

Existing Conditions Report



Blending technical expertise and active community participation to define adaptation options for the low-lying North San Pedro Road through China Camp State Park

June 2020

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Cover photo by Aimee Good



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APPENDIX A. RESULTS OF AVIAN NESTING SURVEY OF INTERIOR MARSHES, 2018 (POINT BLUE CONSERVATION SCIENCE)

Existing Conditions Report

Blending Technical Expertise and Active Community Participation to Define Adaptation Options for the Low-Lying North San Pedro Road through China Camp State Park

Version 1.0

1 Introduction

The purpose of this Existing Conditions Report is to support the development and assessment of long-term adaptation solutions for the low-lying sections of the Marin County-owned North San Pedro Road through and approaching China Camp State Park in Marin County, California. The road through China camp provides recreational access to the State Park, a commute corridor, and an emergency access corridor. The audience for this report is the many varied stakeholders and end users, from elected officials, local government staff, community groups, neighborhood associations, conservation groups, and regulatory and resource agencies.

China Camp State Park is a significant regional resource and one the Bay Area’s most special places. Its name comes from the historic Chinese village near the southeast entrance to the Park. The village has a long history back to the 1860s and it is a significant cultural resource of the modern settlement of the Bay Area. The Park also has an important Native American archaeological history alongside active use. China Camp also contains one of the very few remnant historic tidal marshes in the San Francisco Estuary, and it is one of only a handful of places in the Estuary where this remnant tidal marsh connects directly to adjacent natural uplands. These attributes are why it is one of the two locations that comprise the San Francisco Bay National Estuarine Research Reserve (SF Bay NERR), a federal program administered by San Francisco State University and headquartered at the Estuary & Ocean Science Center at SFSU’s Romberg Tiburon Campus. Recreational use of China Camp State Park consists of hiking and mountain biking trails, the Back Ranch campground, several picnic areas, and a beachfront area at the China Camp village. Views through woodlands out across San Pablo Bay greatly strengthen the recreational attraction of the Park. China Camp is a major mountain biking destination, as it is one of the very few places with legal “single track” biking trails.

China Camp State Park is located in northern San Francisco Estuary (Figure 1), in San Rafael, Marin County, California. It borders San Pablo Bay on the north and east, Gallinas Creek meets

San Pablo Bay at the Park’s northwest corner. To the west is the Marin County San Pedro Mountain Open Space Preserve and to the southwest is the City of San Rafael Henry A. Barbier Memorial Park.

North San Pedro Road runs through China Camp State Park, connecting the Santa Venetia neighborhood of north San Rafael to the west to the Peacock Gap neighborhood of central San Rafael to the south. North San Pedro Road becomes Point San Pedro Road at the Park’s south entrance. This road provides a complete loop around Point San Pedro between central and northern San Rafael. It is a commute corridor for local residences and provides a vital emergency responders corridor – when U.S. Highway 101 and its adjacent frontage road become blocked by traffic, it is the only eastern Marin route between southern and northern Marin and thus access to Sonoma County and beyond to the north. West of Highway 101 the next north-south access is Nicasio Valley Road, located about 9 miles to the west.

This report covers the following topics pertinent to climate change adaptation options for the low-lying road and affected lands in and around China Camp State Park:

- Section 2 summarizes the four dominant processes that climate change will alter and affect China Camp
- Section 3 describes the road and land areas at risk from sea level rise
- Section 4 presents land ownership
- Section 5 summarizes local geology, soils, topography, and hydrology
- Section 6 presents Native American, Spanish, and Chinese history
- Section 7 discusses historic and modern ecology
- Section 8 describes current wildlife, including special status species, invasive species, and other wildlife
- Section 9 describes recreational resources at China Camp State Park

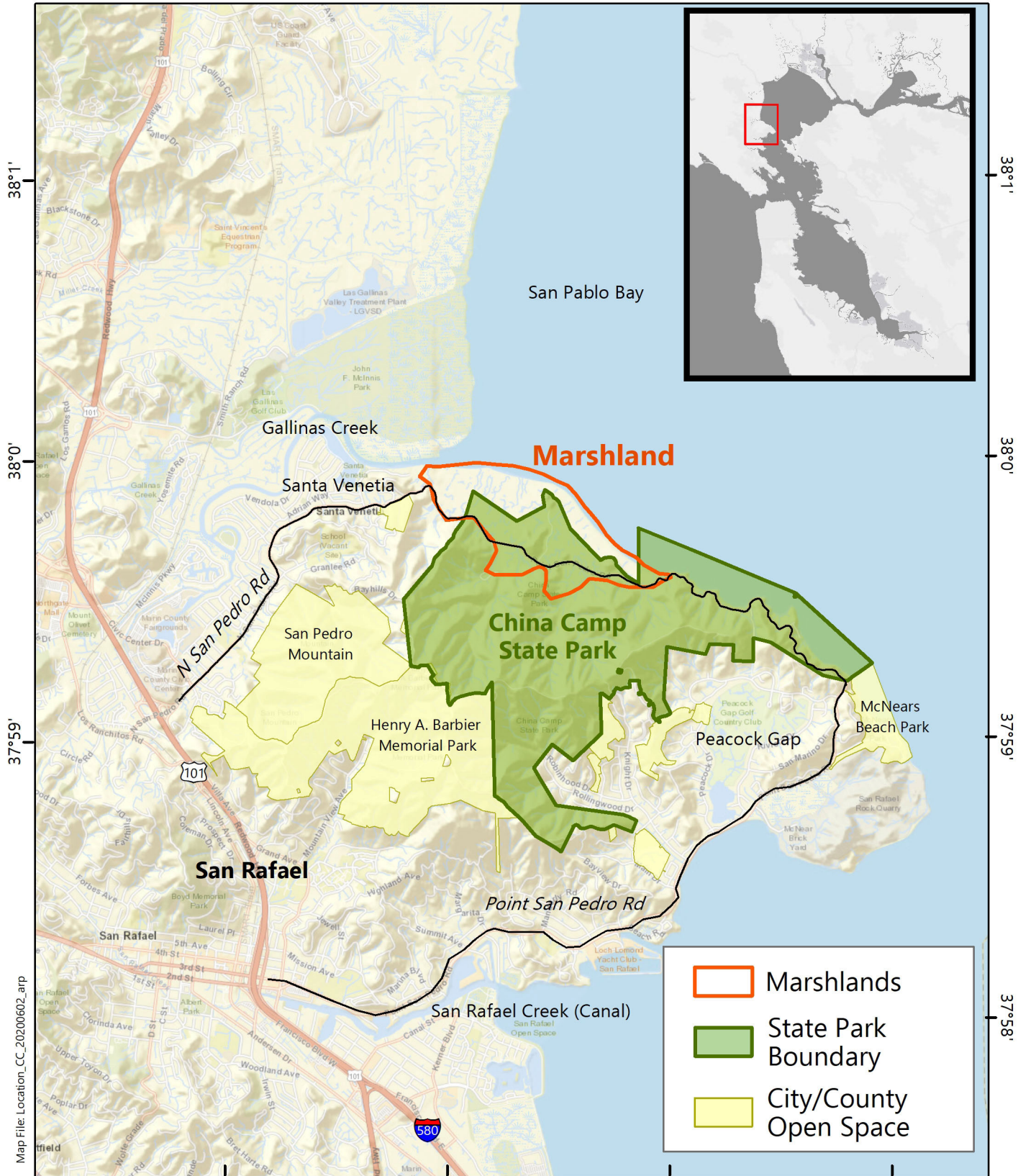
We have consulted a wide variety of information resources to compile this Existing Conditions report. We have done our best to filter this wealth of useful information to those elements that help us understand the cultural, natural history, and physiographic landscape contexts vital to working with the local community to arrive at and implement an effective approach to adapting the road to rising sea levels. As such, this report is “Version 1.0” and recognizes that future updates are appropriate as new information and context becomes better understood. This report accompanies two previous reports for the road adaptation effort, the Options Report (SF Bay NERR 2019) and the Road Map to Implementation Report (SF Bay NERR 2020a).

122°30'

122°29'

122°28'

122°27'



Map File: Location_CC_20200602_arp

Data Sources: Marshland Boundaries (NERR 2017);
 Parks Boundary (Parks 2018); Roads (US Census
 TIGER Product 2013); Coastline (National Hydrography
 Dataset 2017); Basemap (ESRI, HERE, Garmin, OpenStreetMap)

China Camp Vicinity Map

Marin County, CA

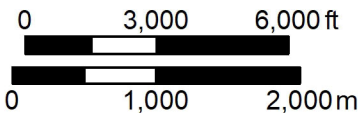


Figure 1

2 Climate Change Adaptation Drivers

Climate change is anticipated to change ecological and human conditions at China Camp State Park and the surrounding areas through five primary mechanisms: trends in ocean conditions, ocean chemistry, tidal range, and sea level will produce changes in inundation regime, salinity, and chemical processes in wetlands (Marin County 2017, Goals Project 2015).

2.1 Sea Level Rise Projections

California’s Ocean Protection Council released its most recent sea level rise projections for the State of California in March 2018 (OPC 2018). These projections cover a number of coastal locations, with San Francisco Golden Gate representing conditions for the San Francisco Estuary. The projections are by decade to 2150 and reflect differing levels of greenhouse gas emissions and differing levels of “risk aversion” that planners can consider for adaptation and other land use planning (Figure 2). For the purposes of mapping the geographic extent of these projections for China Camp for the year 2100, we have selected three of the five scenarios: lowest (low emissions, low risk aversion = 2.5 ft), medium (low emissions, medium-high risk aversion = 5.5 ft), and highest (high emissions, extreme risk aversion = 10 ft).

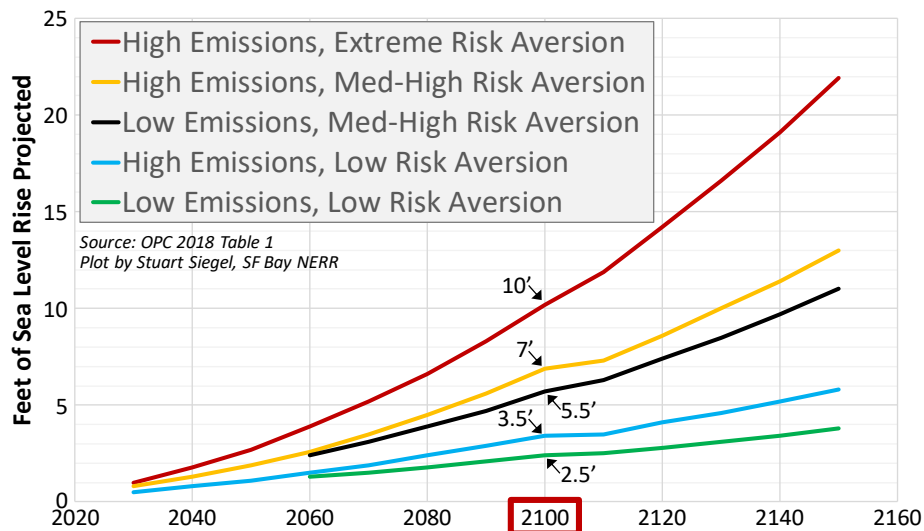


Figure 2. Sea Level Rise Projections

2.2 Sediment Supply Reductions

The contribution of sediment supply to maintaining the relative tidal elevations of tidal marshes globally is long established, the process being that tides deliver sediment to the marsh surface where it deposits and helps build and maintain the elevation of the marsh surface (Mitsch and Gosselink 2015). The Holocene formation of tidal marshes in the San Francisco Estuary, when sea levels rose over 400 feet from the nadir of the last ice age around 12,000 years ago, is also

well established (Atwater *et al.* 1979). The rapid bayward expansion of tidal marshes in the later part of the 19th century (“centennial marshes”) in this Estuary from the massive influx of fine sediment derived from hydraulic gold mining in the Sierra Nevada is also well established (Gilbert 1917), with Central Valley supplies contributing up to 80% of Bay supplies perhaps up through the 1980s (Porterfield 1980 as cited in Schoellhamer *et al.* 2018).

Sediment supply carried by the tides can have two sources that are interconnected: resuspension from intertidal and shallow subtidal mudflats and transport by incoming tides, and sediment carried into the bay from the Central Valley and from local watersheds. Central Valley sediment supply is more readily transported to the Bay’s large shallow mudflats whereas that transported from local watersheds is deposited along and near the mouths of those watersheds (Schoellhamer *et al.* 2018). Mudflat resuspension is the dominant process at the daily time scale, and local and Central Valley watershed inputs are tied to storm events and can reach marshes directly as well as replenish mudflats.

Both of these sediment supply sources to tidal marshes are at risk of declining with climate change (Schoellhamer *et al.* 2018). Declines in Central Valley sediment supply into San Francisco Bay have been documented by the USGS (Schoellhamer 2011), indicating reduced replenishment of the mudflats. Today, roughly two thirds of sediment inputs are from local watersheds (Schoellhamer *et al.* 2018). Further, the process of mudflat resuspension is dependent directly on water depth, and rising sea levels will reduce the ability of the same tidal current and wind-wave resuspension conditions to reach the bay bottom (Ganju *et al.* 2004), thereby reducing resuspended sediment supply.

Taken altogether, the prospect of reduced sediment accretion in the Estuary’s tidal marshes has for some time been incorporated into the region’s efforts to address tidal marsh resiliency under climate change (e.g., Goals Project 2015).

2.3 Storm Pattern Projections

According to the California 4th Climate Change Assessment (Bedsworth *et al.* 2018) and a recent Scripps Institute study (Gershunov *et al.* 2019), climate change will result in increased storm intensity mainly associated with atmospheric rivers, more extremes of drought and flooding, and about the same or more total precipitation though total precipitation change has less certainty. Subsequent adaptation planning efforts will examine how these effects may translate to China Camp State Park and the region more generally, especially regarding local watershed runoff and sediment transport. Observations from winter 2019, one of the wettest since record-keeping began in California, highlight road flooding, sediment transport into the upper reaches of the interior marshes and meadows, and landslide risk.

2.4 Salinity Increases

Modeling salinity regimes for the San Francisco Estuary shows increased salinity as sea-level rises and the estuary experiences salt water intrusion from the Pacific Ocean. In addition, modeling projects decreases in freshwater inflow to the estuary as precipitation patterns change and human populations and demand for fresh water increases. As a result, modeling projects higher surface water salinity in our baylands. The salinity in the estuary varies seasonally with ranges from about 0.1 parts per thousand (ppt) in the winter and upstream locations to about 35 ppt in the summer and close to the Golden Gate. Increasing salinity due to sea-level rise will directly affect most plants and aquatic animals, almost all of which have salinity as a principal determinant of their distributions (Goals Project 2015).

2.5 Water Chemistry

Increased intrusion of ocean waters into the estuary will bring along other features of ocean water, including cooler, more nutrient-rich waters under most climate-change scenarios, and increased acidification. These factors are likely to be much less important to wildlife than changes in salinity. There is little evidence of nutrient limitation in bayland ecosystems. Ocean acidification effects on bay water chemistry are unclear but may limit the ability of larval invertebrates to accumulate enough calcium for shell growth (Goals Project 2015).

3 Road and Land Areas and Functions at Risk

3.1 Role of North San Pedro Road in the Local and Regional Transportation Network

North San Pedro Road is a segment of the route that connects Central and North San Rafael around Point San Pedro (Figure 3). This route connects neighborhoods on both sides of the park and is the only local alternate north-south route to U.S. Highway 101 and its frontage road. The only other north-south routes across the coast range mountains through Marin County are far to the west (Figure 4). The road is used for recreational access to the Park, daily commuting, and emergency vehicles, and it serves as an evacuation route.

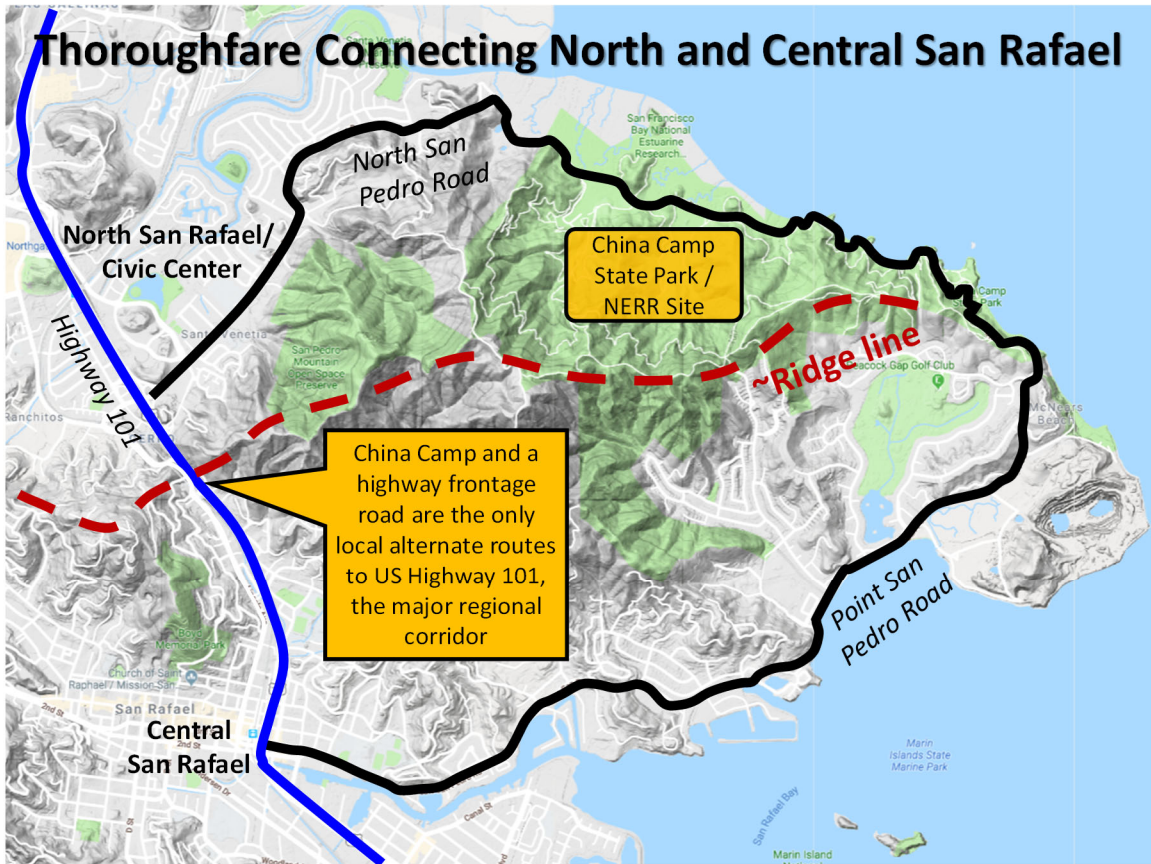


Figure 3. Road Setting Within the Local Central to North San Rafael Transportation Network

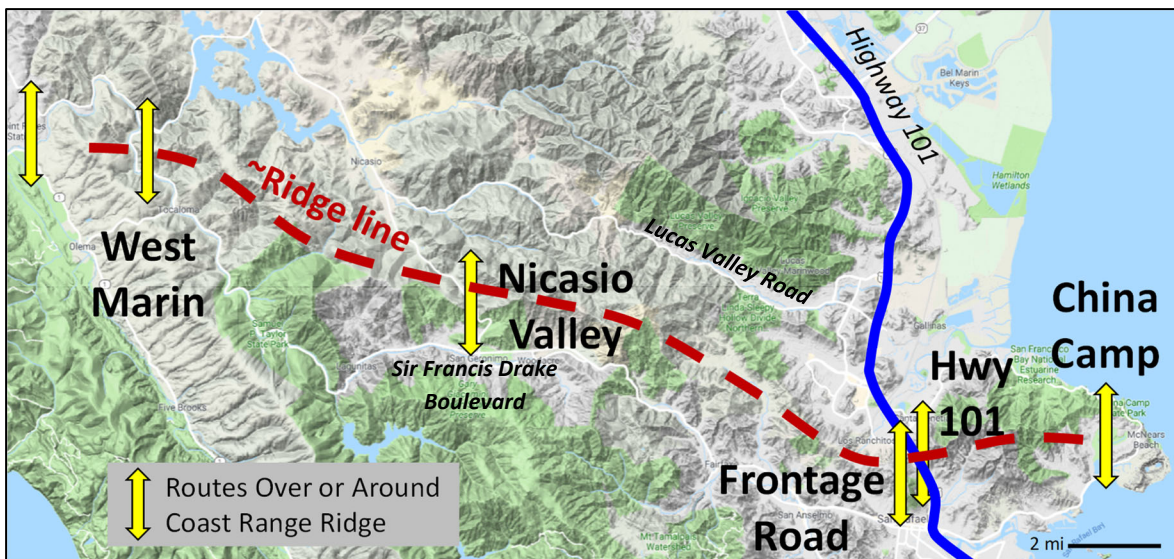


Figure 4. Alternate Transportation Linkages Over San Pedro Ridge

Six routes cross or go around the Coast Range ridge of central Marin County. If Highway 101 and its frontage road are blocked and China Camp is not passable, the only options are miles to the west along two-lane roads.

3.2 Risk from Sea Level Rise

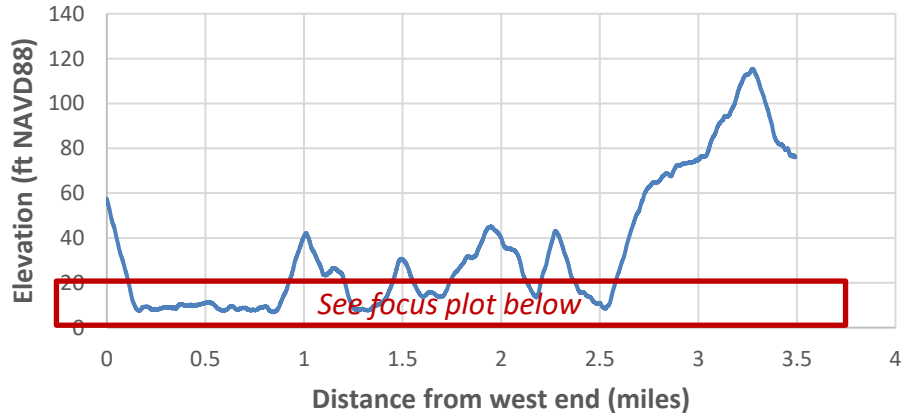
Today’s king tides already flood sections of North San Pedro Road (Figure 5). In total, about 1.5 miles of road are at low-lying elevations at risk from current king tides and increasing submergence over time with sea level rise (Figure 6). The lowest section of road is the reach from Buck’s Landing (outside the Park) to Back Ranch Meadow. The road in front of Miwok Meadow is also low, and there are a few short sections east to the Ranger Station that are not as low but within the reach of higher sea level rise extents.



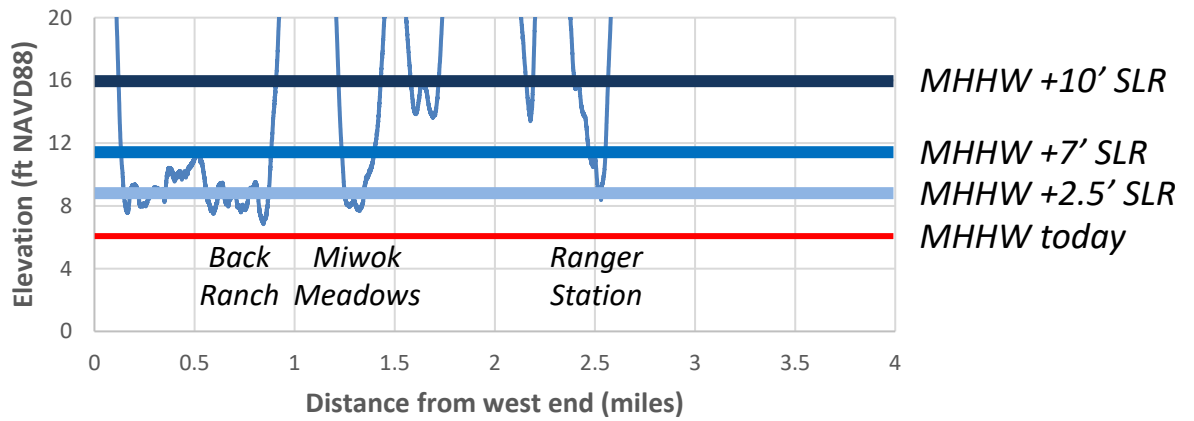
Figure 5. Road Flooding from High Tides

Land areas subject to inundation from sea level rise include the entirety of the tidal marsh bayward of the road, several patches of “interior” marsh on the inland side of the road and connected via culverts, public facilities at and into Back Ranch and Miwok Meadows, and the private residence Boyd compound just to the west of the Park entrance (Figure 7). These interior areas all have culverts below the road to allow some tidal action into the marshes and to drain storm water. Specific to Back Ranch and Miwok Meadows, the entrance roads themselves are at low elevation, so in thinking forward about adaptation solutions that retain access to these recreational facilities, how those low-lying roads are addressed will need to be part of the conversation.

China Camp Road Elevation - Turnoff to Bucks East to Park Boundary



China Camp Road Elevation - Turnoff to Bucks East to Park Boundary (Low Elevation Focus)



File: Fig-0x_Road Elevation Profile_ChinaCampo_2019-0806sws.pptx

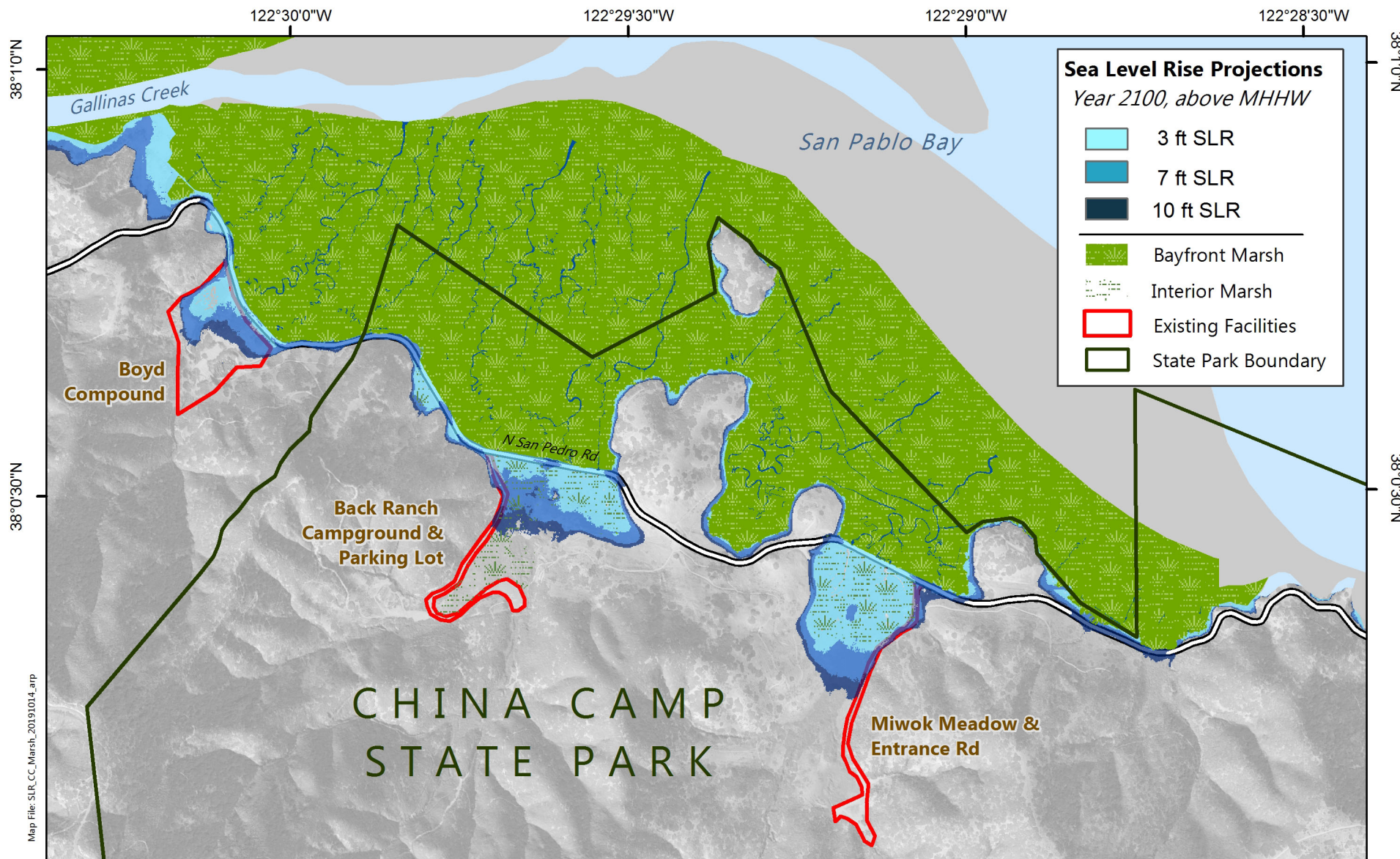
Source: Data from Marin County LIDAR 2010

China Camp Road Long-Term Adaptation Planning
Project No. 4006



Figure 6

Road Elevation Profile

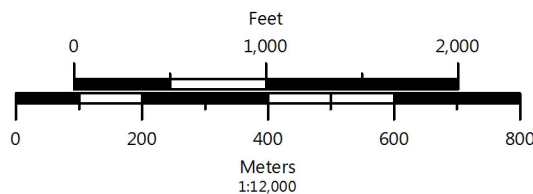


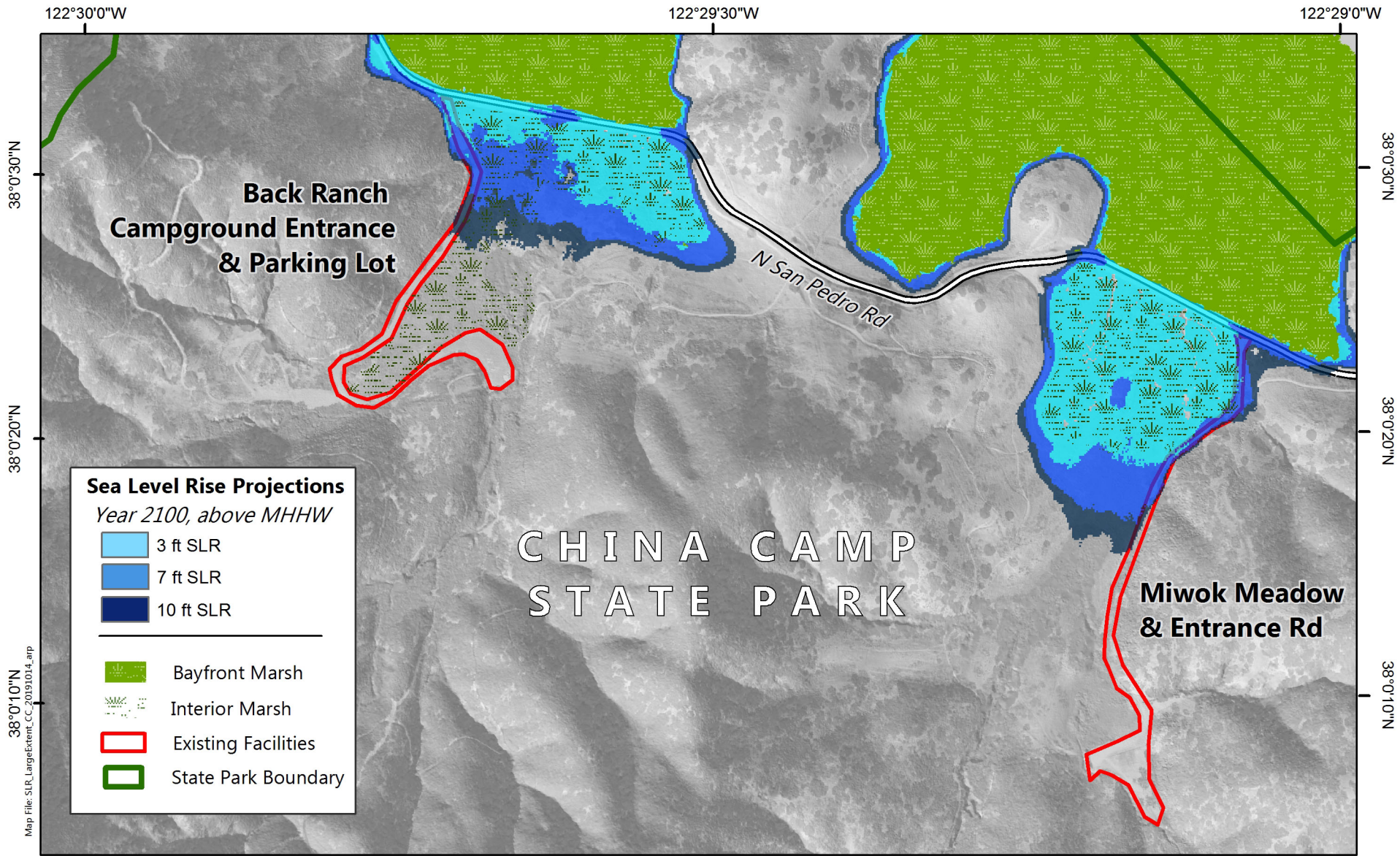
Data Sources: DEM, Marin County 2013; Coastline, National Hydrography Dataset 2017; Road, US Census 2017; Mudflats, SFEI EcoAtlas; Park Boundary, State Parks 2018;

Projected Sea Level Rise at Northwest China Camp State Park

Marin County, CA

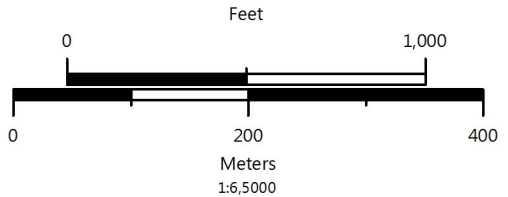
Figure 7





Map File: SLR_LargeExtent_CC_20191014_arj

Data Sources: DEM, Marin County 2013; Coastline, National Hydrography Dataset 2017; Road, US Census 2017; Mudflats, SFEI EcoAtlas; Park Boundary, State Parks 2018;



Projected Sea Level Rise at Back Ranch and Miwok Meadows

Marin County, CA

Figure 8

3.3 Risk from Storms and Tidal High Water Events

The road itself is at risk, with eroding road edges and eroded culverts and culvert headwalls. These risks arise from stormwater runoff (Figure 9) and from king tides. Maintaining effective stormwater drainage and managing sediment discharge from the watershed to the benefit of natural resources, recreational uses, and road transit will also be part of the adaptation planning conversation.

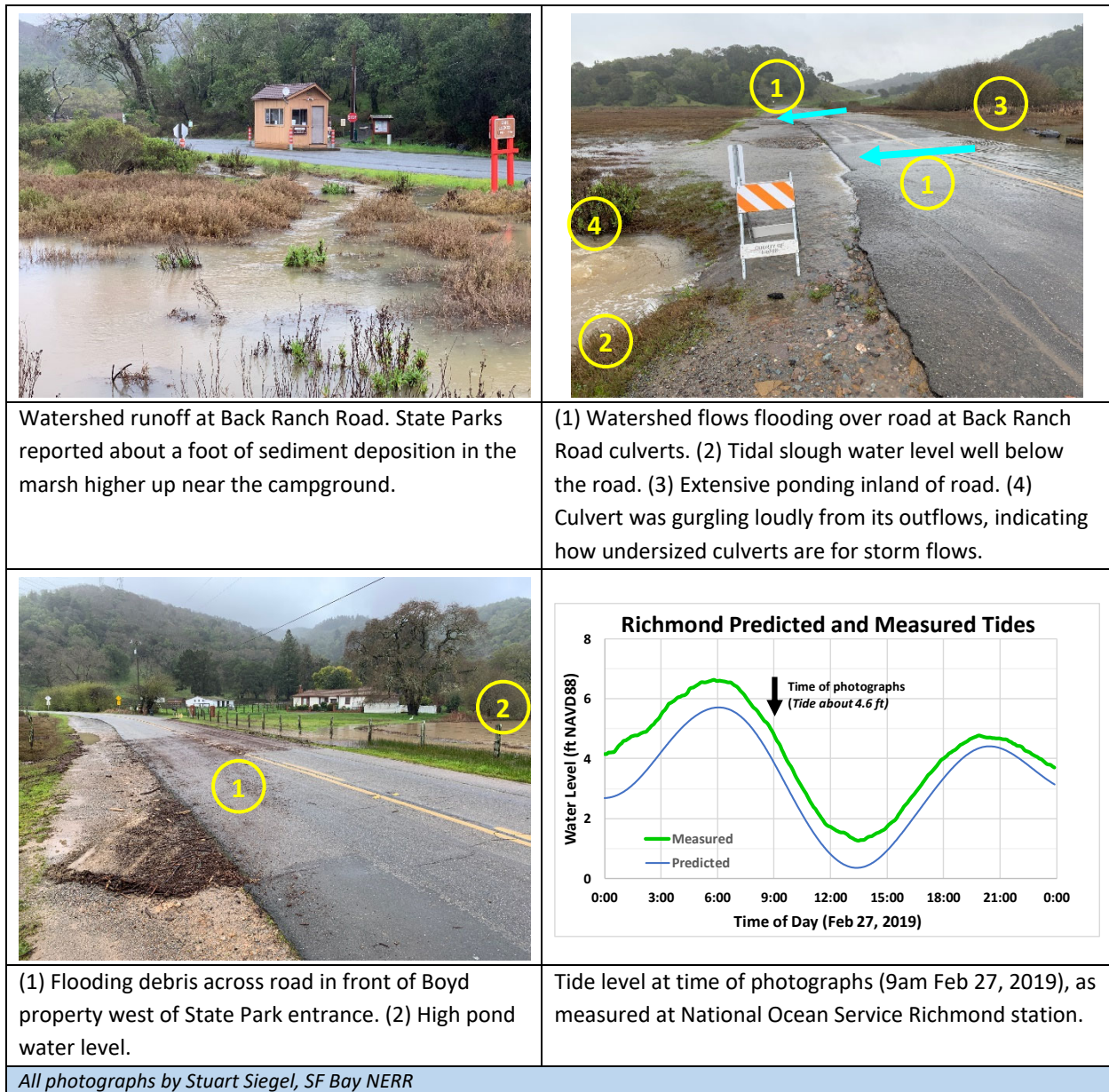
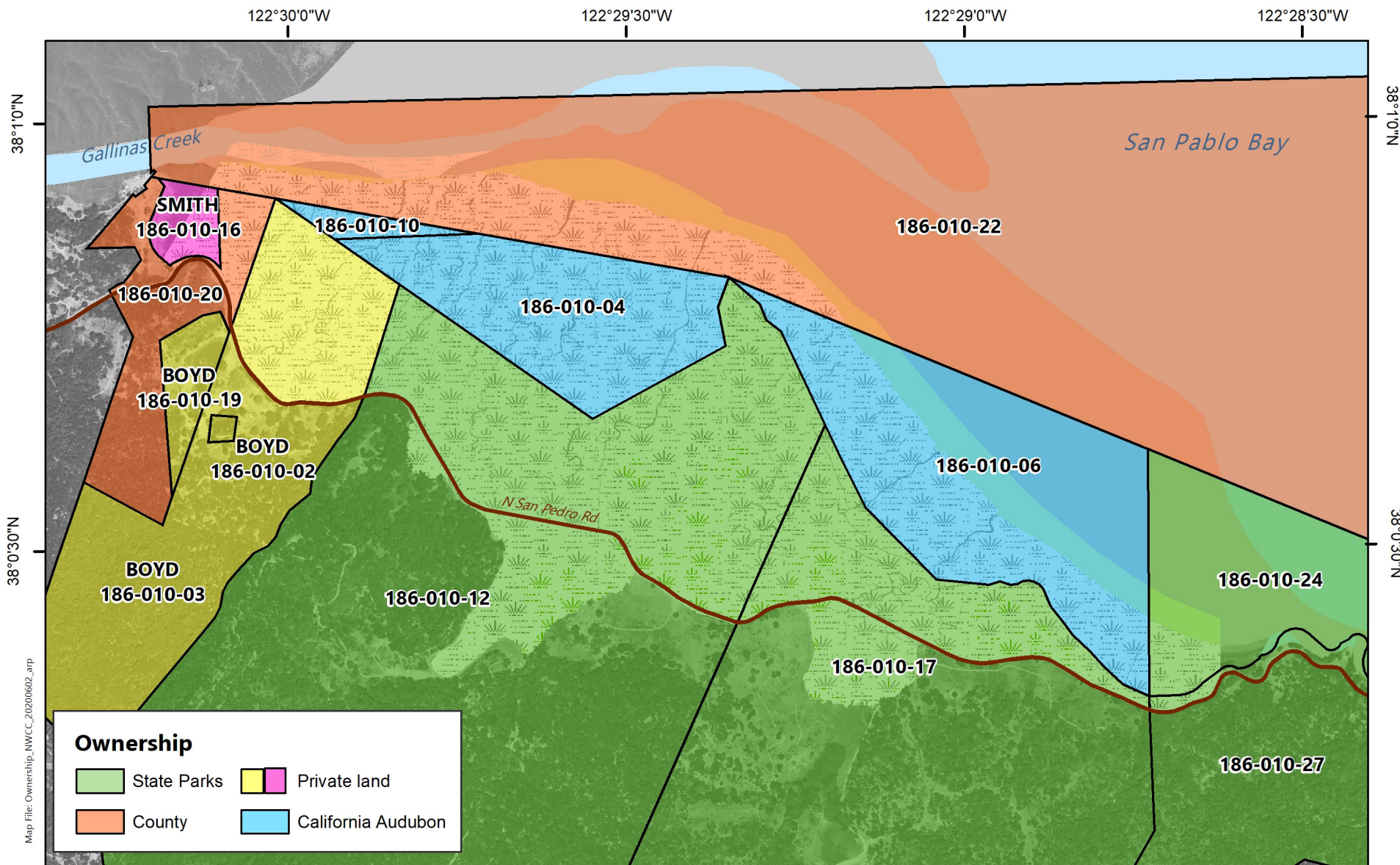


Figure 9. Road Flooding from Stormwater Runoff, February 27, 2019

4 Ownership of China Camp Marshes and Road

China Camp State Park and its nearby low-lying lands are split amongst six landowners (Figure 10):


- 1) **California State Parks** owns the State Park lands including some but not all of the tidal marsh on the bay side of North San Pedro Road
- 2) **Marin County** owns the right of way for North San Pedro Road, it owns offshore bay tidelands and portions of the northern-most sections of tidal marsh, and it recently purchased Bucks Landing and some of the tidal marsh north of the road and hillside lands south of the road. Access to Bucks Landing is from the upland portion of the road.
- 3) **California Audubon** owns a large portion of the tidal marsh, between the State Parks property and Marin County property
- 4) **Two private entities** own the low-lying lands to the west of the Park
 - a. The **Boyd trust** owns the immediately adjacent lands west of the Park including the residence, outbuildings, and pond on the south side of North San Pedro Road near the Park entrance. These holdings include tidal marsh, lowland uplands, and hillsides. Access to the residence area is from a low-lying reach of the road.
 - b. The **Smith family** owns a low-lying property immediately east of Bucks Landing and entirely on the north side of the road. Access is through the entrance to Bucks Landing and a dirt road further east from the low-lying portion of the road.



Map File: Ownership_NWCC_20200602_atp

Data Sources: Ownership, Marin County 2018; Coastline, National Hydrography Dataset 2017; Road, US Census 2017; Mudflats, SFEI EcoAtlas; Imagery, NAIP 2016

Ownership

 State Parks	 Private land
 County	 California Audubon

Ownership, Northwest China Camp
Marin County, CA

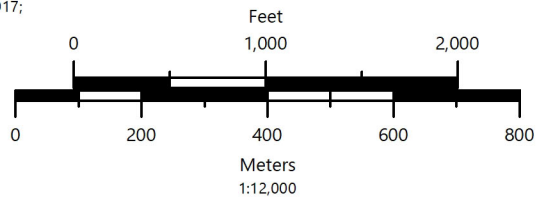


Figure 10

5 Physical Setting

5.1 *Geology, Soils and Topography*

Geology

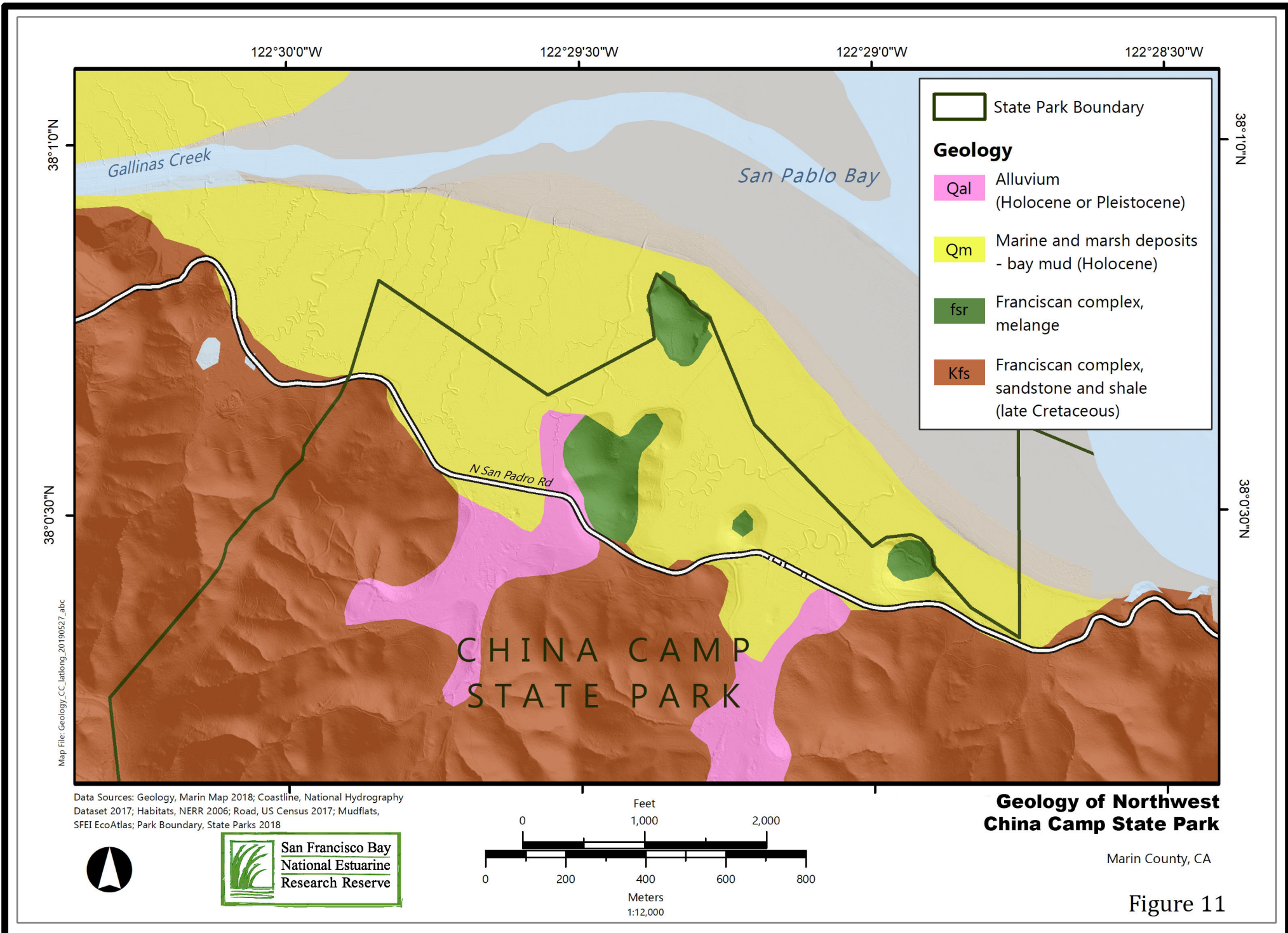
China Camp State Park is surrounded by uplands forming San Pedro Ridge which consist of rocks from the Franciscan Assemblage of late Cretaceous age (Blake et al. 2000) (Figure 11). These rocks represent partially metamorphosed sandstone and meta-shale characteristic of the Novato Quarry Terrain. The steep ridges and canyons of the Park deposit Quaternary alluvium in the lower canyons that then interface with Quaternary fine-grained tidal marsh sediments extending out to surrounding tidal mud flats in the low inter-tidal areas bordering San Pablo Bay. Interestingly, there are no known faults running through San Pedro Ridge so the area is relatively stable from a seismic perspective.

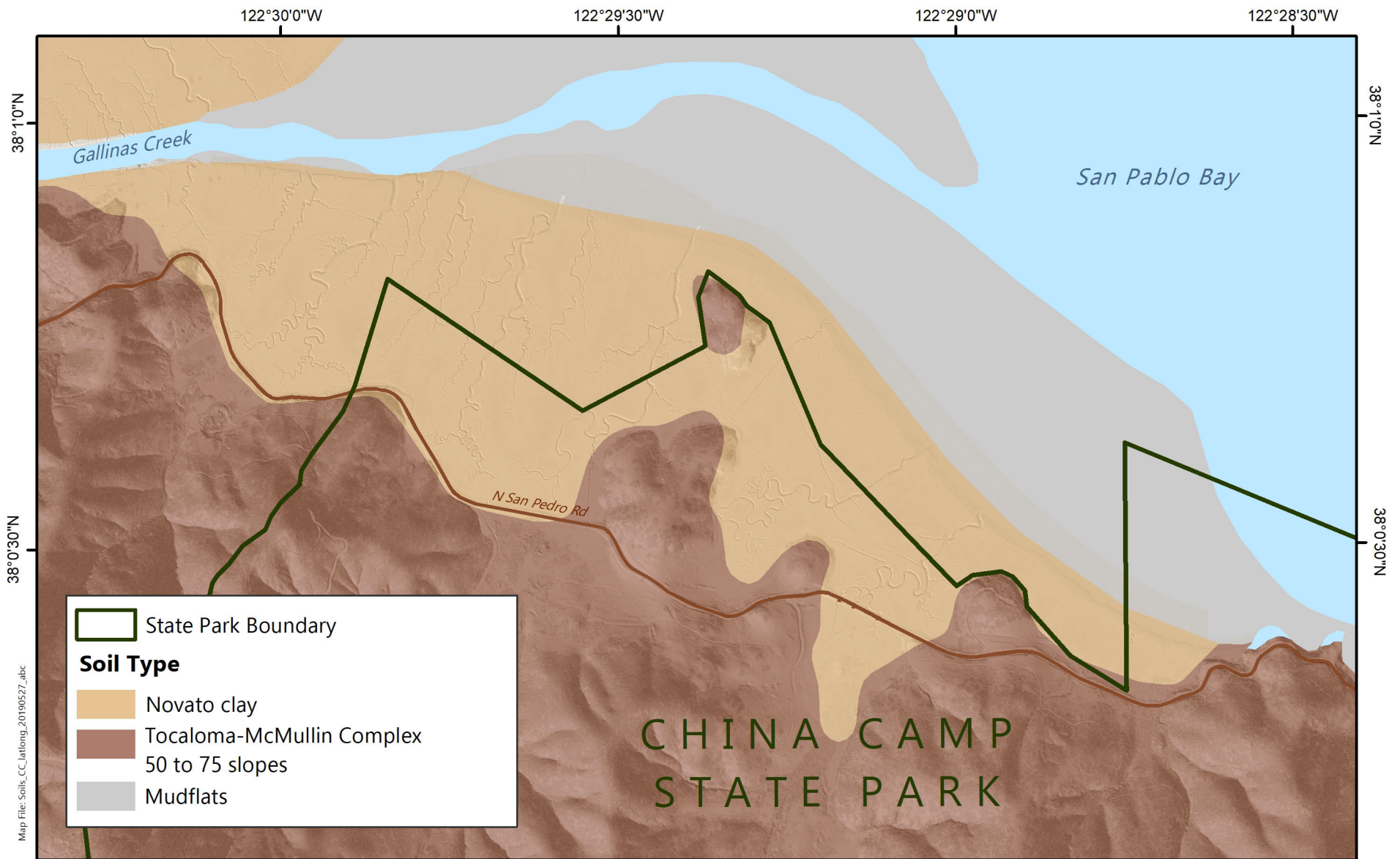
Soils

The soils of China Camp State Park have been mapped (Soil Conservation Service 1985) in two soil series: 1) Tocaloma-McMullin upland soils; and 2) Novato clay wetland soils (Figure 12). The Tocaloma-McMullin soils are shallow to moderately deep and relatively well drained. The Novato soils are deep, poorly drained fine clay soils of the tidal marshes. The alluvium deposited at the base of the watersheds and grading into the tidal marshes is apparently not mapped nor named. The upland soils of the Novato Quarry Terrain are a combination of sandstone and shale, suggesting that the alluvial soils that are deposited at the base of the watershed drainages are both coarse-grained and fine-grained. It is likely that the fine-grained materials are carried further downstream towards the Novato marsh soils so that they typically would help to add sediment to the tidal marsh during flood events.

Topography

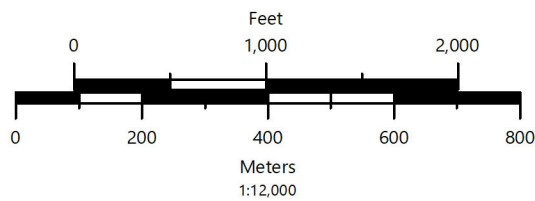
San Pedro Ridge represents a large block of resistant sandstone and meta-shale that has eroded into several steep ridges and canyons running down to the bay. The ridge climbs to about 1000' in elevation but is lower (~600') above China Camp State Park. The majority of the park is defined by two major watersheds that drain down into Miwok Meadow and Back Ranch Meadow. Ridges that frame these two watersheds come down to the bay and terminate in islands (e.g., Jake's Island) or low hills (such as Turtle Back Hill). The upper ridges drop steeply into the canyons and the hills become more gradual near sea level.





Map File: Soils_CC_latlong_20190527_abc

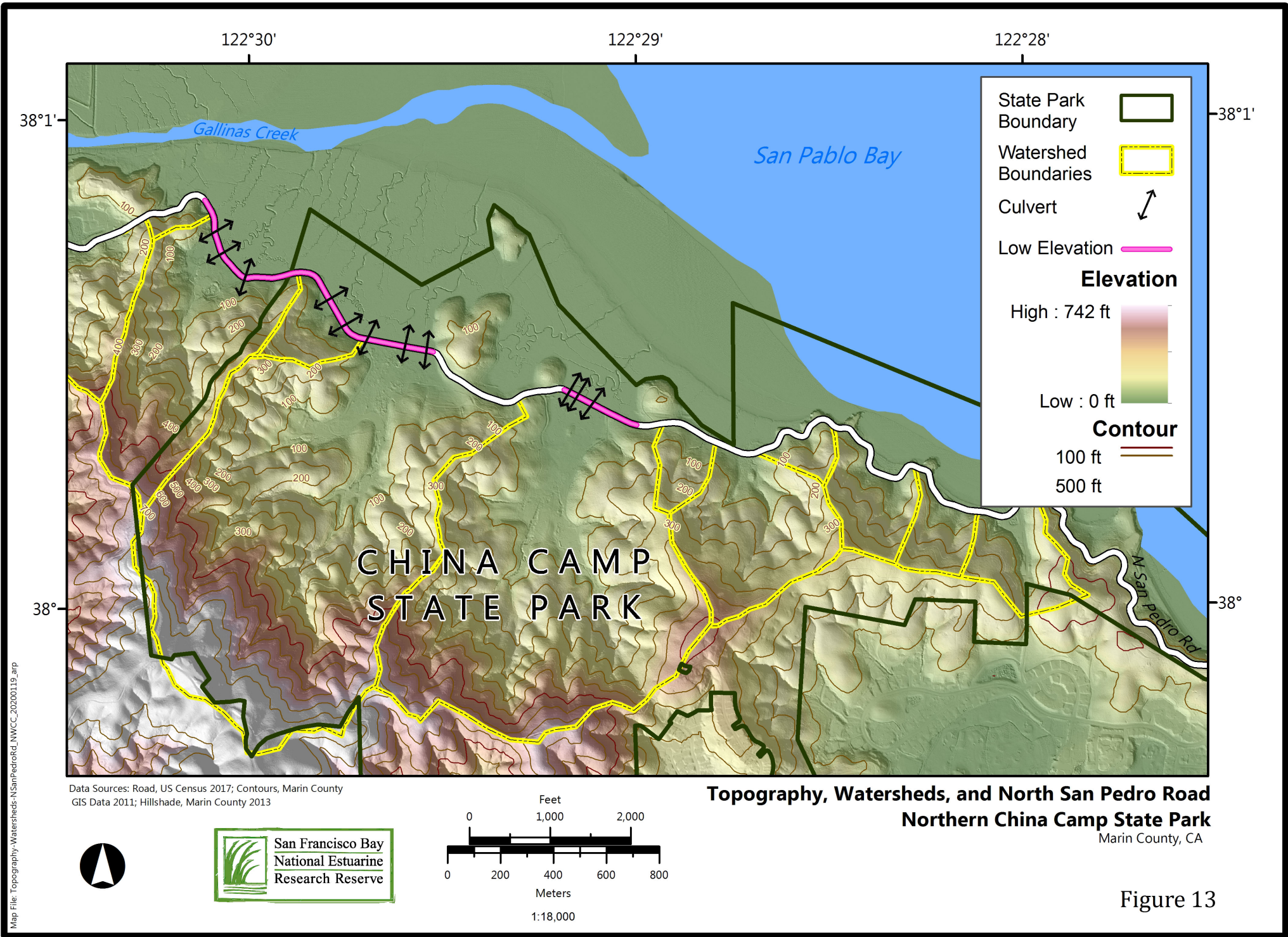
Data Sources: Coastline, National Hydrography Dataset 2017; NERR 2006; Road, US Census 2017; Mudflats, SFEI EcoAtlas; Soil data, USDA NRCS 2018



Soils of Northwest China Camp State Park

Marin County, CA

Figure 12



5.2 Hydrology

5.2.1 Tidal Hydrology

China Camp State Park is on the southwest shoreline of San Pablo Bay. Tides extend across the tidal marsh, through the culverts to the interior marshes south of North San Pedro Road, and up Gallinas Creek to the west.

Local tidal datums from three National Ocean Service tide gauges are provided in Table 1. Two are for nearby NOS stations – Gallinas Creek and Hamilton Airfield Outside – and one is for the nearby continuous station – Richmond Chevron Oil Pier.

Tidal datums express values for long term averages of the tides over a period of 18.6 years which reflects one full cycle of all the gravitational forces that affect tides. Tidal datums are computed as follows:

- HOWL = highest observed water level. Reports the highest recorded tide and the date it occurred since station installation.
- MHHW = mean higher high water. Average of the higher of the two daily high tides.
- MHW = mean high water. Average of all high tides.
- MTL = mean tide level. Average of MHW and MLW.
- MSL = mean sea level. Average of hourly tide heights.
- MLW = mean low water. Average of all low tides.
- MLLW = mean lower low water. Average of the lower of the two daily low tides.
- LOWL = lowest observed water level. Reports the lowest recorded tide and the date it occurred since station installation.

Table 1. Tidal Datums

NOS Station	Tidal Datum Elevations (NAVD88)					
	Gallinas Creek		Hamilton AFB Outside		Richmond Chevron Oil Pier (NWLON station ¹⁾)	
NOS ID	941-5052		941-5124		941-4863	
Data Period	Aug-Oct 1979		Feb-Mar 2000		Oct 1995-Sep 2011	
Datum	(m)	(ft)	(m)	(ft)	(m)	(ft)
HOWL (2/6/1998)					2.637	8.65
MHHW ²	1.868	6.13	1.906	6.25	1.847	6.06
MHW	1.684	5.52	1.726	5.66	1.661	5.45
MTL	1.028	3.37	1.063	3.49	1.002	3.29
MSL	1.020	3.35	1.050	3.44	0.994	3.26
MLW	0.373	1.22	0.396	1.30	0.343	1.13
MLLW	0.065	0.21	0.064	0.21	0.000	0.00
LOWL (1/11/2009)					-0.764	-2.51
Spring Tide Range (MHHW-MLLW)	1.803	5.92	1.842	6.04	1.847	6.06

Notes:

1. The Richmond station is one of five NOS long term continuous tide stations in the San Francisco Estuary.
2. For purposes of mapping simplicity, MHHW of 6 ft NAVD88 is utilized.

5.2.2 Watersheds and Fluvial Hydrology

China Camp State Park has a number of watersheds that drain north toward North San Pedro Road and drain into San Pablo Bay (Figure 13). Four of these watersheds drain to the lowest sections of North San Pedro Road: one at the Boyd property (100 acres), one between Boyd and Back Ranch (20 acres), one at Back Ranch (330 acres), and one at Miwok Meadows (275 acres). Stream channels in these watersheds are seasonal. To the best of our knowledge, none of these watersheds has been measured for stormwater runoff or sediment loads. State Parks did report that in Winter 2019, considerable sedimentation occurred from stream channels draining into Back Ranch Meadows. Figure 9 shows photographs of road flooding from one of these storms, in February 2019. Conditions of these watersheds are ripe for further assessment to assist with planning adaptation approaches for North San Pedro Road.

5.2.3 Groundwater

To the best of our knowledge, no groundwater studies have taken place in China Camp State Park and we have not searched for studies done nearby outside the Park in similar settings. Based on local geology and soils (see above), the shallow to moderately deep and relatively well drained Tocaloma-McMullin soils suggest active winter infiltration and subsurface flow toward

the alluvial base of the hills. Where groundwater contacts the poorly drained Novato soils of the marshes and where there may well be fine to coarse alluvium soils from watershed accumulation, groundwater would be likely to discharge. Groundwater seeps have been observed by many people over the years around the interface of the marshlands and the hillslopes, consistent with the locally mapped geology and soils.

6 Cultural History

6.1 Native Americans

The area encompassing China Camp State Park was inhabited by the indigenous Coast Miwok people for thousands of years prior the arrival of the Spanish in 1775. The Miwok inhabited dozens of small villages throughout Marin and southern Sonoma counties, and thrived on the abundant resources available in the diverse region encompassing China Camp. Approximately 13 Coast Miwok shell mound sites have been discovered within the park (Schneider 2009, 2010). Indigenous people hunted deer and rabbits in this area’s upland habitats and harvested acorns from oak trees, hunted marsh birds and gathered shellfish from the marsh and along the bay shore, and fished winter runs of salmon and steelhead. At the time of Spanish arrival in 1775, the Coast Miwok population is estimated to have been several thousand people. With the establishment of missions San Francisco de Asís in San Francisco in 1776 and San Rafael Archangel in San Rafael in 1817. The Coast Miwok population dramatically declined during the colonial era as the mission system drastically changed the traditional subsistence lifestyle of the Coast Miwok. However, the area around China Camp continued to serve a significant purpose as a place of refuge for the Coast Miwok during the Mission Period (Schneider 2010, 2015). Evidence suggests that the Coast Miwok either escaped or were granted permission to leave the missions, and sought refuge in the rugged, isolated terrain of the area around Point San Pedro, including China Camp. Here, they were able to reconnect with their culture, and continued to maintain their identity and traditional practices in this region. The small tribes that sought refuge in China Camp contributed greatly to the cultural resilience of the Coast Miwok in the San Francisco Bay area that still exists today (Schneider 2015).

6.2 Spanish and Chinese History

The following information is from the Friends of China Camp¹.

The Spanish first sailed into San Francisco Bay on the San Carlos in 1775. They established the Mission San Rafael Archangel at nearby San Rafael in 1817 and brought in Miwok converts, as well as Pomo and Ohlone peoples. Shortly after Mexican independence from Spain in 1821, the

¹ See <https://friendsofchinacamp.org/about-china-camp/history-of-china-camp/>

old Spanish missions were secularized, and the land was supposed to be returned to the Miwok. This did not happen, however, as land was seized to enrich those with influence and power. Trade restrictions were eased under the new Mexican government, and the population of California grew rapidly with the arrival of many Americans and Europeans who came to trade with the pueblos and ranchos.

Timothy Murphy, an Irishman who arrived in 1828, became the administrator at the former San Rafael Mission and later the alcalde, or mayor, of San Rafael. In 1844, he was granted a 21,679-acre land grant by the Mexican governor Manuel Micheltoarena. The grant was called the Rancho San Pedro, Santa Margarita y las Gallinas and it covered much of the area that is now China Camp State Park. Murphy, referred to as Don Timoteo Murphy in Spanish, established a sprawling cattle ranch on the San Pedro peninsula. Timothy Murphy did not fare well with the American takeover of California in 1846, and by 1849 he had lost most of his land to swindlers. He died in 1853 of a burst appendix, while his once extensive empire was divided up and sold to cover his debts.

In 1869, a large portion of Timothy Murphy's rancho was purchased by John A. McNear and his brother George. The McNear brothers were businessmen and landowners in Sonoma County, where they had made their fortune. They established a large dairy ranch that covered more than 2,500 acres, including five miles of waterfront along San Pablo Bay. Their original plans included a shipping terminal and a railroad line that connected to San Rafael, but they lost their financial backing after the 1906 earthquake and fire in San Francisco. The McNear's did succeed in establishing a number of business enterprises on the former ranch, including a quarry and a brickyard. Chinese immigrants, who had been in Marin County as early as 1855, found work as laborers at the McNear ranch. They supplemented their income by fishing for shrimp along the shores of San Pablo Bay, setting up temporary camps around the McNear property.

There were once more than two dozen of these shrimping camps located around San Francisco and San Pablo Bays, although China Camp State Park preserves the only one that still remains. The location of China Camp along the San Pedro peninsula and the shores of San Pablo Bay was ideally suited for shrimping. It provided ideal conditions for a shrimping camp, such as close proximity to the fishing beds, adequate space for processing facilities on land, and a nearby grassy hillside for drying shrimp. Another factor was the deep water of the Bay, which allowed fishing vessels to easily approach the shore without the need for an excessively long pier.

China Camp Village reached the height of its prosperity in the 1880s, with almost 500 residents. There were several small streets lined with wooden buildings, including general stores, a marine supply store, a barber shop, shrimp drying and grinding sheds, and numerous

residences. The people of China Camp Village made their living fishing for shrimp from the tidal mud flats along San Pablo Bay. Some of the shrimp was sold to local restaurants, but the vast majority was dried and prepared for export to China. More than three million pounds of shrimp were harvested from the Bay each year throughout the late 1800s and into the early 20th century.

China Camp Village grew considerably in the 1870s and 1880s, at a time when vicious anti-Chinese sentiment was sweeping California. The economic recession of 1877 made scapegoats out of Chinese laborers, who were viewed as foreigners taking jobs away from Americans. Labor union leaders took advantage of this sentiment and rallied unemployed workers under the cry of “the Chinese must go!” In the midst of this atmosphere, many Chinese were drawn to the remote location of China Camp, where they could carry out self-sustaining lives away from the persecution and discrimination of the cities.

With the passage of the Chinese Exclusion Act in 1882, immigration from China was severely limited, the first time in American history that a specific nationality was prohibited from immigrating to the United States. Over the next few decades, additional discriminatory laws were passed against the Chinese, making life difficult for the fishermen of China Camp Village. In 1905 the export of shrimp was outlawed, striking a severe blow to the China Camp economy. In 1911, the use of the traditional bag nets favored by the Chinese was prohibited. As a result of these laws, the population of China Camp Village declined until almost all residents were gone.

Among the early residents of China Camp Village was Quan Hung Quock, who moved here from San Francisco’s Chinatown. He built a general store here in 1895 and raised a family. His grandson, Frank Quan, lived at China Camp Village as the last remaining resident until his death in August 2016 at age 90. Frank continued to catch shrimp in the Bay for many years, selling most of the catch for bait. The shrimp fishery of San Pablo Bay has been almost completely depleted in recent years, as water diversion and pollution have compromised the health of the Bay.

7 Ecology

7.1 *Historical Ecology*

Historical Estuarine Ecology

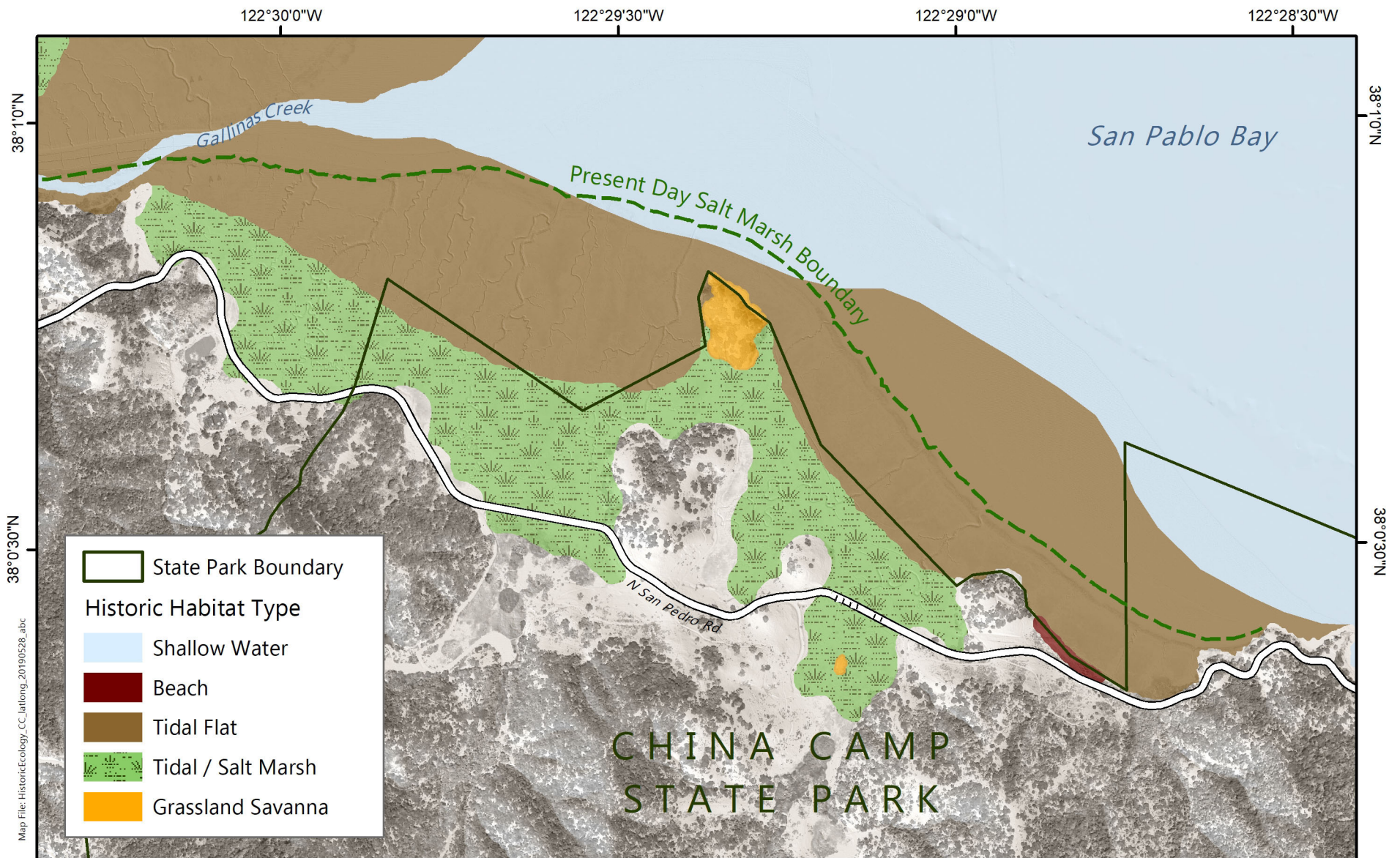
Tidal marshlands in the San Francisco Bay estuary are comprised of ancient marsh (“millennial marsh”) as well as younger “centennial marsh” that formed in the late 1800s due to a dramatic influx of sediment from hydraulic mining in the Sierra Nevada during the Gold Rush. Rapid

sediment input from the hydraulic mining era in areas on the bay side of the marsh resulted in straighter channels than the sinuous channels present in the millennial high-elevation marsh. The China Camp salt marsh was formed between 2,000 and 6,000 years ago, comprising one of the largest, oldest remnants of ancient salt marsh in the San Francisco Bay (Atwater *et al.* 1979). Sediment cores from China Camp indicate that marshes began to develop at least 4,700 years ago, with evidence of Pacific cordgrass (*Spartina foliosa*) roots suggesting the existence of intertidal mudflats. Mature marshes, largely similar to those of today, have existed there for at least 700 years (Goman *et al.* 2008). The zonation of millennial and centennial marsh can be easily seen in the contrast between sinuous, branching channels characteristic of ancient marsh in the shoreward marsh plain and the straight, short channels in the younger marsh along the bay edge (Abbe and Bennett 1991).

Historical Terrestrial Ecology

The terrestrial uplands of China Camp State Park are typical of the low elevation hills and ridges that border northwestern San Pablo Bay. These uplands are dominated by a mixed evergreen forest alliance with different forest associations embedded within it. Canyons are characterized by bay laurel (*Umbellularia californica*) with pockets of redwoods (*Sequoia sempervirens*) along seasonal creeks, lower canyon slopes by coast live oak (*Quercus agrifolia*) and tan oak (*Notholithocarpus densiflorus*), while ridge-crest associations are dominated by madrone (*Arbutus menziesii*) and the deciduous California black oak (*Quercus kelloggii*). Coastal scrub elements occur where there are breaks in the forest, as does perennial grassland mainly dominated by needlegrass (*Stipa pulchra*) and numerous perennial native herbaceous species. Riparian communities that follow seasonal stream margins descend from the uplands to margins of the tidal wetlands. Deciduous trees like arroyo willow (*Salix lasiolepis*) and red elderberry (*Sambucus racemose*) are typical in these habitats, as are a number of rushes and sedges that occur at the upland transition zone as these creeks enter the inter-tidal environment. On low elevation islands, an oak woodland alliance consists of stands of blue oak (*Quercus douglasiana*) and Oregon oak (*Quercus oregana*) which are probably legacies of drier times in this part of the Bay Region that have persisted in favorable, low elevation habitats over time.

Most of the species described below inhabited these uplands during the several thousand post-glacial years leading up to the present. These mammal, fish, bird, and invertebrate populations were undoubtedly important food resources for native Coast Miwok people who lived in this area.

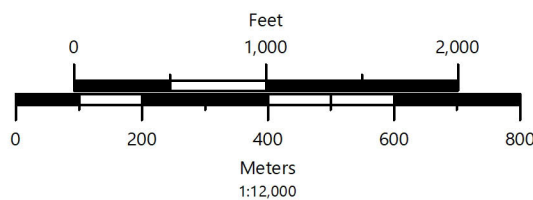


Data Sources: Historic Habitats, SFEI EcoAtlas 1998; Coastline, National Hydrography Dataset 2017; Road, US Census 2017; Park Boundary, State Parks 2018

Historic Ecology of Northwest China Camp State Park

Marin County, CA

Figure 14



7.2 *Modern Habitats of China Camp*

This section provides a summary description of the vegetation communities and common wildlife of the grasslands, woodlands, and marshes of China Camp State Park.

7.2.1 *Lowland and Hillslope Grasslands and Woodlands*

Most of the 1,640-acre park is comprised of hillsides covered with mixed evergreen forest, oak woodland, coastal scrub and chaparral, redwood forest in deep canyons, as well as some native grassland. The hills slope steeply, approaching a ridgeline (maximum elevation of about 1,000 feet) that is comprised of chaparral and dry woodland, including coast live oak, manzanita, madrone, and California black oak. Meadows and hillsides also contain flowering plant species such as lupine, Indian paintbrush, California milkwort, buckeye, and orange sticky monkeyflower. These areas support a diversity of wildlife, including songbirds and mammals. A transition zone consisting of rushes, sedges, and other graminoids (e.g., cattail) grade steeply or gently into the tidal marsh plain. In some cases, it is apparent that ground water flows enter the marsh plain as transition zone seeps. In other cases, seasonal streams spread out into a flood plain and the transition zone is more gradual.

7.2.2 *Bayside Tidal Marsh Estuarine Habitats*

The tidal marshes of China Camp State Park comprise a mix of remnant historic marshes (Figure 14) and marshes that formed beginning in the later 1800s with deposition of hydraulic mining debris washed down from gold mining in the Sierra Nevada mountains (Figure 15), known commonly as “centennial marshes”.

Hydrology Overview

The tidal marshes on the bay side of North San Pedro Road receive daily tidal flooding from San Pablo Bay. Tides reach the marsh through numerous tidal channels, with the northern reaches of these channels through the centennial marsh being fairly straight due to their rapid formation and the southern reaches in the remnant historic marsh being very sinuous (lots of turns) and branching into multiple smaller channels.

Bayfront Low Marsh

The tidal marsh along the San Pablo Bay front (Figure 15) is of lower elevation reflecting more recent sediment deposition. Its greater duration of tidal inundation drives its plant species composition, which is predominantly Pacific cordgrass (*Spartina foliosa*) with some alkali bulrush (*Bolboschoenus maritimus*) at the boundary between pickleweed and cordgrass.

Bayside High Marsh Plains

Most of the tidal marsh at China Camp is “high marsh” and comprises both the remnant historic marsh and centennial marsh (Figure 15). The high marsh plain is dominated by the common salt

marsh plant, pickleweed (*Salicornia pacifica*). The higher elevation banks of tidal channels support marsh gumplant (*Grindelia stricta*), and the lower elevation channel slopes support cordgrass. Other species found across the high marsh plain include the parasite dodder (*Cuscuta salina*), Salt Grass (*Distichlis spicata*), Alkali heath (*Frankenia salina*), and Jaumea (*Jaumea carnosa*).

Marsh – Terrestrial Ecotone

As mentioned, the terrestrial margins of the bay-side tidal marshes are generally steep hillsides. However, at Miwok Meadows and Back Ranch Meadows, there is a reasonably large area of gradual upland transition. In these transition zones, a variety of wetland and lowland terrestrial species are found. On south-facing hillsides, there exists a high-marsh ecotone with valley grassland. This area is co-dominated by the native rush and grass species Baltic rush (*Juncus arcticus* ssp. *balticus*) and Creeping wild rye (*Elymus triticoides*), they extend into the pickleweed/saltgrass marsh, as well as hairy gumplant (*Grindelia hirsutula* ssp. *angustifolia*), and upland shrubs such coyote bush (*Baccharis pilularis*), sticky monkeyflower (*Mimulus aurantiacus*), and western poison oak (*Toxicodendron diversilobum*). On north-facing slopes, the high marsh transitions to oak woodland, and tree canopies of coast live oak (*Quercus agrifolia*), toyon (*Heteromeles arbutifolia*), coyote bush, western poison oak, and California bay laurel (*Umbellularia californica*) create shaded areas along the marsh edge.

Fish and Wildlife Utilizing the Tidal Marshes

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 most commonly detected species of fish are northern anchovy, Longfin Smelt, jacksmelt, Pacific herring, striped bass, American shad, starry flounder, shiner perch, and yellowfin goby (Visitainer *et al.* 2006, Herbold *et al.* 2012). Larger channels within the marsh are likely to support juveniles of some of these species, in addition to staghorn sculpin, California bat ray, leopard shark, and brown smoothhound sharks.

7.2.3 Interior Muted Tidal Marsh Habitats and Connectivity to Baylands and Uplands

China Camp supports two primary areas of marsh interior of North San Pedro Road, one at Back Ranch Meadow and one at Miwok Meadow (Figure 15). There are two other small “interior” marshes further west along the road, one just northwest of Back Ranch and the second further northwest outside the Park boundary on the Boyd property. These areas provide a connection between the lowland grasslands, woodlands, seasonal streams, and riparian corridors of the upland landscape with the marsh landscapes within the meadows and on the bay side of the road. Such landscapes may have been relatively common historically around the bay but have

been lost due to development. Though their hydrology is altered by the road and will be changed with sea level rise, these areas provide some unique ecological functions in their current condition. These areas require special consideration during adaptation planning.

Hydrology Overview

The marshes at China Camp located on the interior (south) side of North San Pedro Road are a mixture of muted tidal marshes, where tidal action is dampened by the few and relatively small culverts connecting to the tidal marshes north of the road, and freshwater marsh where winter rainfall and runoff and groundwater exert their influence on the plant communities and associated marsh ecology. The road also serves as a dam of sorts, slowing drainage out of these interior marshes especially after large rainstorms.

Channels and Ditches

Channels in the interior muted tidal marshes are reduced in size compared to those on the bay side, however, they do support some cordgrass and channel edge species, such as gum plant. The interior muted marshes have also had more mosquito control ditching so are straight and relatively shallow. In the more interior area of Miwok Meadow there are shallow tidal ponds where, presumably, excessive inundation has resulted in drowning of marsh plain vegetation.

Marsh Plains

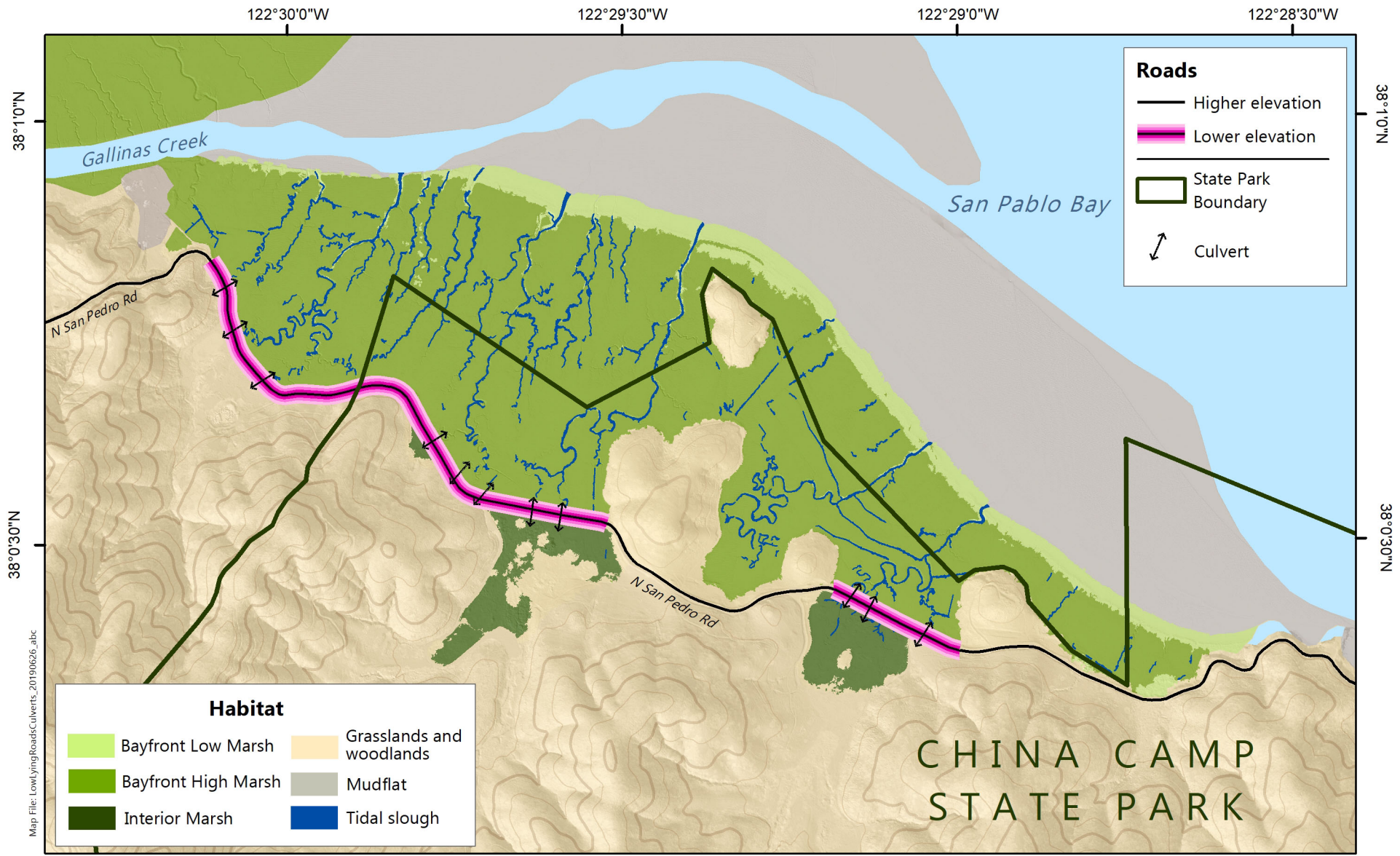
Marsh plains are much more diverse than those of bay-side tidal marshes and there is a greater presence of species such as salt grass, jaumea, as well as pickleweed. In the marsh plain adjacent to the road there are unusually large stands of alkali bulrush. Alkali bulrush is more tolerant of prolonged inundation than most marsh plain species and the road most likely tends to pond freshwater runoff from winter flows so it is likely that the interior marsh plain, especially where water tends to pond up because of the road barrier, is less saline.

Marsh – Terrestrial Ecotone

There are some excellent examples of fresh to brackish species that grade gradually into tidal salt marsh at both Miwok and Back Ranch meadows. Relatively large creeping wild rye stands occur in transition zones of both these muted marshes. At Back Ranch meadow, the fresher parts of the transition zone harbor California tule and broad leaf cattail. Both of these areas have gradual transitions into the salt marsh and, therefore, provide excellent opportunities for tidal marsh migration if the road barrier is removed or mitigated.

On the upland side of these meadows, seasonal streams and associated riparian corridors drain to these meadows. The avian community in these meadows reflects their unique habitat features that are not represented in other portions of China Camp State Park. Based on other

tidal marsh bird surveys by Point Blue in the adjacent fully tidal habitat, it has been established that China Camp tidal marshes support high densities of San Pablo Song Sparrows, a stable population of State threatened California Black Rails, and federal endangered California Ridgway's Rails as compared to the San Pablo Bay region (Wood et. al 2012). The meadows also provide high quality post-fledging habitat for Song Sparrows due to the proximity to the tidal marsh and presence of taller dense vegetation such as California blackberry. Riparian focal species (RHJV 2004) such as Wilson's Warblers, Warbling Vireo, and Tree Swallows (*Tachycineta bicolor*), as well as Common Yellowthroat (*Geothlypis trichas*) and Virginia Rail currently benefit from the reduced tidal action in the meadows. See Appendix A.



Data Sources: Habitats, NERR 2006; Coastline, National Hydrography Dataset 2017; Road, US Census 2018; Mudflats, SFEI EcoAtlas; Hillshade, Marin County 2013; Park Boundary, State Parks 2018

Habitats and Low lying Roads and Culverts of China Camp State Park

Marin County, CA

Figure 15

8 Wildlife

8.1 Special-Status Species

The tidal marshlands at China Camp host several species that are listed as endangered by both the federal and the California Endangered Species acts: Ridgway’s Rail, California Black Rail, Northern Spotted Owl, and the Salt Marsh Harvest Mouse are examples. 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, Salt Marsh Common Yellowthroat and San Pablo Song Sparrow.

8.1.1 Fish

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 (*Oncorhynchus tshawytscha*). Longfin Smelt (*Spirinchus thaleichthys*), which are listed as threatened under the California Endangered Species Act, have commonly occurred in otter trawls and midwater trawls conducted here (Herbold *et al.* 2012).

8.1.2 California Ridgway’s Rail

The federally endangered California Ridgway’s rail (*Rallus obsoletus obsoletus*) (formerly called Clapper Rail) is a secretive, hen-like waterbird, indigenous to estuarine marshlands in the San Francisco Bay (Goals Project 2000). Ridgway’s rails occur almost exclusively in tidal salt and brackish marshes with unrestricted daily tidal flows, adequate invertebrate prey food supply, well developed tidal channel networks, and suitable nesting and escape cover during extreme high tides. They once occupied coastal California tidal marshes from Humboldt Bay southward to Morro Bay, and estuarine marshes of San Francisco Bay and San Pablo Bay to the Carquinez Strait (SEW 2001). Resident populations are currently limited to San Francisco Bay, San Pablo Bay, Suisun Bay, and associated tidal marshes. Point counts for Ridgway’s Rail were conducted in China Camp from 2005-2008, and relative density averaged 0.44 birds per hectare, and ranged from 0.275 birds per hectare 2005 to 0.616 birds per hectare in 2007 (Wood *et al.* 2012).

8.1.3 California Black Rail

The California black rail (*Laterallus jamaicensis coturniculus*) is listed as “threatened” by the State of California and is a federal species of concern. They occur almost exclusively in tidal marsh habitat (Evens *et al.* 1991, Manolis 1978, Nur *et al.* 1997), and the majority of the local species population is currently found in the historical marshes of San Pablo Bay, Suisun Bay, and the Carquinez Strait (Evens *et al.* 1991). The highest concentrations are in marshes associated

with large rivers and sloughs (Petaluma River Marsh, Black John Slough, Coon Island, Fagan Slough, Napa River) (Evens *et al.* 1991, Nur and Spautz 2002). Thus, freshwater input to tidal marshes appears to correlate positively with black rail abundance. Black Rail breeding territories in China Camp were mapped from 2001-2005. Based on these data, black rail density averaged 0.86 birds per hectare ranging from 0.66 in 2003 to 1.40 in 2001 and 2004 (Wood *et al.* 2012).

8.1.4 San Pablo Song Sparrow

The San Pablo song sparrow (*Melospiza melodia samuelis*) is currently a federal species of concern. The San Pablo song sparrow is a distinct subspecies of song sparrow endemic to San Pablo Bay. This species is confined to tidal and muted tidal salt marshes fringing San Pablo Bay (Grinnell and Miller 1944, PRBO unpubl. data). San Pablo song sparrows are primarily associated with high pickleweed marsh and are densest in areas where gumplant occurs along tidal channels (Grenier 2004, Spautz *et al.* 2006). San Pablo song sparrows are distributed over most of their original range, occurring in marshes along San Pablo Bay, from Richardson Bay (Marin County) east to Point Pinole (Contra Costa County). Breeding success of the San Pablo song sparrow within China Camp marshes has been variable, from 30% in 1996 to 6% in 2006, with flooding and predation causing the majority of nest failures. Point counts were conducted from 1996 to 2008. Based on these data, relative density of song sparrows at China Camp ranged from 4.69 to 10.74 birds per hectare at China Camp across the 11 years, with a higher mean density than other sites in San Pablo Bay (Wood *et al.* 2012).

8.1.5 Salt Marsh Common Yellowthroat

The salt marsh common yellowthroat (*Geothlypis trichas sinuosa*) is a State species of special concern. It is a winter resident of tidal marshes but occurs in other habitats (often wetland ecotones) such as riparian thickets, freshwater marshes, marshy coastal forb vegetation, and brush or scrub near wetlands (Terrill 2000). Most breeding (60 percent in the San Francisco Bay region) occurs in brackish marsh, about 5 percent in salt marsh, and the remainder in other wetland or peripheral wetland habitats. Salt marsh common yellowthroats nest in a variety of habitats around San Francisco Bay wetlands and adjacent uplands; moisture appears to be the factor common to all types of breeding habitat. Based on 2012 surveys, the salt marsh common yellowthroat occurs in China Camp, and although breeding was not detected, it was presumed possible based on presence of this species in suitable habitat during breeding season (Wood *et al.* 2012).

8.1.6 Northern Spotted Owl

The Northern Spotted Owl (*Strix occidentalis caurina*) is a federally listed threatened species. It nests in diverse, robust evergreen forests and are an upper level predator that feeds on a variety of rodents. They have been documented in China Camp State Park during surveys

conducted in the past associated with various park projects (State Parks, pers. comm. June 2020). One Tam² has a wealth of information on the Northern Spotted Owl. It projects population trends as “good” with “no change.” Threats to the population include presence of Barred Owls, habitat quantity and quality, and the effects of Sudden Oak Death on forest structure and prey populations.

8.1.7 Salt Marsh Harvest Mouse

Federally endangered salt marsh harvest mice (SMHM; *Reithrodontomys raviventris*) are small, native rodents endemic to the salt marshes and adjacent diked wetlands of the San Francisco Bay (Goals Project 2000). They are generally restricted to saline or subsaline marsh habitats around the San Francisco Bay estuary and mixed saline/brackish areas in the Suisun Bay area. Current studies demonstrate that pickleweed is not necessarily the most "preferred" habitat as defined by the USFWS Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013; CDFW and DWR unpublished data) and their distribution is not restricted to pickleweed habitat. In China Camp, the tidal wetlands can be completely inundated during high tides, leaving little escape cover for SMHM. The muted tidal wetlands on the south side of North San Pedro Road may provide more cover, as inundation levels are generally lower here. However, these areas do become inundated on king tides, but may still provide refuge for mice as they contain a mix of taller vegetation with an upland transition zone that mice can escape into if all vegetation becomes inundated. Two subspecies of the salt marsh harvest mouse occur in San Francisco Bay: the southern subspecies, *R.r. raviventris*, and northern subspecies, *R.r. halicoetes*. China Camp represents the southern limit of the northern subspecies, as the break in marsh between China Camp and marshes to the south creates a boundary between the two subspecies (Shellhammer 2012). SMHM have been confirmed in tidal marsh near China Camp, as well as in the muted-tidal marsh south of the road (Shellhammer 2012, CDFW 2014).

8.1.8 Plants

China Camp tidal marshes are not known to support rare or endangered plant species endemic to the tidal marshes of the San Francisco Bay estuary. Populations of *Chloropyron maritimum* var. *palustre* (syn. *Cordylanthus maritimus* ssp. *palustris*; northern salt marsh bird's-beak) have been reported from nearby Bucks Landing, but this plant has not been detected in China Camp marshes (Baye 2011).

8.2 Non-Native Species

Non-native plant and wildlife species are present throughout the estuarine and terrestrial habitats of China Camp State Park as they are throughout the estuary and its surrounding

² <https://www.onetam.org/peak-health/northern-spotted-owl>

watersheds. Of interest to this effort are those species that negatively impact protecting the estuarine resources of China Camp State Park in the face of climate change and their potential effects on efforts to address climate change adaptation. The term “invasive species” as compared to “non-native” species conveys this distinction. Invasive species can severely alter or inhibit the natural ecological functions of a site through displacement or eradication of native species and changes to native plant community and habitat characteristics. This section identifies the invasive species known from the site.

8.2.1 Invasive Plants

Most of San Pablo Bay’s tidal marshes have experienced severe invasions of exotic marsh species, but China Camp is a bit of an exception. In recent years, pepperweed (*Lepidium latifolium*), Mediterranean tarplant (*Dittrichia graveolens*), and Australian or Pacific bentgrass (*Agrostis avenacea*) have rapidly invaded disturbed levees and high tidal marsh edges in San Pablo Bay, but have only occurred in limited areas within China Camp.

Species of Primary Concern

Hybrid smooth cordgrass (*Spartina alterniflora x foliosa*), which poses a severe threat to the estuary’s tidal marshes, had established at Bullhead Flat in China Camp and is continually monitored and eradicated by the Invasive Spartina Project of the California State Coastal Conservancy. The full abundance and distribution of the hybrid population is difficult to determine. This hybrid exhibits adaptive traits such as increased salt and submergence tolerance, and its spread can potentially alter the erosion patterns of the fringing marsh/mudflat zone, and morphology of ancient tidal creeks.

Species of Secondary Concern

Pepperweed is only found in local disturbed brackish marsh edges at the north and south end of China Camp, above and below San Pedro Road. Mediterranean tarplant occurs very infrequently along roadside tidal marsh edges of China Camp.

Other Species of Concern

Other species that have invaded surrounding areas, such as non-native Algerian sea-lavender (*Limonium ramossisimum*) and the invasive rush *Juncus gerardi* have not yet been detected in China Camp. Many non-native wetland and upland weeds occur in or near drift-lines of the uppermost marsh edges, especially in the vicinity of road culverts and disturbed roadside fill. These species seldom become abundant or highly invasive in China Camp tidal marsh vegetation. They include *Atriplex prostrata*, *Bromus hordeaceus*, *Cotula coronopifolia*, *Hordeum gussoneanum*, *Lolium perenne*, *Lotus corniculatus*, *Lythrum hyssopifolium*, *Mentha pulegium*, *Polypogon monspeliensis*, *Parapholis incurva*, *Sonchus oleraceus*, and *Spergularia rubra*.

8.2.2 Invasive Wildlife

There are many species of introduced birds and mammals that reside at China Camp. Wild Turkey, house mice, rats and others to name a few. They have been resident for many decades, are not considered invasive, and for the purposes of planning sea level rise adaptation are not considered as important drivers.

8.2.3 Invasive Invertebrates

The San Francisco Estuary is one of the most invaded aquatic habitats in the world (Cohen and Carlton 1998). From the perspective of considering tidal marsh resilience and adaptation for sea level rise at China Camp, a small number of these non-native species pose concern at China Camp or in the waters of San Pablo Bay that affect ecological functions at China Camp. Some of these species are present at or near China Camp itself while others are remote yet significant or remote with a strong possibility of reaching China Camp.

- **Green crab**, *Carcinus maenus*, lives in subtidal and low intertidal environments including cordgrass marshes, it has a high breeding potential, and its diet and feeding behavior suggest its potential for extensive ecosystem alterations through predator-prey interactions, competition, disturbance, and indirect effects (Cohen *et al.* 1995).
- **Overbite clam**, *Corbula amurensis*, is a filter-feeding bottom dwelling organism that consumes significant plankton and thereby adversely affects the aquatic food web functions and productivity (Greene *et al.* 2011).
- **Mud snail**, *Batillaria attramentaria*, is an invasive snail found in west coast estuaries that consumes primarily epibenthic diatoms, and especially when infected by a parasitic worm can exacerbate algal blooms through nutrient increases (Fabian 2016). It is present nearby at McNear's Beach. *Batillaria* can essentially convert mudflats to gravel bars with dead shell and live animals.
- **Australasian isopod**, *Sphaeroma quoyanum*, live in and burrow into the banks of steep tidal marsh channels, increasing rates of channel bank erosion thereby altering geomorphic structure and tidal flows (Talley *et al.* 2001). No detections have been made of this species at China Camp though no concerted surveys have yet been conducted.
- **Japanese mud shrimp**, *Upogebia major*, is present at China Camp mostly in the mudflats and competes with the native mud shrimp, *Upogebia pugettensis*. Both species burrow into the mud, compromising sediment stability. These effects have been considered mostly around oyster production (e.g., Graham and Bollens 2010) but also feed into sediment dynamics.
- **Asian bopyrid isopod**, *Orthione griffenis*, is presumably present at China Camp in the mudflats as it co-occurs with mud shrimp (both the invasive Japanese mud shrimp and

the native mud shrimp). It greatly reduces the host mud shrimp's ability to reproduce and may have contributed to declines in Pacific coast mud shrimp populations (Cohen 2012).

- **Japanese oyster**, *Crassostrea gigas*, dominates space and potentially outcompetes other hard substrate organisms including the native oyster. In past survey it has been found nearby at Loch Lomond (Chela Zabin, SERC, pers. comm. June 2020).

8.3 Other Biological Resources

8.3.1 Terrestrial Wildlife

The marshes and upland areas of China Camp host a diversity of terrestrial wildlife species, including mammals, reptiles and amphibians, and birds. Deer are the most common mammals here; others include raccoons, skunks, foxes, coyotes, bobcats, rodents, and bats. Terrestrial bird species inhabiting this area include wild turkeys, scrub jays, acorn woodpeckers, spotted towhees, black-capped chickadees, and several species of raptors.

8.3.2 Invertebrates

The tidal marsh, rocky intertidal, and upland habitats of China Camp support a host of marine and terrestrial invertebrate species, most of which are exotic species. Several native species, including the Olympia oyster, bay mussel, and several species of barnacles inhabit the rocky intertidal. Common tidal marsh marine invertebrates include the amphipod *Traskorchestia traskiana*, planthopper *Prokelisia marginata*, and oligochaete and polychaete worms (Robinson *et al.* 2011). Other marine invertebrates include several species of crab and two species of shrimp.

9 Recreation

China Camp serves as a recreational hub in Marin county, the park offers fifteen miles of hiking, mountain biking and equestrian trails (Figure 16). Visitors can enjoy some of the best single-track mountain biking available in the County and a State Parks campground for tent camping. The beach is frequented for boating, swimming, picnicking and summer time water sports like windsurfing and kayaking. There are several group picnic areas along with exceptional views and opportunities for wildlife viewing, birding, botanizing, horseback riding and scenic drives. This park is a well-loved Marin county gem for both locals as well as visitors from afar.

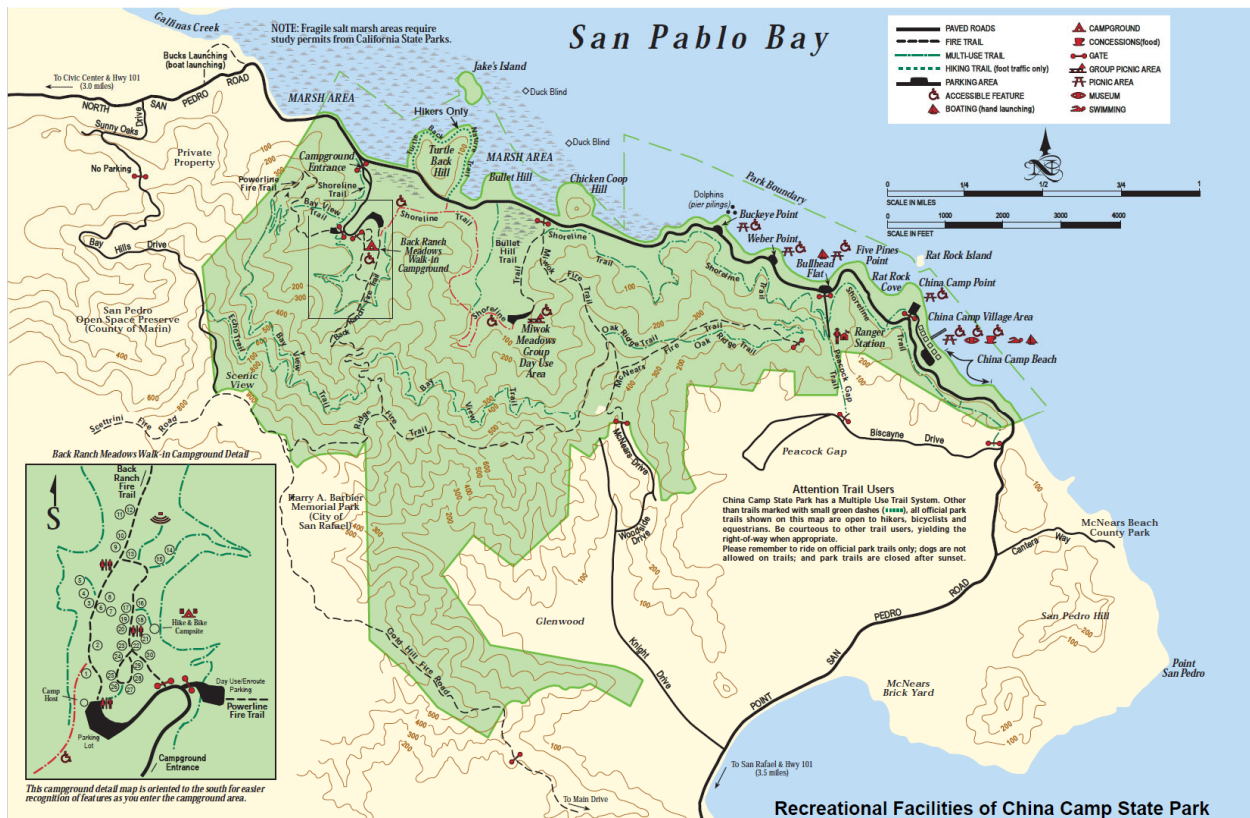


Figure 16. Main Recreation Trails

Source: California State Parks

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APPENDIX A. RESULTS OF AVIAN NESTING SURVEY OF INTERIOR
MARSHEs, 2018 (POINT BLUE CONSERVATION SCIENCE)

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June 24, 2019

FROM: Megan Elrod, San Francisco Bay Biologist
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SUMMARY MEMORANDUM

China Camp Meadows Breeding Bird Surveys

This memorandum summarizes our 2019 bird survey efforts at China Camp State Park Back Ranch and Miwok Meadows, as agreed upon by Point Blue and NERRS. This summary memo fulfills our contractual obligations with the National Estuarine Research Reserve System (NERRS) to establish and conduct baseline bird surveys in two China Camp meadows. All surveys were conducted under U.S. Fish and Wildlife service permit TE-807078-17 and China Camp State Parks Collecting permit.

Background

China Camp State Park exists in a unique and valuable geographic location within the San Francisco Bay, containing large intact tidal marsh dominated by perennial pickleweed (*Salicornia pacifica*) with a sinuous channel network lined with gumplant (*Grindelia stricta*). The tidal marsh is generally bordered by a natural and often steep transition zone to hillslope grasslands and oak woodland. Currently, North San Pedro Road borders the tidal marsh along the upslope edge, restricting tidal action the alluvial valleys, Miwok and Back Ranch meadows, creating brackish and muted tidal wetland habitat that transitions to willow and riparian scrub habitat. The “China Camp Road Adaptation Project” was established to assess options to address a low section of North San Pedro Road already affected by periodic flooding from higher tides and threatened by sea level rise. The project is multi-stakeholder and combines an interest in the repair, restoration and enhancement of the road and portions of the adjacent wetlands potentially altering tidal exchange and impacting existing habitat. In order to evaluate potential ecological impacts of various adaptation alternatives, Point Blue Conservation Science entered into agreement with the NERRS to conduct baseline surveys to describe the avian community in the meadows.

Methods

The standardized Area Search Census protocol (Point Blue 1999) was used to survey Back Ranch and Miwok Meadows. A single observer entered a predefined plot to search for and record all bird species observed and document breeding behaviors. Six total plots were established (Figure 1) such that each 3-5 ha area could be covered sufficiently in twenty minutes. The plots were created with elevational and habitat changes in mind such that an entire plot was either muted tidal marsh or willow dominated riparian, with mixed grass-shrub-oak woodland borders. Plot boundaries are also aligned with vegetation monitoring transects established by the NERRS such that plot 1 in each meadow encompasses the transects. Three plots were established in each meadow, each surveyed three times from April to June 2019 following the dates in Table 1.

Figure 1. Area Search plots established in 2019 in Back Ranch and Miwok Meadows. Each meadow has three plots.



Table 1. Biologists Julian Wood and Megan Elrod conducted three visits during the breeding season (April 29, June 3, and June 14, 2019) to the two meadow sites and surveyed all six plots within three hours of sunrise.

Site	Visit	Date	Observer
Miwok Meadows	1	4/29	Megan Elrod
Miwok Meadows	2	6/03	Megan Elrod
Miwok Meadows	3	6/14	Julian Wood
Back Ranch Meadows	1	4/29	Megan Elrod
Back Ranch Meadows	2	6/03	Julian Wood
Back Ranch Meadows	3	6/14	Julian Wood

One of the features of the area search protocol is that the observer does not follow a specific path through the plot but rather is able to walk through the site in a way that best allows them to identify and count all the birds. For example, if a bird is suspected to be nesting nearby then the observer will alter course to investigate. The observer also might alter course to get closer to a mixed flock in order to identify all individuals to species.

All data were entered and stored in the California Avian Data Center, a node of the Avian Knowledge Network (<http://avianknowledge.net/>), and is available upon request.

Results

A total of 42 species were detected across all surveys in China Camp State Park meadows. Portions of both Back Ranch and Miwok meadows offer suitable habitat for riparian and tidal marsh dependent species (Table 2). Species typically associated with oak woodland habitat were also detected in the meadows which likely provide foraging opportunities for those species during the breeding season. Total abundance for the 42 species are reported in Table 3 where abundance is the average number of individuals detected per visit. Notable observations include the state threatened California Black Rail (*Laterallus jamaicensis coturniculus*), and Bird Species of Special Concern Samuels (San Pablo) Song Sparrow (*Melospiza melodia samuelis*). Distant clatters from California Ridgway's Rails (*Rallus obsoletus obsoletus*) were heard in the tidal marsh on the other side of North San Pedro Road but were not detected in the meadows.

Table 2. All bird species observed in Back Ranch and Miwok Meadows on three visits from April-June 2019. Predominate habitat association for each species is listed as it relates to the dominate vegetation found in the meadows.

Common Name	Scientific Name	Predominate Habitat Association		
		Tidal Marsh	Riparian	Oak Woodland
Acorn Woodpecker	<i>Melanerpes formicivorus</i>			x
American Crow	<i>Corvus brachyrhynchos</i>		x	x
American Goldfinch	<i>Spinus tristis</i>		x	x
Anna's Hummingbird	<i>Calypte anna</i>		x	x
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>			x
Barn Swallow	<i>Hirundo rustica</i>		x	x
Bewick's Wren	<i>Thryomanes bewickii</i>		x	x
Black Phoebe	<i>Sayornis nigricans</i>		x	x
Black Rail	<i>Laterallus jamaicensis</i>	x		
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>			x
Bushtit	<i>Psaltiriparus minimus</i>		x	x
California Quail	<i>Callipepla californica</i>		x	x
California Scrub-Jay	<i>Aphelocoma californica</i>		x	x
Chestnut-backed Chickadee	<i>Poecile rufescens</i>		x	x
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>		x	x
Common Yellowthroat	<i>Geothlypis trichas</i>	x	x	

Common Name	Scientific Name	Predominate Habitat Association		
		Tidal Marsh	Riparian	Oak Woodland
Gadwall	<i>Anas strepera</i>	x		
House Wren	<i>Troglodytes aedon</i>			x
Hutton's Vireo	<i>Vireo huttoni</i>		x	x
Lesser Goldfinch	<i>Spinus psaltria</i>			x
Mallard	<i>Anas platyrhynchos</i>	x		
Mourning Dove	<i>Zenaida macroura</i>		x	x
Nuttall's Woodpecker	<i>Picoides nuttallii</i>			x
Oak Titmouse	<i>Baeolophus inornatus</i>			x
Orange-crowned Warbler	<i>Oreothlypis celata</i>		x	x
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>		x	x
Selasphorous Hummingbirds	<i>Selasphorus spp.</i>		x	x
Snowy Egret	<i>Egretta thula</i>	x		
Song Sparrow	<i>Melospiza melodia</i>	x	x	
Spotted Towhee	<i>Pipilo maculatus</i>		x	x
Tree Swallow	<i>Tachycineta bicolor</i>		x	
Turkey Vulture	<i>Cathartes aura</i>		x	x
Violet-green Swallow	<i>Tachycineta thalassina</i>			x
Virginia Rail	<i>Rallus limicola</i>	x		
Warbling Vireo	<i>Vireo gilvus</i>		x	
Western Bluebird	<i>Sialia mexicana</i>			x
Western Wood-Pewee	<i>Contopus sordidulus</i>			x
White-breasted Nuthatch	<i>Sitta carolinensis</i>			x
White-tailed Kite	<i>Elanus leucurus</i>	x		
Wild Turkey	<i>Meleagris gallopavo</i>			x
Wilson's Warbler	<i>Cardellina pusilla</i>		x	
Wrentit	<i>Chamaea fasciata</i>		x	x

Table 3. (Attached as file “CCMTotalSppAbundance2019.xls”) Total abundance for the 42 species observed during the Area Search Census, where abundance is the average number of individuals detected per visit.

Evidence of breeding behavior observed within the plots included nesting material and food carries by Song Sparrows. Singing males detected in all three visits is supportive of an established territory and potential breeding, even when no other nesting behavior is observed. Species detected singing in all three rounds in one or more plots include Song Sparrow, Spotted Towhee (*Pipilo maculatus*), Anna’s Hummingbird (*Calypte anna*), Wilson’s Warbler (*Cardellina pusilla*), and Warbling Vireo (*Vireo gilvus*). California Black Rail territorial vocalizations, “ki-ki-doo” calls, were heard in Back Ranch Plots 1 and 2 and Miwok Plots 2 and 3 strongly suggesting they are breeding in those areas. The territorial “grunt” call of the Virginia Rail (*Rallus limicola*), often

indicative of pair bonding, was heard in Back Ranch Plot 3 and Miwok Plot 1. The presence of groups of ten or more juvenile Song Sparrows in both June surveys indicate potential movement post-fledging to the meadows from the tidal marsh across North San Pedro road.

Conclusion

Habitat features currently in the meadows include tidal marsh transitioning to riparian, with grass and scrub to oak woodland edges, and the avian community reflects the unique habitat features of the meadows that are not represented in other portions of China Camp State Park. Based on other tidal marsh bird surveys by Point Blue in the adjacent fully tidal habitat, it has been established that China Camp tidal marshes support high densities of San Pablo Song Sparrows, a stable population of State threatened California Black Rails, and federal endangered California Ridgway's Rails as compared to the San Pablo Bay region (Wood et. al 2012). The meadows also provide high quality post-fledging habitat for Song Sparrows due to the proximity to the tidal marsh and presence of taller dense vegetation such as California blackberry (*Rubus ursinus*). Riparian focal species (RHJV 2004) such as Wilson's Warblers, Warbling Vireo, and Tree Swallows (*Tachycineta bicolor*), as well as Common Yellowthroat (*Geothlypis trichas*) and Virginia Rail currently benefit from the reduced tidal action in the meadows.

It is recommended to consider the State Parks and other key stakeholder interests in the potential changes to the vegetation and therefore potential changes to the bird community with any increase in tidal action due to road repair. Pairing bird surveys in additional years with finer scale vegetation mapping may be needed to better predict and assess the effects of different road futures and sea level rise scenarios on the bird community.

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