve System.
- C. The National Oceanic and Atmospheric Administration has concurred with that finding and, pursuant to its authority under Section 315 of the Coastal Zone Management Act of 1972, as amended (CZMA, 16 U.S.C. § 1461), and in accordance with implementing regulations at 15 C.F.R. § 921.30, has designated the San Francisco Bay National Estuarine Research Reserve.
- D. The San Francisco State University, as the agency designated by the Governor of California is responsible for maintaining and managing the San Francisco Bay National Estuarine Research Reserve in accordance with Section 315 of the CZMA and acknowledges the value of state-federal cooperation for the long-term management of the reserve in a manner consistent with the purpose of its designation.
- E. The San Francisco Bay National Estuarine Research Reserve management plan, approved by NOAA, describes the goals, objectives, strategies/actions, administrative structure, and institutional arrangements for the reserve, including

this MOA and others. In consideration of the mutual agreements herein, NOAA and San Francisco State University agree to the following roles indicated in Section II of this agreement.

II. STATE-FEDERAL ROLES IN RESERVE MANAGEMENT

A. San Francisco State University Role in Reserve Management

The San Francisco State University shall:

1. be responsible for compliance with all federal laws and regulations, and ensure that the San Francisco Bay National Estuarine Research Reserve management plan is consistent with the provisions of the CZMA and implementing regulations;
2. ensure protection of the natural and cultural resources of the reserve, and ensure enforcement of the provisions of state law, including rules and regulations of the San Francisco Bay Conservation and Development Commission;
3. ensure adequate, long-term protection and management of lands and waters included within the reserve boundary;
4. apply for, budget, allocate, and expend funds in accordance with federal and state laws, the reserve management plan, and annual funding guidance for reserve operations, research and monitoring, education and stewardship, and, as necessary, land acquisition and reserve facility construction;
5. conduct and coordinate research and monitoring programs that encourage scientists from a variety of institutions to work together to understand the ecology of the reserve ecosystem to improve coastal management;
6. conduct and maintain programs that disseminate research results via materials, activities, workshops, and conferences to resource users, state and local agencies, school systems, general public, and other interested parties;
7. provide staff and endeavor to secure state funding for the manager, education coordinator, and research coordinator;
8. secure facilities and equipment required to implement the provisions within the reserve management plan;
9. ensure adequate funding for facilities operation and maintenance;
10. maintain effective liaison with local, regional, state, and federal policy makers, regulators and the general public;

11. serve as principal contact for issues involving proposed boundary changes and/or amendments to the reserve management plan;
12. respond to NOAA's requests for information made pursuant to Section 312 of the CZMA, particularly cooperative agreement and grant progress reports and evaluation findings, including necessary actions and recommendations; and
13. Coordinate and support research, monitoring, education, and management activities with staff at China Camp State Park and Rush Ranch.

B. Federal Role in Reserve Management

NOAA's Office for Coastal Management shall:

1. administer the provisions of the Sections 315 and 312 of the CZMA to ensure that the reserve operates in accordance with goals of the reserve system and the San Francisco Bay National Estuarine Research Reserve management plan;
2. review and process applications for financial assistance from the San Francisco State University, consistent with 15 C.F.R. § 921, for management and operation, and, as appropriate, land acquisition and facility construction;
3. advise San Francisco State University of existing and emerging national and regional issues that have bearing on the reserve and reserve system;
4. maintain an information exchange network among reserves, including available research and monitoring data and educational materials developed within the reserve system;
5. to the extent possible, facilitate the allocation of NOAA resources and capabilities in support of reserve goals and programs.

C. General Provisions

1. Nothing in this agreement or subsequent financial assistance awards shall obligate either party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.
2. Upon termination of this agreement or any subsequent financial assistance awards to San Francisco State University, any equipment purchased for studies to further this agreement will be disposed of in accordance with 15 C.F.R. § 24.32.
3. A free exchange of research and assessment data between the parties is encouraged and is necessary to ensure success of cooperative studies.

D. Other Provisions

1. Nothing in this agreement diminishes the independent authority or coordination responsibility of either party in administering its respective statutory obligations. Nothing in this agreement is intended to conflict with current written directives or policies of either party. If the terms of this agreement are inconsistent with existing written directives or policies of either party entering this agreement, then those portions of the agreement which are determined to be inconsistent with such written directives and policies shall be invalid; but the remaining terms not affected by the inconsistency shall remain in full force and effect. At the first opportunity for revision of this agreement, all necessary changes shall be made by either an amendment to this agreement or by entering in a new superseding agreement, whichever is deemed expedient to the interested parties. Should disagreement arise on the interpretation of the provisions and/or amendments of this agreement, such disagreement shall be resolved by negotiations at the operating level of each party.

III. REAL PROPERTY ACQUIRED FOR PURPOSE OF THE RESERVE

As well as acknowledging the rest of the requirements set forth at 15 C.F.R. § 921, San Francisco State University specifically acknowledges and will fully comply with conditions set forth at 15 C.F.R. § 921.21(e), which specify the legal documentation requirements concerning the use and disposition of real property acquired for reserve purposes with federal funds under Section 315 of the CZMA.

IV. PROGRAM EVALUATION

The Office for Coastal Management of NOAA will schedule periodic evaluations of San Francisco State University performance in meeting the terms of this agreement, financial assistance awards, and the reserve management plan. Where findings of deficiency occur, NOAA may initiate action in accordance with the designation withdrawal or interim sanctions procedures established by the CZMA and applicable regulations at 15 C.F.R. § 921.40-41.

V. EFFECTIVE DATE, REVIEW, AMENDMENT AND TERMINATION

- A. This agreement is effective on the date of the last signature on this agreement and shall be in effect until terminated by either party.
- B. This agreement will be reviewed periodically by both parties and may only be amended by the mutual written consent of both parties.
- C. This agreement may be terminated by mutual consent of both parties, or by NOAA if NOAA withdraws designation of the reserve within the reserve system, pursuant to applicable provisions of the CZMA and its implementing regulations as described under 15 C.F.R. §923 Subpart L, or if NOAA finds that San Francisco State University fails to comply with this MOA. Should this

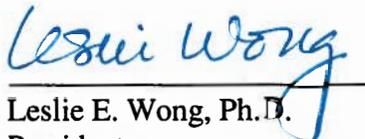
agreement be terminated, reimbursement of unexpended funds from financial assistance awards shall be determined on a pro rata basis according to the amount of work done by the parties at the time of termination. Additionally, reimbursement for land purchased and facilities constructed with NOAA funds shall be consistent with terms and special award conditions of financial assistance awards.

- D. If any clause, sentence or other portion of this MOA shall become illegal, null, or void for any reason, the remaining portions of this MOA shall remain in full force and effect.
- E. No waiver of right by either party of any provision of this MOA shall be binding unless expressly confirmed in writing by the party giving the waiver.

IN WITNESS THEREOF, the parties have caused this agreement to be executed.



Jeffrey C. Payne, Ph.D.
Director
Office for Coastal Management
National Ocean Service
National Oceanic and
Atmospheric Administration
U.S. Department of Commerce



Leslie E. Wong, Ph.D.
President
San Francisco State University
1600 Holloway Ave
San Francisco, CA 94132

Aug 4, 2016
Date

8-18-16
Date

APPENDIX D

**Memorandum of Understanding between
San Francisco Bay National Estuarine Research Reserve and Audubon California**

MEMORANDUM OF UNDERSTANDING

This Memorandum serves as an expression of intent between two parties-in-interest ("parties"): San Francisco State University ("SFSU"), the state lead agency on behalf of the San Francisco Bay National Estuarine Research Reserve (San Francisco Bay NERR), and National Audubon Society, Inc. dba, Richardson Bay Audubon Center & Sanctuary ("Audubon") concerning collaboration on the management and protection of San Francisco Bay, and in particular, Richardson Bay.

Witnesseth:

WHEREAS, the Solano Land Trust, the California Department of Parks and Recreation, the San Francisco Bay Conservation and Development Commission and SFSU entered into that certain Memorandum of Understanding dated as of July 2, 2003 (the "MOU") to create new opportunities for coordinated San Francisco Bay estuarine resource management, research, monitoring, stewardship and public education (the Program), and

WHEREAS, the National Oceanic and Atmospheric Administration designated the San Francisco Bay NERR on August 27, 2003, and

WHEREAS, Audubon's mission focusing on stewardship, education, research and restoration of Richardson Bay aligns with the mission of the San Francisco Bay NERR, and

WHEREAS, Audubon currently owns land adjacent to, and undertakes research in, China Camp State Park, one of the federally designated San Francisco Bay NERR sites, and

WHEREAS, San Francisco Bay NERR staff and Audubon staff are currently collaborating on stewardship projects, research, and education projects and programs in the community, and are committed to continuing these collaborations,

NOW THEREFORE, in consideration of the mutual benefits to be derived from such collaboration, the parties agree to the following:

1. San Francisco Bay NERR staff and Audubon staff will cooperate in ways that will strengthen their respective education programs. San Francisco Bay NERR staff will offer additional support and expertise in estuarine science and science education to Audubon, while Audubon staff will offer San Francisco Bay NERR access to field sites and education facilities. Educators and managers from both organizations will work together to write grants to fund joint programs. At the request of Audubon, San Francisco Bay

NERR's Education Coordinator will assist with curriculum development for Audubon's education programs and training of education volunteers. In addition, San Francisco Bay NERR Education staff will consult with scientists working within the Sanctuary to create temporary exhibits about research in Richardson Bay. The temporary exhibits will be displayed on Audubon property and at other locations within Tiburon. The scientists will also occasionally speak at San Francisco Bay NERR and Audubon education programs.

2. Audubon will provide, at mutually acceptable times subject to scheduling, use of classroom facilities and access to field sites at the Richardson Bay Audubon Center & Sanctuary for San Francisco Bay NERR education workshops, such as professional development workshops for teachers and training sessions for coastal decision makers. San Francisco Bay NERR will provide, at mutually acceptable times subject to scheduling, use by Audubon of classroom facilities for education programs at the Romberg Tiburon Center and use by Audubon staff of the San Francisco Bay NERR laboratory facilities at the Romberg Tiburon Center.
3. The parties may link websites and cross-promote each other's work and programs as appropriate.
4. The parties agree that Audubon, through its Richardson Bay Audubon Center & Sanctuary Director, will participate in the proceedings of the Management Advisory Board of the San Francisco Bay NERR.
5. Audubon shall implement its programs in consideration of the San Francisco Bay NERR's Management Plan, and the San Francisco Bay NERR shall implement their programs at Richardson Bay in consideration of the plans and regulations of Audubon.
6. No projects shall be carried out on San Francisco Bay NERR lands without the approval of the party having proprietary control over such lands.
7. The parties agree to reasonably commit their respective available resources towards achieving the objectives of this Memorandum, but no party shall be obligated to provide or expend any funds, staff, equipment or other resources over and above what such party is normally authorized in connection with the management and operation of its respective programs.
8. This Memorandum may be amended by the mutual agreement of the parties. Either party may terminate this Memorandum by providing sixty (60) days written notice to the other party.
9. The parties shall neither be construed as partners nor an agent of the other by reason of this Memorandum nor be given any power to bind the other party to any obligation or liability. No provision of this Memorandum shall be interpreted to mean that a party assumes any responsibility for liability or claims of third parties on lands of the other party.

10. This Memorandum does not supersede or modify existing statutory authority or direction of the parties; the parties will continue to administer their respective lands and programs or otherwise work within existing statutory authority. Decisions made pursuant to this Memorandum shall not be binding on a party unless the party's representative has the authority to bind the party regarding the specific decision.

11. This Memorandum shall be governed by the laws of the State of California and appropriate local jurisdictions. It is the intent of the parties that the provisions of the Memorandum be interpreted in the broadest manner so as to give effect to the purposes thereof. However, neither party shall be required to participate in a cooperative activity that it, in good faith, believes is not consistent with its underlying statutory, regulatory, budget authority or policies.

12. Counterparts: This Memorandum may be executed in counterparts with each counterpart, when taken all together, constituting a full and complete binding document.

Signed,

San Francisco Bay National Estuarine Research Reserve
San Francisco State University
1600 Holloway Avenue, San Francisco CA 94132


By: Jaime C. Kooser, Ph.D.
Title: Reserve Manager


Date: 2/17/08

National Audubon Society
Richardson Bay Audubon Center & Sanctuary
376 Greenwood Beach Rd
Tiburon CA 94920


By: Brooke Langston
Title: Center Director


Date: 2/17/08

APPENDIX E

Species Lists

Appendix E*

List of Referenced Species by Common Names

Common Name*	Taxonomic name	Plant	Origin	Status
Alkali bulrush	<i>Bolboschoenus maritimus</i>	Plant	N	
American shad	<i>Alosa sapidissima</i>	Fish	I	
arroyo willow	<i>Salix lasiolepis</i>	Plant	N	
Asian mudsnail	<i>Batillaria cumingi</i>	Gastropod	I	
Baltic rush	<i>Juncus balticus</i>	Plant	N	
blue oak	<i>Quercus douglasiana</i>	Plant	N	
broad leaved cattail	<i>Typha latifolia</i>	Plant	N	
brown smoothhound sharks	<i>Mustelus henlei</i>	Fish	N	
Burrowing Owl	<i>Athene culicularia hypugea</i>	Bird	N	SSC
California bat ray	<i>Myliobatis californica</i>	Fish	N	
California bay laurel	<i>Umbellularia californica</i>	Plant	N	
California black oak	<i>Quercus kelloggii</i>	Plant	N	
California Black Rail	<i>Laterallis jamaicensis coturniculus</i>	Bird	N	CT
California buckeye	<i>Aesculus californicus</i>	Plant	N	
California Least Tern	<i>Sterna antillara</i>	Bird	N	FE, CE
California Tiger Salamander	<i>Ambystoma californiense</i>	Amphibian	N	FT
cattail	<i>Typha spp.</i>	Plant	N	
coast live oak	<i>Quercus agrifolia</i>	Plant	N	
Coast redwood	<i>Sequoia sempervirens</i>	Plant	N	
Contra Costa goldfields	<i>Lasthenia conjugens</i>	Plant	N	FE
Delta Smelt	<i>Hypomesus pacificus</i>	Fish	N	FE
Delta Tule Pea	<i>Lathyrus jepsonii</i>	Plant	N	SSC
dodder	<i>Cuscuta salina</i>	Plant	N	
eelgrass	<i>Zostera marina</i>	Plant	N	
European green crab	<i>Carcinus maenas</i>	Crustacean	I	
fall-run chinook salmon,	<i>Oncorhynchus tshawytscha</i>	Fish	N	
fat hen	<i>Atriplex prostrata</i>	Plant	N	
feral pig	<i>Sus scrofa</i>	Mammal	I	
frankenian	<i>Frankenia grandiflora</i>	Plant	N	
golden eagle	<i>Aquila chrysaetos</i>	Bird	N	
gum plant	<i>Grindelia stricta subsp.</i>	Plant	N	
herring	<i>Clupea pallasii</i>	Fish	N	
Hybrid cord grass	<i>Spartina foliosa x S. alterniflora</i>	Plant	I	
jacksmelt	<i>Therionopsis californiensis</i>	Fish	N	

leopard shark	<i>Triakis semifasciata</i>	Fish	N	
Longfin Smelt	<i>Spirinchus thaleichthys</i>	Fish	N	CT
madrone	<i>Arbutus menziesii</i>	Plant	N	
manzanita	<i>Arctostaphylos manzanita</i>	Plant	N	
Mason's Lilaeopsis,	<i>Lilaeopsis masonii</i>	Plant	N	CR
medsa head	<i>Elymus caput-medusae</i>	Plant	I	
northern anchovy,	<i>Engraulis mordax)</i>	Fish	N	
Northern Harrier	<i>Circus cyaneus</i>	Bird	N	
Olympia Oyster	<i>Ostrea lurida</i>	Bivalve	N	
Oregon oak	<i>Quercus garryana</i>	Plant	N	
Pacific cordgrass	<i>Spartina foliosa</i>	Plant	N	
Pacific herring	<i>Clupea pallasii,</i>	Fish	N	
pepperweed	<i>Lepidium latifolium</i>	Plant	I	
peregrine falcon	<i>Falco peregrinus anatum</i>	Bird	N	
pickleweed	<i>Salicornia pacifica</i>	Plant	N	
purple needlegrass	<i>Stipa pulchra</i>	Plant	N	
red willow	<i>Salix laevigata</i>	Plant	N	
Ridgeway's Rail	<i>Railus obsoletus</i>	Bird	N	FE
ripgut brome	<i>Bromus diandrus</i>	Plant	I	
Sacramento Splittail	<i>Pogonichthys macrolepidotus</i>	Fish	N	SSC
salt grass	<i>Dischlis spicata</i>	Plant	N	
Salt Marsh Harvest Mouse	<i>Reithrodontomys raviventris</i>	Mammal	N	FE, CE
Salt Marsh Yellowthroat,	<i>Geothlypis trichas sinuosa</i>	Bird	N	SSC
San Francisco Song Sparrow	<i>Melospiza melodia maxillaris</i>	Bird	N	SSC
shiner perch	<i>Cymatogaster aggregata</i>	Fish	N	
Short-Eared Owl	<i>Asio flammeus</i>	Bird	N	SSC
Soft Bird's Beak	<i>Chloropyron molle molle</i>	Plant	I	FE, SSC
soft chess	<i>Bromus hordaceous</i>	Plant	N	
staghorn sculpin	<i>Leptocottus armatus</i>	Fish	N	
starry flounder	<i>Platichthys stellatus</i>	Fish	N	
Steelhead Trout	<i>Oncorhynchus mykiss</i>	Fish	N	FT
striped bass	<i>Morone saxatilis</i>	Fish	I	
Suisun Marsh Aster	<i>Symphyotrichum lentum</i>	Plant	N	SSC
Suisun Shrew	<i>Sorex ornatus sinuosus</i>	Mammal	N	SSC
Suisun Thistle	<i>Cirsium hydrophilum hydrophilum</i>	Plant	N	FE, SSC
three square bulrush	<i>Schoenoplectus americanus</i>	Plant	N	
toyon	<i>Heteromeles arbutifolia</i>	Plant	N	
Tricolored blackbird	<i>Agelaius tricolor</i>	Bird	N	CE
tule	<i>Schoenoplectus spp.</i>	Plant	N	
valley oak	<i>Quercus lobata</i>	Plant	N	

wall barley	<i>Hordeum murinum</i>	Plant	I	
white-tailed kite	<i>Elanus leucurus</i>	Bird	N	
wild oats	<i>Avena barbata</i>	Plant	I	
Winter-run Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	Fish	N	FE
yarrow	<i>Achillea millefolia</i>	Plant	N	
yellowfin goby	<i>Acanthogobius flavimanus</i>	Fish	I	

Origin - N = California native, I = Introduced

Status - FE = federally endangered, FT = Federally threatened, CE = California endangered

CT = California threatened, SSC = California Species of Special Concern

*** For further detailed information about these and other species, habitats, and ecosystems, please refer to the Reserve site profile**

(https://coast.noaa.gov/data/docs/nerrs/Reserves_SFB_SiteProfile.pdf)

and other references such as Ferner 2011a, Ferner 2012b, and other documents in the Reference Section.

**** Common names for special status species are capitalized**

APPENDIX F

Federal Consistency Determination

San Francisco Bay Conservation and Development Commission

455 Golden Gate Avenue, Suite 10600, San Francisco, California 94102 tel 415 352 3600 fax 415 352 3606

December 7, 2017

Dr. Michael Vasey
San Francisco National Estuarine Research Reserve
3152 Paradise Drive
Tiburon, California 94920-1205

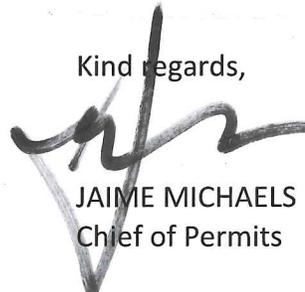
SUBJECT: BCDC Consistency Determination No. C2017.006.00
PROPOSED PROJECT: NERR Five-Year Management Plan
LOCATION: Various locations within the Coastal Zone

Dear Dr. Vasey

On December 5, 2017, the San Francisco Bay Conservation and Development Commission ("Commission") staff received from the San Francisco National Estuarine Research Reserve (NERR) the above-referenced consistency determination for its Five-Year Management Plan of NERR sites within the Coastal Zone for 2017-2022. In this determination, you assert that your proposed activity will have no effect on coastal resources will be conducted in a manner that is consistent to the maximum extent practicable with the policies of the BCDC's Coastal Management Program (CMP). Staff has reviewed your submittal on behalf of the Commission and has determined that the activity will have "no effect" on the Coastal Zone of San Francisco Bay or its resources. Accordingly, the BCDC declines to assert its consistency review jurisdiction under the federal Coastal Zone Management Act (CZMA) over the activity described in your submittal. Pursuant to 15 CFR § 930.45(b)/930.65(b), BCDC reserves the right to conduct a consistency review of this activity if it is being conducted in a manner, or is affecting coastal resources, other than as described in your submittal.

If you should have any questions regarding this letter, please contact Ethan Lavine of our staff at 415-352-3618 or ethan.lavine@bcdc.ca.gov.

Kind regards,



JAIMIE MICHAELS
Chief of Permits

JM/ra

APPENDIX G

Management Plan Process and Response to Public Comment

Appendix G

Management Plan Process and Response to Public Comment

Reserve staff worked in close collaboration with the Office for Coastal Management (OCM) on the management plan process, in accordance with OCM's guidance document entitled Reserve System Management Plan Guidelines and Resources (2013).

Reserve staff also worked in collaboration with all our signatory partners to create the draft of this plan. This effort included a series of individual meetings with both land-owning partners - California State Parks and Solano Land Trust - and the Bay Conservation and Development Commission. The discussions of all these meetings were reflected in a draft that was provided for review by all partners and OCM prior to engaging stakeholders and the public.

Outreach to the wider Bay community was pursued and occurred in a variety of media and venues. On December 7, 2017, a public notice advertising our December 18, 2017 public meeting was published in the Solano County Daily Republic. On December 8, 2017, a similar public notice was published in the Marin Independent Journal. Both public notices invited the public to attend our meeting and notified the public that comments on the Draft Revised Management Plan would be due by January 17, 2018. The legal notice of availability for the 30-day public comment period was published in the Federal Register on December 21, 2017. Additionally, an email was posted to a Reserve email list announcing that the Draft Management Plan was posted on the San Francisco Bay NERR website (sfbaynerr.org) for public review with a thirty-day comment period. The public meeting was then held at the Bay Conference Center on December 18, 2017. The public meeting was videotaped and made available through the Reserve website. Again, an email was sent out to our Reserve email list inviting people to view the video of the public meeting, to send questions to staff, and to provide comments during the 30- day public comment period.

Comments were received via mail and e-mail. Comments received during the 30-day public comment period are summarized in the table below, along with our response to each comment. The table is organized by page number in the Draft Management Plan document.

We thank everyone involved in commenting on this draft for helping to make the Management Plan as clear and effective as possible.

<i>Page</i>	<i>Comment Received</i>	<i>Response To Comment</i>
Page 1	Under Reserve Context / This language needs to be clarified as I think there is confusion between the CEQA term "lead agency" and how it is used here. You may be able to add that the land owners retain the lead agency designation under CEQA to clarify the difference.	<i>Text revised to distinguish California State Parks as lead agency for China Camp State Park</i>

Page 1	Under Threats & Stressors/ The term "high intensity" should be removed unless it is supported with a clear definition and citation. The China Camp SP General Management Plan calls for certain intensities of use in areas of the park but there is a clear definition of that term.	<i>The term "high intensity" was removed</i>
Page 2	Under Priority Management/bullet # 2 /suggest more direct language: replace "choices about effective management decision-making" to "management decisions..."	<i>Text revised as requested.</i>
Page 4	Bullet point #3. "Educating" target audiences is a term that seems to be falling out of favor as too pedantic; could be modified to "engaging" or "inspiring"?	<i>Text revised as requested. Thank you for the suggestion</i>
Page 6	Last paragraph / Need to clarify the term "lead agency", see comment on pg. 1	<i>Lead agency for State Reserve partner clarified</i>
Page 10	Under 1.2.2 / California State Parks - throughout the document this varies from California State Parks to State Parks, please use California State Parks for consistency.	<i>We have made a global change identifying "California State Parks"</i>
Page 10	Under 1.2.2 / This needs clarification. Friends of China Camp is the park operator, they are responsible for the day to day operations however State Parks is still the lead agency for CEQA, provides support from district staff, and retains management of all the natural and cultural resources. There is an operating agreement between FoCC and State Parks that clearly defined the roles and responsibilities of the operator and State Parks.	<i>We have revised this section to attempt to clarify these observations</i>
Page 18	Under 1.2.3.2/ Isn't there more recent data related to climate change affects/temperature affecting days/extent of fog in the Bay Area? Should this be referenced?	<i>We have referenced Johnstone and Dawson (2010) to address this issue</i>
Page 23	Under 1.4 / Several helpful editorial suggestions	<i>Text revised as requested.</i>
Page 24	Under 1.4.1 / Several helpful editorial suggestions	<i>Text revised as suggested.</i>
Page 25	Under 1.4.2 / Several helpful editorial suggestions	<i>Text revised as suggested.</i>
Page 26	Under 1.5.1 / 5th bullet point / Mountain biking should be removed from this statement as it implicates the user and not the recreational facilities in the generation of sediment. Suggest changing to "Natural upland erosion processes and erosion associated with park infrastructure can contribute sediment to the marsh, however, this sediment does not freely access the bayward marsh because of the road.	<i>Text revised as suggested.</i>

Page 27	Under 1.5.3 / Remove "higher fire danger" as this does not accurately describe the conditions in the context of fire science. Instead the focus can be on climate change scenarios that describe increased annual mean temp, increased variability in annual precipitation, and generally drier conditions.	<i>Text revised as requested.</i>
Page 27	Under 1.5.4 / Change "usage" to "access routes"	<i>Text revised as requested.</i>
Page 27	Under 1.5.2 / If not mentioned in section above, fog should be mentioned here, as well as potential changes in water chemistry ("estuarine acidification").	<i>Text revised as requested. Mentioned Johnstone and Dawson (2010)</i>
Page 28	Under 1.6.4 / This seems rather subjective. And subject to change- shouldn't the long-term management plan state what the research objectives are for future studies to identify best management practices for grazing on its lands?	<i>Comment noted. Text revised accordingly.</i>
Page 29	Under 1.7.2 / Please remove the county easement along San Pedro Road as the land under the road is already in fee and title to the State of California and any statement of this nature would have to be reviewed and verified by our Land Agent and we cannot complete that review by the 1/31 due date.	<i>Text revised as requested.</i>
Page 31	Under 1.8 / Future Boundary Conditions, paragraph 3/Recommends initiating boundary expansion process to include Richardson Bay component as soon as possible so as not to miss partnership opportunities with Smithsonian Institution, RTC, and Audubon California.	<i>We will explore the possibilities with Office for Coastal Management once the Revised Management Plan is approved</i>
Page 33	Under 2.5.1 / Please define acronym, it is not defined until the next section of the document.	<i>Acronym assigned to full name.</i>
Page 34	Please define acronym (SSAM)	<i>Acronym assigned to full name.</i>
Page 34	Please define acronym, although in this case for consistency I would recommend using China Camp and Rush Ranch instead of CC and RR.	<i>Acronyms assigned to full name.</i>
Page 35	Under 2.5.2 / Objective 5, fifth bullet point – Great!	<i>Thanks.</i>
Page 39	Under 3.3 / Caption under photo. Remove "Matt collecting water sample".	<i>Caption revised as suggested.</i>
Page 44,	Under 3.5.3 / data produced by the program is DISSEMINATED, understood and applied appropriately." and where data is accessed	<i>Text revised as requested</i>

Page 62	Under CA State Parks contact / Please change the contact to Cyndy Shafer, she is now the natural resource program manager and supervises the district natural resource staff.	<i>Text revised as requested.</i>
Page 66	State Parks staff provides the natural and cultural resource management and stewardship activities at China Camp SP, please remove FoCC from this list and they do not conduct any of the programmatic activities listed above.	<i>Revised sentence to more broadly recognize that stewardship activities are provided both by CSP staff and FoCC volunteers</i>
Page 69	Last paragraph / State Parks is the lead for stewardship activities in the park, and while FoCC can support those activities at the direction of State Parks staff, including them here creates confusion around their defined roles and responsibilities.	<i>Text revised as requested.</i>
Page 73	Under 7.2 / Pacific oysters" should be "Olympia oysters"(Pacific oysters usually refers to <i>Crassostrea gigas</i> , not <i>Ostrea lurida</i>).	<i>Text revised as suggested</i>
Page 79	Under Objective 5 / FoCC is not defined as a core partner and should be removed from this list.	<i>We removed "core" so as to eliminate confusion but reflect our commitment to work with all site partners.</i>
Page 88	Under 9.1 / China Camp State Park	<i>Text revised as requested.</i>
Page 99	Under 10.3.5 / This last sentence seems like an afterthought and should either be removed or changed to reflect the potential climate stressors are such as increased annual mean temp, increased variability in annual precipitation, and generally drier conditions.	<i>Text revised as requested.</i>
General Comments	The report does not mention the Federated Indians of Graton Rancheria or Yocha De He Wintun Nation whose traditional territory the NERR areas fall into. Both are federally recognized tribes and the cultural sites and other traditional plant and animal resources within China Camp and Rush Ranch are potentially of ongoing interest to both groups. I would suggest that the tribes should be a part of this discussion and/or might be interested in partnering or discussing some of these topics with the folks at the Reserve and should at least be contacted.	<i>Thank you for this comment. The NERR would welcome the input and knowledge of the Tribal governments and agrees that coordination and discussion with Tribal partners is valuable to this process. As such, the NERR is interested and willing to reach out to Tribal partners to engage in these discussions. NOAA concurs with the value of Tribal knowledge and input and encourages the NERR state agencies to reach out to Tribal governments.</i>
General Comments	The management plan calls for additional programing, outreach, and activities across multiple program areas, (research and monitoring, citizen science, interpretive and education etc.) an integral part of successfully implementing the management plan will be a robust communication strategy with the	<i>We agree with these comments and will follow up accordingly.</i>

	<p>associated State Park staff including natural resource, cultural resource and interpretation program staff. I recommend that there be a regular meeting or communication schedule to ensure that as additional programming and activities are developed, from the conceptual stage through the implementation stage, that they are reviewed and discussed with State Parks staff so we are engaged in the process throughout.</p>	
<p>General Comments</p>	<p>In the plan, there is detailed information on coordination between NERR staff for example regular meeting between the Research Coordinator and Education Coordinator. That should be a strategy that occurs with State Parks staff as well so that the interpretive programming is consistent across NERR and State Parks and to ensure that we are all using the most recent science to communicate with stakeholders, visitors, teacher, etc.</p>	<p><i>We agree with these comments and will follow up accordingly.</i></p>