California Clapper Rail Surveys for the San Francisco Estuary Invasive Spartina Project 2006

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CONTENTS

FIGURES AND TABLES

1.0 INTRODUCTION

Eradication of invasive *Spartina* from the San Francisco Estuary has been identified as a critical component of ecosystem recovery and endangered species protection by U.S. Fish and Wildlife Service (USFWS), California Coastal Conservancy, and many environmental groups and scientists. The urgency of this issue was recently affirmed by international *Spartina* and invasive species experts at the Third International Conference on Invasive *Spartina*, held in San Francisco, November 8-10, 2004.

A major issue facing the Invasive *Spartina* Project (ISP) and others attempting to control invasive *Spartina* in the San Francisco Estuary is that the endangered California clapper rail (*Rallus longirostris obsoletus*) has been found to use invasive *Spartina* for cover and nesting. In fact, clapper rails have colonized marshes created by invasion of non-native *Spartina*, and the assumption is that removal of that *Spartina* will result in localized loss of clapper rail habitat. The ISP has been working extensively with USFWS and other biologists to develop strategies that will allow control of invasive *Spartina* while minimizing impacts to the clapper rail.

This report provides results of breeding season surveys for California clapper rails conducted by Olofson Environmental, Inc. in 2006 for the ISP. These surveys were conducted for the ISP to provide information on clapper rails at invasive *Spartina* treatment sites to inform treatment strategies, monitor potential changes in clapper rail populations, and assess compliance with requirements of the USFWS Biological Opinion (2005).

2.0 STUDY AREA

Call count surveys were conducted at 38 sites located in the Central San Francisco Bay in the counties of Alameda, San Francisco, San Mateo, and Santa Clara, with clusters in Alameda, San Leandro Bay, and Hayward (**Figure 1**; **Table 1**, **Table 2**). These sites were a subset of sites slated for non-native *Spartina* treatment in 2006. Surveys for clapper rails at other project sites were conducted by Avocet Research Associates (ARA, under funds provided by the ISP and other grants), U. S. Fish and Wildlife Service, PRBO Conservation Science, and H.T. Harvey and Associates.

Most surveys were conducted at sites where rails had previously been documented, but there were also several sites where rail use was probable but unknown due to lack of previous survey data (e.g. West Point Slough near Bair Island in Santa Clara County). Several sites were also surveyed for the presence of potential clapper rail habitat to determine whether clapper rail surveys were warranted (e.g. San Francisco International Airport).

3.0 METHODS

3.1 FIELD SURVEY METHODS

California clapper rail surveys were conducted between January 15 and April 15, 2006, using standardized survey protocols approved by the USFWS. Two types of surveys were conducted: call count surveys and habitat assessment surveys (details below).

3.1.1 Clapper Rail Breeding Season Call Count Surveys

Protocol "A". Protocol "A" is the standard "walking transect" survey protocol written by USFWS biologists and used by researchers throughout the San Francisco Estuary to document California clapper rail presence during the breeding season and to calculate rail relative abundance and/or density. Within each survey site, survey stations were established 200 meters (m) apart, primarily on peripheral footpaths, levees, and boardwalks (rather than within marsh vegetation) where possible, to minimize disturbance to habitat and for observer safety. The number of survey stations established at each site varied due to site size, configuration, and accessibility. Sites were visited three times during the season, with at least seven days between visits. During the first two rounds, a trained observer stood at each point for 10 minutes, recording all rails detected visually or aurally. For each bird or pair of birds detected, the observer recorded the number of birds, call type, distance and angle on a pre-printed datasheet and plotted the approximate location on an aerial photo. Pre-recorded clapper rail vocalizations were used at survey stations on the third visit to elicit response from rails if no rails were detected during the two previous passive surveys (or during the first five minutes during the third survey) within 200 m of the survey station. The full protocol and datasheets are included in Appendix 1 (the "official" draft clapper rail protocol document furnished by USFWS Endangered Species Office); Appendix 2 (an expanded version created by ISP containing more detailed descriptions of data collection and interpretation methods); and Appendix 3 (clapper rail call count survey datasheet).

Protocol "C". A modified protocol for clapper rail call count surveys was developed by USFWS and ISP staff to maximize the chances of detecting rails in invasive *Spartina* treatment areas deemed beforehand to have a low (but non-zero) likelihood of supporting clapper rails (using habitat assessment protocol "F", below). These sites are typically isolated, small marsh patches that to a clapper rail biologist appear to be marginal to poor habitat. Sites where rail presence is determined during habitat assessment to be extremely highly unlikely would not be surveyed further. Sites where rails are determined to be absent can be treated during the rail breeding season, maximizing the potential window of time available for treatment.

Protocol "C" allows permitted biologists to play pre-recorded rail vocalizations during the first (and subsequent) visits to a site, unlike protocol "A" which requires two passive surveys with no detections before a tape can be played. If a rail is detected, the recording must be immediately switched off and cannot be played again within 200 m of the detection. To determine with sufficient certainty that no rails are present three visits with no rail detections are required.

If rails were detected using this survey protocol in 2005, we used the standard "A" protocol in 2006.

3.1.2 Clapper Rail Habitat Assessment: Protocol F

This protocol was developed by ISP staff, in association with Jules Evens (ARA) and Joy Albertson (USFWS), to determine whether apparently marginal habitat meets a suggested minimum set of criteria for likely clapper rail use. These criteria include restoration status, salinity, tidal regime, marsh overall size and configuration, levee configuration, marsh elevation, presence of upper marsh vegetation, degree of non-native *Spartina* invasion, distance from the nearest marsh with known clapper rails, degree of channelization, and amount of open water (ponding). If at least four criteria related to probable clapper rail presence were met, there was sufficient probability that clapper rails were present, and a recommendation was made for further call count surveys, usually protocol "C". If these criteria were not met, the site was assumed to not support clapper rails, no further clapper rail surveys were recommended, and the site was proposed for early treatment. Appendix 4 includes the detailed survey protocol and field datasheet.

3.1.3 Vegetation Surveys & Invasive *Spartina* Inventory Data

The ISP *Spartina* Inventory Program conducted a complete inventory of invasive *Spartina* in the estuary in 2005, using a combination of field surveys and remote sensing techniques (see Zaremba in prep., for methods). We also collected a suite of vegetation data in the field in the fall of 2005 for a separate study of clapper rail habitat use. In order to describe general site characteristics, we report here the cover of non-native *Spartina alterniflora* hybrids (from inventory data) and overall vegetation cover data (from field-collected data) for each survey site, where available.

For habitat use studies, we randomly selected 2 - 16 sampling points within the survey area in each marsh, the number of points depending on marsh size. In the field at each sampling point, we recorded the relative percent cover of all plant species (of overall vegetation) within 50 m. For this report we calculated the mean cover for each species at each site.

We then calculated the overall cover of invasive *Spartina* for each survey area by intersecting the rail survey area and *Spartina* inventory polygon data in ArcView 3.2. These data are absolute percentages: percent cover of *Spartina* of the entire marsh area (including channels and ponds, and other unvegetated areas). Thus the cover of invasive *Spartina* calculated from inventory data is likely to be lower than the percent invasive *Spartina* of the vegetation (as recorded at random points for the habitat study), especially at sites where there are large unvegetated areas, such as restoration sites.

3.2 DATA COLLECTION AND MANAGEMENT

Most clapper rail survey point locations used in 2006 were established in 2005. Points were established in the field, recorded with a Trimble hand-held GPS unit, post-processed for maximum accuracy, and converted to a GIS shapefile in ArcView GIS 3.2. Points added in 2006 were established in ArcView 3.2 using aerial photos, before going into the field. All points were navigated to during surveys using either a Garmin GPS 76 hand-held unit or a Magellan Meridian Platinum GPS unit (with WAAS satellite reception enabled and an accuracy of $\leq$ 10 m).

All survey data were entered in the field on pre-printed datasheets. Clapper rail survey data were entered on datasheets developed by Avocet Research Associates (Appendix 3) and habitat assessment data were entered on datasheets developed by ISP staff (Appendix 4). Maps for recording clapper rail locations were generated in ArcView GIS 3.2 using recent high resolution (pixel size < 1 m) USGS digital ortho-quarter-quads (DOQQs) or digital geo-referenced and rectified images created from aerial photography generated for invasive *Spartina* inventory mapping in 2005.

We entered survey detection data and habitat assessment data into an Access database, which had been developed by PRBO Conservation Science and modified by the ISP.. We also developed a database in ArcView GIS 3.2 to record detection locations, and to aid interpretation and triangulation of data collected by multiple observers or from multiple transects (see below).

Data were entered and proofed against original datasheets for accuracy. We examined all fields for obvious outliers and checked these against the original data. We performed additional QA/QC by comparing the rail counts determined by surveyors in the field with those calculated within the Access database.

3.3 SITE-LEVEL SPATIAL DATA: GIS

To calculate the relative abundance of clapper rails at each site (expressed in birds per hectare and also generally referred to as "density"), we calculated the area of each site that was surveyed in ArcView GIS 3.2. or ArcGIS 9.0.

First, site boundaries were digitized (heads up method, i.e., tracing over a digitized image on the computer monitor with a mouse or digital pen on a digitizing tablet) using recent high resolution (pixel size < 1 m) USGS DOQQs or digital geo-referenced and rectified images created from aerial photography generated for invasive *Spartina* inventory mapping in 2005. Channels > 10 m wide and ponds were digitized so that their areas were excluded from calculations of marsh area.

Second, site survey boundaries were calculated using the site boundaries, above, intersected with a 200 m buffer around survey stations. This 200 m distance is the approximate maximum distance for most clapper rail detections under moderate survey conditions. For most sites the area surveyed was the same as the entire site area, but for some large sites the survey area was smaller than the entire site area, e.g., Citation and Oro Loma East, where points were placed only along one side of the marsh, and only rails in that portion of the marsh were likely to be detected.

3.4 DATA INTERPRETATION AND ANALYSIS

Standardized methods for interpreting field data were developed in association with ISP collaborators (Appendix 2). Additional techniques for improving accuracy of data collected by multiple observers, or triangulating observations of a single observer, were developed by ISP (Appendix 5).

For each detection, we made assumptions about the number of birds represented. For instance, one bird calling alone could represent a single unmated bird or a pair, and thus was recorded as a range of 1 to 2 birds. For smaller sites with low to moderate clapper rail density, calculating the number of birds detected was relatively straightforward, and could be done accurately immediately following the field survey. For other sites, particularly high density sites where multiple transects with multiple observers were used, or where birds were detected from multiple points by a single observer, it was not always immediately clear if particular birds were detected from more than one point. In these cases, we made assumptions in the field about which birds were detected from multiple points and made preliminary estimates of the number of birds detected. Later, we plotted bird locations, using distance and detection data recorded in the field, with Distance and Azimuth Tools v. 1.6 (Jenness 2005) in ArcView 3.2. We first plotted locations separately for each observer's transect, using detections from multiple locations to more accurately estimate placement of individual birds. For sites with multiple observers, we then re-examined the data to confirm whether birds detected at a point were likely to be the same as those detected from other points by other observers. In some cases two observers each estimated the location of a bird in such close proximity to each other that it was highly probable that both observers detected the same bird. In other instances, it was not clear whether observers detected the same bird, or whether there were actually two different birds in the same area. To reduce the probability of over-estimating the number of birds at a site, it was assumed that observers closer to a given area were more likely to estimate the number and location of birds accurately than a farther observer, and the data recorded by the closer observer were used.

We estimated the total minimum and maximum number of birds detected for each survey at each marsh. We examined the range in the number of birds estimated across all surveys for each site, and presented the highest low and highest high as the range in the minimum number of clapper rails likely present at that site. We calculated minimum and maximum relative abundance (i.e., density) using these numbers divided by the area surveyed (described above in the GIS site data section).

We graphed (in Microsoft Excel 2000) the minimum and maximum abundance indices calculated for each site for both 2006 and 2005. OEI previously reported clapper rail data collected in 2005 (Spautz 2005). Where OEI did not conduct surveys in 2005, we present data provided by research collaborators (ARA, PRBO, and EBRPD) for comparison. We recalculated and re-interpreted

2005 data, including that provided by PRBO and EBRPD, when original data were available, using the same methods we used in 2006. In the future, we will conduct statistical analyses to determine whether there was a statistically significant change in clapper rail abundances between years, and help assess whether any of those changes could be attributable to invasive *Spartina* removal. For these analyses we will need to assess intra- and inter-year variability in survey results, and determine the level of real differences in bird numbers detectable using the existing survey methods. For present purposes we present 2005 and 2006 data for preliminary visual interpretation only. Where there is an overlap in numbers across years, we cannot detect any difference. Where there is a large difference between years, and the minimum and maximum numbers do not overlap at all, there is a higher probability that the numbers represent a real change. However, until we quantify the variability as described above, we cannot say with certainty in these cases that the numbers changed across years.

4.0 RESULTS

Three rounds of clapper rail surveys were completed at 35 sites covering 528.4 hectares (ha) of tidal marsh habitat. Habitat suitability surveys were completed at three sites (**Tables 1, 2 & 3**).

The regional mean abundance index (birds/ha) for all sites surveyed in 2006 by ISP was 0.61 to 0.91 birds/ha (mean: 0.75 birds/ha or 0.30 birds/acre). In 2005 the values for these same sites (including sites surveyed by others) was 0.43 – 0.65 birds/ha (0.54 birds/ha or 0.22 birds/acre). At most sites, the number of rails detected and the associated relative rail abundance in 2006 were similar to those calculated for 2005. At some sites, the number of rails appears to have increased significantly since 2005. There is no evidence of a significant increase or decrease in numbers at any 2005 invasive *Spartina* treatment site, except Oro Loma East. At that site, two birds were detected in 2005 and none in 2006; however, the area surveyed in 2006 was smaller than that surveyed in 2005, so some birds may have been missed in 2006 (see below).

Following are clapper rail survey results and a description of habitat at each of the sites surveyed. We also present a comparison of 2006 survey results with 2005 results, where data are available. In most cases surveys were completed by OEI staff both years, but at sites managed by East Bay Regional Parks District (EBRPD), most surveys were completed in 2005 by EBPRD staff. Differences in rail numbers among years are potentially due to several factors:

1. Real differences in population size and/or distribution, potentially caused by changes in processes at the site such as predation of adults, juveniles and nests, tidal flooding of nests, disease, and inter-marsh movements.
2. Differences in observer abilities to detect rails by sight or sound, or to estimate detection distances.
3. Differences in area covered by surveys.
4. Differences in clapper rail vocalization rate due to weather or reproductive status.
5. Differences in survey protocol.
6. Differences in data interpretation techniques.

4.1 CALIFORNIA CLAPPER RAIL CALL COUNT SURVEY RESULTS

4.1.1 Alameda/San Leandro Bay Complex

This complex includes 9 subsites (subsites 17a, b, d, h, and j-m) surveyed by OEI/ISP and two sites surveyed by EBRPD (subsites 17a & 17c): Arrowhead and Elsie Roemer (the latter also surveyed by ISP). Arrowhead has the highest number of clapper rails in this complex. and one of the highest densities in the East Bay: an estimated 64 birds at the site in 2005[1]. The San Leandro Bay area is highly invaded by *Spartina alterniflora* hybrids.

Clapper rails have been previously documented in all sites surveyed in San Leandro Bay. There were 77 - 109 clapper rails detected during surveys conducted by OEI staff. If EBRPD detected approximately 64 birds at Arrowhead again in 2006 (based on 2005 winter high tide surveys estimates), there were approximately 141 - 173 birds in all of San Leandro Bay. In 2005 OEI & EBRPD staff detected 113 - 150 clapper rails, including 64 at Arrowhead. The locations of birds were similar in 2005 and 2006, but the number of birds appears to be higher in 2006 than it was in 2005 (**Table 2, Table 3, Figure 2.a - 2.e, Figure 5.a., 5.b.**). In 2005 the mean abundance index (based on all sites but Arrowhead) was 0.92 – 1.40 birds per ha; in 2006 the range was 1.09 – 1.58 birds per ha (**Table 3**). Because numbers appear to have increased in San Leandro Bay, and conditions have not significantly changed (in spite of some *Spartina* treatment) we suspect that 2005 may have been a very good year for clapper rail recruitment (i.e., birds hatched in 2005 and surviving to breeding maturity in 2006).

The clapper rail abundance indices for sites in this area are the highest in all of the East Bay. This high concentration of rails may be due to the quality of the rail habitat throughout the area, or it may be driven primarily by the high quality of Arrowhead marsh, which may be the source of the population in the region (i.e. birds may be successfully breeding there and the young dispersing out to adjacent more marginal marshes). However, until we have estimates for the number of birds at EBRPD, and more is known about reproductive success at Arrowhead relative to the rest of the area, we cannot know for sure what is driving this high population concentration.

Elsie Roemer Marsh (site 17a; **Figure 2.b.**) is one of the three most developed marshes in San Leandro Bay, in terms of marsh width and the presence of high marsh; but it has less high marsh than Arrowhead and MLK Shoreline. The vegetation at this site in 2005 was approximately 80% *Spartina* hybrids, with < 5% cover each *Salicornia virginica* (synonym for *Sarcicornia pacifica*, perennial pickleweed), *Jaumea carnosa*, *Distichlis spicata* (salt grass), and wrack (dead vegetation deposited on a high tide). Invasive *Spartina* was treated in two areas (approximately ½ of the site area) in late 2005, but treatment efficacy was low: in 2006 non-native *Spartina* was growing as vigorously in most treated areas as in untreated areas. EBRPD staff conducted rail surveys at this site in 2005, and detected a range of 11 – 24 rails during three rounds of "A" surveys. During our 2006 surveys, we detected 11 – 18 rails during 3 rounds of "A" surveys (**Table 2**; **Figure 5.a.)**. The most likely number of birds is 12, or 6 pairs. In both years, most of the detections were in the western portion of the marsh where the marsh is widest. There was significant overlap in the estimates of birds, and we don't believe there has been a significant change in the number of birds between 2005 and 2006 surveys.

Tidal marsh at **Bayfarm Island** (site 17b; **Figure 2.b.**) is a narrow strip adjacent to a housing development, approximately 5 – 20 m wide. In 2005, *Spartina* hybrids composed approximately 50% of the vegetation along with 15% *Salicornia virginica*, 9% *Grindelia stricta* (gumplant), 10% *Distichlis*

[1] EBPRD estimates were based on winter high-tide airboat surveys for clapper rails. They have not yet calculated minimum and maximum estimates of the number of birds detected during 2005 and 2006 call count surveys.

spicata and 8% wrack. *Spartina* hybrid areas were treated in 2005. Prior to 2005 no rails had been reported in this area, and were not expected because the marsh was so narrow and there were no tidal channels. However, because there was some high marsh, and it was so close to Arrowhead and Elsie Roemer marshes where rail densities were high, a "C" survey was conducted in 2005; 4 – 5 birds were detected during one "C" survey. In 2006, three rounds of standard passive "A" surveys were conducted and 5 – 10 birds were detected (most likely only 5 – 6 birds, or 2 – 3 pairs; **Table 2**). Both years, most birds were detected in the eastern portion of the marsh, where the marsh tends to be wider and there is more high marsh. There may have been an increase in the number of birds in 2006, but because there was overlap in the estimates, it is probable that the same number of birds were present in 2005 and 2006 (**Figure 5.a.**). At adjacent **Bayfarm Island Bridge South marsh** (17b), at the southern end of Bayfarm Island Bridge, no clapper rails were detected during one "C" survey in 2005 and three rounds of "A" surveys (including a final round with tapes played) in 2006. However, rails from the main part of Bayfarm Island marsh may use this small area for foraging at times. It is not likely to be used for nesting.

On **Alameda Island East** (site 17m, **Figure 2.c.)**, surveys were conducted at the north end of the Bayfarm Island Bridge, at the Aeolian Yacht Harbor and at three points on the Alameda Island eastern shoreline. The eastern shoreline is lined with riprap and the vegetation was 100% *Spartina* hybrid in 2005, except at Aeolian Yacht Harbor and the adjacent area of the shoreline where *Grindelia* comprised approximately 10% of the vegetation; overall invasive *Spartina* cover was approximately 75%. No formal vegetation surveys were conducted for species other than non-native *Spartina*. *Spartina* hybrid areas were treated in 2005. When we examined this area in 2005 we thought it was unlikely to support rails due to the lack of high marsh for nesting. One round of "C" surveys was conducted in 2005 and one female responded to the taped vocalizations to the east of Aeolian Yacht Harbor. Because she was giving the repeated "kek-burr" call typically associated with unmated females, we thought it likely that she did not have a breeding territory, but we still assume there were 1 – 2 rails present. During three rounds of "A" surveys in 2006, with vocalizations broadcast at all points on the final round, no rails were detected at the Bridge or Yacht Harbor. One pair near shoreline survey point 2 responded by duetting (**Table 2**; **Figure 5.a.)**. This pair was in approximately the same area as the bird detected in 2005, and we suspect it was a breeding pair.

Fan Marsh (site 17j; **Figure 2.c.**) is separated from the Airport Channel and the rest of the bay by Doolittle Drive. As the name implies, it is fan-shaped, and has a dendritic channel system with muted tidal action (SFEI 1999) with sufficient high marsh to support clapper rails. In 2005, Non-native *Spartina* hybrids comprised 54% of the overall cover; there are no other available vegetation data. There is a small, square, diked marsh to the south comprised primarily of *Salicornia virginica*. *Spartina* hybrid areas were not treated in 2005. Three rounds of "A" surveys were conducted from points along Doolittle Drive in 2005 and 2006. In 2005, 7 – 8 rails were detected, while in 2006, there were 6 – 12 rails (**Table 2**; **Figure 5.b.)**. There was no indication of a significant change between years.

Marsh habitat in the **Oakland Airport Channel** (site 17k; **Figure 2.c. & 2.e.**) lies in a narrow band formed on the outboard edge of a rip-rapped shoreline, and is continuous with Arrowhead Marsh on the east side. Much of the channel is unvegetated. Although the vegetation is predominantly *Spartina* hybrids (80% in 2005; or 49 – 57% overall cover), there are small patches of *Salicornia virginica*, *Grindelia stricta* and *Distichlis spicata*, all indicative of high marsh. *Spartina* hybrid areas were treated in 2005. In 2005 we conducted one round of "C" surveys around the entire perimeter of the channel. In one round 8 – 10 birds were detected. In 2006 we conducted three rounds of "A" surveys at the same survey stations and detected 7 – 10 birds (**Table 2**; **Figure 5.b.)**. Al-

though the locations of the birds were somewhat different between years, the numbers were virtually identical.

Doolittle Pond (site 17l; **Figure 2.c.**) is continuous with Airport Channel. It is joined to the Bay by two rip-rapped openings that are high enough so that even during the lowest tides, the pond does not drain and the level or water in the pond is equivalent to high tide. A narrow strip of marsh has formed on the inside perimeter of the pond, with about 15% *Spartina* hybrid cover, estimated in 2005. There were also significant patches of *Grindelia stricta* and *Salicornia virginica.* Formal vegetation surveys were not conducted for plants other than non-native *Spartina*. *Spartina* hybrid areas were not treated in 2005. Although the muted tidal action probably reduces habitat quality for clapper rails, there is sufficient high vegetation and proximity to documented rail habitat (Arrowhead and Fan marshes) that a "C" survey was warranted in 2005. Two to three clapper rails were detected within the site, which was not expected. The birds responded to taped vocalizations by calling and walking virtually the entire interior perimeter of the site. In 2006 we conducted three rounds of "A" surveys and detected 1 – 2 rails **(Table 2**; **Figure 5.b.**). The birds detected both years may have a breeding territory within the pond, or they may have walked over from the adjacent fully tidal habitat in Airport Channel. There was no indication of a change in numbers between years.

Martin Luther King, Jr. (MLK) Shoreline Marsh (site 17d; **Figure 2.d. & 2.e.**) is a heterogeneous grouping of narrow marsh strips along rip-rapped portions of the shoreline, including Oakland Coliseum channel mouths (see below), and two larger areas of marsh, one north of the mouth of Damon Slough (Damon Marsh) and one north of the mouth of East Creek. In 2005, *Spartina alterniflora* hybrids comprised approximately 41% of the cover. There are no other vegetation data available for this site. *Spartina* hybrid areas were not treated in 2005. EBRPD surveyed Damon marsh in 2005 and detected 6 – 7 rails. In 2006 we surveyed the entire stretch from the southern end of Oakland inner harbor to the northern end of San Leandro Creek, at the mouth of Elmhurst Canal, including Damon Marsh, and detected 18 – 20 rails (**Table 2**; **Figure 5.b.**). Of those rails, 14 – 18 were detected in the area surveyed by EBRPD in 2005, indicating a probable significant increase between years.

Oakland Coliseum Channels (site 17i; **Figure 2.d.**) extend from the MLK Shoreline Marsh eastward under Highway 880, next to highly urbanized industrial streets and up around the Coliseum. There are three channels, from north to south: East Creek, Damon Slough and Elmhurst Canal. Vegetation cover data are not available, but *Spartina* hybrids comprise the dominant vegetation, particularly near the channel mouths. In 2005 we conducted "C" surveys along most of the stretch of channels, focusing on areas with densest vegetation, and detected no rails. In 2006 we detected 4 – 6 clapper rails at the mouth of the channels (**Table 2**). These birds were in habitat continuous with the MLK Shoreline Marsh managed by EBRPD and could be nesting on either side of the property boundary. We show the data both together and separately for Coliseum Channels and Shoreline marshes in Table 2, and grouped the data in the graph (**Figure 5.b.**).

San Leandro Creek (site 17e; **Figure 2.e.**) is virtually continuous with Arrowhead and MLK Restoration Marsh, separated from MLK Restoration Marsh by a 12 m pedestrian trail. Much of the creek is lined with rip-rap and marsh habitat is confined to several narrow patches. The best habitat is in the area north of Hegenberger Road where there is some high marsh. In 2005, *Spartina* hybrid cover was approximately 35%, *Salicornia virginica* cover was 21%, and *Distichlis spicata*, *Grindelia stricta* and *Jaumea carnosa* were each 15 – 18%. *Spartina* hybrid areas were not treated in 2005. In this area in 2005, one clapper rail was detected during the third round of surveys, after it responded to a taped vocalization. It was less than 50 m north of Hegenberger in a clump of *Grindelia*. Many rails were heard from San Leandro Creek, in Arrowhead, at the northern end of Martin Luther King marsh, and at the mouth of Elmhurst Canal (part of the Coliseum channel complex). In 2006,

there were numerous spontaneous rail vocalizations and several visual detections along this northern stretch of San Leandro Creek. We estimated there were 4 to 5 birds, including 2 to 3 pairs (**Table 2**; **Figure 5.b.)**. These birds may be breeding in the marsh on San Leandro Creek or they may have breeding territories in MLK Restoration Marsh (where the number of rails also appears to have doubled since 2005 surveys; see above) and fly or walk over into San Leandro Creek to forage. Either way, the use of San Leandro Creek by clapper rails in 2006 appears to be higher than in 2005. South of Hegenberger, the vegetation is sparser and channel banks are gravelly (not likely to be good for clapper rail foraging activities), and the habitat is less likely to support clapper rails. In 2005 *Spartina* hybrid cover was 73% of the vegetation, and 12% of overall cover. In 2005, three "C" surveys were conducted and no clapper rails were detected. In 2006, three rounds of "A" surveys were conducted (with taped vocalizations played on the final round) and again no rails were detected.

Martin Luther King, Jr. Restoration Marsh (site 17h; **Figure 2.e.**) was opened to tidal action in 1998 (Siegel 2003) and in 2005 was approximately 55% vegetated (OEI unpubl. data). Vegetation cover in 2005 was approximately 37% *Spartina alterniflora* hybrids, 37% *Salicornia virginica*, and 21% *Salicornia europea* (annual pickleweed). *Spartina* hybrid areas were not treated in 2005. In 2005 this site was surveyed by EBRPD. In 2005 and 2006, three rounds of "A" surveys were conducted by EBRPD and OEI, respectively. In 2005, 12 – 16 rails were detected, and in 2006, 23 – 30 rails **(Table 2**; **Figure 5.b.)**. This is a near doubling of rail numbers between years. This may be due to a real change in numbers or to differences in survey techniques, but the reasons are unknown.

4.1.2 San Leandro / Hayward Shoreline

The San Leandro/Hayward shoreline includes a cluster of large, relatively recent restoration sites at Roberts Landing, plus the mouth of San Lorenzo Creek (sites 20c – 20l, in the City of San Leandro and northern San Lorenzo), Oro Loma restoration marsh (San Lorenzo; sites 07a & 07b), Cogswell marsh (20m – 20o; also a restoration site), and several creek mouths (Hayward and Johnson's Landing, sites 20k & 20l, in the City of Hayward;**Table 2**; **Table 3**).

Bunker Marsh (20g; **Figure 2.f.**), like other marshes at Roberts Landing, was restored in 1995, but it is fully tidal and is more vegetated than the other marshes (Siegel 2003, SFEI 1998): in 2005 it was 76 – 86% vegetated (OEI unpubl. data). This site is highly invaded with hybrid *Spartina*: 51% of vegetation or 38% of the entire site in 2005. Other vegetation measured in 2005 included 46% *Salicornia virginica* and 6% *Grindelia stricta*. *Spartina* hybrid areas were not treated in 2005. Three rounds of "A" surveys were conducted in both 2005 and 2006. In 2005, 8 – 10 rails were detected and in 2006, 7 - 12 were detected (**Table 2**; **Figure 5.c.**). There was no evidence of a change between years.

Citation Marsh (site 20d; **Figure 2.f.**) is at the northern end of Roberts Landing. In 1999 the site was restored as mitigation for the adjacent Citation housing complex (Siegel 2003). The site receives muted tidal action (SFEI 1998). It was approximately 54 – 64% vegetated in 2005 (OEI unpubl. data). *Spartina* hybrids are relatively sparse: 6.4% of the vegetation or 11.8% of the entire site, measured in 2005; the primary plant species is *Salicornia virginica*, with smaller amounts of *Salicornia europea* and *Frankenia salina*. Three rounds of "A" surveys were conducted in 2005 and 5 - 10 clapper rails were detected. The rails appeared to be associated with high-elevation internal levees. In 2006, three rounds of "A" surveys were again conducted and 4 – 6 birds were detected (**Table 2; Figure 5.c.**). This is a decrease of almost 25%, but because there was some overlap in the estimate range, the difference was probably not statistically significant. Invasive *Spartina* was not treated at this site, or within Roberts Landing at all in 2005, so any change was due to some other unknown factor(s).

Dogbone Marsh (site 20c; **Figure 2.f.**)**,** also known as North Basin and South Basin wetlands, is at the northern end of Roberts Landing next to the Tony Lema Golf Course. The marsh has muted tidal action and water appears stagnant. It was opened to tidal action in 1991 (Siegel 2003, SFEI 1998). Hybrid *Spartina* is the dominant plant species (41% of marsh area in 2005; no other vegetation data are available). *Spartina* hybrid areas were not treated in 2005. The habitat is marginal, and no rails were previously reported, but it is continuous with North Marsh, which was known to have clapper rails, so we elected to perform one round of "C" surveys in 2005. No rails were detected. In 2006, we decided to conduct "A" surveys because we realized it was likely that rails were using the site because it was continuous with rail-occupied marshes at Roberts Landing. Three rounds were conducted and on the third round, one pair of rails responded to recorded vocalizations at the far southern end of the site (**Table 2; Figure 5.c.**). These birds may have had a breeding territory within Dogbone Marsh or may have crossed over from North Marsh. This is potentially an increase in rail use between years, however, since only one round of surveys was conducted in 2005, it's not clear that rails were truly absent at that time.

East Marsh (site 20e; **Figure 2.f.**), also known as the Roberts Landing Shoreline Marshlands Enhancement, was restored in 1995 (Siegel 2003), but is still at least partly diked. *Spartina alterniflora* hybrids comprised only 1% of the site area in 2005 (no other vegetation data are available). As mentioned above, *Spartina* hybrid areas were not treated in 2005. Three rounds of "A" surveys were conducted in 2005 and 1 – 2 clapper rails were detected. In 2006, we conducted three rounds of "A" surveys but did not cover points along the east side of the marsh that were surveyed in 2005. We again detected 1 – 2 rails (**Table 2; Figure 5.c.**). These birds were associated with the channel system in the southwestern portion of the site. There was no evidence of a change between years.

North Marsh (site 20f; **Figure 2.f.**), also known as the Roberts Landing Shoreline Marshlands Enhancement, was also opened to tidal action in 1995 (Siegel 2003), but tides are still muted (SFEI 1998). In 2005 it was 52 – 61% vegetated (OEI unpubl. data). This site is more highly invaded than Citation or East marshes, with 12% *Spartina alterniflora* hybrids in 2005 (of total vegetation). *Salicornia virginica* and *Salicornia europea* were dominant. *Spartina* hybrid areas were not treated in 2005. Three rounds of "A" surveys were conducted and 7 - 12 clapper rails were detected. In 2006, 15 – 25 rails were detected, double the numbers found the previous year (**Table 2; Figure 5.c.**). The potential cause of this increase is unknown.

San Lorenzo Creek (site 20h; **Figure 2.f.**) is continuous with the Roberts Landing sites. The creek mouth is highly invaded (invasive *Spartina* was 77% of the vegetation, or 62% of the site in 2005). The vegetation along the creek narrows east of a pedestrian bridge; in this area the vegetation was approximately 10% invasive *Spartina* (or 4% of the site), with *Salicornia virginica* dominant. *Spartina* hybrid areas were not treated in 2005. In 2005 three rounds of "A" surveys were conducted at the mouth and along the Creek, and 5 – 10 clapper rails were detected. In 2006, three rounds of surveys at these same points resulted in detections of 7 – 10 rails, a virtually identical number (**Table 2**; **Figure 5.c.**). Most of the birds detected were in the same general area in both years, with most birds found at the creek mouth.

Bockmann Channel (site 20i; **Figure 2.g.**) is continuous with San Lorenzo Creek to the north and Oro Loma Restoration Marsh to the south. The vegetated portion of the channel is less than 200 m long, and is comprised primarily of *Spartina* hybrids (visual estimate; no other vegetation data are available). *Spartina* hybrid areas were treated in 2005. Two rounds of "C" surveys were completed in 2005 and three rounds of "A" surveys in 2006 (with taped recordings on the last visit). No clapper rails were detected either year (**Table 2**; **Figure 5.c.**).

Oro Loma Marsh (sites 07a & 07b; **Figure 2.g.**) is a relatively new restoration site managed by EBPRD and was opened to tidal action in 2000. There are two distinct areas with separate channel systems. Oro Loma East (07a) is less invaded by *Spartina alterniflora* hybrids than Oro Loma West (07b), and it is also less vegetated: *Spartina* hybrid cover relative to all vegetation in Oro Loma East was 6% in 2005 (the site was 41-54% vegetated in 2005) while Oro Loma West was 79.1% (the site is 28 – 39% vegetated; OEI unpubl data). Other plant species at both sites were predominantly *Salicornia virginica*, *Salicornia europea*, *Jaumea carnosa* and *Frankenia salina*. All invasive *Spartina* at this site was treated in fall 2005, and efficacy was apparently high, approaching 90% (ISP preliminary estimates). The number of birds detected by EBRPD in Oro Loma West in 2005 (14 – 22 birds; three rounds "A" surveys) was similar to the number detected in 2006 (12 – 24 birds; three rounds "A" surveys) (**Table 2; Figure 5.d.**). The abundance index in 2006 was 0.22 – 0.44; compared to other sites in the East Bay and to the overall mean, this is relatively low. Oro Loma East contrasts sharply with Oro Loma West in that only 2 birds were detected in 2005 and none were detected in 2006. Oro Loma East was surveyed only from its western edge both years, thus the survey was not thorough. It is recommended that a thorough survey of both east and west sides be completed in 2007. Although Oro Loma was treated with good efficacy in 2005, there does not appear to be a significant change in rail distribution or numbers, except for the potential reduction in the east plot.

Hayward Landing (site 20k; **Figure 2.h.**) is one kilometer (km) south of Oro Loma Marsh, and 0.5 km north of Cogswell Marsh. Hayward Creek channel is dominated by hybrid *Spartina*, but it covered only 9% of the site in 2005 (no other vegetation data are available). *Spartina* hybrid areas were treated with high efficacy in 2005. Two rounds of "C" surveys were conducted in 2005, and rails were not detected. In 2006, we conducted three rounds of "A" surveys and detected one rail along the Hayward channel, and 3 – 4 rails in a muted tidal pickleweed marsh immediately to the south, **Triangle marsh**, which was not previously surveyed (**Table 2**; **Figure 5.d.**). This appears to be a significant increase from 2005 numbers.

Johnson's Landing (site 20l; **Figure 2.h.**) is at the southern end of Cogswell Marsh. Invasive *Spartina* covered 12% of the site in 2005 (no other vegetation data are available). *Spartina* hybrid areas were treated in 2005. In 2005 one round of "C" surveys was conducted but no rails were detected. In 2006, three rounds of "A" surveys were conducted (with broadcast vocalizations on the final round) and no rails were detected (**Table 2**; **Figure 5.d.**). However, detections in the site during the winter during previous years (H. Spautz, pers.obs.) and the site's proximity to Cogswell Marsh indicate that rails are likely to be present, if only foraging.

Cogswell Marsh (sites 20m – 20o; **Figure 2.h.**) lies north of the Hayward- San Mateo Bridge and is part of a mosaic of wetlands managed by EBRPD and the City of Hayward. Cogswell was opened to tidal action in 1980 (Siegel 2003). Cogswell A (north-western segment) was 81 – 93% vegetated in 2005, while Cogswell B (eastern segment) was 70 – 80% vegetated (OEI unpubl data). No data are available for Cogswell C, but it appears to be similar to A and B. In 2005, Cogswell A vegetation included approximately 34% *Spartina alterniflora* hybrids and approximately 76% *Salicornia virginica*. Cogswell B vegetation included 57% *Spartina alterniflora* hybrids and 62% *Salicornia virginica*. In fall 2005, invasive *Spartina* was treated in the southern portion of segment B, and a few clones around the central breach area. Efficacy appears to have been high. EBRPD conducted three rounds of "A" surveys in 2005 and detected two rails in Cogswell A, 27 – 28 rails in Cogswell B, and 11 – 13 rails in Cogswell C. These numbers are preliminary, however, and have not gone through the ISP's standard interpretation process. In 2006 we detected 25 – 26 rails in Cogswell A, 28 – 38 rails in Cogswell B, and 13 – 20 rails in Cogswell C (**Table 2; Figure 5.d.**). The number of rails was significantly higher in all areas, particularly in Cogswell A, with a potential change from two birds in 2005 to 25 – 26 birds in 2006. However, the data interpretation methods differed

among years, so the differences may not indicate a real increase in bird numbers. Cogswell exhibits the highest concentration of rails in the East Bay south of San Leandro Bay, with an abundance index (based on 2006 data) of 0.65 – 1.9 birds/ha, while the remaining sites have a mean of 0.55 – 0.72 birds/ha (mean: 0.26; **Table 3**).

4.1.3 Other East Bay Sites

Newark Slough (Site 05c; **Figure 2.i.**) is located in the City of Newark within the Don Edwards San Francisco Bay National Wildlife Refuge (NWR). *Spartina alterniflora* hybrids comprised approximately 0.3% of the cover in 2005; no hybrids were counted within sample plots. The dominant plant species cover in 2005 was: 64% *Salicornia virginica*, 15% *Distichlis spicata*, 13% *Grindelia stricta*, and approximately 2% *Spartina foliosa* (native California cordgrass). *Spartina* hybrid areas were treated in 2005. In 2005, PRBO (H. Spautz was contracted by PRBO) conducted three rounds of "A" surveys and detected 2 – 4 rails In 2006 we detected 5 – 10 rails, an apparent increase of more than 100% (**Table 4**; **Figure 5.d**). The reason for this increase in rails is unknown, but it is in parallel with the increases in the region. Invasive *Spartina* has been regularly treated at this site, but the cover is very low and the affects of treatment on rail habitat value are assumed to be low.

Emeryville Crescent West (Site 06b; **Figure 2.j.**) is located just north of the Bay Bridge toll plaza and is managed by EBRPD. Here, also, *Spartina* hybrid cover was low in 2005: < 1%. Dominants were *Salicornia virginica* (78%), *Distichlis spicata* (15%) and *Spartina foliosa* (10%). *Spartina* hybrid areas were treated in 2005. The eastern portion of the site was not surveyed for clapper rails. EBPRD conducted three rounds of "A" surveys in 2005 and detected two rails adjacent to the toll plaza. In 2006 we conducted three rounds of surveys and detected 6 – 10 rails (**Table 2**). Because it is not clear how many points EBPRD surveyed and what area they covered, we don't know if this increase in numbers between years is real. We believe they surveyed only one point near the toll plaza, and if so, their area of coverage was much smaller than the 2006 survey.

4.1.4 West Bay

West Bay marshes include several large marshes within the NWR: Greco Island North (site 02f); Outer Bair B2 North and South (sites 02c & 02d), and West Pt Slough (sites 02e & 02f); plus two smaller, more isolated marshes to the north: Seal Slough (site 19p) and Sanchez Marsh (site 19k; **Figure 1**; **Table 2**).

Rail abundance indices at these sites tended to be lower in 2006 than the regional mean: 0.30 – 0.49 rails per hectare vs. 0.5 – 0.75 overall. Overall numbers were significantly higher in 2006 than in 2005, when the abundance indices were 0.12 – 0.21 (**Table 3**).

Outer Bair Island – B2 North (Site 02c; **Figure 2.k.**) is at the northeastern end of Bair Island. Overall *Spartina* hybrid cover was 13% in 2005. Invasive *Spartina* was treated in the Bair-Greco complex in fall 2005, but the area treated was relatively small and efficacy was relatively high. In 2005, PRBO conducted three rounds of "A" surveys at 10 points distributed throughout the marsh and detected 11 - 18 birds. In 2005, we conducted three rounds of "A" surveys entirely from a levee dividing B2 North from B2 South (focusing primarily on B2 South), and detected 11 - 18 rails. However, these rails were primarily within the area closest to the aforementioned levee, a much smaller area. The abundance index in 2005 was 0.13 – 0.21 rails per hectare, while in 2006 it was 0.67 – 1.10 rails per hectare (**Table 2**; **Figure 5.e**.). This amounts to greater than 400% increase. The potential reasons for this increase, if real, are unknown.

Outer Bair Island – B2 South (Site 02d; **Figure 2.k.**) is just to the southeast of B2 North. There are two segments: a fully tidal area in the north, and an area that receives muted tidal flow through a relatively recent breach in the south. The more fully tidal segment of B2 South is the most highly

invaded area in the Greco-Bair complex: *Spartina alterniflora* hybrids amounted to approximately 35% of the total area or 28% of the vegetation in 2005. The dominant plant species is *Salicornia virginica*. As mentioned above, *Spartina* hybrid areas were treated in 2005. In the muted tidal marsh section, hybrids amounted to less than 1% of the overall cover. PRBO conducted three rounds of "A" surveys in this area in 2005; they detected no rails in the fully tidal section, and 2 – 4 rails in the muted tidal marsh. In 2006, we detected 6 – 10 rails in the fully tidal section and 3 – 6 rails in the muted tidal marsh section (**Table 2**; **Figure 5.e.**). In the muted tidal section the numbers are very similar across years. However, in the fully tidal section there was an apparent increase in birds between years. The potential reasons for this increase are unknown.

Greco Island North (Site 02f; **Figure 2.l.**) is a large area of primarily native marsh, separated by West Point Slough from Cargill salt processing ponds to the south. In 2005, *Spartina alterniflora* hybrid cover was 2%, and *Salicornia virginica* was dominant; there was approximately 10% *Spartina foliosa* cover. *Spartina* hybrid areas were treated in 2005. PRBO conducted three rounds of "A" surveys at 16 points in 2005, and 20 – 33 rails were detected. In 2006, we surveyed eight points, covering a smaller area, and detected 14 – 22 rails (**Table 2**; **Figure 5.e.**). The abundance index was virtually the same across years, and there was no evidence of change.

West Point Slough NW and **SE** (Sites 02e & 02g; **Figure 2.l.**) is a very wide slough, ranging from 40 to 150 m wide. Greco Island lies to the north, and on the southern edge of the slough is a relatively narrow strip of marsh that developed on the outboard edge of a levee enclosing salt evaporation ponds. West Point Slough marsh is the name of the narrow strip on the southern edge of the slough. *Spartina alterniflora* hybrids comprised approximately 8% of the cover in this marsh in 2005. *Spartina* hybrid areas were treated in 2005. We are not aware of formal clapper rail call count surveys conducted at this site prior to our 2006 surveys. We conducted three rounds of protocol "A" surveys at eight points spread along the length of the slough, most of which were separated by over 200 m. We detected no rails.

Sanchez Marsh (Site 19k; **Figure 2.m.**) is at the western end of Burlingame Lagoon, in the City of Burlingame. The marsh apparently receives slightly muted tidal action. This site is not highly invaded by *Spartina alterniflora* hybrids (4.6% of the area in 2005). It is the only site in the South Bay with the non-native *Spartina densiflora* (< 1%), which has primarily invaded the Corte Madera Creek area in Marin County. Other dominant plant species in 2005 were: 25% *Salicornia virginica*, 18% *Distichlis spicata*, and 25% *Jaumea carnosa*. This marsh appears to be highly disturbed. Highway 101 lies to the south, a recreation area to the north, and the marsh edges are dominated by invasive plants. During point count surveys conducted in 1999 – 2001, no native marsh birds were detected at all, even the Alameda song sparrow, *Melospiza melodia pusillula*, which is typically ubiquitous in pickleweed marshes in the south bay (PRBO unpubl. Data) ARA conducted one round of "C" surveys in 2005 and detected no rails, but suspected they might be present. We conducted three rounds of "A" surveys in 2006, with pre-recorded vocalizations on the final round, and detected no rails (**Table 2**; **Figure 5.e**.)

Seal Slough Marsh (Site 19p; **Figure 2.n**), is an isolated marsh at the mouth of Seal Slough in Foster City. It is highly invaded, with 71% *Spartina alterniflora* hybrid cover and approximately 21% *Salicornia virginica* cover in 2005. ARA surveyed the site once from three points in 2005 and detected 3 – 6 rails. In 2006 we conducted 3 rounds of "A" surveys at six points and detected 18 – 28 rails (**Table 2**; **Figure 5.e.**). Because a smaller area was surveyed in 2005 and it was only surveyed once, we cannot say for sure if the higher abundance index we calculated for 2006 indicates a real increase in rail numbers.

4.2 CALIFORNIA CLAPPER RAIL HABITAT ASSESSMENT SURVEY RESULTS

4.2.1 San Francisco International Airport

On February 16, 2006, we conducted a habitat assessment survey (protocol "F" survey) to evaluate the potential for California clapper rail habitat provided by the marsh fragments bordering the San Francisco airport (SFO; ISP site 19h). Each fragment was labeled with a section letter (A through G, **Figure 3.a.**). The entire length of the approximate 10 km of shoreline along SFO was visited. Sections A through C required an escort in an airport vehicle, while sections D through G were accessible by public road. Specific evaluations and recommendations for further surveys for clapper rails for each section follow below.

SFO, Section G (Figure 3.b.): Section G is a medium-sized marsh (about 2.5 ha). It is dominated by invasive *Spartina* in the lower marsh and by ice plant in the upper marsh. The patch contains no apparent channels and is 60 m across at its widest. On its own, section G might be classified as marginal to poor habitat. However, the Sam Trans Peninsula Marsh, with a known high density population of clapper rails, is less than 200 m away, and this increases the likelihood that clapper rails could use section G. Thus, a follow-up "C" call response survey is recommended to determine whether the California clapper rail is present in this section of the SFO marshes before considering early invasive *Spartina* treatment. We did not have time to complete clapper rail surveys at this site.

SFO, Sections E & F (Figure 3.c.): Sections E and F are both small marsh fragments (0.11 ha and 0.15 ha, respectively). The substrate is riprap and the vegetation is composed of non-contiguous *Spartina* clones. Neither patch has any channels. The nearest marsh with a known clapper rail population is less than 1 km away. The combination of poor habitat and moderate isolation make it highly unlikely that clapper rail would use these isolated *Spartina* patches. No further surveys are recommended.

SFO, Section D (Figure 3.d.): Section D is a linear marsh, about 1.3 ha in size. It is dominated by invasive hybrid *Spartina*, with a strip of *Salicornia virginica* and ice plant in the upper marsh zone. Section D is very isolated: the nearest marsh patch is about 900 m away and the nearest marsh with a known clapper rail population is greater than 1.5 km away. The combination of poor habitat and moderate isolation make it unlikely that this section of SFO would be used by clapper rail and no further surveys are recommended.

SFO, Sections A & B (Figure 3.e.): Both sections A & B are small fragments (about 0.25 ha each) of marsh vegetation colonizing riprap, composed nearly entirely of invasive hybrid *Spartina*. The two marsh patches are bordered by the bay edge on one side and the airfield on the other, and are no wider than 20 meters. Neither patch has any channels. The nearest marsh with a known clapper rail population is the Sam Trans Peninsula, about 2.5 km away. The poor habitat and high level of isolation make it highly unlikely that clapper rail would use these patches. No further surveys are recommended.

SFO, Section C (Figure 3.f.): Section C is a medium-sized, linear marsh of about 9.9 ha adjacent to the southern edge of the SFO airfield. The marsh is mostly at low elevation, dominated by *Spartina foliosa* with discrete patches of the invasive hybrid. In February, when the "F" survey was conducted, all *Spartina* plants were short and sparse and there was only a small, exposed strip of upper marsh present, providing little apparent cover for clapper rails. The marsh has no obvious

channels and, at its widest, is no greater than 100 meters across. The nearest marsh with a known clapper rail population is almost 3 km away. Section C is marginal habitat, and could warrant a subsequent visit in 2007 if the *Spartina* hybrid invasion progresses and the marsh grows in size and vertical structure.

4.2.2 Candlestick Cove, Yosemite Slough and Hunters Point Naval Shipyard

The Candlestick area is highly urbanized, and tidal marsh habitat is found only in tiny patches with high levels of invasive *Spartina* hybrids (**Figure 4.a.**). California clapper rails have not been previously documented in this area, but because *Spartina alterniflora* hybrids have increased the marsh area and added structure not previously present, we considered it important to formally assess the habitat suitability before making plans to treat the *Spartina* during the clapper rail breeding season. The site is more than 4 km from the nearest potential clapper rail habitat in Oyster Cove, to the south, and over 6 km from the nearest documented breeding populations at San Bruno marsh and Colma Creek. Due to the poor quality of the habitat patches examined, we don't believe that clapper rails are likely to set up breeding territories in the Candlestick Cove area. We didn't think it necessary to conduct clapper rail call count surveys. We believe it will be safe to treat the entire during the clapper rail breeding season.

The tidal marsh on the edge of the **Hunters Point Naval Shipyard** (Site 12d; **Figure 4.b.**) was examined through binoculars from Candlestick Cove (see below). It is approximately 0.40 hectares. It appears to consist entirely of *Spartina alterniflora* hybrids and is so narrow that it is highly unlikely to support clapper rails. Because it looked like such poor habitat we didn't attempt to gain access to the site to examine it more closely.

Yosemite Slough (Site 12e; **Figure 4.c.**) is a narrow, sparse marsh bordering a disturbed riprapped shoreline. It is approximately 1.33 ha, the largest of the marshes in this area. *Spartina alterniflora* hybrids comprise approximately 75% of the vegetation and there are small amounts of *Salicornia virginica*, *Distichlis spicata*, *Grindelia stricta* and *Jaumea carnosa*. The upper marsh edge is covered with grasses, *Carproprotus edulis* (iceplant) and other non-native plants. The area is so small, isolated, and disturbed that it is highly unlikely to support clapper rails and no further surveys were determined necessary.

Marsh habitat at the **Candlestick Cove State Recreation area** (Site 12e; **Figure 4.d.**) consists of two tiny, sparse patches of vegetation, primarily *Spartina alterniflora* hybrids (73%) with small amounts of *Distichlis spicata* and *Salicornia virginica*. The total area is 0.26 ha. One of the patches has developed in riprap, while the other has a densely vegetated upland edge. Due to the small size and high level of isolation, clapper rails are highly unlikely to set up breeding territories. We believe that it is safe to treat this area during the clapper rail breeding season.

The marsh at **South Candlestick Cove** (Site 12f; **Figure 4.e.**) is best-looking marsh in the area, although it is adjacent to Highway 101 and is lined with riprap. *Spartina alterniflora* hybrids comprise approximately 50% of the vegetation (or 15% of the site), and there is significant *Salicornia virginica* and *Distichlis spicata* cover. It is approximately 0.80 ha, which is relatively small. However, the area appears to be non-tidal and the upper marsh edge is unvegetated on one side. The area is highly unlikely to support clapper rails, so we believe it is safe to treat the area during the clapper rail breeding season.

4.2.3 Hayward Shoreline Bayfront Mudflat Spartina Clones

Bayfront outlier *Spartina* clones (Site 20p) are found in clusters near San Lorenzo Creek and Hayward Landing. Because these mudflat clones are increasing in size, and developing sufficient high marsh for *Salicornia* to establish, we wanted to check to see if there was a possibility that any

of them were large enough or high elevation enough to potentially support clapper rails. We examined the entire shoreline between Cogswell and Roberts Landing in 2005 and 2006 from the shoreline footpath with binoculars. Even the largest clones are sufficiently submerged during high tides, and so buffeted by waves, that they are not appropriate for clapper rail nesting. Clapper rails were not detected calling from any of these clones during surveys at San Lorenzo Creek or Hayward Landing. However, because these clones are very close to documented clapper rail habitat, they could be used for foraging during low tides. We believe that there is such low probability that rails will use the areas for nesting that treatment during the rail breeding season is probably safe. Treatment via helicopter is the preferred method in the area, due to high rail numbers, and this method could also be used safely on the mudflat clones.

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REFERENCES

Herzog, M., L. Liu, J. Evens, N. Nur and N. Warnock. 2005. Temporal and Spatial Patterns in Population Trends of the California Clapper Rail (*Rallus longirostris obsoletus*): 2005 Progress Report. Available from PRBO Conservation Science, Petaluma, CA.

Jenness Enterprises. 2005. Distance & Azimuth Tools v 1.6.

SFEI (San Francisco Estuary Institute). 1998. Bay Area EcoAtlas 1.50 beta 4 (http:www.sfei.org).

Siegel, S. 2003. Wetland restoration and enhancement projects. Completed and planned projects in the South and Central Bay, San Francisco Estuary, California. Wetlands and Water Resources, San Rafael, CA. Available from http://www.wetlands-and-water-resources.com

Spautz, H. 2005. Alameda County California Clapper Rail Surveys for the San Francisco Estuary Invasive Spartina Project, 2005

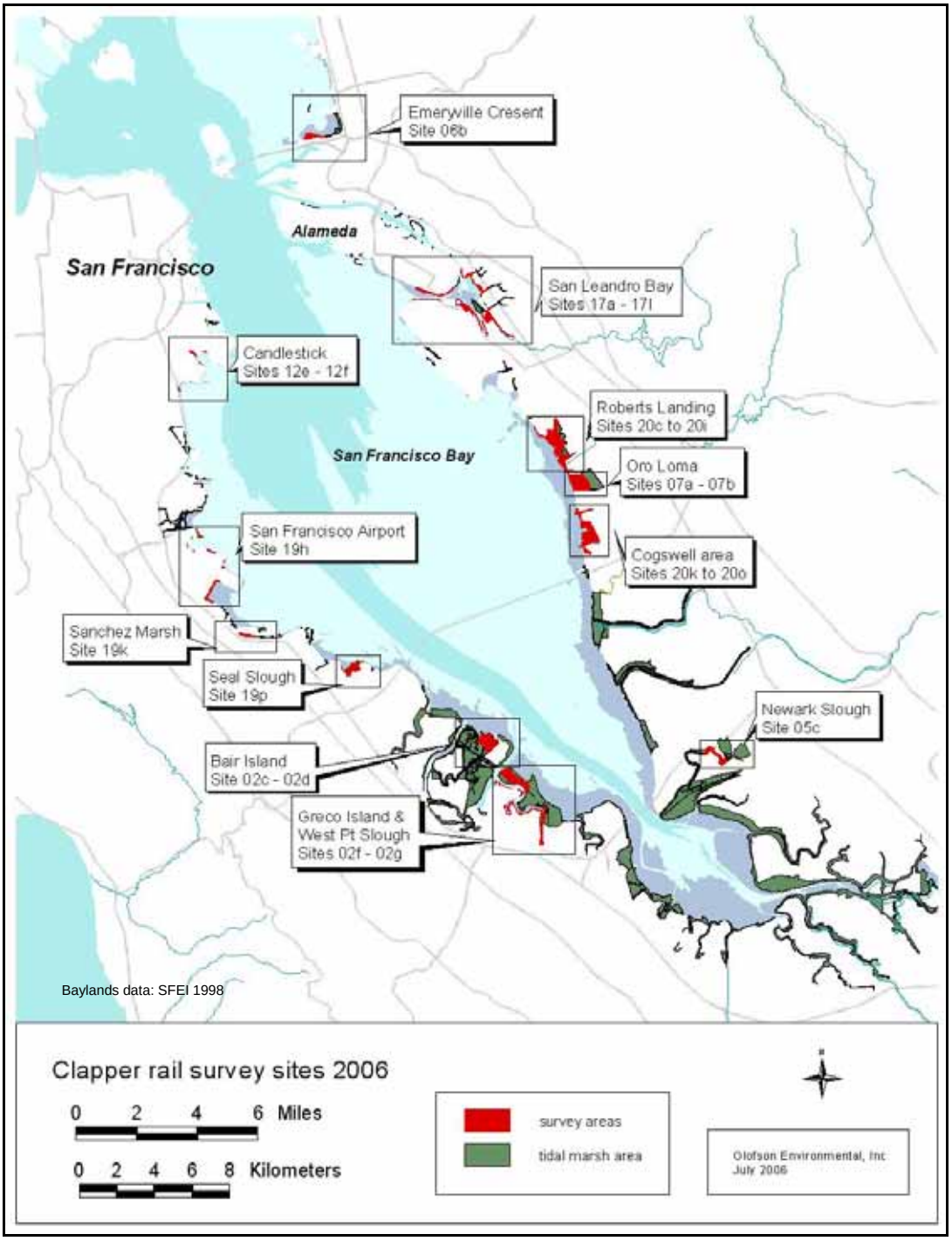

Figure 1. California clapper rail survey sites, 2006.

Invasive *Spartina* treatment sites in Central San Francisco Bay, Alameda County, where California clapper rail surveys were completed in 2006 by Olofson Environmental, Inc., staff. Background Baylands data sources: SFEI's EcoAtlas (1998) and Invasive *Spartina* Project.

Figure 2. California clapper rail survey stations and locations of individuals detected.

We visited each site at least three times, surveying the marsh from each survey station shown. We mapped the locations of birds detected during each survey round (see text for field and GIS methods). The area surveyed included the entire marsh area, except where survey area boundaries are explicitly shown including only a portion of the habitat (black outlines). Background aerial photography: USGS (2004) and Invasive *Spartina* Project. Baylands data: SFEI (1998; marsh polygons south of Calaveras Point only, and water) and Invasive *Spartina* Project (all other marsh polygons).

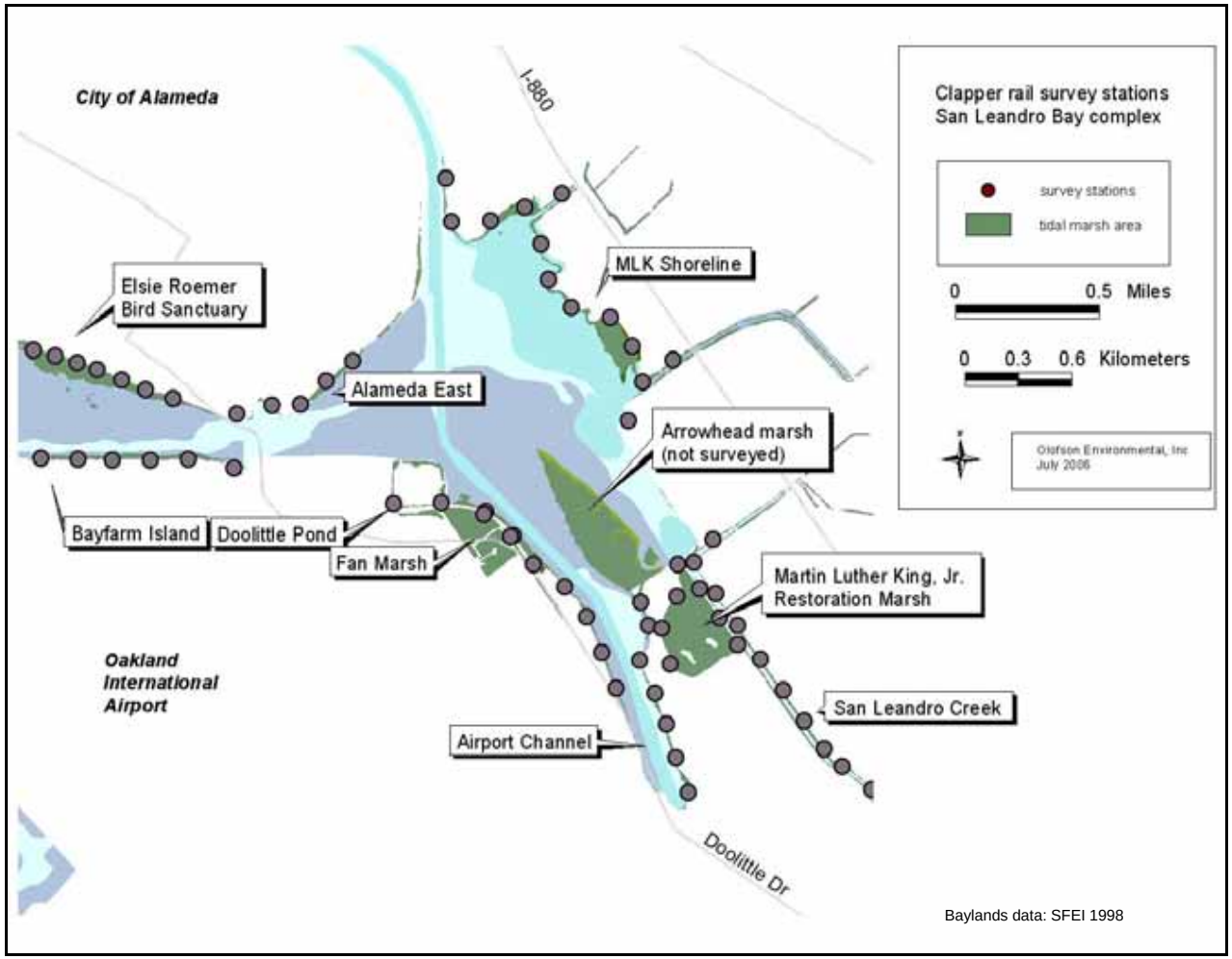

Figure 2.a. San Leandro Bay sites.

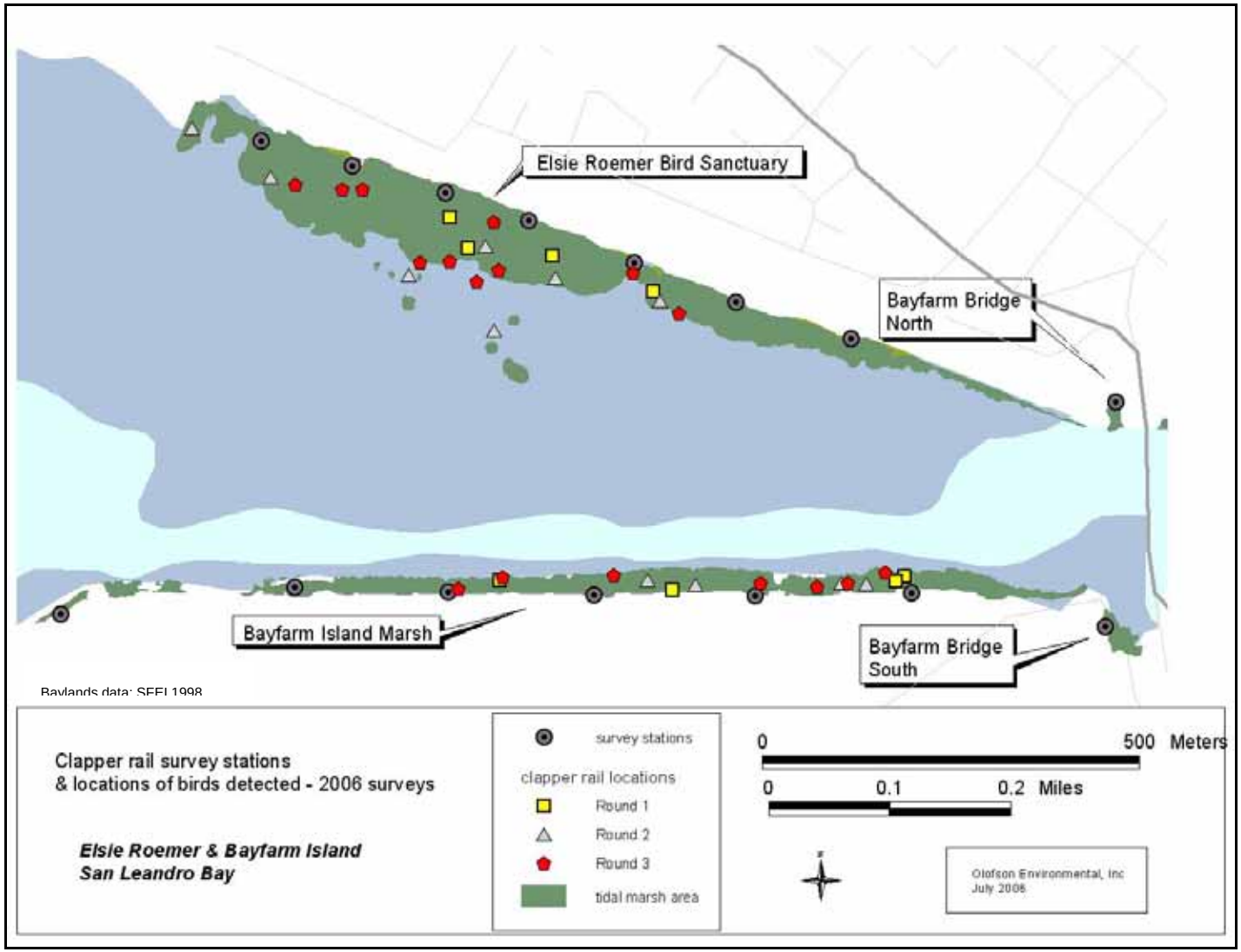

Figure 2.b. Elsie Roemer and Bayfarm Island marshes.

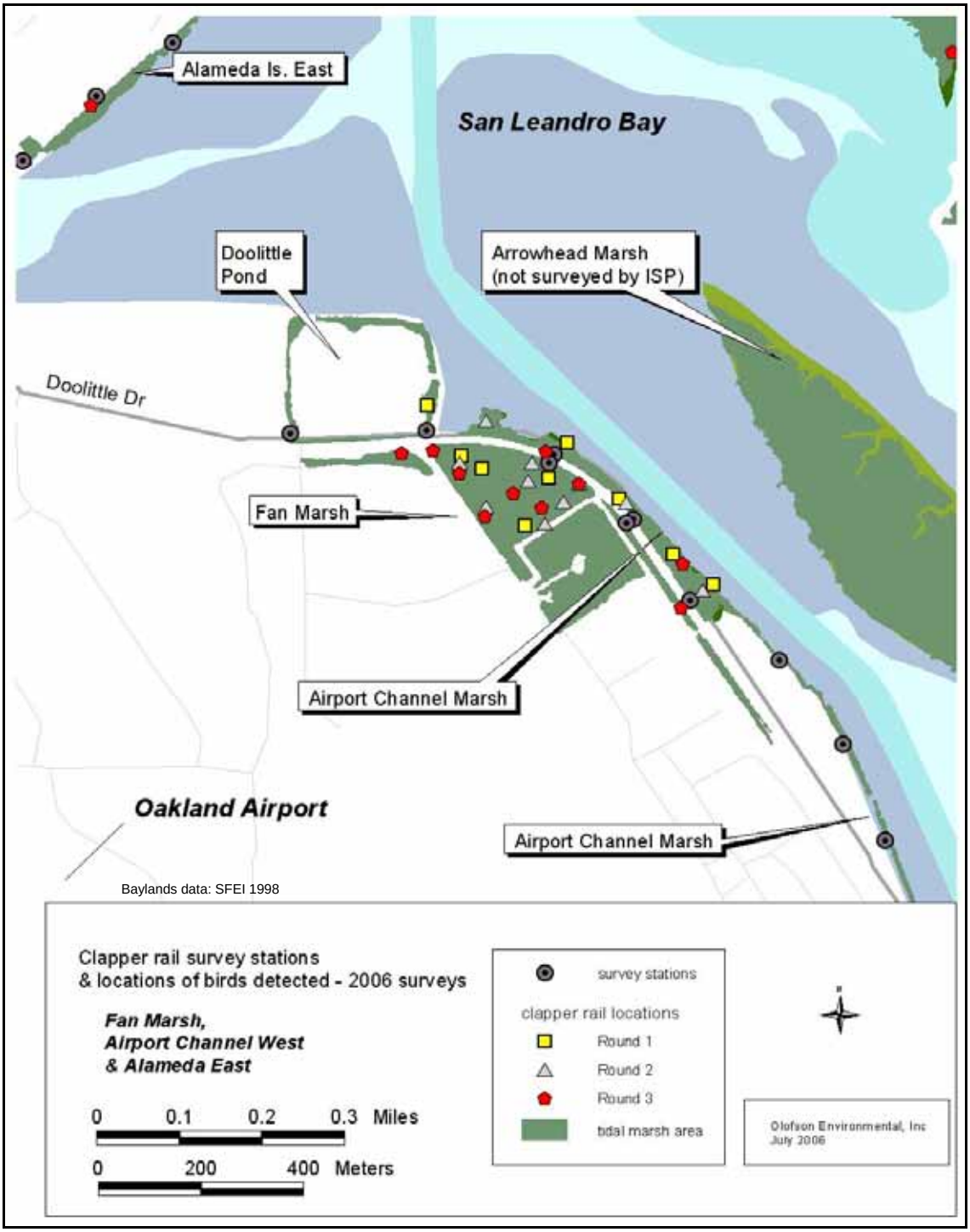

Figure 2.c. Alameda Island East, Fan Marsh, Doolittle Pond & Airport Channel

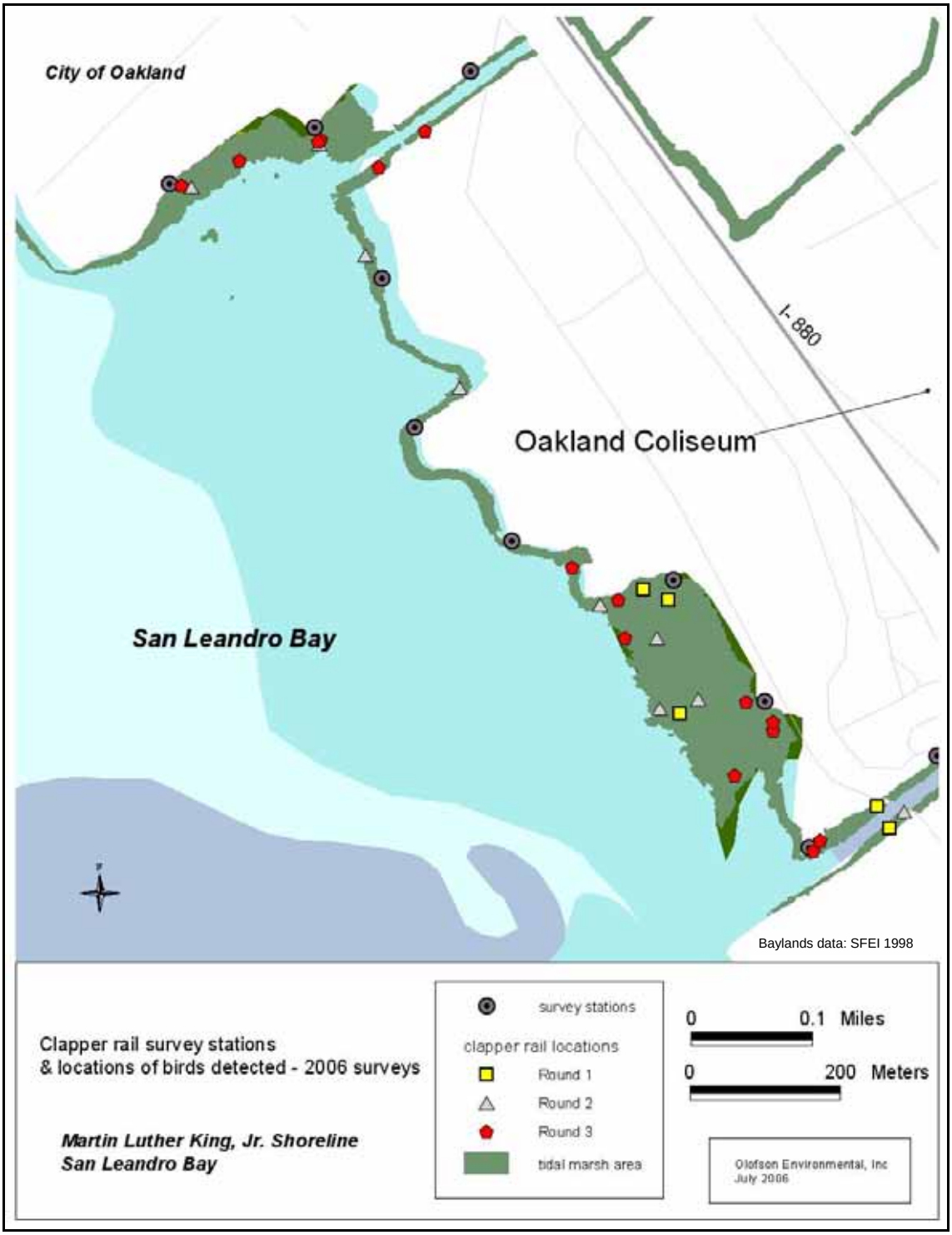

Figure 2.d. Martin Luther King, Jr. Shoreline area.

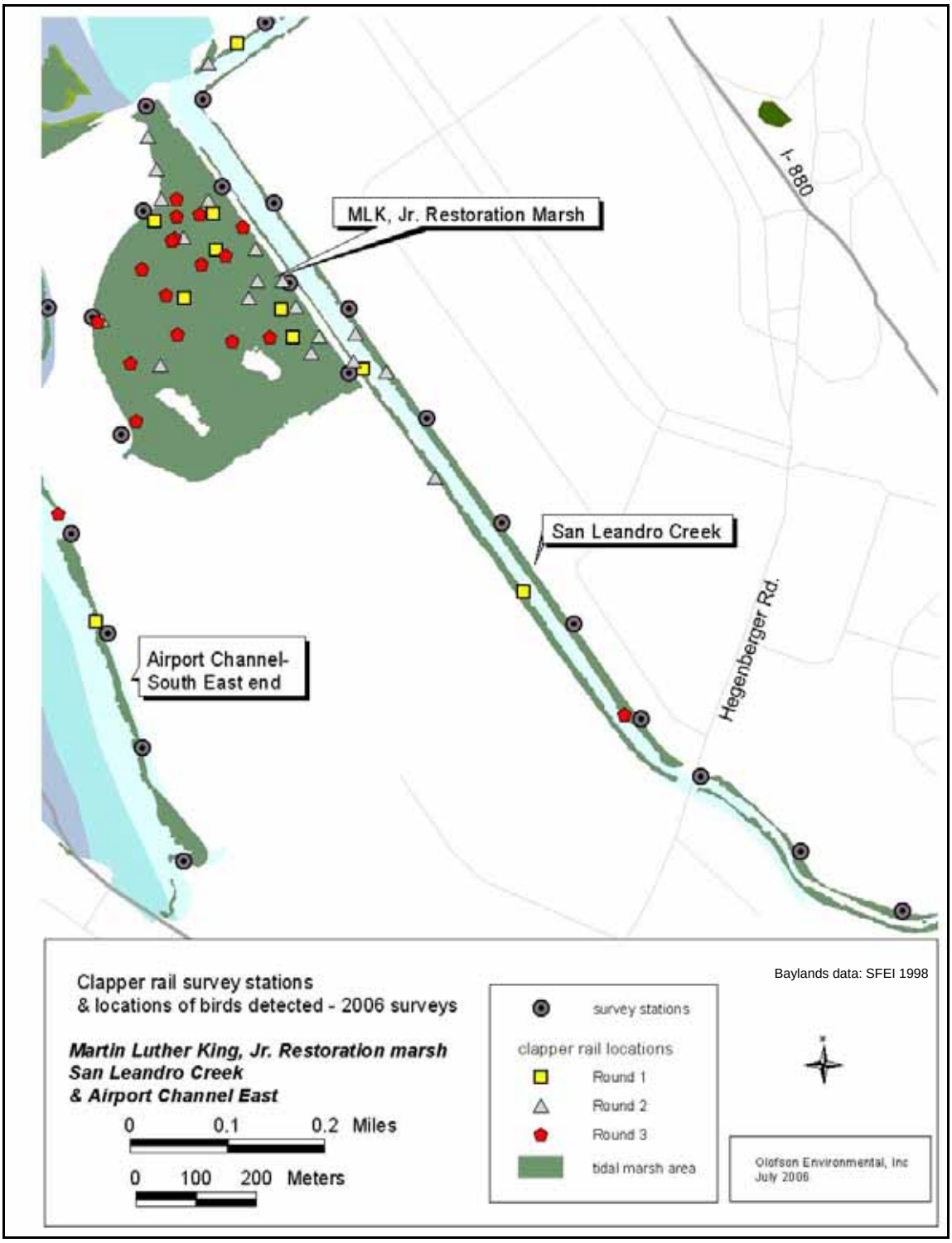

Figure 2.e. Martin Luther King, Jr. Restoration marsh, San Leandro Creek & Airport Channel marshes.

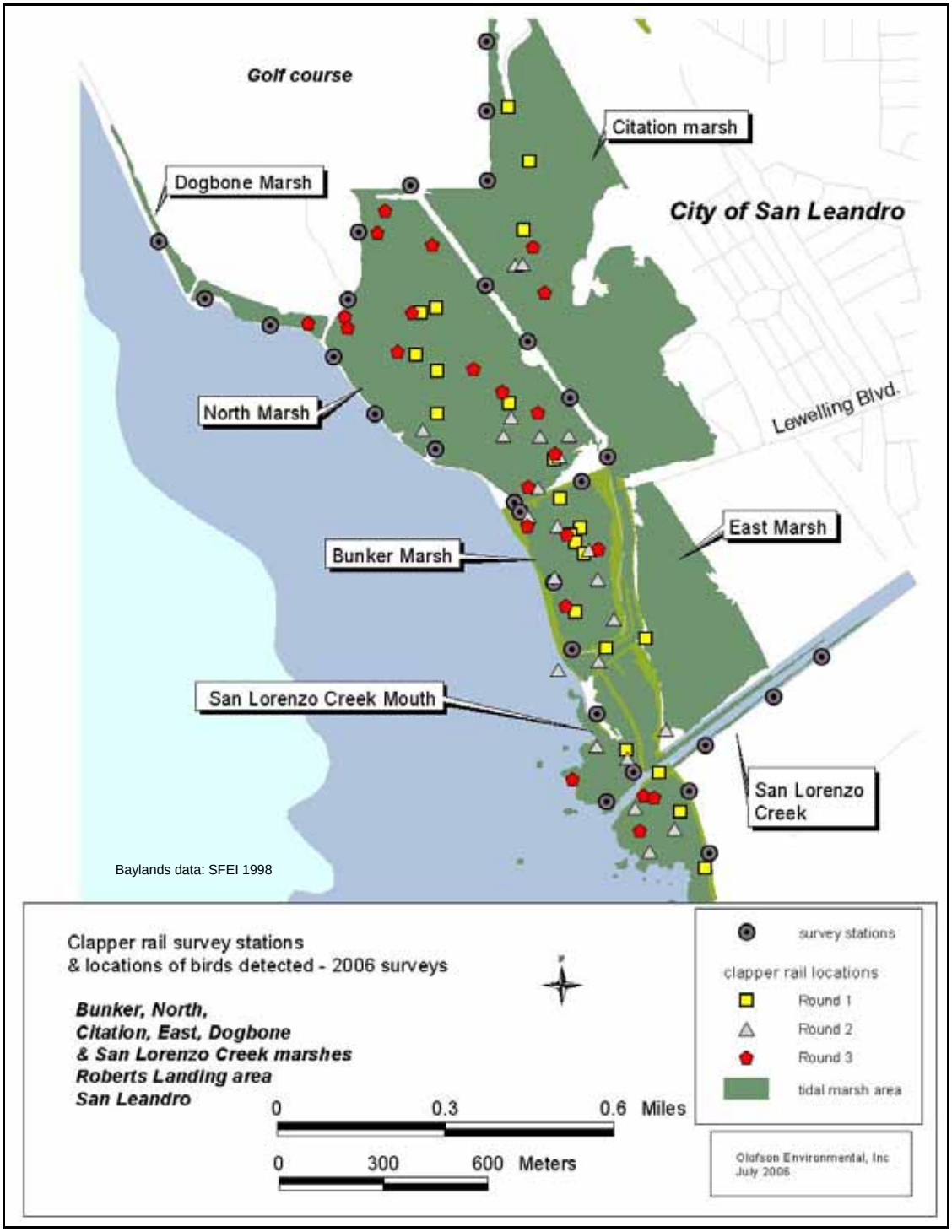

Figure 2.f. Roberts Landing area marshes.

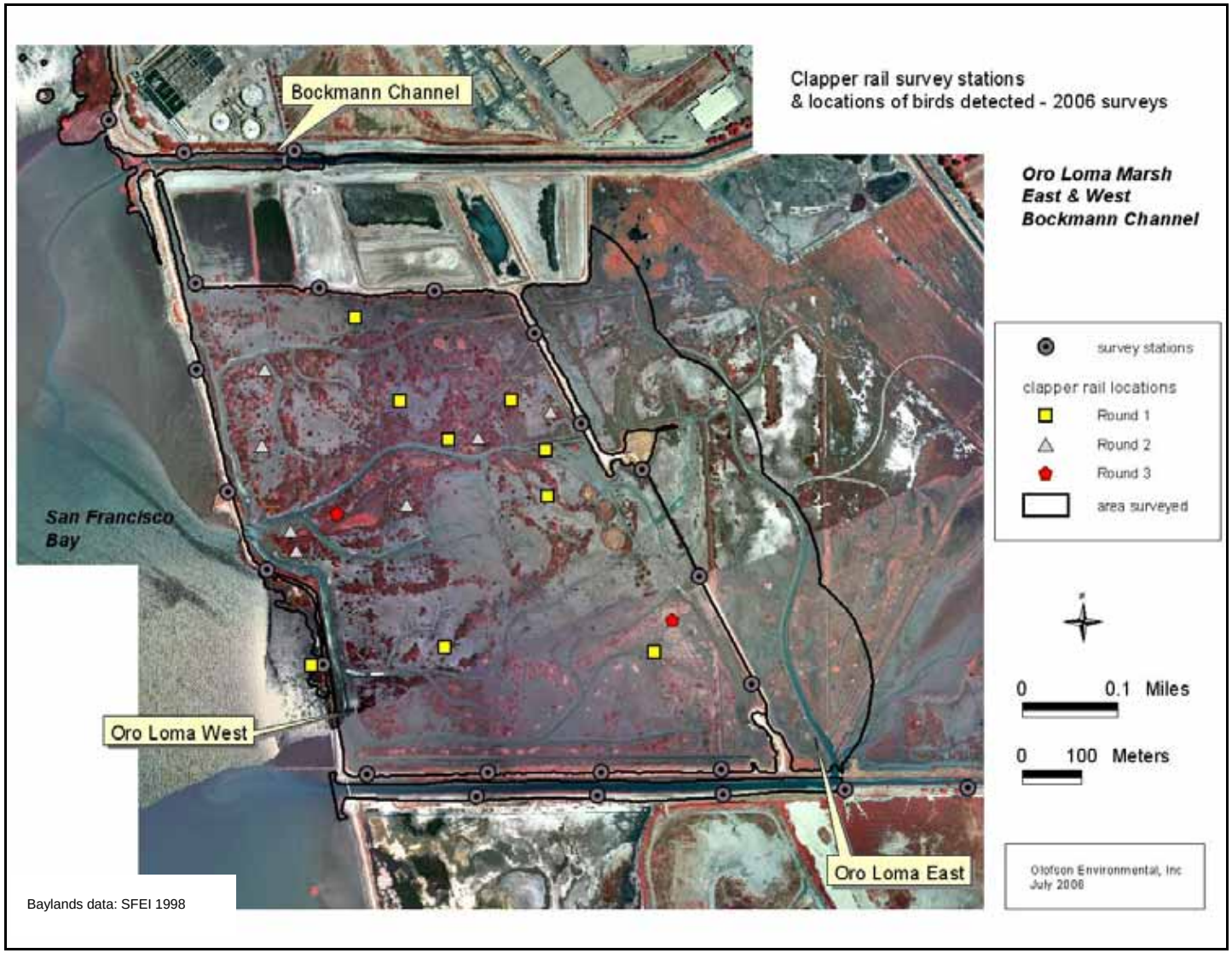

Figure 2.g. Oro Loma marsh

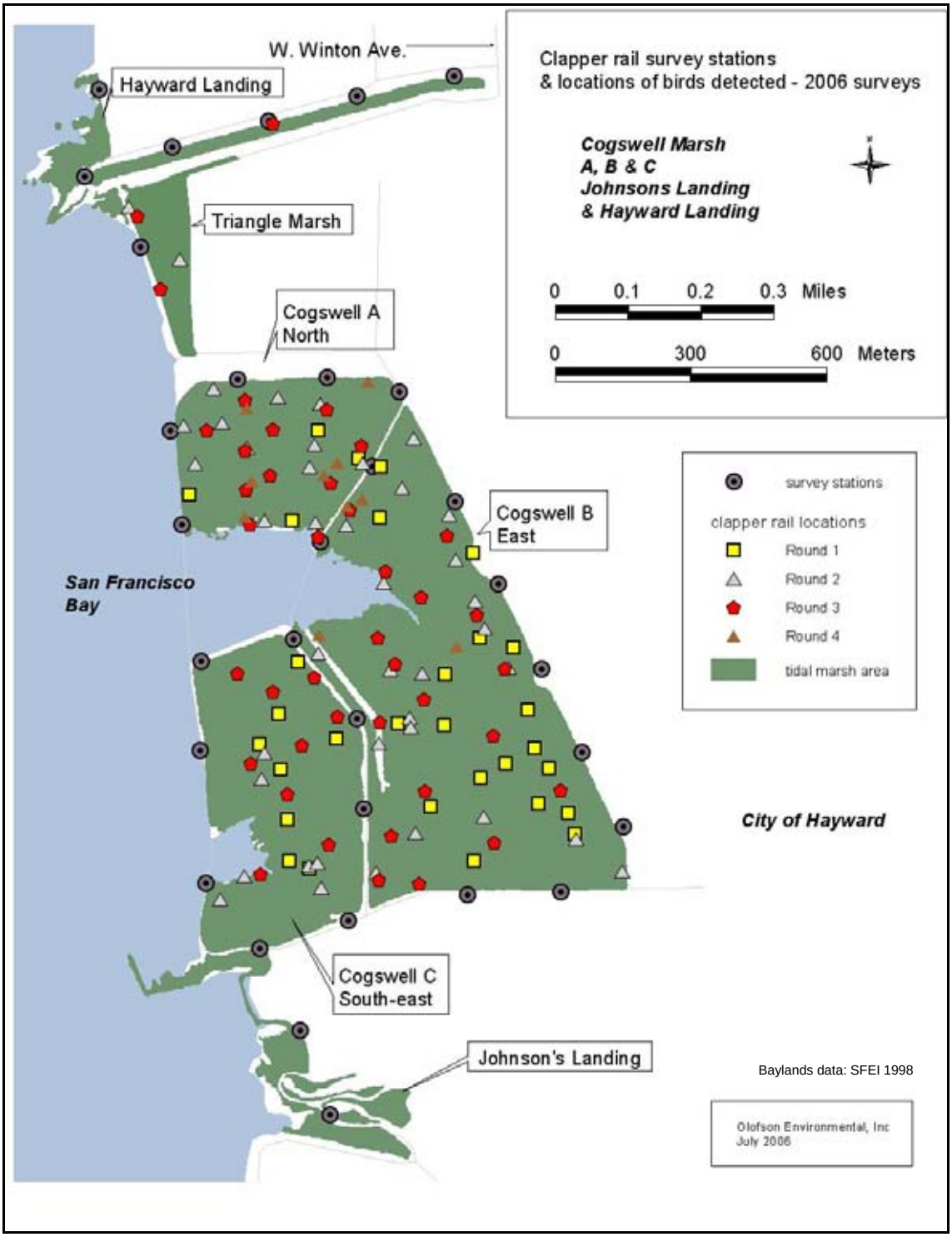

Figure 2.h. Cogswell, Johnson's Landing & Hayward Landing marshes

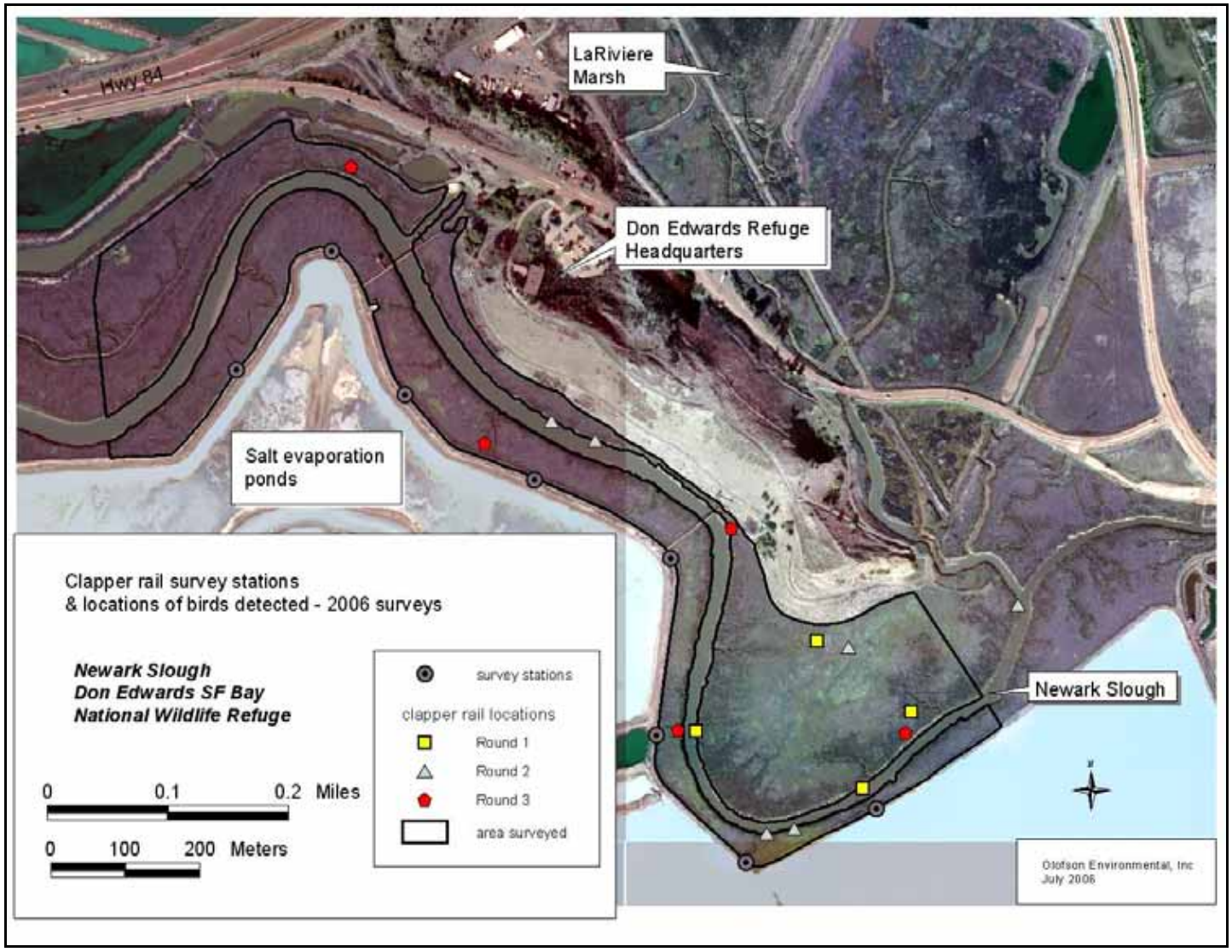

Figure 2.i. Newark Slough

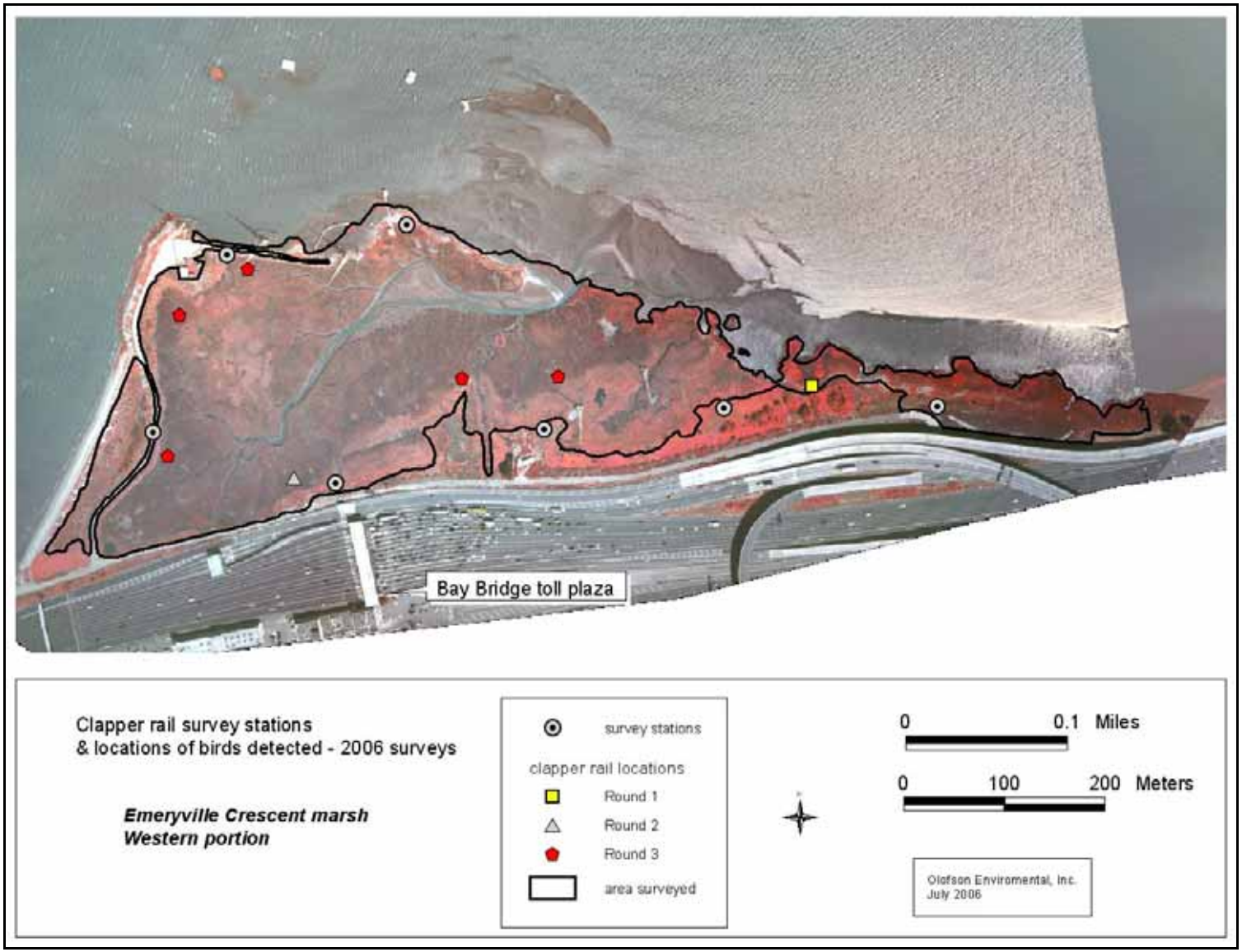

Figure 2.j. Emeryville Crescent West

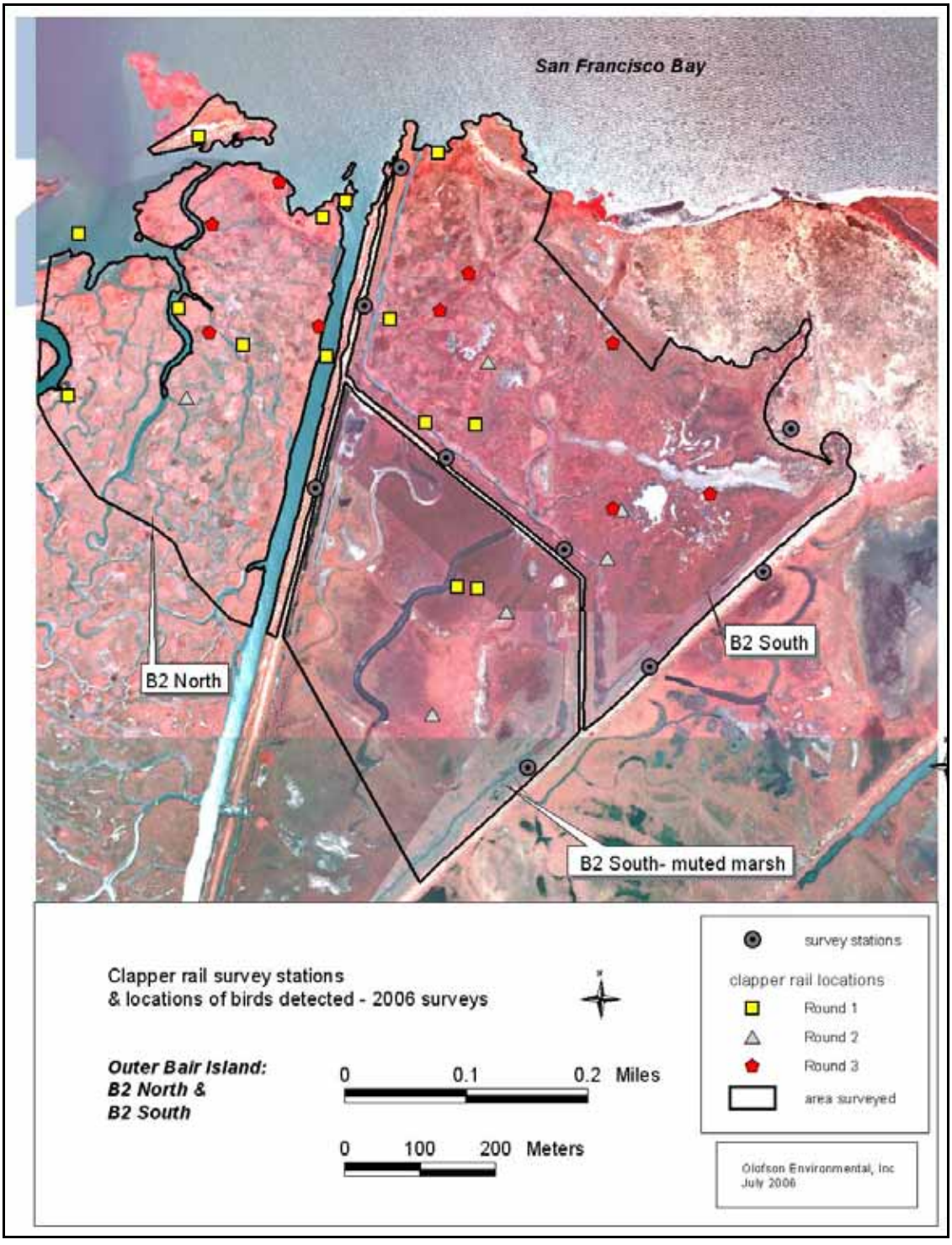

Figure 2.k. Outer Bair Island: B2 North and B2 South

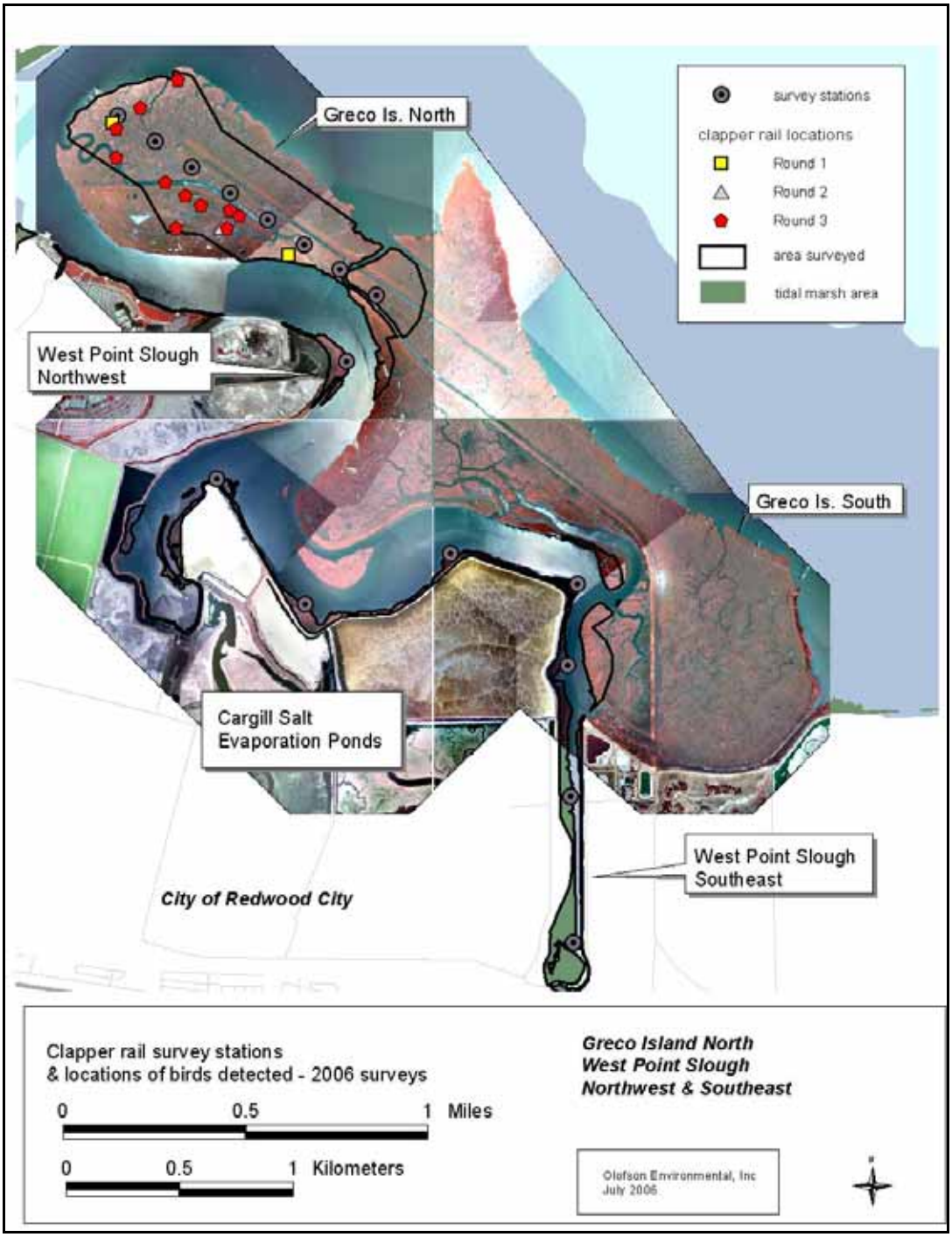

Figure 2.l. Greco Island & West Point Slough marshes

Figure 2.m. Sanchez marsh

Photo source: USGS.

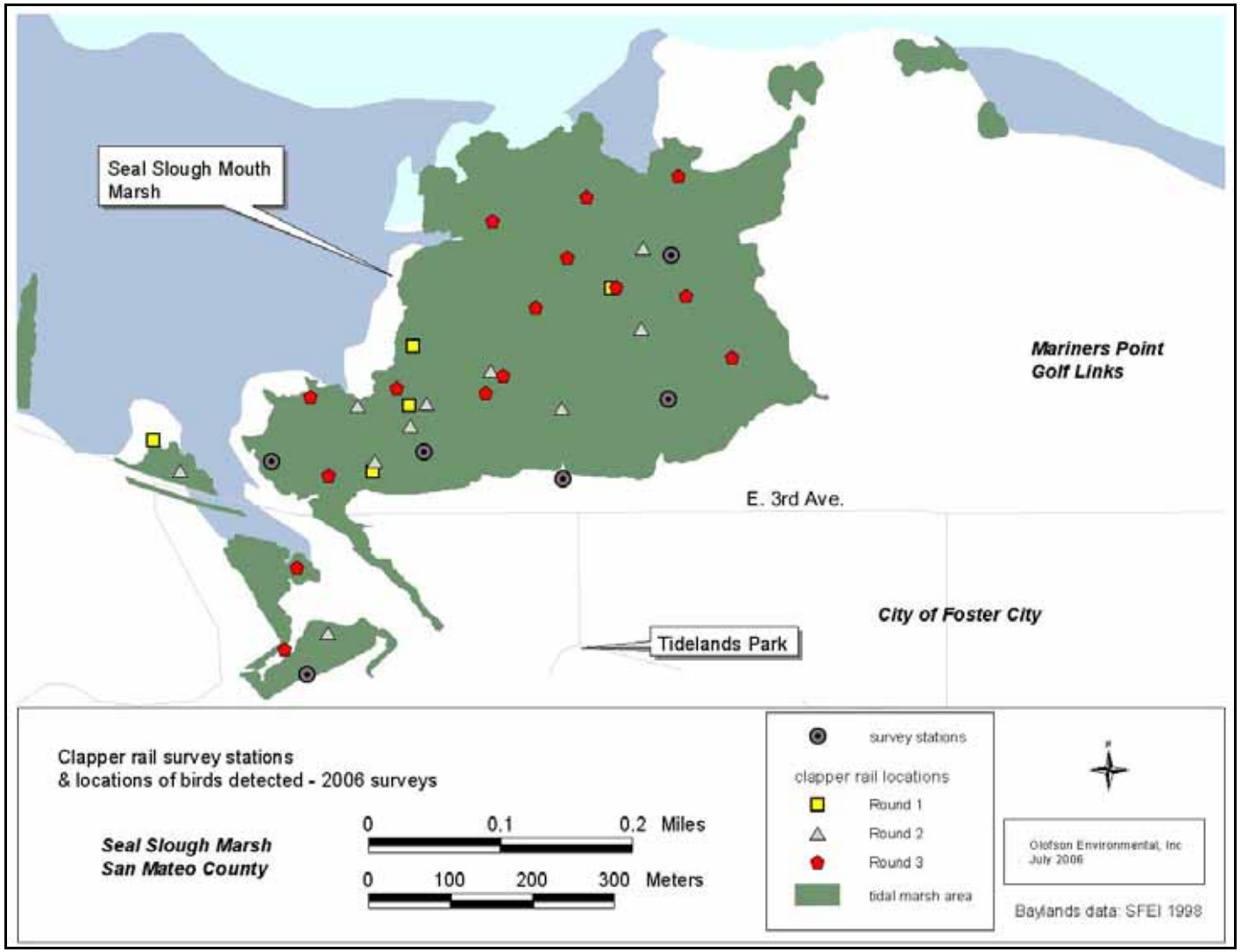

Figure 2.n. Seal Slough mouth

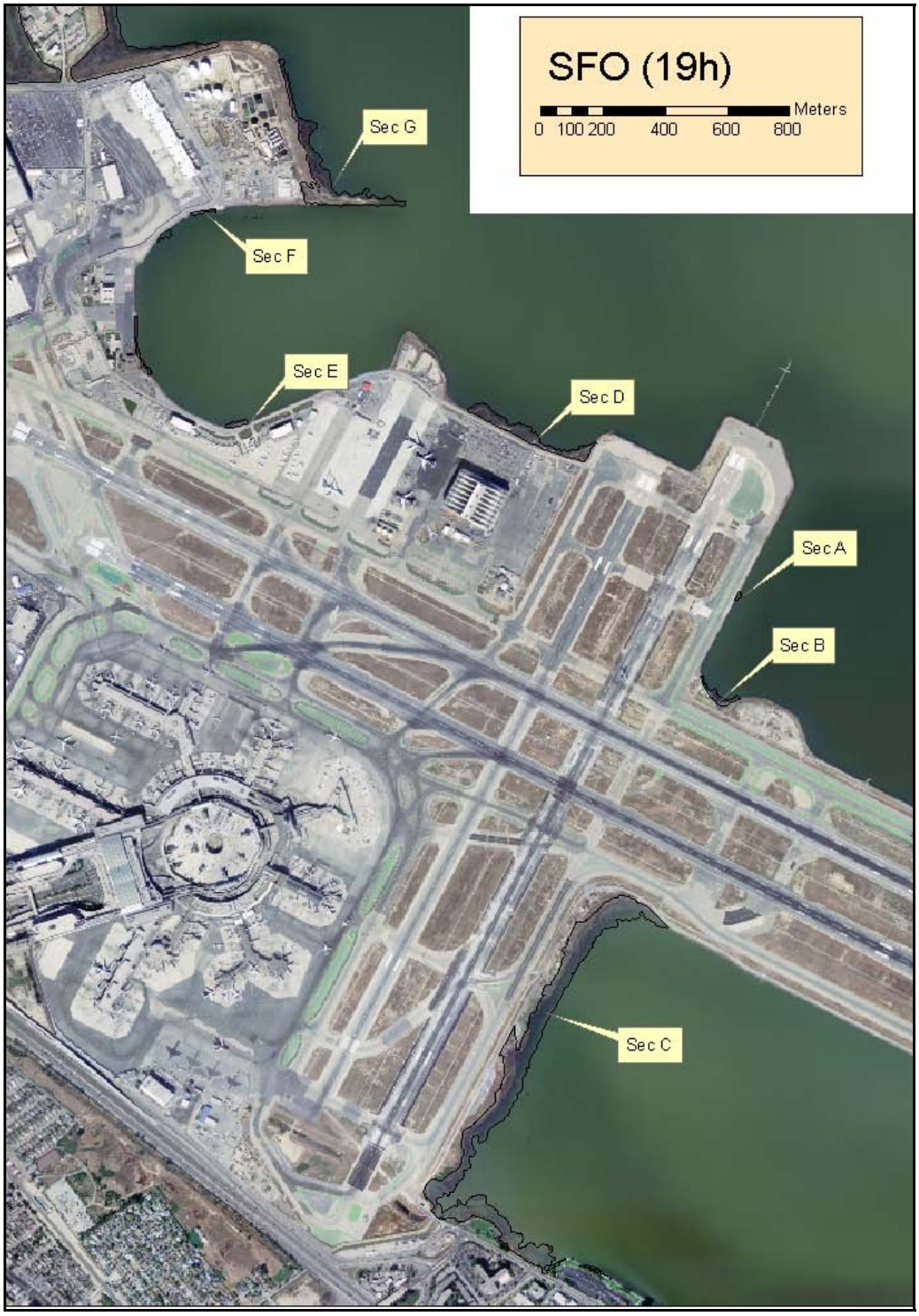

Figure 3.a. Map of California clapper rail habitat assessment locations, SFO.
Photo source: USGS.

Figure 3.b. SFO Section G and fraction of Sam Trans Peninsula marsh.

Photo source: USGS.

Figure 3.c. SFO Sections E & F.

Photo source: USGS.

Figure 3.d. SFO Section D.

Photo source: USGS.

Figure 3.e. SFO Section A & B.

Photo source: USGS.

Figure 3.f. SFO Section C.

Photo source: USGS.

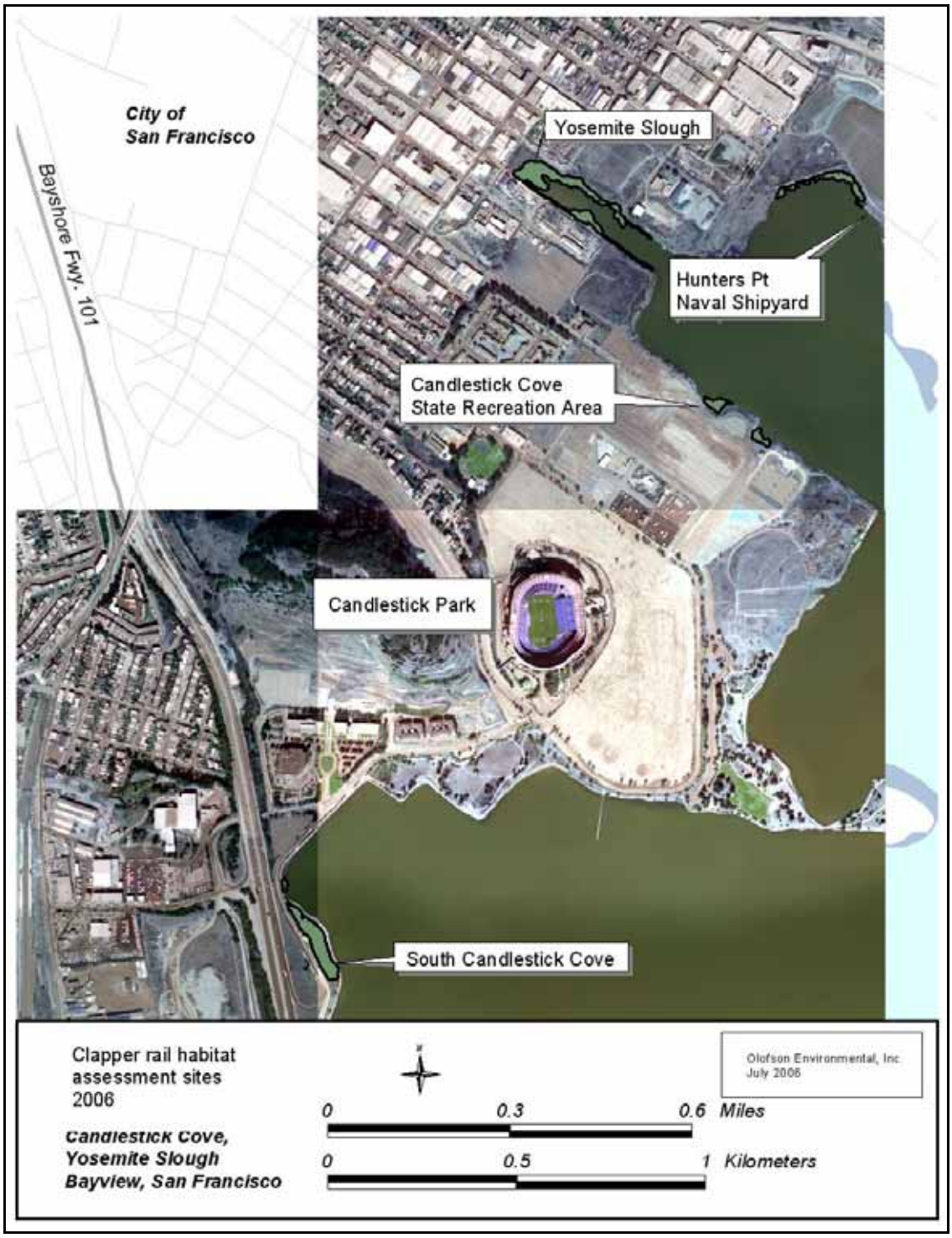

Figure 4.a. Map of California clapper rail habitat assessment locations, Candlestick Cove area.

Photo source: USGS.

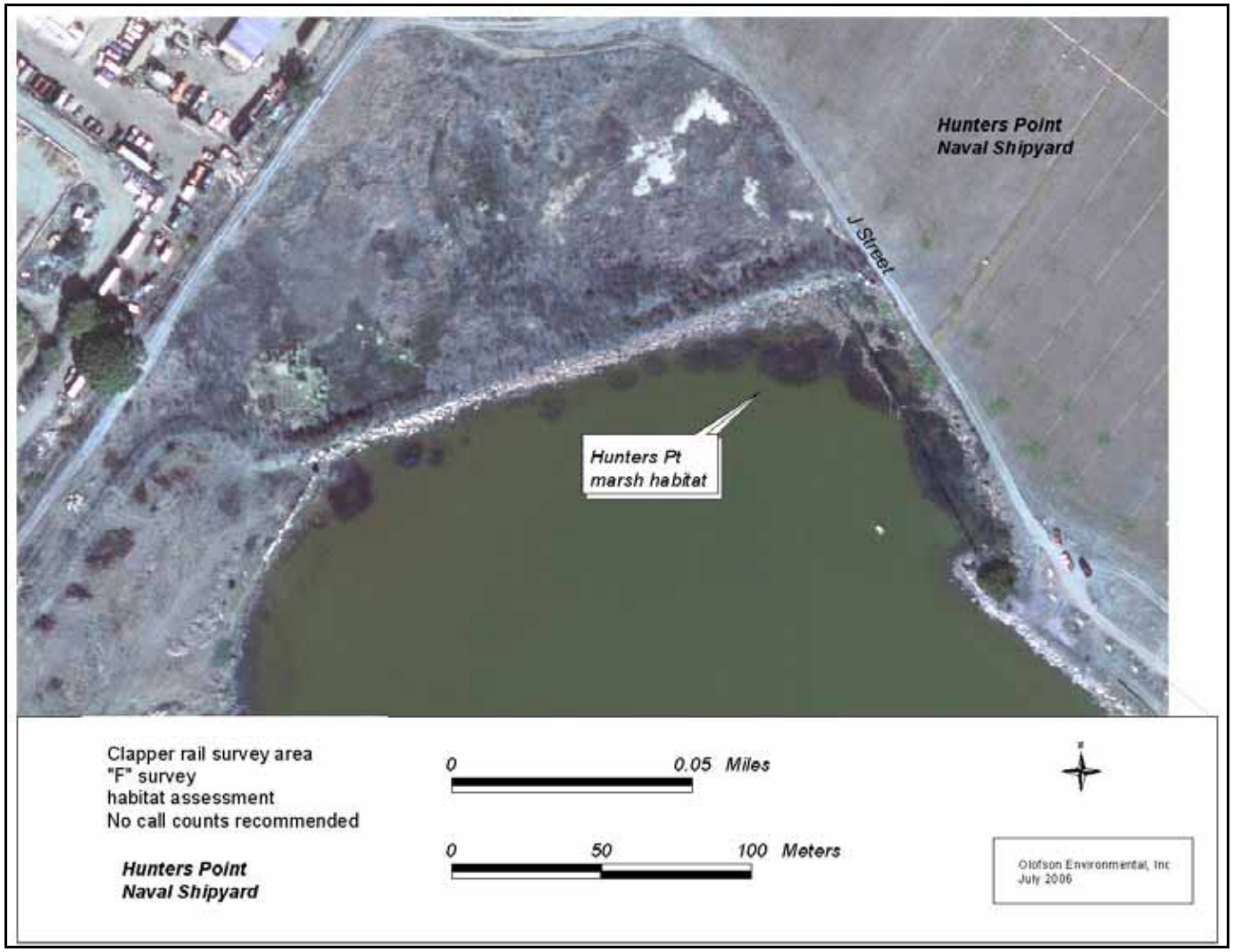

Figure 4.b. Hunters Point Naval Shipyard.

Photo source: USGS

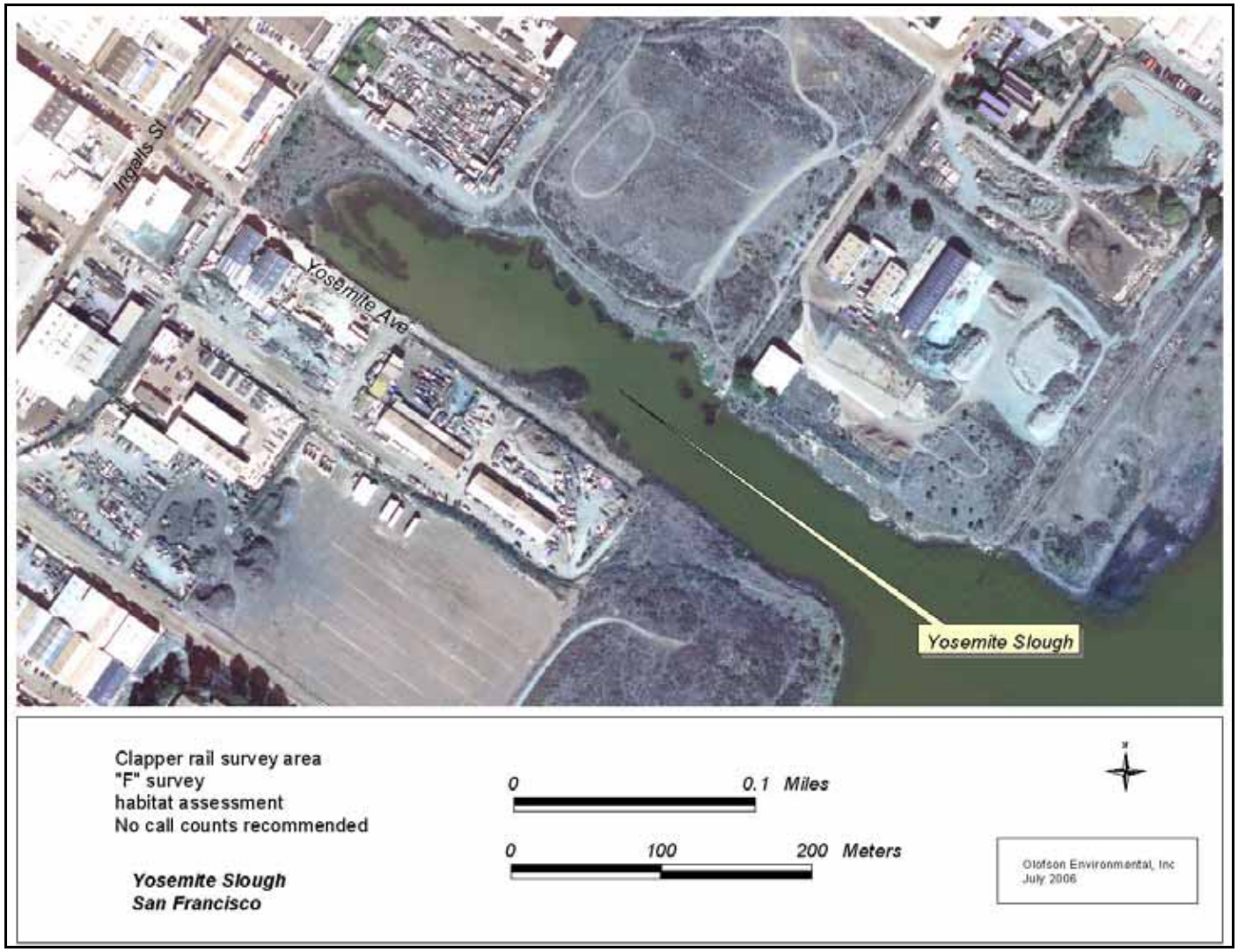

Figure 4.c. Yosemite Slough.

Photo source: USGS

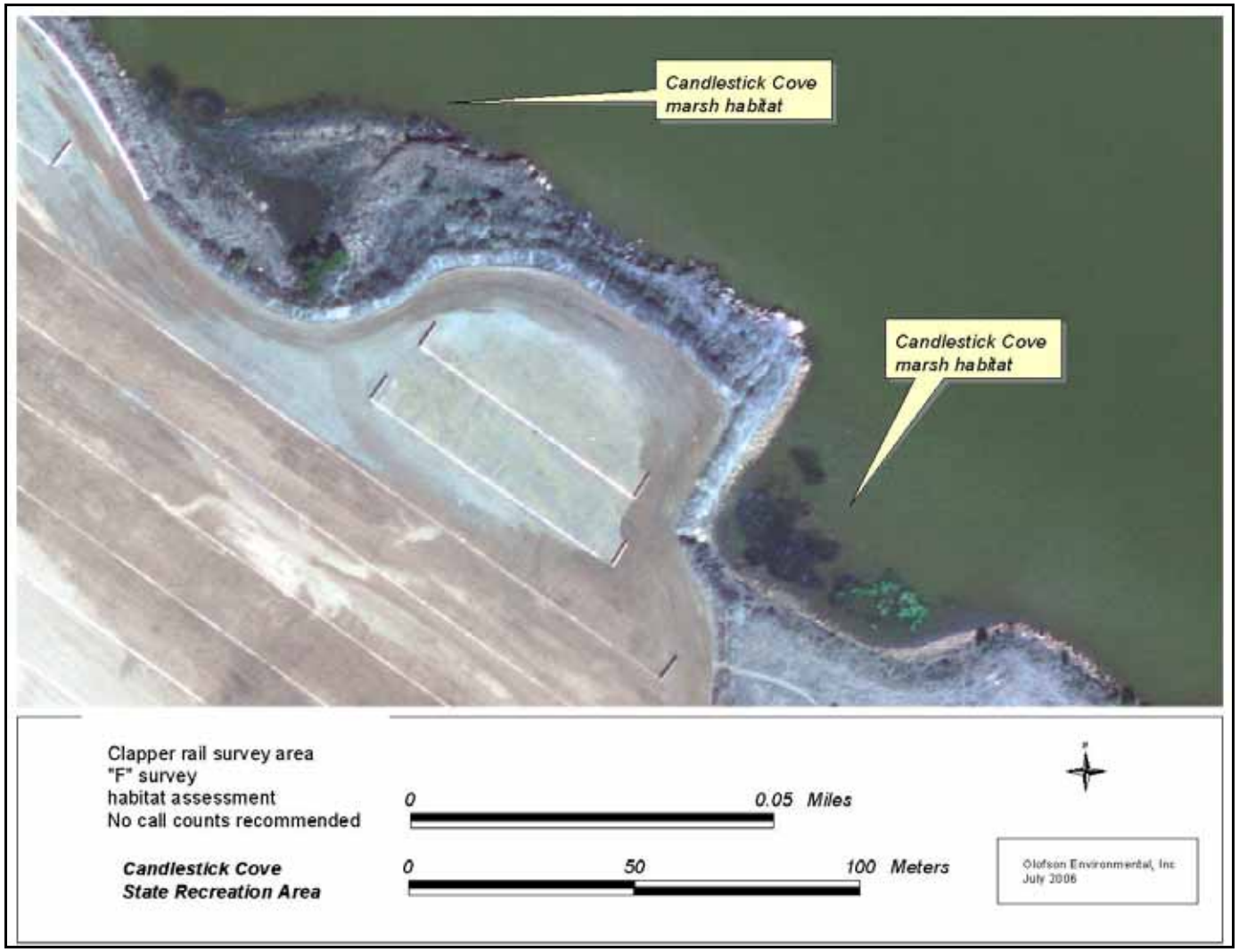

Figure 4.d. Candlestick State Recreation Area.

Photo source: USGS

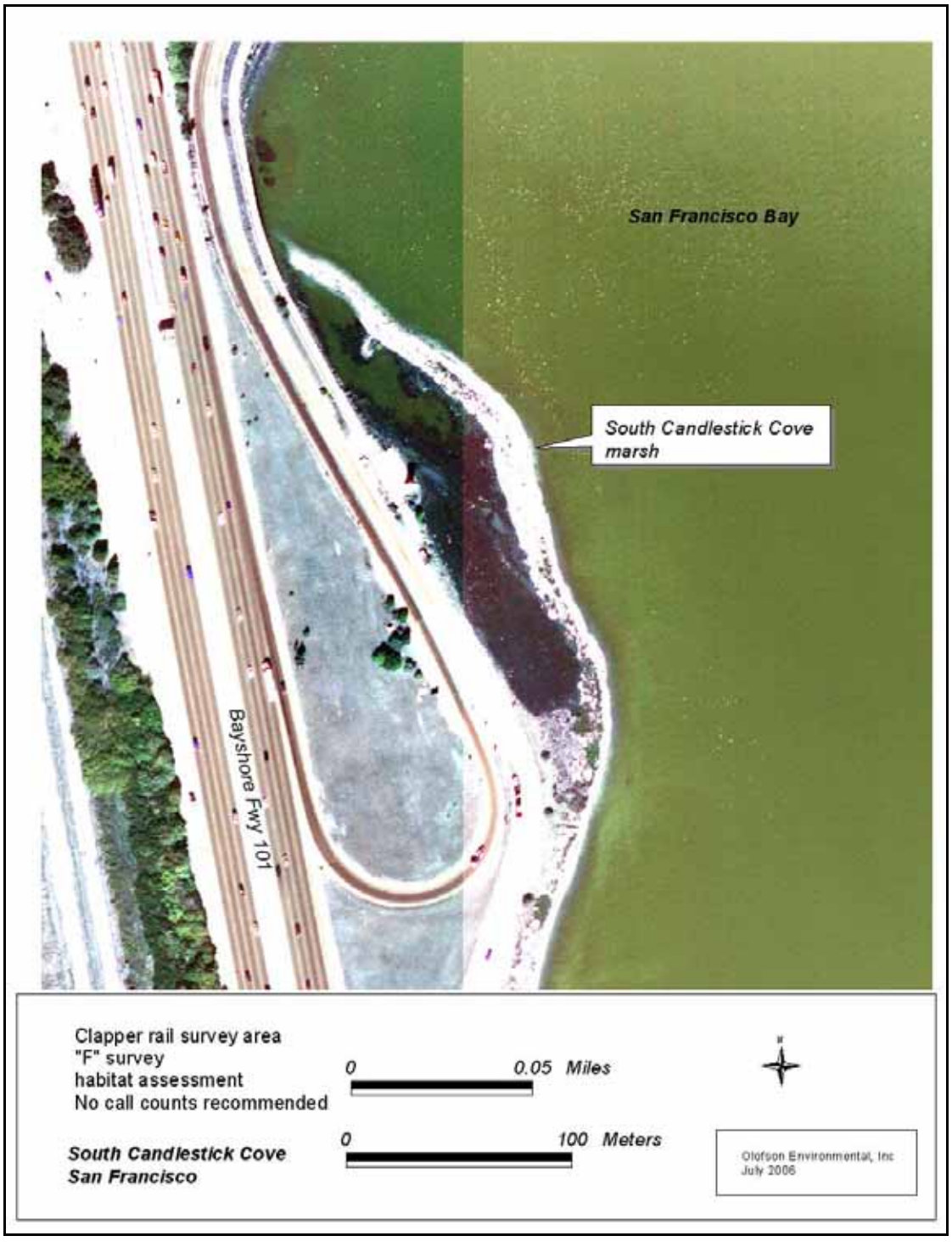

Figure 4.e. South Candlestick Cove.

Photo source: USGS

Figure 5. Comparison of California clapper rail relative abundance (birds detected per hectares of area surveyed) in 2006 and 2005.

All 2006 rail survey data were collected by Olofson Environmental, Inc. for the Invasive Spartina Project. A portion of the 2005 data were collected by ISP partners (see **Table 2**). All graphs present the minimum and maximum abundance indices (birds/ha) for each site. Minimum values are solid bars; the upper striped portion sums to the maximum value. The real value at each site is probably somewhere between these 2 values. Note the differences in scale on the y-axis between graphs. The regional mean abundance index for all sites studied by ISP in 2006 was 0.61 –0.90 birds/ha, or a mean of 0.75 birds/ha (0.30 birds/ha); this value is shown for comparison purposes.

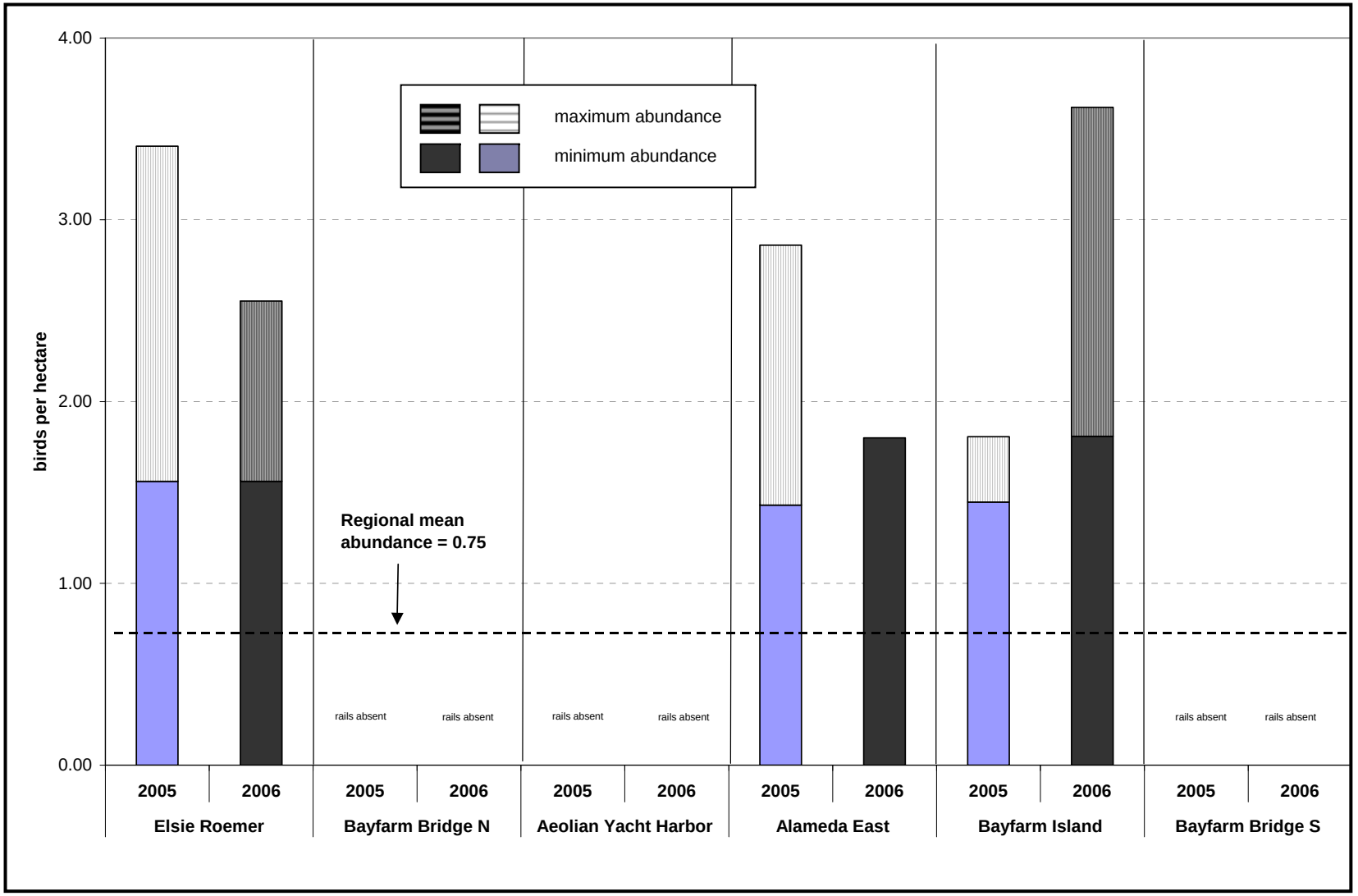

Figure 5.a. San Leandro Bay, western portion. Alameda County.

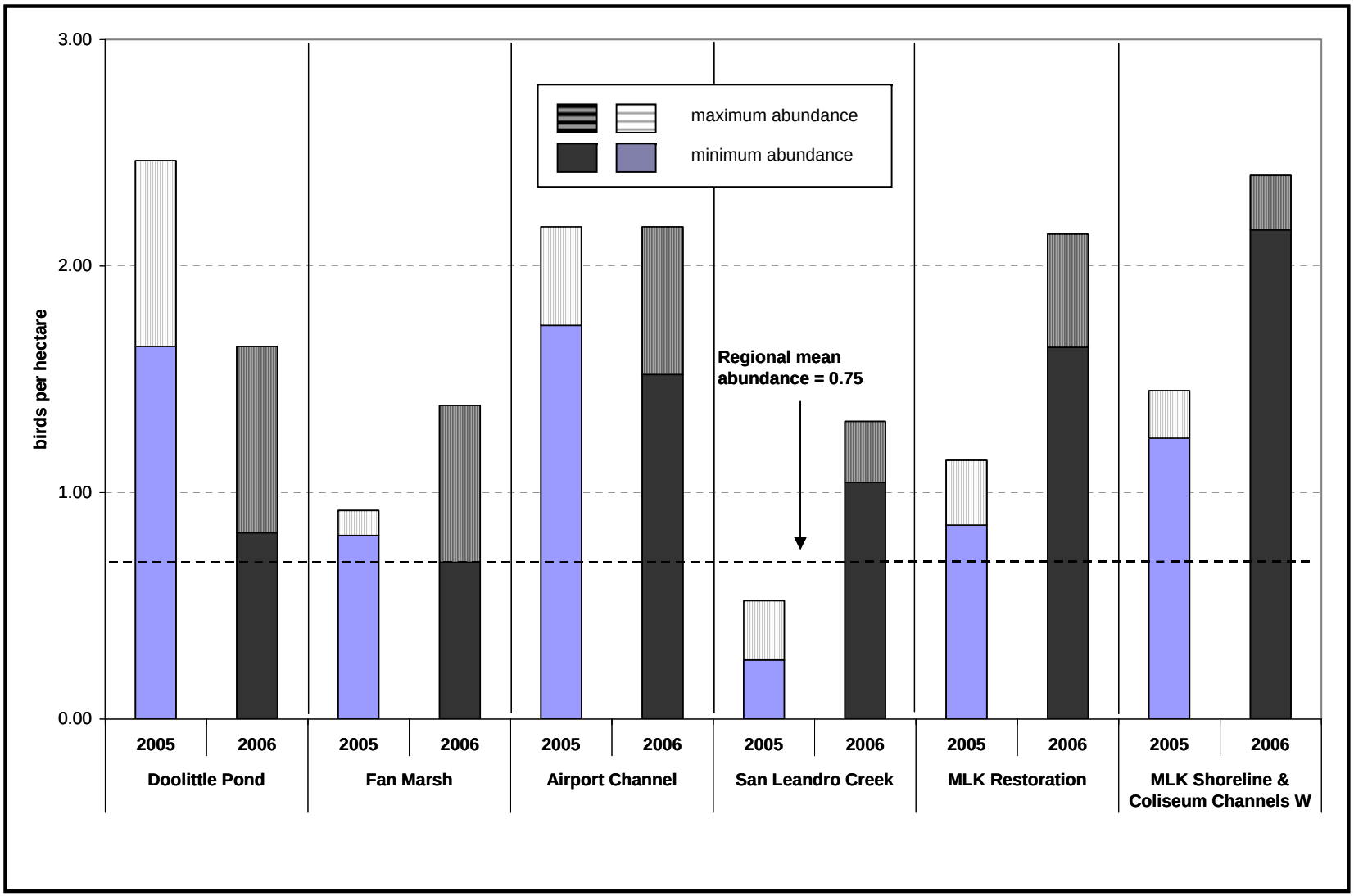

Figure 5.b. San Leandro Bay, Eastern portion. Alameda County.

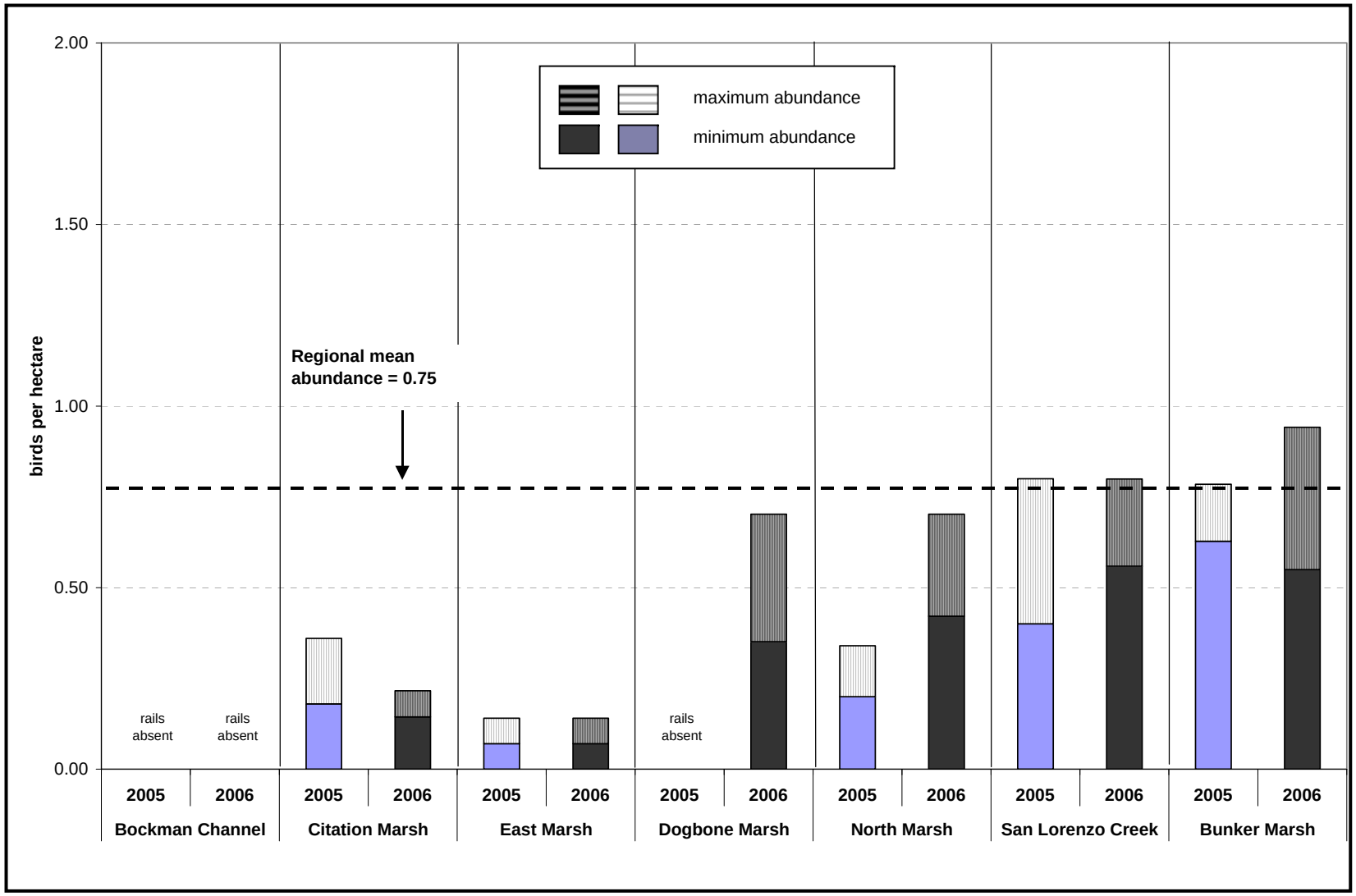

Figure 5.c. East Bay: Roberts Landing area, San Leandro.

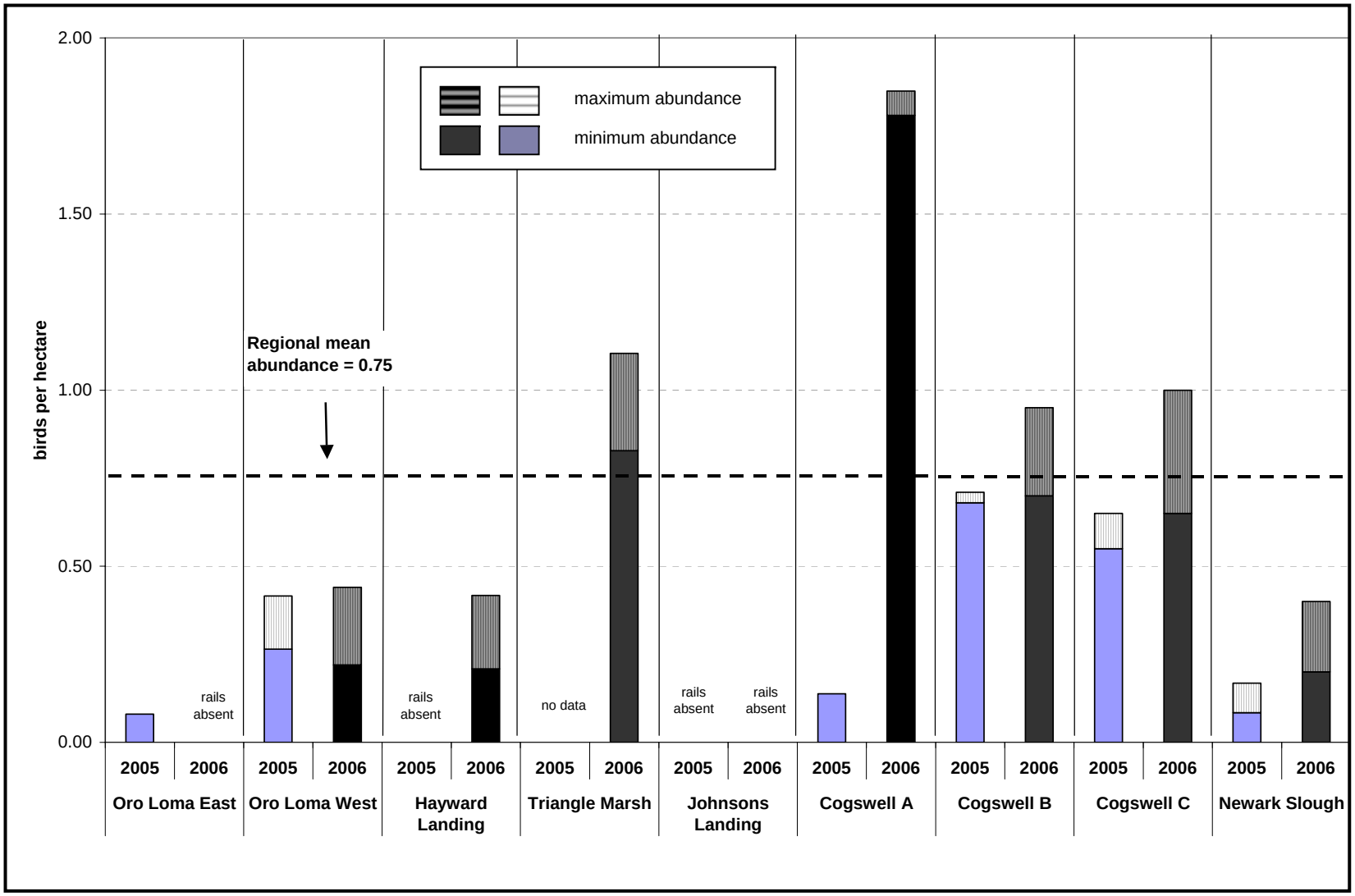

Figure 5.d. East Bay: Hayward Shoreline south to Fremont.

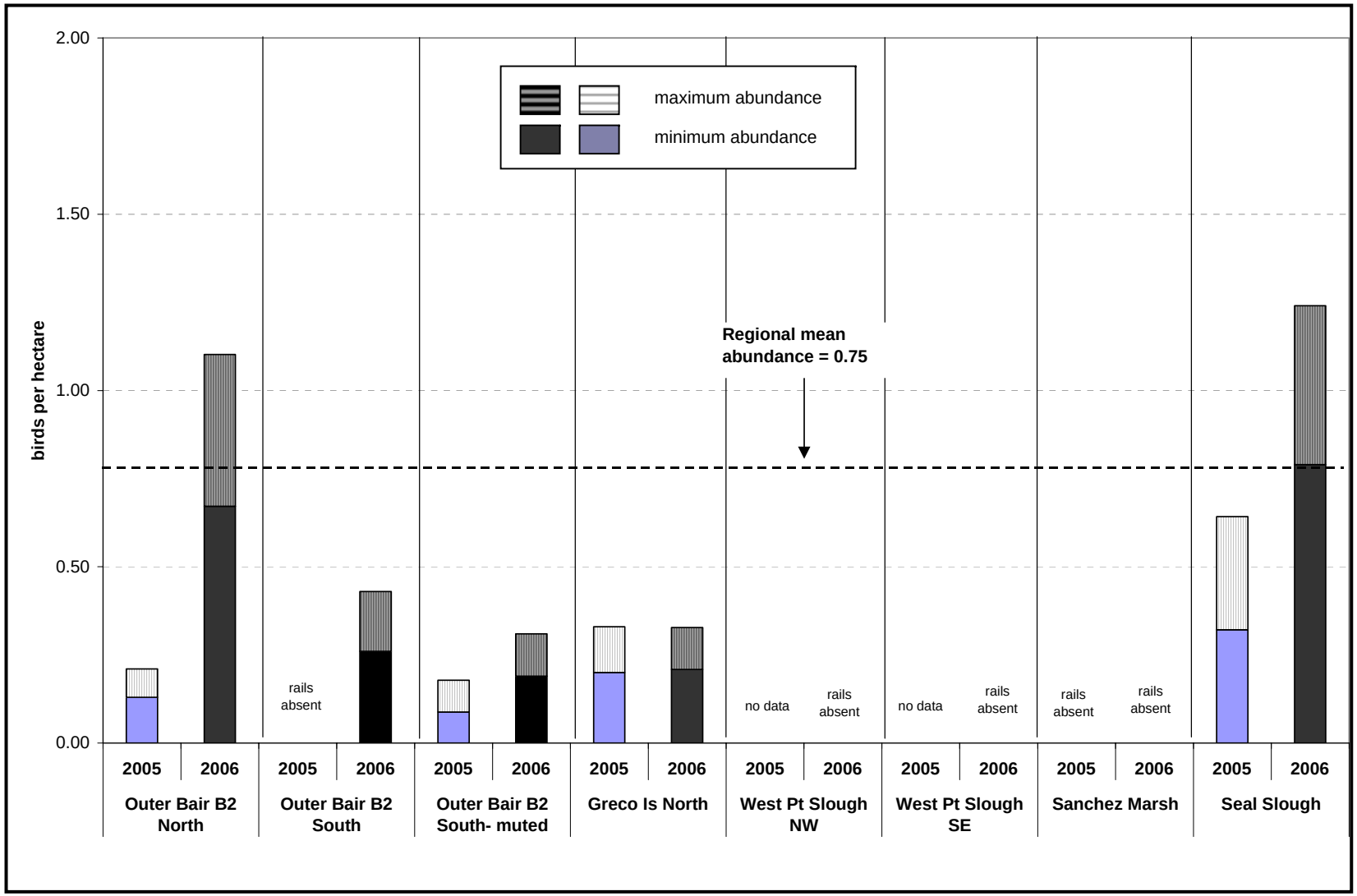

Figure 5.e. West Bay: Bair Island, Greco Island & San Mateo County.

Table 1. Clapper Rail survey dates, number of survey stations, and station placement, 2006.

Where more than one date is indicated for a round, the site was large enough to require more than one set of 8 survey stations, and only one portion of the stations was surveyed on any given date. For some larger sites, e.g. Cogswell, several observers conducted surveys simultaneously to cover a larger number of stations on one date.

Site name	ISP site number	Site Abbre-viation	Number of stations	Station place-ment	Date Round 1	Date Round 2	Date Round 3
East Bay							
Airport Channel	17k	AICH	14	External levee trail	1/16/2006 & 1/17/2006	2/9/2006 & 2/15/2006	3/29/2006
Alameda East, Aeolian Yacht Harbor & Bayfarm Bridge North	17m	ALAM	5	External levee trail	2/4/2006	3/18/2006	4/4/2006
Bayfarm Island & Bayfarm Bridge South	17b	BFIS	7	External levee trail	1/17/2006	2/4/2006	3/29/2006
Bunker Marsh & East Marsh	20g	BUNK	5	External levee trail	1/30/2006	2/17/2006	3/31/2006
Citation Marsh	20d	CITA	8	External levee trail	2/6/2006	2/16/2006	4/8/2006
Cogswell A, B& C [2]	20	COGS	22	External levee trail	1/26/2006 & 1/27/2006	2/14/2006	3/1/2006
Dogbone Marsh	20c	DOGB	3	External levee trail	2/1/2006	2/16/2006	4/8/2006
Doolittle Pond	17l	DOPO	2	External levee trail	2/4/2006	2/15/2006	4/4/2006
Elsie Roemer	17a	ELRO	7	External levee trail & upland edge	1/22/2006	2/21/2006	3/30/2006

Site name	ISP site number	Site Abbre-viation	Number of stations	Station place-ment	Date Round 1	Date Round 2	Date Round 3
Emeryville Crescent West	06b	EMCR	7	External levee trail	2/12/2006	2/26/2006	4/9/2006
Fan Marsh	17j	FANM	3	External levee trail	1/16/2006	2/4/2006	2/15/2006
Hayward Landing & Triangle marsh	20k	HALA	7	External levee trail	2/6/2006	3/16/2006	3/30/2006
Hayward Shoreline outboard *Spartina* clones [1]	20p	HAYO	N/A	External levee trail	4/7/2006 & 4/19/2006	NA	NA
Johnson's Landing	20l	JOLA	2	External levee trail	1/27/2006	2/14/2006	4/6/2006
Martin Luther King Jr. Restora-tion	17h	MLKR	7	External levee trail	1/23/2006	2/8/2006	3/23/2006
Martin Luther King Jr. Shoreline & Oakland Coliseum channels - western end	17d	MLKS	14	External levee trail	1/24/2006	2/23/2006 & 2/24/2006	4/3/2006
Newark Slough	05c	NEWS	8	External levee trail	1/24/2006	2/11/2006	3/30/2006
North Marsh	20f	NORT	6	External levee trail	1/30/2006 2/1/2006 & 2/6/2006	2/16/2006 & 2/17/2006	3/31/2006 & 4/8/2006
Oro Loma East and West	07a & 07b	ORLO	16	External levee trail	2/8/2006	3/16/2006	4/12/2006 & 4/13/2006
San Leandro Creek	17e	SLEA	11	External levee trail	1/22/2006 & 2/7/2006	2/10/2006 & 4/4/2006	4/5/2006 & 4/15/2006

Site name	ISP site number	Site Abbre-viation	Number of stations	Station place-ment	Date Round 1	Date Round 2	Date Round 3
San Lorenzo Creek & Bock-mann Channel	20h	SLRZ	11	External levee trail, marsh inte-rior	1/25/2006	2/22/2006	3/31/2006
West Bay							
Candlestick Cove, Candlestick State Recreation Area & Yo-semite Slough [1]	12e	CAND	N/A	External levee trail	4/9/2006	NA	NA
Greco Island North	02f	GRIN	8	Boardwalk	1/31/2006	2/13/2006	4/5/2006
Outer Bair B2	02d	OBE	8	External levee trail	1/31/2006	2/13/2006	4/6/2006
San Francisco Airport [1]	19h	SFO	N/A	External levee trail	2/16/2006	NA	NA
Sanchez Marsh	19k	SANC	4	External levee trail & internal boardwalk	2/12/2006	2/26/2006	4/9/2006
Seal Slough/Joinsville	19p	SEAL	6	Internal & external levee trail	1/25/2006	2/7/2006	3/18/2006
West Point Slough NW and SE	02e & 02g	WPSN	8	Boat within main slough	3/4/2006	3/22/2006	4/5/2006

1 Habitat assessment survey was completed, and it was determined that a clapper rail survey was not required.

2 Fourth round completed at Cogswell A only on 4/6/2006 to compensate for poor survey conditions on 1/26/2006.

Table 2. California clapper rail breeding season call count survey data, site details: a comparison of 2005 and 2006.

For each site where we conducted call count surveys for California clapper rails we present site name, marsh area (hectares), ISP site number, minimum and maximum number of clapper rails estimated to be present within area of site surveyed, minimum and maximum abundance index (birds per area surveyed), and area surveyed (hectares). Data collected in 2005 at these sites are provided for comparison, some of which were collected by ISP collaborators East Bay Regional Parks (EBPRD), PRBO Conservation Science (PRBO; Herzog et al 2005), and Avocet Research Associates (ARA). Note that for some sites the area surveyed in 2006 was different from that surveyed in 2005, so comparison of numbers between years is not necessarily indicative of population changes. See **Figure 1** for a map of site locations.

			2006					2005					
Site Name	**ISP site num**	**Site area (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**	**2005 Data source**
East Bay													
Aeolian Yacht Harbor	17m	1.6	0	0	0	0	0.23	0	0	0	0	0.2	OEI/ISP
Airport Channel	17k	4.6	7	10	1.52	2.17	4.6	8	10	1.74	2.17	4.6	OEI/ISP
Alameda East	17m	1.1	2	2	1.80	1.80	1.11	1	2	1.43	2.86	0.7	OEI/ISP
Bayfarm Bridge North	17m	0.05	0	0	0	0	0.05	0	0	0	0	0.05	OEI/ISP
Bayfarm Bridge South	17b	0.2	0	0	0	0	0.16	0	0	0	0	0.2	OEI/ISP
Bayfarm Island	17b	2.8	5	10	1.81	3.62	2.76	4	5	1.45	1.81	2.8	OEI/ISP
Bockmann Channel	20i	1.1	0	0	0	0	1.11	0	0	0	0	1.1	OEI/ISP
Bunker Marsh	20g	12.7	7	12	0.55	0.94	12.74	8	10	0.63	2.46	12.7	OEI/ISP
Citation Marsh	20d	44.5	4	6	0.14	0.22	27.75	5	10	0.18	0.36	27.8	OEI/ISP
Cogswell A – North [2]	20m	14.1	25	26	1.78	1.85	14.06	2	2	0.14	0.14	14.1	EBRPD
Cogswell B – East [2]	20n	39.8	28	38	0.70	0.95	39.84	27	28	0.68	0.70	39.8	EBRPD
Cogswell C - South-west [2]	20o	19.9	13	20	0.65	1.01	19.87	11	13	0.55	0.65	19.9	EBRPD
Dogbone Marsh	20c	2.9	1	2	0.35	0.70	2.85	0	0	0	0	2.9	OEI/ISP
Doolittle Pond	17l	1.2	1	2	0.82	1.64	1.22	2	3	1.64	2.46	1.2	OEI/ISP

			2006					2005					
Site Name	**ISP site num**	**Site area (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**	**2005 Data source**
East Marsh [1]	20e	14.8	1	2	0.22	0.44	4.6	1	2	0.07	0.14	14.8	OEI/ISP
Elsie Roemer	17a	7.1	11	18	1.56	2.55	7.1	11	24	1.56	3.40	7.1	EBRPD
Emeryville Crescent West [2]	06b	15.3	6	10	0.41	0.69	14.6	2	2	0.14	0.14	14.6	EBRPD
Fan Marsh	17j	8.7	6	12	0.69	1.38	8.7	7	8	0.81	0.92	8.7	OEI/ISP
Hayward Landing	20k	4.8	1	2	0.21	0.42	4.8	0	0	0	0	4.8	OEI/ISP
Johnson's Landing	20l	5	0	0	0	0	5	0	0	0	0	5	OEI/ISP
Martin Luther King Jr. Restoration	17h	14.0	23	30	1.64	2.14	14.0	12	16	0.86	1.14	14.0	EBRPD
Martin Luther King Jr. Shoreline [1]	17d	8.4	18	20	2.16	2.40	8.4	6	7	1.24	1.45	4.8	EBRPD
Newark Slough	05c	132.3	5	10	0.20	0.40	24.8	2	4	0.08	0.16	24.8	PRBO
North Marsh	20f	35.6	15	25	0.42	0.70	35.6	7	12	0.20	0.34	35.6	OEI/ISP
Oakland Coliseum channels [1, 3]	17i	6.8	4	6	5.00	7.50	0.8	0	0	0	0	5.8	OEI/ISP
Oro Loma East [1]	07a	79.7	0	0	0	0	17.1	2	2	0.08	0.08	25.8	EBRPD
Oro Loma West	07b	53.4	12	24	0.23	0.45	53.4	14	22	0.26	0.41	53.4	EBRPD
San Leandro Creek	17e	3.8	4	5	1.04	1.31	3.8	1	2	0.26	0.52	3.8	OEI/ISP
San Lorenzo Creek	20h	12.5	7	10	0.56	0.80	12.5	5	10	0.40	0.80	12.5	OEI/ISP
Triangle Marsh	20k	3.6	3	4	0.83	1.10	3.6						No data
West Bay													
Greco Is North [1]	02f	202.6	14	22	0.21	0.33	67.2	20	33	0.20	0.33	100.2	PRBO
Outer Bair B2 North [1]	02c	206.9	11	18	0.67	1.10	16.4	11	18	0.13	0.21	85.4	PRBO
Outer Bair B2 South	02d	24.8	6	10	0.26	0.44	22.9	0	0	0	0	19.2	PRBO

			2006					2005					
Site Name	**ISP site num**	**Site area (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**	**2005 Data source**
Outer Bair B2 South, muted	02d	23.0	3	6	0.19	0.39	15.5	2	4	0.09	0.18	22.5	PRBO
Sanchez Marsh	19k	5.8	0	0	0	0	5.8	0	0	0	0	5.8	ARA/ISP
Seal Slough [1]	19p	23.5	18	28	0.79	1.24	22.7	3	6	0.32	0.64	9.3	ARA/ISP
West Point Slough NW	02e	3.3	0	0	0	0	1.9						No data
West Point Slough SE	02g	17.9	0	0	0	0	11.9						No data

1 Area surveyed in 2006 was significantly different from that surveyed in 2005. Oakland Coliseum channels, Oro Loma East, Outer Bair North, & Greco Island North areas were smaller in 2006. MLK Shoreline & Seal Slough areas were larger in 2006.

2 East Bay Regional Park District 2005 data provided are preliminary; final numbers are not yet available. For most sites, with the exception of Emeryville and Cogswell, we had access to all datasheets and re-calculated the numbers using the same data interpretation methods that we used for all 2006 data we calculated ourselves.

3 Oakland Coliseum channel 2006 data are presented separately and are also included in the values presented for MLK Shoreline.

Table 3. California clapper rail breeding season call count survey data, means for complex: a comparison of 2005 and 2006.

Data presented here are calculated from site level data in **Table 2**, weighted for site area.

			2006					2005				
Complex Name	**ISP site num**	**Site area (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**	**Minimum count**	**Maximum count**	**Minimum abun-dance**	**Maximum abun-dance**	**Area surveyed (ha)**
San Leandro Bay	17a – 17m	58.4	141	173	1.09	1.58	52.1	119	150	0.92	1.40	51.6
San Leandro/ Rob-erts Landing	20c – 20h	124.2	35	57	0.30	0.50	107.4	26	44	0.21	0.35	107.4
Hayward Shoreline	20m- 20o	219.8	82	114	0.55	0.72	157.7	56	67	0.24	0.28	162.8
West Bay	02c – 02g; 19k, 19p	507.8	52	84	0.30	0.49	171.9	31	52	0.12	0.21	250.7
Emeryville Cresc. West	06b	15.3	6	10	0.41	0.69	14.6	2	2	0.14	0.14	14.6
Newark Slough	05c	132.3	5	10	0.20	0.40	24.8	2	4	0.08	0.16	24.8
All sites combined		**1057.8**	**321**	**448**	**0.61**	**0.91**	**528.5**	**236**	**319**	**0.43**	**0.65**	**611.9**

1 Exact area surveyed by EBRPD unknown.

APPENDICES

APPENDIX 1. CALIFORNIA CLAPPER RAIL OFFICIAL USFWS DRAFT PROTOCOL, 2000: SURVEY PROTOCOL A.

USFWS 2000

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

DRAFT SURVEY PROTOCOL

California Clapper Rail (*Rallus longistrostris obsoletus*)

January 21, 2000

Below is a description of the standard methodology used to detect presence or absence of clapp rail breeding activity. Surveys should be conducted once a week for a minimum of four weeks. The optimal time to conduct call count surveys is mid-January through March. Once a survey protocol has been developed, it should be sent to the Service for final approval prior to implementation. After the results are compiled and submitted to us, we will make a final decision on the possibility of doing any work as described.

Methodology

1. Surveys should be conducted from January through mid-April, which encompasses the optimum time period of mid-January through March when the frequency of calls is typically highest. Surveys should not be conducted when tides greater than 4.5 feet NGVD as predicted at the Golden Gate occur at the marsh during the survey period or during full moon periods.

2. Listening stations should be established no more than 150 meters apart along transects ir or adjacent to marsh areas. Stations should be established so that the entire marsh is covered by 75 to 100-meter radius circular plots. Listening stations should be placed near marsh features, such as sloughs, but not along slough edges to minimize disturbanc to rails. Surveys should be conducted from levee crowns or boardwalks to minimize disturbances to marsh areas where possible. A detailed map depicting sloughs and other marsh landmarks or features should be developed.

3. Surveys should be conducted at sunset or sunrise. Surveys conducted at sunrise should begin 45 minutes before sunrise and continuing until 1 1/4 hours after sunrise. Surveys conducted at sunset should begin 1 1/4 hours before sunset and continue until 45 minute after sunset.

4. An observer should be assigned to each listening station for the duration of each survey. Observers should locate key marsh landmarks or features on a map in relation to teach listening station location.

5. All rail vocalizations should be recorded, noting the call type, location, and time on a detailed map of the marsh. The call types are coded as C = clapper, D = duet, K = kek,

USFWS 2000

B=kek-burr with a V representing a visual sighting. Other unusual calls also should be noted. The calls of one bird or pair should be marked by circling the calls together. If a rail is moving during the survey, several locations may be noted for the same bird(s). Attention should be focused on accurately mapping the birds that are nearby, especially between observers or towards the edge of the marsh if the station is positioned at the marsh's edge.

6. At the end of each survey, observers should compare maps to determine overlap in detections and to create a master map showing all pairs and individuals located during the survey. Another master map should be developed once all surveys are completed, showing the dates and locations of detections.

7. Weather information, including wind velocities and direction, should be recorded. Call count surveys should not be conducted when wind velocities exceed 10 mph or wind gusts exceed 12 mph, or during moderate to heavy rains. Information on disturbances (e.g., dogs or cats in marsh and aircraft flyovers) occurring during the surveys should be recorded.

8. If a survey of a marsh is conducted over more than one night, observers should be assigned to stations adjacent to their previous night's station if at all possible.

9. New observers should be trained by an experienced observer. Trainees should familiarize themselves with various calls and with estimating distances to calls before training in the field. In-field training should include ways to minimize disturbance to rails and marsh vegetation. Trainees should be stationed with an experienced observer during a call count for a minimum of 2 nights to assess the trainee's ability to accurately detect and map calls in the field. The Palo Alto Baylands is a marsh with many rails typically calling in the evening and easy access via a boardwalk, thus providing an excellent training opportunity for new observers and their instructors. A recording of clapper rail calls is available for training purposes at the U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Suite W2605, Sacramento, California 95825.

APPENDIX 2. DRAFT VERSION OF PROPOSED REVISIONS TO THE OFFICIAL PROTOCOL: SURVEY PROTOCOL A.

San Francisco Estuary Invasive *Spartina* Project

California Clapper Rail Survey Protocol A:

"Standard Transect Survey"

March 2006

The ISP's Protocol A is the "walking transect survey" method described in "Draft clapper rail protocol for the San Francisco Estuary large-scale population surveys" (Albertson & Downard 2004) and "Revised draft clapper rail protocol for the San Francisco Estuary large-scale population surveys" (Spautz 2005). The protocol is excerpted verbatim from Spautz 2005, except as otherwise noted. Note: The ISP refers to the "standing survey" method described in Albertson & Downard 2004 and Spautz 2005 as "Protocol B".

General Survey Requirements:

1) ***Permits.*** Obtain required survey permits: USFWS Endangered Species Permit, ESA Section 10(a)(1)(A); California DFG permit (i.e. Memorandum of Understanding); site-specific permissions (e.g. Special Use Permit from a NWR).
2) ***Training.*** Observers must be trained to identify clapper rail calls and distinguish CLRA calls from other marsh bird species (see Rail Training document, April 2004). Observers must also be trained to minimize disturbance while conducting surveys (see Walking in the Marsh document, April 2004).
3) ***Tides and moon phase.*** Conduct surveys when tidal sloughs are less than bank full, <4.5-ft NGVD at the Golden Gate tide station. Tide height at bank full will vary by site. Avoid high (flood) tides. Full moon periods should be avoided during active surveys when tape playback is utilized, as birds may be attracted out of cover or a response may be elicited, and increase the likelihood of predation. There is also evidence of reduced calling rates during full moon periods.
4) ***Survey Timing.*** Morning surveys should be initiated no sooner than one hour before sunrise and extended no more that 1.5 hours after sunrise; evening surveys should begin one hour prior to sunset and extend no more than one hour following sunset. Surveys at a particular location should be spaced at least 1 week apart and should be conducted at both sunrise and sunset.
5) ***Weather.*** Record wind velocities and weather; conduct surveys at winds <10 mph; do not conduct surveys during heavy rainfall.
6) ***Seasonality.*** Conduct surveys between January 15 and mid-April.
7) ***Survey Stations.*** Stations should be spaced approximately 200-m apart. Stations should be placed on boardwalks or levee tops when possible to minimize disturbance. When surveys

are conducted within a marsh, stations should be placed away from slough/channel edges to minimize disturbance to rail species.

8) ***Data collection.*** All rail vocalizations should be recorded, noting the call type, location, and time. Locations where rails are detected should be plotted on a map during the survey with numbered reference codes that correspond to detections on the datasheet. The call types should be coded as follows:

Call Code	Call Description	Number of Birds Indicated*
C	Clapper/clatter by one individual	1-2 birds
D	"Duet"- two individuals clattering simultaneously	2 or more birds, depending on situation
K	"kek"	1-2 birds
AK	agitated "kek"	1-2 birds
B	"kek-burr"	1-2 birds
V	Visual sighting	1-2 birds per sighting
SK	"squawk"	1-2 birds
SC	"screech"	1-2 birds
CH	"chur"	1-2 birds
P	"purr"	1-2 birds

* See data interpretation section below for more details about determining number of birds per detection type.

If the bird was definitely or possibly previously detected, e.g. as part of a pair, make this clear on the datasheet. Record when birds were detected simultaneously or nearly so, which will verify they were separate individuals. Calls of other rail species should also be recorded as above, with species clearly marked.

9) ***Disturbance.*** Record all Information on disturbance (e.g., predator sightings or boats) detected during surveys.

10) Review the WRMP CLRA protocol (Evens 2002) for other general information (http://www.wrmp.org/docs/protocols/Wetland%20Birds.pdf, p.21 Rails). Defer to the requirements listed above if they are more restrictive than the WRMP protocol.

SURVEY SPECIFICS

The Protocol A transect survey is suitable for linear sites and for sites with low to medium rail density. Surveys as sites with high clapper rail density should use "Protocol B" – the standing or stationary survey protocol described by Albertson & Downard 2004 and Spautz 2005.

The transect survey may be performed by one or two observers. Listening stations are established at approximately 200 meter intervals along a transect, preferably along the edge of the marsh. The first two of three surveys are passive (listening) for 10-minutes at each station. On the third survey, if a clapper rail was not previously detected within 200 meters of a listening station during the two previous passive surveys or incidentally within the season, recorded calls are played, according to the "*Recorded Call Playback Procedure*" described below. If a clapper rail has been previously detected within 200 meters of a listening station, the third survey should also be passive. There should be a minimum of one week between surveys.

Recorded Call Playback Procedure

A standardized recording of clapper rail calls should be obtained from USFWS. The recording should include a combination of clapper/clatter and duet calls, and there should be at least four complete calls with at least 5-seconds of silence between calls. The recording should be of good quality, and should be played at a volume of 80-90 dB at 1-meter distance from the speaker. A digital sound level meter should be used to calibrate the playback device.

The survey should begin with an initial 5-minute passive listening period, followed by 1-minute of clapper rail calls, and completed with a 4-minute passive listening period (10-minutes/survey). Tape playbacks should be broadcast in all directions over the marsh at a station. Assume rails can hear tapes at distances of ≤200-m.

Note: Only play recorded clapper rail calls at stations when you are certain rails have not yet been detected. As soon as a clapper rail is detected, stop the recording.

Data Interpretation and Data Analysis

Use the following key to determine how many birds to record for each detection type. Use your "field" judgment to avoid redundancy (overlap) and interpret uncertainty as a range. Keep in mind the part of the breeding season in which your survey occurs.

Detection type	Code	Number of birds	Description	Notes and Exceptions
Clatter	C	1 - 2	Primary territorial call. Rapid series of kek notes, often trailing off at the end.	• Usually clattering individuals are paired. Often it's difficult to determine whether one or two birds are calling, if completely synchronized; thus, the range of 1-2 birds. • Example scenario: at the end of a survey session you have 4 distinct duets, 3 single clatters away from duets and away from one another. The estimate for breeding birds would be 11-14 (# duets x 2 = 8 + 3-6 birds represented by clatters).
Duet clatter	D	2	Two bird clattering simultaneously.	• Usually given by a pair, or less often, neighboring territorial males (J. Evens peers. obis. 2005). • When chorusing birds are masking one another and you are uncertain whether it was one duet or two, record as 1-2 duets (1-2 pairs) or 2-4 clatters. Again, interpret uncertainty as a range.
Kek	K	1-2	Single sharp "kek" call, given singly or in series, with significant space between calls (as compared to clatter, which is very rapid).	• Given by males, most often when unmated or prior to setting up pair bond, thus is most typically heard early in the season. However, can be given by a mated male throughout the breeding season, thus the range of 1-2 birds. • Sometimes paired/breeding birds make random keks or kek-burrs intermingled with clatters, especially at the beginning of the breeding season. If you hear a single kek followed by a duet in the same location, the kekking individual is likely part of the duet pair and would not be counted separately.

Detection type	Code	Number of birds	Description	Notes and Exceptions
Agitated Kek	AK	1-2	As above but higher pitched, rougher, and with what can be interpreted as an element of alarm. Mid-way between kek and squawk or screech.	• As above, the call may indicate either an unmated or mated male, thus the range of 1-2 birds.
Kek-burr	B	1-2	One or several rapid "kek" calls followed by a more attenuated, "burrrr". Often repeated constantly over many minutes, and can be heard about 1 km away, depending on conditions.	• Given by female clapper rails, primarily during pair bond formation or when fertile and soliciting a copulation with her mate, thus, it is most typically heard early in the season. The call is not likely to be given when she is incubating. Later in the season, it may be given when a nest has failed and the female is beginning another nesting attempt. The call may indicate either an unmated or mated female, thus the range of 1-2 birds. • A single kek-burr followed by a duet: the individual is likely part of the duet pair and would not be counted separately.
Visual	V	1- 2		Clapper rails are most often seen when foraging along tidal channel banks, often near the shelter of overhanging vegetation. They are often seen crossing channels, and regularly swim across open water within a channel. A sighting of one bird may indicate the presence of a pair; thus record as 1 – 2 birds.
The following descriptions were not included in Albertson & Downard 2004 or Spautz 2005, but are provided here for completeness.				
Squawk	SK	1-2	More highly agitated than an agitated kek,	Typically given only once as an alarm call. Bird may later make other vocalizations.
Screech	SC	1-2	More rare than a squawk. Like a squawk but even more high-pitched.	Typically given only once as an alarm call.
Churr	CH	1-2	Similar to the last syllable in a kek-bur call	Typically given by a female.
Purr	P	1-2	Very soft, like churr or burr.	Typically given by a female at the nest.

APPENDIX 3. CALIFORNIA CLAPPER RAIL CALL COUNT SURVEY DATASHEET.

Clapper Rail Survey Form 2006

Location_____ **Date** (mm/dd/yy)_____

Observer_____ **Time** (start)_____(end)_____

Weather: Temp_____Sky_____Wind speed_____

Station #	Tape Y/N	Time	Dist (m)	Dir. (º)	Call code*	# birds	Notes	Map ref

Notes:_____

_____

_____

_____

*Call types: Clatter (C); duet (D); kek (K); agitated kek (AK); kik-kik-burr (kkb); squawk (SK); screech (SC); churr (CH); purr (P); visual (V)

APPENDIX 4. CALIFORNIA CLAPPER RAIL HABITAT ASSESSMENT: PROTOCOL F. PROTOCOL AND DATASHEET.

California Clapper Rail Survey Protocol F:

California Clapper Rail Habitat Assessment

March 14, 2006

Protocol description

The San Francisco Estuary Invasive *Spartina* Project (ISP) is required (under the USFWS Biological Opinion dated September 2005) to conduct surveys for California clapper rails (*Rallus longirostris obsoletus*) to determine clapper rail presence or absence prior to treatment of non-native *Spartina*. Sites that are clearly insufficient to support clapper rails, e.g., stretches of concrete riprap with a scattering of small non-native *Spartina* clones, do not require clapper rail surveys. However, sites requiring *Spartina* control exhibit a continuum of habitat characteristics, many of which are documented clapper rail habitat requirements (e.g., extensive channels for foraging and vegetated upper marsh for refuge during high tides). This makes it difficult in some cases to determine whether the habitat at the site is of sufficiently high quality to require a call count survey. In 2005, the ISP developed a standardized method to document the decision whether or not a clapper rail survey was required (Protocol F).

ISP staff consulted with Joy Albertson and Jules Evens to develop a list of required habitat elements for clapper rails based on field knowledge and published sources. This information was used to develop a field checklist to assess the habitat using multiple criteria and to document the decision as to whether the marsh will require a formal clapper rail call count survey. The habitat assessment is typically completed at sites where clapper rails have previously not been documented.

The process of determining whether the site is of sufficient quality to require a call count survey is based on a cumulative score of positive characteristics. Patches with no necessary habitat elements are considered very poor habitat and clapper rail use is "highly unlikely", and require no further clapper rail survey; such sites are determined to be available for early non-native *Spartina* treatment. If the site is poor but is geographically near enough to good habitat or known rail habitat to potentially provide habitat for at least some clapper rail activities (such as foraging or shelter), it will require a call count survey. Potentially good habitat with at least two positive characteristics will also be likely to require a call count survey, but this will be site-dependent. Possibly good habitat or likely good habitat (with at least four or six characteristics, respectively) will require a call count survey.

If call count surveys are required, the biologist will generally recommend using clapper rail call count survey protocol "C", which is conducted at apparently low quality sites where clapper rails are not likely and have not been previously documented. However, it is possible that the site is of sufficiently high quality that clapper rails are at least moderately likely and a standard call count protocol "A" survey will be recommended.

Habitat characteristics documented to be associated with California clapper rails and included on the habitat assessment datasheet include the following:

1. Young or mature restoration site (at least 50% vegetated)

2. Upper marsh vegetation present
3. Vegetated levee slopes
4. Marsh patch size > 10 ha
5. Closer than 500 m to nearest marsh with documented clapper rail presence
6. Fully tidal
7. Saline
8. High proportion of *Salicornia virginica*, tall hybrid *Spartina* clones, and/or *Grindelia stricta* cover
9. At least a few second and third order channels, or highly channelized

Habitat characteristics associated with California clapper rail absence and included on the habitat assessment datasheet as negative characteristics include the following:

1. New restoration site < 50% vegetated
2. Upper marsh vegetation absent
3. Levee slopes unvegetated
4. Small marsh patch size (< 1 ha)
5. Distance to nearest known marsh with clapper rails > 1000 m
6. Sparse vegetation in rip-rap
7. Highly muted tidal regime or non-tidal
8. Freshwater

CLRA survey protocol "F" - Clapper rail habitat assessment datasheet 2005 - Page 1

Study site _____ Date _____ Obs _____

All these questions can be answered by checking the appropriate box, with the exception of the percent vegetation, which requires a number

Variable	Options	pos/neg for CLRA	Data
restoration status	natural		
	mature restoration site	+	
	restoring < 10 years but > 50% vegetated	+	
	new restoration site, less than 50% vegetated	-	
	unknown		
elevation	upper marsh present (*S. virginica*, *Grindelia*)	+	
	upper marsh absent (*S. europea* & *Spartina* only)	-	
levees	levee slopes vegetated	+	
	levee slopes unvegetated	-	
	no levees, natural upland gradient, vegetated > 50%	+	
	no levees, natural upland gradient < 50% vegetated	-	
marsh size	largest patch < 1 ha (100 x 100 m)	-	
	largest patch 1 to 10 ha		
	largest patch > 10 ha	+	
marsh width (linear marsh)	<20 m		
	20 to 50 m		
	50 to 200 m		
	>200 m		
distance to nearest CLRA + marsh	distance < 500m	+	
	distance 500 - 1000 m		
	distance > 1000m	-	
	unknown		
marsh configuration	surrounded by levees on 4 sides		
	no levee on bayward edge		
	linear marsh with slough		
	sparse vegetation in riprap	-	

Variable	Options	pos/neg for CLRA	Data
tidal regime	fully tidal	+	
	slightly muted tidal		
	highly muted/managed	-	
	unknown		
salinity	saline	+	
	moderately brackish	+	
	brackish to fresh (*S. acutus*/*Typha* present_	?	
Spartina hybrid invasion	complete (marsh 100% *Spartina*)		
	moderate		
	sparse		
vegetation cover	percent *Salicornia virginica*	+	
(as percent of vegetation)	percent tall *Spartina* hybrids	+	
	percent short form *Spartina* hybrids		
	percent *S. foliosa*		
	percent *Grindelia*	+	
	percent other		
channelization	highly channelized	+	
	a few second and third order channels	+	
	no channels > first order	?	
	only one channel with narrow marsh strip either side		
	no channels, marsh at bay edge		
open water	ponds > 75% of marsh		
	ponds 50 - 75% of marsh		
	ponds 25 - 50%% of marsh		
	ponds < 25% of marsh		
	ponds absent		

CLRA survey protocol “F” - Clapper rail habitat assessment datasheet 2005 Page 3

Variable	Options	pos/neg for CLRA	Data
overall likelihood of CLRA use	highly unlikely		
	poor but close enough to good habitat that may be in home range & used for foraging		
	potentially marginal habitat; at least 2 positive characteristics		
	possibly good habitat; at least 4 positive characteristics		
	likely to be good habitat; at least 6-8 positive characteristics		
	other notes		
Recommendation for CLRA surveys	"A" regular CLRA survey 3 rounds		
	"C" call response survey 3 rounds		
	no further surveys necessary		

APPENDIX 5. CALIFORNIA CLAPPER RAIL SURVEY DATA INTERPRETATION METHODS.

The methodologies described here are expected to change as 2005 & 2006 data are analyzed. In 2005 all data received from partners and used for ISP control program numbers are presumed to be derived by examining raw numbers on datasheets and maps, as described in USFWS protocols (A1, A3 & D1).

Code	Survey protocol used	Description	Year used	Organization using
A1	A	Estimate numbers using USFWS protocols. Numbers were relatively simple to estimate directly due to small marsh size or narrow marsh configuration and limited overlapping survey stations, typically using only one observer's data. Single birds detected only by clatter (C), kek (K), kek-burr (SK) or visual (V) are counted as 1 to 2 individuals	2005 & 2006	ISP
A2	A	Estimate numbers using USFWS protocols, as in A1, with the following exception: single birds detected only by clatter (C), kek (K), kek-burr (SK) or visual (V) are counted as 1.5 individuals	2005	ARA (Marin Audubon Society report)
A3	A	Estimate numbers using USFWS protocols with the following exceptions: numbers were estimated using multiple transects on the same or different days, but triangulation was done on paper maps, NOT using ArcView (as was done with A4). This process is assumed to be less accurate than that used in A4. Single birds detected only by clatter (C) , kek (K), kek-burr (SK) or visual (V) are counted as 1 to 2 individuals	2005 & 2006	ISP
A4	A	Estimate numbers using USFWS protocols except for the following: numbers were estimated using multiple transects on the same or different days. In contrast to A3, triangulation was completed by mapping distance and angle in ArcView. Single birds detected only by clatter (C), kek (K), kek-burr (SK) or visual (V) are counted as 1 to 2 individuals. More complex sites e.g. Cogswell, Roberts Landing.	2005 & 2006	ISP
A5	A	Estimation derived using DISTANCE software. The process involves calculating detection probabilities and using these calculations to calculate absolute density for each site.		PRBO, ARA

Code	Survey protocol used	Description	Year used	Organization using
C1	C	Estimate derived from 3 rounds of surveys, whether or not tapes were played at all points on all rounds (i.e., after detecting birds during a "C" survey, subsequent rounds at that point would be passive and performed as "A" surveys).	2005 2006	ISP, ARA
C2	C	Estimate derived from fewer than 3 rounds of surveys, whether or not tapes were played at all points on all rounds (i.e., after detecting birds during a "C" survey, subsequent rounds at that point would be passive and performed as "A" surveys).	2005 2006	ISP, ARA
D1	D	Estimate derived from fewer than 3 rounds of surveys, all conducted as passive "A" surveys		UFWS
D2	D	Estimate derived from fewer than 3 rounds of surveys, all conducted as active "C" surveys		UFWS
E1	E	Estimate derived by counting birds flushed during single winter high tide airboat survey		UFWS, EBRPD
E2	E	Estimate derived by counting birds flushed during two or more winter high tide airboat surveys		UFWS, EBRPD
P1	not applicable	Minimum numbers derived only from point count surveys		
I	not applicable	Minimum numbers derived from non-protocol surveys or incidental sightings		

APPENDIX 6. CALIFORNIA CLAPPER RAIL SURVEY STATION COORDINATES.

Stations at San Francisco Airport, Candlestick and Yosemite Sloughs were use for habitat assessment surveys only; no call count surveys were conducted. Coordinate system used: UTM NAD83 Zone 10.

Site Name	Point ID	ISP Site number	Easting	Northing
Aeolian yacht harbor	AEOL01	17m	567453	4178421
Airport channel	AICH01	17k	569773	4176298
Airport channel	AICH02	17k	569705	4176486
Airport channel	AICH03	17k	569648	4176675
Airport channel	AICH04	17k	569588	4176840
Airport channel	AICH05	17k	569501	4177019
Airport channel	AICH06	17k	569550	4177213
Airport channel	AICH07	17k	569506	4177339
Airport channel	AICH08	17k	568643	4177837
Airport channel	AICH09	17k	568798	4177707
Airport channel	AICH10	17k	568909	4177545
Airport channel	AICH11	17k	569081	4177424
Airport channel	AICH12	17k	569206	4177257
Airport channel	AICH13	17k	569288	4177066
Airport channel	AICH14	17k	569367	4176867
Alameda Is East	ALAM01	17m	567610	4178422
Alameda Is East	ALAM02	17m	567754	4178553
Alameda Is East	ALAM03	17m	567901	4178659
Bayfarm Bridge N.	BFBN02	17m	567255	4178374
Bayfarm Bridge S.	BFBS01	17b	567242	4178077
Bayfarm Island	BFIS01	17b	565858	4178094
Bayfarm Island	BFIS02	17b	566169	4178128
Bayfarm Island	BFIS03	17b	566372	4178122
Bayfarm Island	BFIS04	17b	566565	4178118
Bayfarm Island	BFIS05	17b	566777	4178117
Bayfarm Island	BFIS06	17b	566985	4178121
Bockmann Channel	BOCH01	20i	574261	4169084
Bockmann Channel	BOCH02	20i	574076	4169082
Bunker Marsh	BUNK01	20g	573411	4170308
Bunker Marsh	BUNK02	20g	573507	4170104
Bunker Marsh	BUNK03	20g	573561	4169912
Bunker Marsh	BUNK04	20g	573631	4169725
Candlestick SRA	CAND02	12e	554628	4174749
Citation marsh	CITA01	20d	573661	4170466
Citation marsh	CITA02	20d	573555	4170639

Site Name	Point ID	ISP Site number	Easting	Northing
Citation marsh	CITA03	20d	573435	4170800
Citation marsh	CITA04	20d	573314	4170961
Citation marsh	CITA05	20d	573318	4171265
Citation marsh	CITA06	20d	573316	4171466
Citation marsh	CITA07	20d	573314	4171666
Cogswell	COGS01	20m	574738	4166041
Cogswell	COGS02	20m	574713	4166250
Cogswell	COGS03	20m	574862	4166363
Cogswell	COGS04	20m	575059	4166368
Cogswell	COGS05	20m	575218	4166336
Cogswell	COGS06	20m	575158	4166170
Cogswell	COGS07	20m	575043	4166004
Cogswell	COGS08	20o	574984	4165788
Cogswell	COGS09	20o	575124	4165612
Cogswell	COGS10	20o	575138	4165412
Cogswell	COGS11	20o	575105	4165165
Cogswell	COGS12	20o	574791	4165248
Cogswell	COGS13	20o	574779	4165542
Cogswell	COGS14	20o	574781	4165740
Cogswell	COGS15	20n	575367	4165223
Cogswell	COGS16	20n	575572	4165228
Cogswell	COGS17	20n	575710	4165373
Cogswell	COGS18	20n	575620	4165538
Cogswell	COGS19	20n	575531	4165722
Cogswell	COGS20	20n	575436	4165912
Cogswell	COGS21	20n	575340	4166092
Coliseum channel	COCH06	17i	569684	4178668
Dogbone marsh	DOGB01	20c	572695	4170847
Dogbone marsh	DOGB02	20c	572510	4170924
Dogbone marsh	DOGB03	20c	572377	4171090
Doolittle pond	DOPO01	17l	568374	4178092
Doolittle pond	DOPO02	17l	568144	4178108
Doolittle pond	DOPO03	17l	568130	4177879
Doolittle pond	DOPO04	17l	568396	4177885
Easton Creek	EACR01	19j	556334	4160909
Elsie Roemer	ELRO1	17a	566123	4178720
Elsie Roemer	ELRO2	17a	566244	4178687
Elsie Roemer	ELRO3	17a	566367	4178650
Elsie Roemer	ELRO4	17a	566479	4178613
Elsie Roemer	ELRO5	17a	566617	4178558
Elsie Roemer	ELRO6	17a	566752	4178506
Elsie Roemer	ELRO7	17a	566904	4178458
Emeryville Crescent	EMCR01	06b	560428	4186926

Site Name	Point ID	ISP Site number	Easting	Northing
Emeryville Crescent	EMCR02	06b	560250	4186896
Emeryville Crescent	EMCR03	06b	560177	4186720
Emeryville Crescent	EMCR04	06b	560358	4186670
Emeryville Crescent	EMCR05	06b	560565	4186723
Emeryville Crescent	EMCR06	06b	560742	4186744
Emeryville Crescent	EMCR07	06b	560954	4186746
Fan marsh	FANM01	17j	568582	4177668
Fan marsh	FANM02	17j	568783	4177699
Fan marsh	FANM03	17j	568635	4177820
Greco Island North	GRIN11	02f	570656	4153100
Greco Island North	GRIN12	02f	570822	4152984
Greco Island North	GRIN13	02f	570983	4152868
Greco Island North	GRIN14	02f	571154	4152756
Greco Island North	GRIN15	02f	571316	4152639
Greco Island North	GRIN16	02f	571480	4152527
Greco Island North	GRIN17	02f	571634	4152417
Greco Island North	GRIN18	02f	571798	4152304
Hayward Landing	HALA01	20k	574524	4166812
Hayward Landing	HALA02	20k	574556	4167005
Hayward Landing	HALA03	20k	574717	4166878
Hayward Landing	HALA04	20k	574929	4166935
Hayward Landing	HALA05	20k	575124	4166989
Hayward Landing	HALA06	20k	575337	4167034
Johnson’s Landing	JOLA02	20l	575064	4164736
Johnson’s Landing	JOLA03	20l	574999	4164923
Johnson’s Landing	JOLA04	20o	574909	4165104
MLK Restoration	MLKR01	17h	569671	4177003
MLK Restoration	MLKR02	17h	569622	4177196
MLK Restoration	MLKR03	17h	569706	4177372
MLK Restoration	MLKR04	17h	569712	4177546
MLK Restoration	MLKR05	17h	569837	4177413
MLK Restoration	MLKR06	17h	569948	4177254
MLK Restoration	MLKR07	17h	570046	4177104
MLK Shoreline	MLKS01	17d	568422	4179660
MLK Shoreline	MLKS02	17d	568451	4179423
MLK Shoreline	MLKS03	17d	568671	4179429
MLK Shoreline	MLKS04	17d	568863	4179503
MLK Shoreline	MLKS05	17i	569069	4179578
MLK Shoreline	MLKS06	17d	568952	4179302
MLK Shoreline	MLKS07	17d	568995	4179104
MLK Shoreline	MLKS08	17d	569123	4178953
MLK Shoreline	MLKS09	17d	569336	4178901
MLK Shoreline	MLKS10	17d	569456	4178741

Site Name	Point ID	ISP Site number	Easting	Northing
MLK Shoreline	MLKS11	17d	569515	4178546
MLK Shoreline	MLKS12	17d	569437	4178333
MLK Shoreline	MLKS13	17d	569909	4177684
Newark Slough	NEW01	05c	581607	4154285
Newark Slough	NEW02	05c	581705	4154094
Newark Slough	NEW03	05c	581878	4153981
Newark Slough	NEW04	05c	582059	4153877
Newark Slough	NEW05	05c	582040	4153641
Newark Slough	NEW06	05c	582159	4153473
Newark Slough	NEW07	05c	582333	4153544
Newark Slough	NEW08	05c	581481	4154127
North Marsh	NORT01	20f	573097	4171251
North Marsh	NORT02	20f	572949	4171118
North Marsh	NORT03	20f	572920	4170920
North Marsh	NORT04	20f	572877	4170757
North Marsh	NORT05	20f	572997	4170591
North Marsh	NORT06	20f	573168	4170488
North Marsh	NORT07	20f	573395	4170336
North Marsh	NORT08	20f	573588	4170397
Oro Loma Marsh	ORLO01	07b	574936	4168382
Oro Loma Marsh	ORLO02	07b	575023	4168204
Oro Loma Marsh	ORLO03	07b	574972	4168062
Oro Loma Marsh	ORLO04	07b	574771	4168057
Oro Loma Marsh	ORLO05	07b	574584	4168057
Oro Loma Marsh	ORLO06	07b	574382	4168054
Oro Loma Marsh	ORLO07	07b	574308	4168235
Oro Loma Marsh	ORLO08	07b	574215	4168393
Oro Loma Marsh	ORLO09	07b	574150	4168521
Oro Loma Marsh	ORLO10	07b	574098	4168723
Oro Loma Marsh	ORLO11	07b	574095	4168866
Oro Loma Marsh	ORLO12	07b	574302	4168857
Oro Loma Marsh	ORLO13	07b	574495	4168854
Oro Loma Marsh	ORLO14	07b	574661	4168784
Oro Loma Marsh	ORLO15	07b	574739	4168633
Oro Loma Marsh	ORLO16	07b	574840	4168558
Outer Bair B2	OBE04	02d	569950	4154260
Outer Bair B2	OBE05	02d	570112	4154394
Outer Bair B2	OBE06	02d	570297	4154709
Outer Bair B2	OBE07	02d	570261	4154520
Outer Bair B2	OBE23	02d	569669	4154629
Outer Bair B2	OBE24	02d	569733	4154871
Outer Bair B2	OBE25	02d	569782	4155053
Outer Bair B2	OBE26	02d	569842	4154671

Site Name	Point ID	ISP Site number	Easting	Northing
Outer Bair B2	OBE27	02d	569999	4154548
San Francisco Airport	SFO01	19h	554477	4165619
San Francisco Airport	SFO02	19h	555171	4162847
San Francisco Airport	SFO03	19h	555210	4164753
San Francisco Airport	SFO04	19h	555782	4163912
San Francisco Airport	SFO05	19h	553924	4165022
San Leandro Creek	SLEA01	17e	569805	4177557
San Leandro Creek	SLEA02	17e	569923	4177386
San Leandro Creek	SLEA03	17e	570046	4177211
San Leandro Creek	SLEA04	17e	570174	4177030
San Leandro Creek	SLEA05	17e	570298	4176856
San Leandro Creek	SLEA06	17e	570418	4176690
San Leandro Creek	SLEA07	17e	570529	4176533
San Leandro Creek	SLEA08	17e	570627	4176438
San Leandro Creek	SLEA10	17e	570792	4176314
San Leandro Creek	SLEA11	17e	570960	4176215
San Leandro Creek	SLEA12	17e	571154	4176192
San Lorenzo Creek	SLRZ01	20h	573737	4169556
San Lorenzo Creek	SLRZ02	20h	573659	4169471
San Lorenzo Creek	SLRZ03	20h	573943	4169633
San Lorenzo Creek	SLRZ04	20h	574138	4169774
San Lorenzo Creek	SLRZ05	20h	574277	4169889
San Lorenzo Creek	SLRZ07	20h	573896	4169503
San Lorenzo Creek	SLRZ08	20h	573955	4169323
San Lorenzo Creek	SLRZ09	20h	573951	4169136
Sanchez Marsh	SANC01	19k	556832	4160375
Sanchez Marsh	SANC02	19k	556689	4160466
Sanchez Marsh	SANC03	19k	557028	4160398
Sanchez Marsh	SANC04	19k	557215	4160382
Seal Slough	SEAL01	19p	562561	4158484
Seal Slough	SEAL02	19p	562376	4158472
Seal Slough	SEAL03	19p	562729	4158450
Seal Slough	SEAL04	19p	562857	4158547
Seal Slough	SEAL05	19p	562861	4158722
Seal Slough	JOIN01	19p	562418	4158213
South Candlestick	CAND01	12f	553444	4173390
West Point Slough NW	WPSN01	02e	571664	4152010
West Point Slough SE	WPSS01	02g	570830	4151187
West Point Slough SE	WPSS02	02g	571095	4151491
West Point Slough SE	WPSS03	02g	571482	4150936
West Point Slough SE	WPSS04	02g	572122	4151160
West Point Slough SE	WPSS05	02g	572679	4151024
West Point Slough SE	WPSS06	02g	572637	4150664

Site Name	Point ID	ISP Site number	Easting	Northing
West Point Slough SE	WPSS07	02g	572653	4150083
West Point Slough SE	WPSS08	02g	572666	4149435
Yosemite Slough	YOSE01	12e	554269	4175315