San Francisco Estuary Invasive *Spartina* Project 2021-2022 Monitoring and Treatment Report

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SAN FRANCISCO BAY RESTORATION AUTHORITY MEASURE AA

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1. INTRODUCTION

By the early 1970s, four non-native cordgrasses, including *Spartina alterniflora* (Atlantic smooth cordgrass), *S. densiflora* (Chilean cordgrass), *S. anglica* (English cordgrass), and *S. patens* (salt meadow cordgrass), had been introduced to the San Francisco Estuary ('Estuary' or 'Bay' throughout this report). Each of these species is known to be invasive outside of its native range, and each has demonstrated varying degrees of invasiveness since establishing in the Estuary. *Spartina* species are closely related, and both *S. alterniflora* and *S. densiflora* subsequently hybridized with native *S. foliosa* (Daehler and Strong 1996; Ayres, Strong et al. 2003; Ayres, Grotkopp et al. 2008). Offspring of hybrid *S. alterniflora* × *foliosa* backcrossed with both parent species, producing an extremely robust and fertile "hybrid swarm," which invaded habitat throughout the Estuary, threatening the ecological integrity of the existing tidal wetlands and mudflats as well as the potential for future restoration efforts (Daehler and Strong 1996; Goals 1999; Ayres, Strong et al. 2003; State Coastal Conservancy 2003; Ayres, Zaremba et al. 2004; Ayres, Grotkopp et al. 2008). For further detail on each species of *Spartina* found in the Estuary, see **Appendix I**.

The San Francisco Estuary Invasive *Spartina* Project (ISP) was established in 2000 by the California State Coastal Conservancy (Conservancy), in partnership with the U.*S.* Fish and Wildlife Service (USFWS), in response to the invasion of non-native *Spartina*. Non-native *Spartina* had been determined to pose many serious threats to the Estuary, as was described in the ISP's Programmatic Environmental Impact Statement/Environmental Impact Report (PEIS/EIR; State Coastal Conservancy 2003). Predicted impacts of non-native *Spartina* in the Estuary included the destruction or degradation of endangered species habitat, loss of mudflats that are vital for shorebird foraging, loss of urban flood control capacity, creation of mosquito-breeding areas by impounding water, corruption of salt marsh restoration efforts, and the possible eventual extinction of native *Spartina foliosa*. The purpose of the ISP is to implement a regional program to eradicate invasive *Spartina* species from the Estuary. This goal is being accomplished through a coordinated program of inventory mapping and treatment that is planned and supervised by ISP biologists and implemented by a bay-wide network of partners, including hundreds of landowners, resource agencies, contractors, grantees, and stakeholder groups throughout the nine counties of the Bay Area.

The project has been supported since 2000 by a combination of state (75%), federal (21%), and local/other funds (4%) totaling $51.5M. The program expenditure for 2020 and 2021 seasons was approximately $6.4M with $3.1M of that for invasive *Spartina* treatment and monitoring, $800K for Ridgway's rail research, monitoring, and permitting, and $1.2M for wetland habitat restoration through revegetation and construction of high tide refuge islands.

Working within limited annual windows of opportunity due to tides, stage of plant development, and presence of endangered species in the work area, the ISP conducts mapping and treatment of invasive *Spartina* annually throughout up to 70,000 acres of potential habitat.

Defining "Area"

The ISP uses the terms "net area" and "treatment area" to define the extent of non-native *Spartina*.

Net area refers to the size of the infestation if the space between stems were subtracted from the overall footprint of the plant or clump of plants. Net area is the metric typically used in botanical surveys.

Treatment area describes the area that will be directly affected by treatment. Treatment area is a separate measurement used for planning, and it is generally five to seven times greater than the net area of a given instance of invasive *Spartina*.

Unless otherwise noted in the text, all references to area in this report are net area.

Since 2008, inventory efforts have been conducted primarily on the ground or using boats. Most sites are inventoried each year prior to treatment to allow thorough and focused mapping and potential collection of genetic samples, and to map precise locations of invasive *Spartina* plants to inform treatment. Having the target plant locations identified and mapped in advance allows treatment crews to work more efficiently without having to hunt for the target invasive *Spartina* at the same time. The approach also enhances worker safety, reduces the area crews must cover, and minimizes disturbance to the marsh. A small number of sites with a substantial mudflat component are mapped via airboat at the same time as treatment due to logistical concerns. Biologists map invasive *Spartina* plants they have detected using rugged handheld tablet PCs with Global Positioning System (GPS), spatially demarcating each feature. A cover class is assigned to each feature to record the density of living invasive *Spartina* within that feature's delineated boundary (see inset: Defining "Area"). The *Spartina* data are then synchronized to a cloud-based server, becoming readily accessible to all staff for real-time coordination in the field.

During treatment, ISP biologists guide contracted herbicide applicators or agency personnel to each previously mapped invasive *Spartina* feature and update that feature on the tablet to record that day's treatment activity (e.g., "sprayed", "dug", "not treated", "sub-optimally treated," etc.). This methodology has been implemented by ISP since 2009 and has greatly improved the ability to achieve thorough treatment of sites in the limited time available with the treatment crew(s) for a given day. For further detail on the methods employed by ISP for treatment, monitoring, and other work, please see **Appendix II**.

In 2011 and 2012, the USFWS placed treatment restrictions on a number of sub-areas, resulting ultimately in 11 restricted sub-areas, located primarily in the East Bay. During consultation with USFWS in 2018, some of these 11 sub-areas were split into smaller pieces, resulting in 15 sub-areas. In its 2018 Biological Opinion for the Project, the USFWS permitted full treatment to be reinitiated at nine of the 15 sub-areas[1], a period referred to going forward as "Phase 1 of re-initiation." By the end of the 2020 season, treatment had been reinitiated in all nine Phase 1 sub-areas authorized for full treatment, and significant progress toward eradication was being made. In 2020, the ISP mapped a total of 33.1 net acres of invasive *Spartina*, 78% of which was in the six sub-areas where treatment is still restricted.

The Project has made tremendous progress toward eradication since 2005, when inventory and treatment began throughout the Estuary and in the neighboring coastal areas. Historic infestations have been reduced by greater than 97% within the Estuary, completely eradicated from the Point Reyes National Seashore and Bolinas Lagoon, and very nearly eradicated from Tomales Bay.

Section 2 provides information on recent inventory and treatment activities. For a more complete history of the invasion and treatment activities, see the 2012 ISP Monitoring and Treatment Report (Rohmer, Kerr et al. 2014), subsequent annual reports from 2013 to 2016, and biennial reports since 2017.

[1] Partial treatment, "seed suppression" was authorized at one additional sub-area at this time.

2. TREATMENT AND MONITORING COMPLETED 2021-2022

The ISP's activities and progress over the two-year period 2021-2022 are described in this section, first from a bay-wide perspective, and then in more detail for each of 12 reporting regions (see inset at right and **Figure 1**). The reporting regions are based on regions initially defined by USFWS for assessment of California Ridgway's rail (*Rallus obsoletus obsoletus*) populations. The reporting region boundaries also take into consideration natural and political landscape features, similarities in land management, geographic proximity and ecological connectedness of the treatment sub-areas, site access, and general impact of non-native *Spartina* invasion on the region. ISP uses these reporting regions to cohesively present treatment and monitoring data in a manner more suitable for correlation with California Ridgway's rail ("Ridgway's rail") data. Information presented here predominantly reflects data from the 2022 season, though activities from 2021 are included as needed and where specifically identified.

ISP Reporting Regions

Region 1. Marin
Region 2. San Francisco Peninsula
Region 3. San Mateo
Region 4. Dumbarton South
Region 5. Union City
Region 6. Hayward
Region 7. San Leandro Bay
Region 8. Bay Bridge North
Region 9. Suisun
Region 10. Vallejo
Region 11. Petaluma
Region 12. Outer Coast

2.1 Bay-wide Inventory

Bay-wide Inventory Methods

There are 70,000 acres of potential *Spartina* habitat within the ISP Project Area. Factors including but not limited to staff availability, budget, a short growing season (June to November), and appropriate tide windows constrain the Project's ability to complete inventory (and treatment) in all areas every year. To make the best use of available resources, ISP Managers plan each season by setting priorities according to relative invasion pressure and frequency of inventory. These decisions are informed by historic presence of invasive *Spartina*, proximity to invasive *Spartina* seed sources, habitat suitability for colonization by invasive *Spartina,* and time since the area was thoroughly surveyed for invasive *Spartina*.

Prioritized sub-areas are assigned to one of three inventory categories: (1) complete inventory, (2) partial inventory, or (3) coarse inventory. Sub-areas prioritized for complete inventory typically have historic infestation or high risk of colonization, or several years have passed since the last thorough inventory and the sub-area requires reassessment. Partial inventory is conducted in portions of very large sub-areas where there are known isolated infestations that pose limited threat of expansion to other portions of the marsh. Coarse inventory is conducted in sub-areas with heavy infestations, such as where treatment has been restricted due to permit requirements (details in **Section 3.1**), or where treatment will be broad enough to not warrant a high level of inventory data detail. Coarse inventory may be conducted as a less detail-oriented

form of standard inventory or by using a 25x25 meter grid method[2]. No inventory is conducted in low-priority sub-areas, those with no historic infestation and low risk of colonization, or where a recent thorough inventory concluded there was low risk. **Appendices IV** and **V** provide the inventory plans for 2021 and 2022, respectively, and show any changes from the plan made during implementation.

The six sub-areas where treatment has been restricted since 2011 do not receive thorough inventory. Rather, they are surveyed by grids biennially in odd-numbered years, and that data is carried over as a proxy for the next even-numbered year. Once treatment is authorized, more frequent and detailed inventory will be resumed to inform treatment and progress towards eradication.

A second round of inventory is frequently conducted late in the season at select sub-areas that are approaching local eradication. This additional assessment is critical to identify invasive *Spartina* plants that may not have been detected in the first round, usually because they were heavily impacted by prior treatment and were not yet sufficiently developed, had emerged after the initial inventory, or had suffered herbivory by geese. Many of these contain linear stretches of marsh that do not provide habitat for Ridgway's rails, and so they may be given initial treatment earlier in the season (e.g., prior to the end of rail nesting season). The early initial treatment allows enough time for plants to show treatment stress before the second treatment round, allowing for highly effective second-round applications targeting plants not already showing treatment stress.

In 2022, 13 sub-areas within the three southernmost regions were selected to be either partially inventoried and treated or neither inventoried nor treated in their entirety for the 2022 season. These included B2 North South (02c.2) and B2 South (02d.1a-b, 02d.2-3) in Region 3: San Mateo; Mowry Marsh and Slough (05a) in Region 4: Dumbarton South; and portions of Alameda Flood Control Channel (01b, 01c, 01f) and Old Alameda Creek (13a-c, 13g) in Region 5: Union City. Approximately 30% of B2 North South was inventoried and treated in 2022, but twelve other sub-areas included in this list were not visited in 2022. *Spartina* inventory data for the portions of or complete sub-areas that were not inventoried in 2022 have been carried over from 2021 to 2022 as a proxy of 2022 cover, though these plants were treated in 2021 and cover was very likely reduced in 2022. These marshes will be inventoried and treated in their entirety during the 2023 season (further discussed in **Section 2.2**).

In addition to the bay-wide efforts to eradicate hybrid *S. alterniflora*, the Project also does work on two other types of invasive *Spartina*: *S. anglica*, and *S. densiflora* and its hybrids, though these species are currently found only in small numbers in Marin County, so the level of effort is

[2] The grid method was developed by ISP in 2008 to map major infestations, but its use is now limited to the restricted treatment sub-areas and sometimes their direct neighbors. Mapping by grid at the restricted sub-areas follows the rationale that detailed surveys are not needed to inform treatment and is intended to keep track of bay-wide infestation levels until treatment resumes at these most invaded marshes. Thus, using the much quicker grid method frees up time that is better allocated to active treatment sites.

less. (See **Appendix 1**). The Project previously surveyed for and treated a fourth invasive *Spartina*, *S. patens*, which is found only in Southampton Marsh at Benicia State Recreation Area. Management of this species was taken over by the California Department of State Parks in 2020, and work there is no longer reported by the ISP.

Timing of completed inventory by target species is shown in **Table 1**. **Figures 1** and **2** show the location of the ISP reporting regions, inventory boundaries, and status of survey completion for 2021 and 2022.

Workflow in 2021 was disrupted by a cyber-attack in August that locked all office computers and blocked use of many technical systems, including several daily processes to integrate and share data collected in the field. While the computer system was being restored over the next several months, staff had to revert to previous, lower-tech methods, and the inventory goals for the year had to be dialed back. While no data was permanently lost, the event reduced efficiency and influenced staff morale for the rest of the season.

In 2022, the rapidly increasing cost of living and job market volatility resulted in an abrupt loss of veteran ISP staff and made it difficult to attract the number of seasonal staff needed to support the 2022 *Spartina* Treatment Season. Consequently, treatment and inventory goals for 2022 were adjusted to match available staff resources, and prioritization decisions were given careful attention throughout the season.

Table 1. Inventory timing for *Spartina* by species in 2021 and 2022

***Spartina* species**	**Time frame of 2021 inventory**	**Time frame of 2022 inventory**
hybrid *S. alterniflora*	June 21, 2021 – December 9, 2021	May 18, 2022 – November 21, 2022
S. densiflora and hybrids (I)	June 4, 2021 - June 24, 2021	June 2, 2022 - July 25, 2022
S. densiflora and hybrids (II)	January 10, 2022 - February 3, 2022	January 3, 2023 - March 8, 2023
S. densiflora and hybrids (III)	February 21, 2022 - February 28, 2022	n/a
S. anglica	July 16, 2021	July 19, 2022

Bay-wide Inventory Results

In 2021, ISP inventoried 43,300 acres (62%) of the ~70,000-acre Project Area. An additional 7,700 acres adjacent to the Project Area were assessed for *Spartina* habitat in support of Phase II of the South Bay Salt Pond Restoration Project (**Figure 1**). Every sub-area and portion of the Estuary with known infestation was inventoried, and the estuary total for detected invasive *Spartina* was 22.5 acres net cover. In 2022, ISP inventoried 41,400 acres (59%) of the Project Area and detected 20.7 acres of invasive *Spartina* (**Figure 2, Figure 3, Table 2**). This reflects a 97.4% reduction from infestation peak levels in 2005, and an 8.1% reduction from 2021 levels. Of the remaining invasive *Spartina* in the Estuary, 17.9 acres (87%) of hybrid *S. alterniflora* is located within the six sub-areas of Central San Francisco Bay where treatment restrictions established in 2011 remain in place as mentioned above. See **Section 3.1** for more detail on these six sub-areas.

All but 0.5 m^2 of invasive *Spartina* mapped in 2022 was hybrid *S. alterniflora* (**Table 3**), 99.7% of which was in four reporting regions (listed here in order of decreasing invasive *Spartina* cover):

- Region 6: Hayward – 10.5 acres
- Region 7: San Leandro Bay – 7.8 acres
- Region 3: San Mateo – 2.1 acres
- Region 4: Dumbarton South – 0.2 acres

The treatment restrictions in place for six sub-areas in regions 6 and 7 drive the infestations in these two regions. Region 3 has the next sizeable infestation that is due in part to former treatment restrictions that were in place for B2 North East (02c.1b) from 2011 to 2018. During this period the sub-area was treated aerially with a dilute concentration intended to halt seed production while maintaining plant vertical structure to provide habitat for Ridgway's rails. Despite this treatment, it is likely that some seed production continued, and propagules were exported to neighboring large marshes including several young large-scale restoration sites like Inner Bair Restoration (02l), Pond B3 (02m), and Central Bair (02o).

Of the top four, Region 4 has the lowest level of infestation that has undergone a dramatic decline in recent years. Still, it remains formidable due to its extensive size, complexity of marshes, young restoration sites, and difficult access that frequently requires facilitation by boat. This region also hosts the bulk of upcoming large-scale restoration marshes being planned by the South Bay Salt Pond Restoration Project, so continued efforts and diligence remain integral here to ensure the success of these native marshes.

The three regions with the highest 2022 infestations include sub-areas that were restricted from 2011 to 2018 ("Phase 1" sub-areas), and the top two regions with highest infestations include sub-areas where treatment remains restricted. See **Section 3.1** for further discussion of these sub-areas and progress on local eradication.

Table 2. Summary of Invasive *Spartina* Mapped in 2021 and 2022

# Sub-Areas	Potential Invasive *Spartina* Habitat (ac)	Proportion of Acreage Authorized for Full Treatment	Net Cover 2021 (ac)	Net Cover 2022 (ac)	Change Since 2021 (ac)	% Change Since 2021	Peak Year	Peak Amount (ac)	% Change Since Peak	% Remaining since Peak
221	71,368	99.6%	22.5	20.7	-1.8	-4.9%	2005	805	-97.4%	2.6%

Table 3. Summary of invasive *Spartina* Mapped in 2021 and 2022 by Species and Treatment Authorization Status

Spartina species	Net Cover 2022	Net Cover 2021	Change Since 2021	% Change Since 2021	Peak Year	Peak Amount	Change Since Peak	% Change Since Peak	% Remaining since Peak
S. alterniflora x foliosa									
Sub-areas with 2022 Full Treatment Authorized	2.8 ac.	4.6 ac.	-1.80 ac.	-39.1%	2005	714.4 ac.	-706.99 ac.	-99.6%	1.0%
Sub-areas with 2022 Treatment Restrictions	17.9 ac.	17.9 ac.	0	0%	2005	73.2 ac.	-55.29 ac.	-75.5%	35.1%
TOTAL	20.7 ac.	22.5 ac.	-1.80 ac.	-8.0%	2005	787.6 ac.	-766.89 ac.	-97.4%	4.2%
S. densiflora	0.30 m^2	0.32 m^2	-0.02 m^2	-6.3%	2005	4.17 ac.	-4.1699 ac.	-99.998%	0.005%
S. densiflora x foliosa	0.13 m^2	0.21 m^2	-0.08 m^2	-38.1%	2005	347.82 m^2	-347.69 m^2	-99.96%	0.2%
S. anglica	0.03 m^2	0.13 m^2	-0.10 m^2	-76.9%	2006	382.66 m^2	-382.63 m^2	-99.99%	0.04%

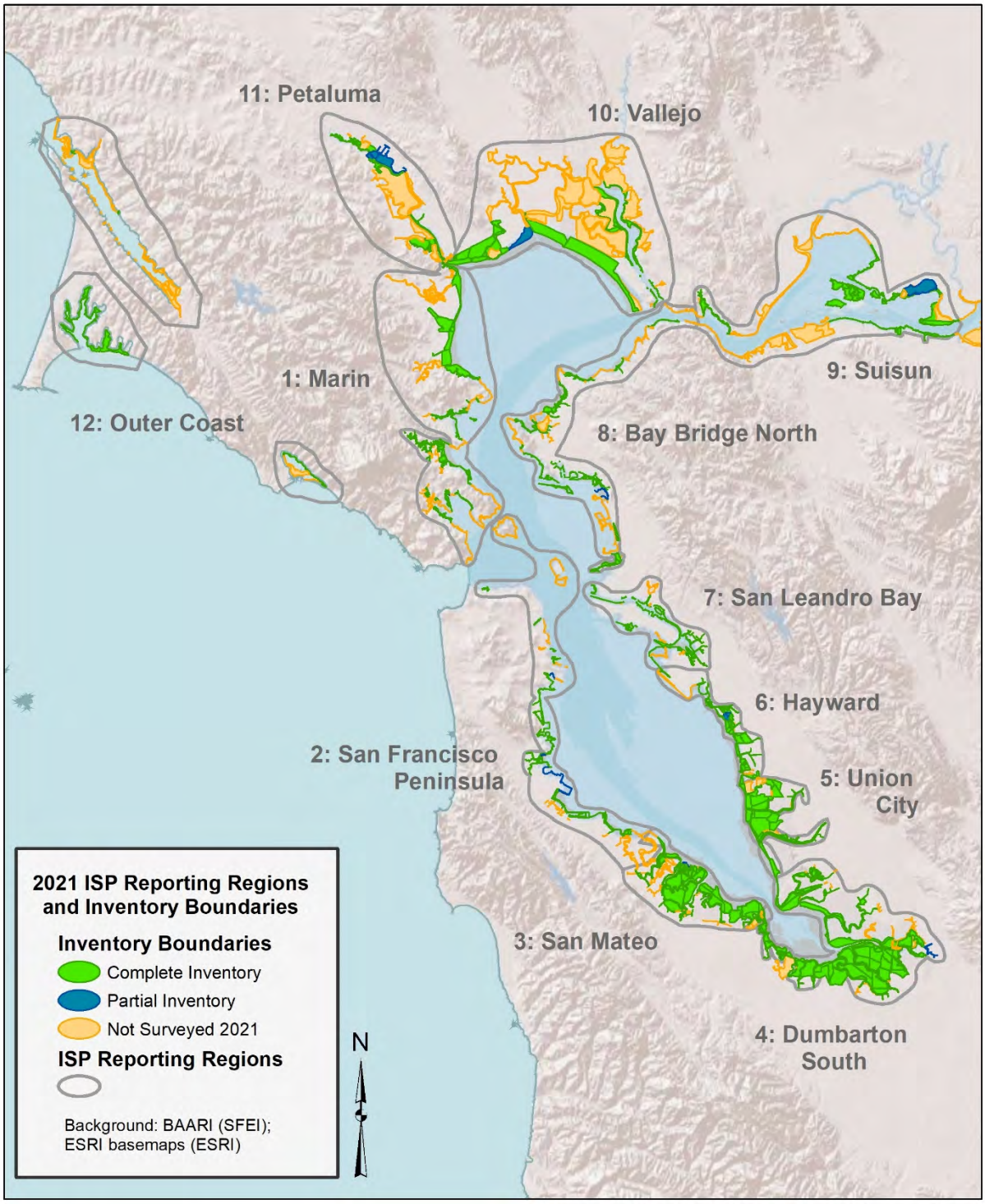

Figure 1. ISP Reporting Regions and 2021 survey efforts throughout San Francisco Bay Estuary.

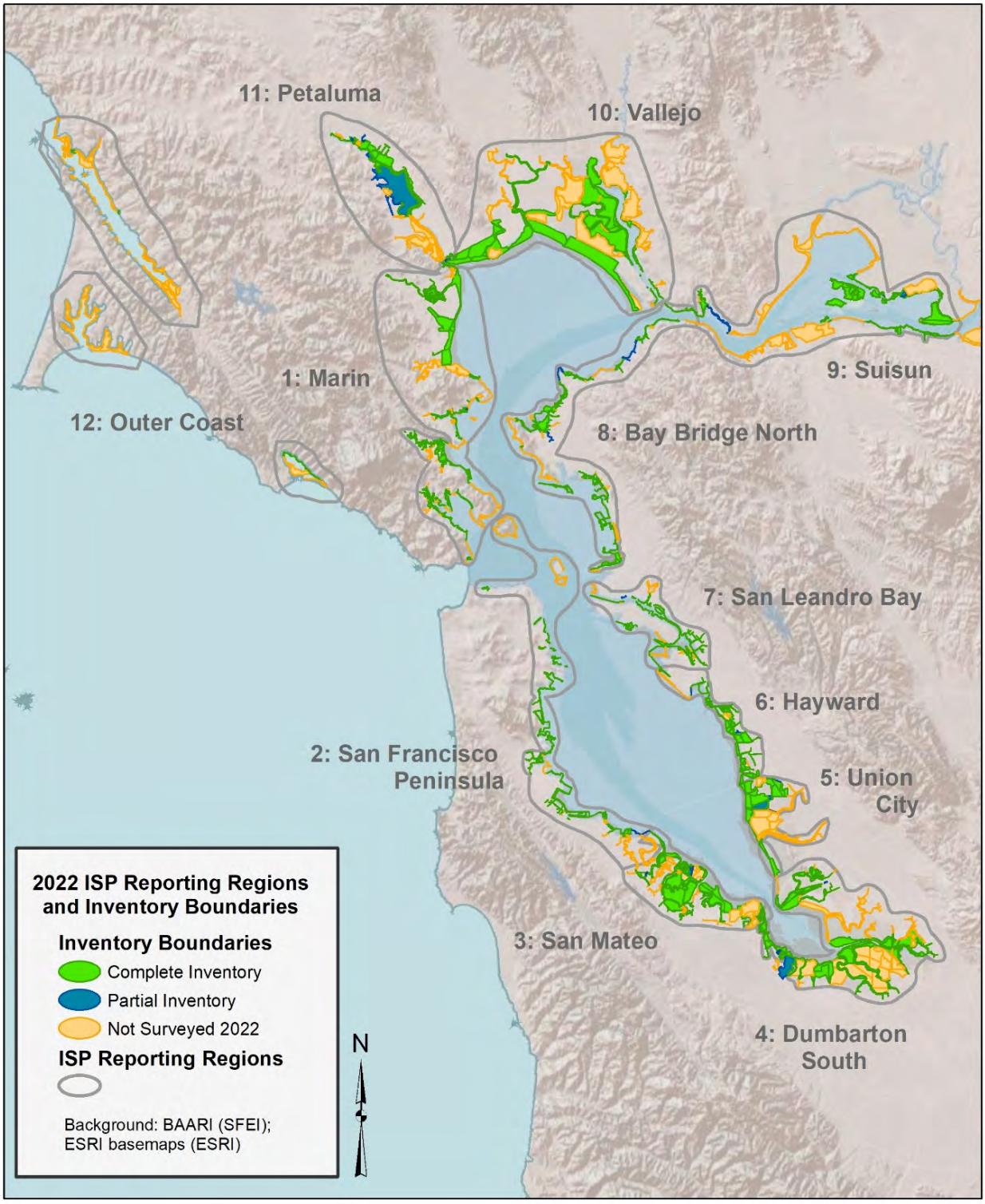

Figure 2. ISP Reporting Regions and 2022 survey efforts throughout San Francisco Bay Estuary.

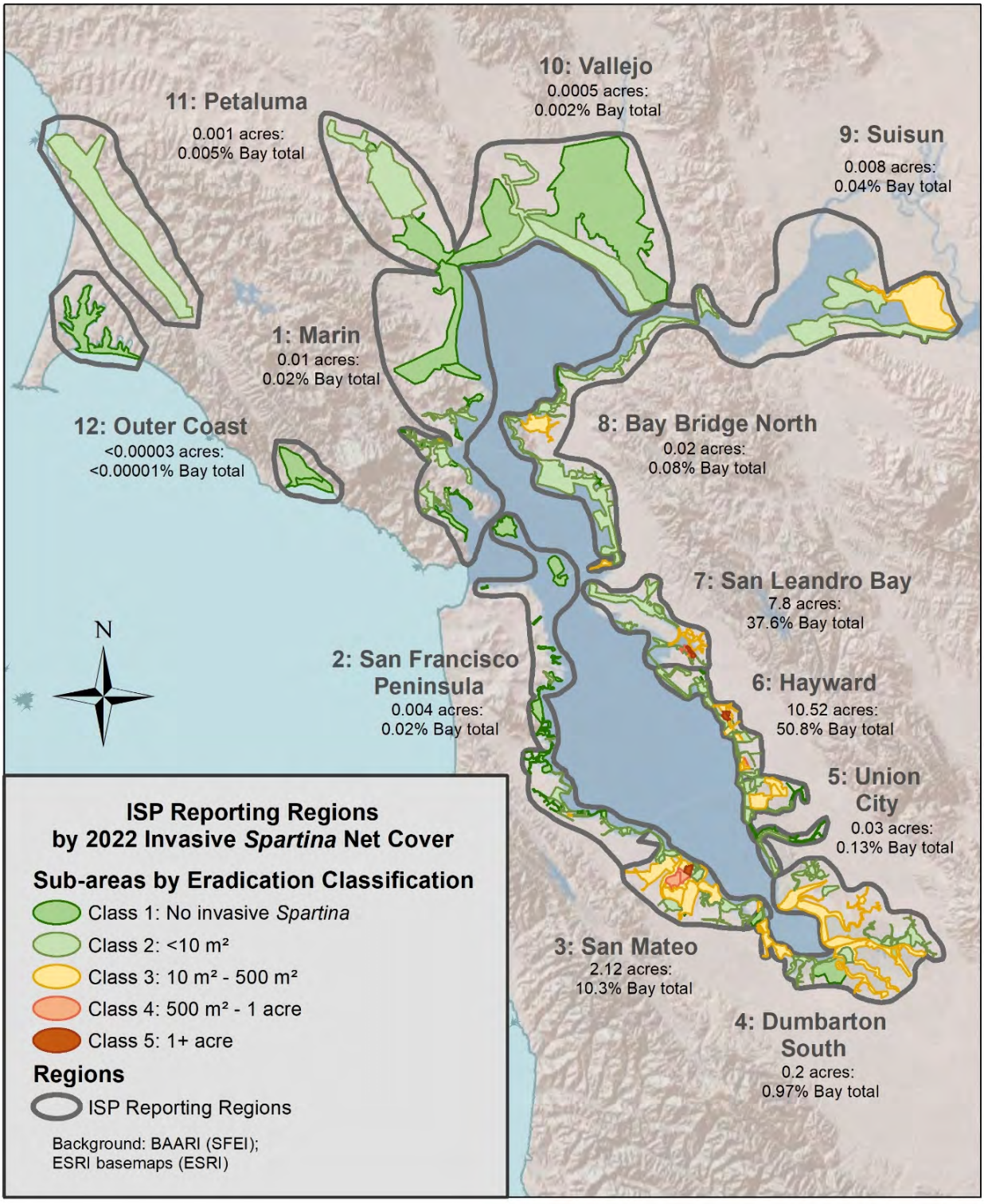

Figure 3. Net Area and Percentage of Bay Total of Invasive *Spartina* in 2022 by ISP Reporting Region and Classification of Invasive *Spartina* Eradication by Sub-area.

In 2021 there were 54 sub-areas with prior invasion history where no invasive *Spartina* was found, and in 2022 there were 60, the most the Project has ever achieved. Invasive *Spartina* was re-detected in six sub-areas in 2022 where none had been found in 2021 (**Table 4**) These were all small plants less than 1 m^2 that were treated and are individually discussed in **Section 2.2**. The number of "zero detect" sub-areas have steadily increased every year since secondary rounds were implemented in 2014, with 25 sub-areas in 2014, 52 sub-areas in 2019 before dropping for the first time to 45 sub-areas in 2020, then rising to 60 in 2022.

Figure 4 illustrates bay-wide trends of invasive *Spartina* over the years. Since the peak infestation of 805 acres in 2005, cover has dropped to 20.7 acres in 2022. In 2021, inventory was conducted by grid (mentioned above) at the six restricted treatment sub-areas. Inventory was not conducted in 2022 at sub-areas where treatment was not authorized; all 2022 data for these six sub-areas are carryovers from the 2021 inventory.

Table 4. Sub-areas with historic infestation in which no invasive *Spartina* of any kind was detected in either 2021 or 2022

Sub-areas that maintained "Zero detect" Status for both 2021 and 2022

Region	Code	Sub-area
1	03a	Blackie's Creek (above bridge)
	03b	Blackie's Creek Mouth
	04l	Murphy Creek
	23k	Sausalito
	23l	Starkweather Park
	23m	Novato
	23n	Triangle Marsh and shoreline
	23o	China Camp
2	12a	Pier 94
	12b	Pier 98 / Heron's Head
	12c	India Basin
	12d	Hunters Point Naval Reserve
	12f	Candlestick Cove
	12g	Crissy Field
	12h	Yerba Buena Island
	12i	Mission Creek
	18a	Colma Creek
	18b	Navigable Slough
	18c	Old Shipyard
	18d	Inner Harbor
	18e	Sam Trans Peninsula
	18f	Confluence Marsh
	18g	San Bruno Marsh
	19a	Brisbane Lagoon
2 (cont.)	19b	Sierra Point
	19c	Oyster Cove
	19d	Oyster Point Marina
	19f	Point San Bruno
	19g	Seaplane Harbor
	19i	Mills Creek Mouth
	19m	Fisherman's Park
	19n	Coyote Point Marina / Marsh
	19r	Anza Lagoon
3	19s	Maple Street Channel
4	02n	SF2
5	01c	Upper Channel
	01d	Upper Channel - Union City Blvd to I-880
	01f	Pond 3 - AFCC
	13a	Old Alameda Creek North Bank
	13g	Upstream of 20 Tide Gates
8	10b	Southern Marsh
10	26a	White Slough / Napa River
	26d	Sonoma Baylands
11	24b	Grey's Field
12	25b	Limantour Estero
	25c	Drakes Estero
	25d	Bolinas Lagoon, North
	25e	Bolinas Lagoon, South

Sub-areas achieving initial year of "Zero detect" in 2022

Region	Code	Sub-area	2021 area (m^2)	2022
1	04b	College of Marin Ecol Study Area	0.001	zero detect
	04d	Piper Park West	0.009	zero detect
	04f	Riviera Circle	0.15	zero detect
	04k	Boardwalk No. 1 (Arkites)	0.04	zero detect
	23a	Brickyard Cove	0.24	zero detect
	23g	Greenwood Cove	0.004	zero detect
2	18h	San Bruno Creek	0.05	zero detect
4	15d	Sunnyvale Baylands	2.69	zero detect
5	01e	Strip Marsh No. of Channel Mouth	0.06	zero detect
6	20b	Oakland Metropolitan Golf Links	0.58	zero detect
7	17g	Coast Guard Island	1.41	zero detect
8	22e	Hoffman Marsh	0.12	zero detect

Sub-areas that were "Zero detect" in 2021 but were re-infested in 2022

Region	Code	Sub-area	2021	2022 area (m^2)
1	04c	Piper Park East	zero detect	0.003
	23c	Loch Lomond Marina	zero detect	0.62
2	12e	Yosemite Channel	zero detect	0.10
	19e	Oyster Point Park	zero detect	0.24
5	13f	Cargill Mitigation Marsh	zero detect	0.008
6	20k	Hayward Landing	zero detect	0.21

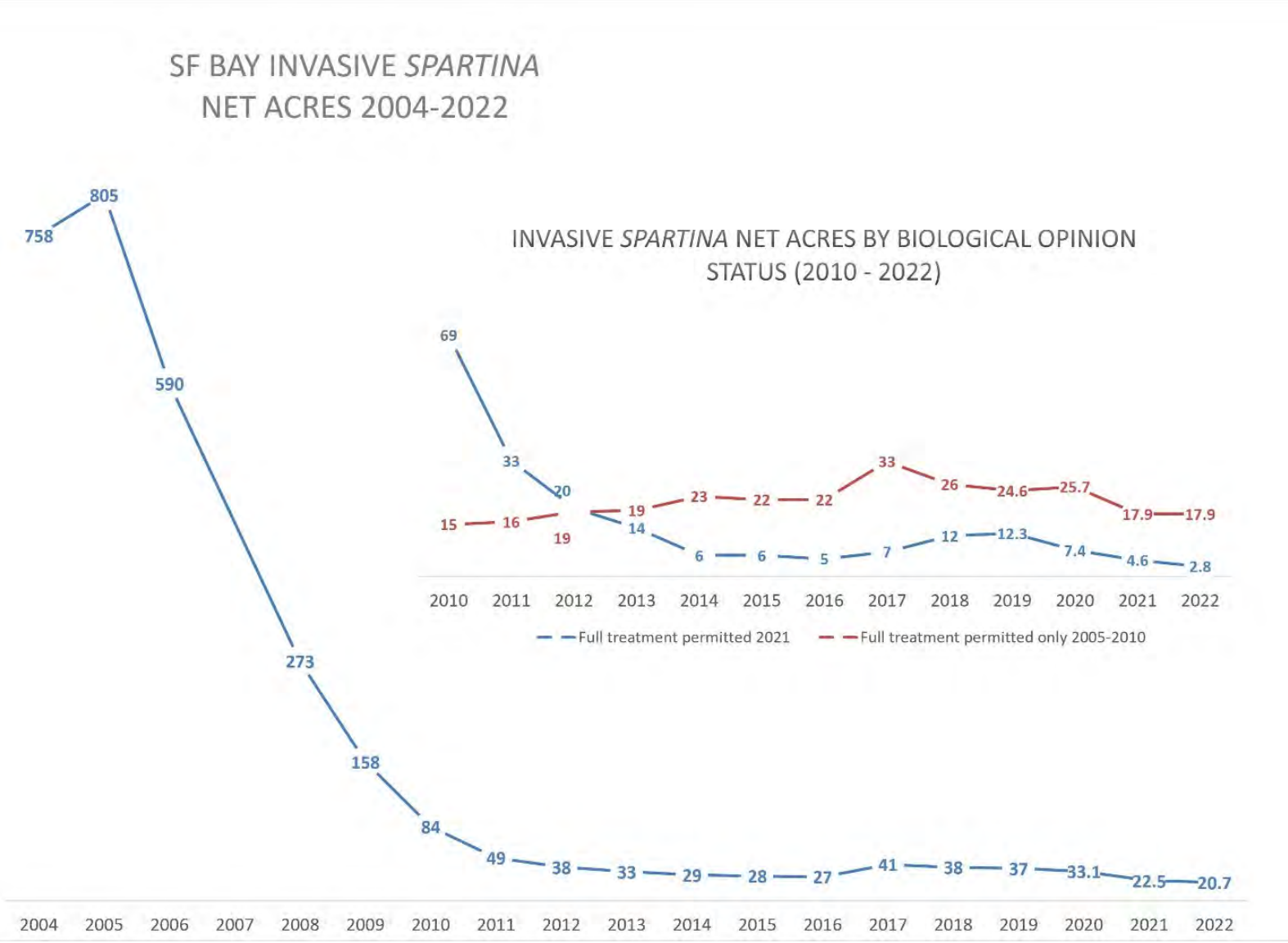

Figure 4. Bay-wide trend of invasive *Spartina* from 2004-2022 by net cover (acres) and treatment authorization since 2010.

2.2 Regional Inventory and Treatment

Section 2.1 introduced the ISP Reporting Regions as part of a discussion of bay-wide trends in invasive *Spartina* cover and treatment. This section provides additional detail by Reporting Region. **Table 5** provides a summary 2022 invasive spartina cover by reporting region, and the following sections provide details of 2021 and 2022 invasive Spartina cover and treatment, restoration activities, and Ridgway's rail status for each of the twelve Reporting Regions.

Region 1: Marin

The Marin Region (Region 1) is composed of 32 sub-areas in Marin County and extends from the Golden Gate Bridge north to the mouth of the Petaluma River. It includes several large, contiguous tracts of marsh, most notably those in the Novato Creek, Corte Madera Creek and Las Gallinas Creek Watersheds. Relative to regions in the Central and South Bays, the Marin Region never had a very sizeable infestation in terms of acreage, but instead had many small infestations scattered throughout the marshes and tidal channels. Four non-native *Spartina* species are present (hybrid *S. alterniflora*, *S. densiflora*, hybrid *S. densiflora*, and *S. anglica*), the majority occurring in the Corte Madera Creek Watershed. Creekside Park (04g) on upper Corte Madera Creek is the original introduction site for both *S. densiflora* and *S. anglica* to the Estuary. The 2022 distribution and abundance of invasive *Spartina* within each sub- area are presented in **Figure 5, Figure 6,** and **Table 6.** Treatment dates and methods are included in Table 6**.**

The ISP inventoried all 32 sub-areas in this region in both 2021 and 2022– on foot when the shoreline was accessible, supplemented by kayak on difficult shorelines and upstream portions of the watershed, and by airboat for the Novato Shoreline (23m). Five sub-areas were only partially inventoried in either 2021 or 2022 due to low infestation pressure and/or access complications. These included Loch Lomond Marina (23c), Bothin Marsh (23j), Sausalito (23k), Novato (23m), and China Camp (23o). The outer breakwater strip of Loch Lomond Marina was inaccessible in 2022 due to construction. The portions of the remaining four sub-areas that were only partially inventoried included areas with detections of hybrid *S. alterniflora* within the last three years and those areas with highest invasion pressure. The Las Gallinas Creek portion of the Novato sub-area was not inventoried in 2021 and 2022, has had no detected infestation in more than eight years, and was last surveyed thoroughly in 2020. All sub-areas with historic detections of *S. densiflora* were surveyed for this species in both the summer and winter inventory rounds in 2021 and 2022 except for the inaccessible breakwater strip of Loch Lomond Marina in 2022. In February 2021, a third round of inventory and treatment for *S. densiflora* was conducted at multiple sub-areas, the dates of which are reflected in Table 6.

The ISP mapped a total of 32 m^2 of non-native cordgrass of four species (including two hybrid types) in the Marin Region in 2022. This reflects a 21 m^2 (39%) reduction from 2021 inventory and a reduction of 6.1 acres (>99%) since peak infestation in 2005. The Marin Region infestation comprises 0.04% of the Estuary total.

Table 5. Summary of 2022 Invasive *Spartina* Cover by Reporting Region.

Region #	Region Name	# Sub-Areas	Potential Invasive Spartina Habitat (ac)	Proportion of Region Authorized for Full Treatment (by acreage)	Net Cover 2022 (ac)	% Bay-wide Total	Change Since 2021 (ac)	% Change Since 2021	Peak Year	Peak Amount (ac)	Change Since Peak (ac)	% Change Since Peak	% Remaining since Peak
1	Marin	32	4,150	All	0.008	0.04%	-0.005	-39.3%	2005	6.1	-6.09	-99.9%	0.1%
2	SF Peninsula	35	1,151	All	0.004	0.02%	-0.0005	-10.4%	2004	125.5	-125.47	-100.00%	0.003%
3	San Mateo	26	5,630	All	2.1	10.3%	-0.62	-22.7%	2004	134.8	-132.7	-98.4%	1.6%
4	Dumbarton South	26	10,351	All	0.20	1.0%	-0.17	-46.2%	2008	39.5	-39.3	-99.5%	0.5%
5	Union City	21	3,375	All	0.03	0.1%	+0.0002	0.9%	2004	233.1	-233.0	-99.99%	0.01%
6	Hayward*	30	1,493	86%	10.5	50.8%	-0.8	-7.2%	2005	225.9	-215.4	-95.3%	4.7%
7	San Leandro Bay*	20	483	85%	7.8	37.6%	-0.2	-2.6%	2006	84.6	-76.8	-90.8%	9.2%
8	Bay Bridge North	13	1,705	All	0.02	0.1%	+0.002	14.8%	2009	6.5	-6.5	-99.7%	0.3%
9	Suisun	5	12,084	All	0.008	0.04%	+0.0004	5.1%	2005	0.65	-0.6	-98.8%	1.2%
10	Vallejo	4	20,789	All	0.0005	0.00%	-0.0004	-48.1%	2009	0.32	-0.3	-99.9%	0.1%
11	Petaluma	4	5,696	All	0.001	0.005%	-0.002	-71.6%	2007	0.15	-0.2	-99.4%	0.6%
12	Outer Coast	5	3,028	All	0.000003	0.00001%	+2.348-06	493.9%	2007	0.05	-0.048	-99.994%	0.006%
ALL	**SFB Estuary**	**221**	**69,935**	**99.6%**	**20.7**	**100%**	**-1.8**	**-8.1%**	**2005**	**805**	**-784.3**	**-97.4%**	**2.6%**

* This region had treatment restrictions in multiple sub-areas in 2021-22. The amount of the region that is authorized for full treatment is calculated by area in column 5.

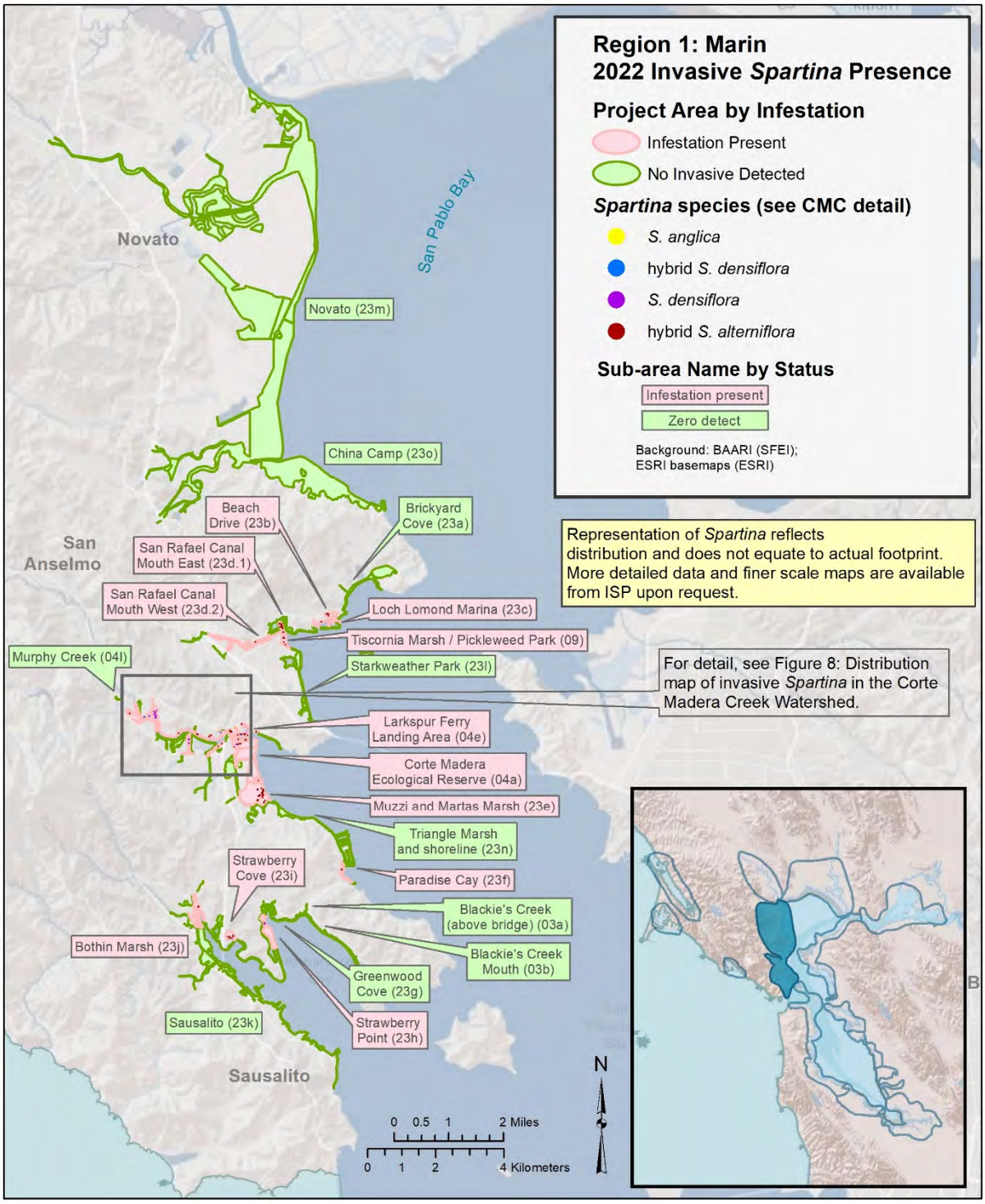

Figure 5. Distribution of invasive *Spartina* in 2022 across the 32 sub-areas of Reporting Region 1: Marin. Sub- areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

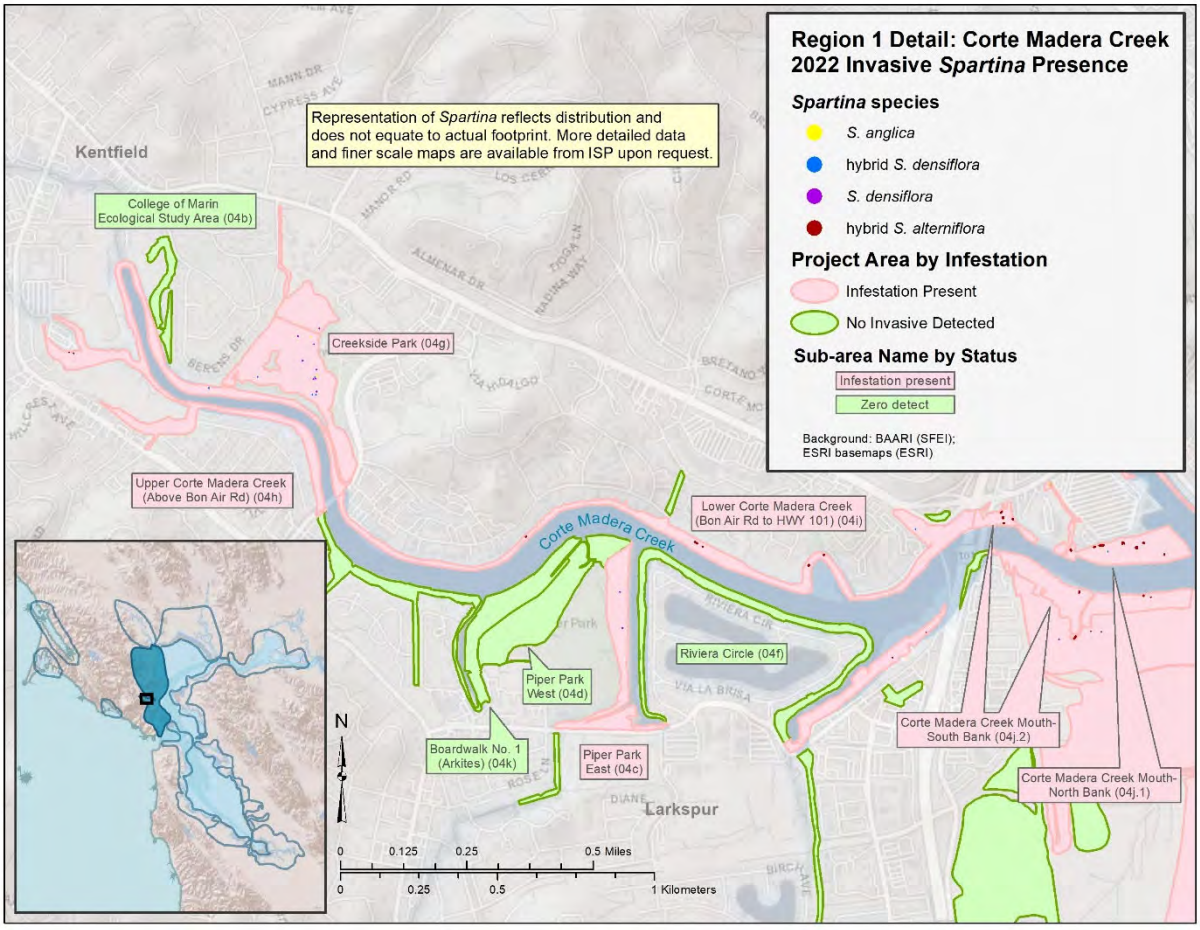

Figure 6. Distribution of invasive *Spartina* in 2022 within the Corte Madera Creek Watershed of ISP's Marin Region. Sub- areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

A total of 31.4 m^2 of hybrid *S. alterniflora* was mapped throughout 16 sub-areas of the region. Three sub-areas had infestations larger than 1 m^2 net cover and they account for 81% of the regional infestation: Corte Madera Creek Mouth – North Bank (04j.1), Tiscornia/Pickleweed Park (09), and Muzzi & Marta's Marsh (23e). Only a handful of Marin marshes have ever been heavily infested by hybrid *S. alterniflora*, but eradication efforts are complicated by the landscape of intricate, privately owned shorelines, which also support abundant *S. foliosa*. The ISP and the Friends of Corte Madera Creek Watershed have adapted inventory methods to address these areas, including shifting to ground surveys from kayak surveys conducted from the creek, which enables more thorough detection, but which requires extensive landowner coordination to gain access to private properties. All treatment for hybrid *S. alterniflora* in Region 1 now involves small-scale spot applications of imazapyr, so work has been conducted by backpack sprayer for multiple years.

Table 6. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 1: Marin. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
REGION 1: MARIN											
03a: Blackie's Creek (above bridge)	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2005	100%	n/a
03b: Blackie's Creek Mouth	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2005	100%	n/a
04a: Corte Madera Ecological Reserve	6/6; 10/10; 11/9	Dug, Backpack	0		0.7 m²	0.0002 m²	0.7 m²	14 m²	2005	>99%	Increase (0.6 m²)
04b: College of Marin Ecological Study Area	No Invasive Spartina 2022		0		0	0	0	0	2004	100%	100%
04c: Piper Park East	6/7; 2/3/23	Dug	0		0	0.003 m²	0.003 m²	0.02 m²	2005	>99%	n/a
04d: Piper Park West	No Invasive Spartina 2022		0		0	0	0	0	2005	100%	100%
04e: Larkspur Ferry Landing Area	10/11	Backpack	0		0.06 m²	0	0.06 m²	1 m²	2005	>99%	57%
04f: Riviera Circle	No Invasive Spartina 2022		0		0	0	0	0	2005	100%	100%
04g: Creekside Park	6/2; 8/25; 1/30/23	Dug, Backpack, Tarped	0.03 m² 0.04 m²		0	0.1 m²	0.2 m²	2 m²	2005	>99%	Increase (0.02 m²)
04h: Upper Corte Madera Creek (Above Bon Air Rd)	8/25; 10/14	Dug, Backpack, Tarped	0.08 m²		0.005 m²	0	0.09 m²	2 m²	2006	>99%	64%
04i: Lower Corte Madera Creek (Bon Air Rd to HWY 101)	10/10; 10/14; 1/12/23	Dug, Backpack	0		0.8 m²	0.004 m²	0.8 m²	23 m²	2005	>99%	23%
04j.1: Corte Madera Creek Mouth - North Bank	8/25; 9/14; 10/11	Tarped, Backpack	0.009 m²		12 m²	0	12 m²	100 m²	2007	>99%	Increase (9 m²)
04j.2: Corte Madera Creek Mouth - South Bank	10/10; 10/11	Backpack	0		1 m²	0	1 m²	49 m²	2007	>99%	Increase (0.5 m²)
04k: Boardwalk No. 1 (Arkites)	No Invasive Spartina 2022		0		0	0	0	0	2006	100%	100%
04l: Murphy Creek	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2007	100%	n/a
09: Tiscornia Marsh / Pickleweed Park	9/2; 9/14	Backpack	0		8 m²	0	8 m²	127 m²	2004	97%	Increase (6 m²)
23a: Brickyard Cove	No Invasive Spartina 2022		0		0	0	0	0	2008	100%	100%
23b: Beach Drive	9/2; 9/26	Backpack	0		0.5 m²	0	0.5 m²	16 m²	2006	>99%	53%
23c: Loch Lomond Marina	9/26	Backpack	0		0.6 m²	0	0.6 m²	18 m²	2004	>99%	n/a
23d.1: San Rafael Canal Mouth East	9/2	Backpack	0		1 m²	0	1 m²	45 m²	2007	>99%	78%
23d.2: San Rafael Canal Mouth West	11/4	Backpack	0		0.07 m²	0	0.07 m²	7 m²	2004	>99%	91%
23e: Muzzi and Martas Marsh	9/14; 9/20; 9/27; 10/10	Backpack	0		6 m²	0	6 m²	143 m²	2007	99%	84%
23f: Paradise Cay	11/9	Backpack	0		0.5 m²	0	0.5 m²	23 m²	2005	>99%	Increase (0.3 m²)
23g: Greenwood Cove	No Invasive Spartina 2022		0		0	0	0	0	2006	100%	100%
23h: Strawberry Point	6/14; 11/2	Dug, Backpack	0		0.1 m²	0.2 m²	0.3 m²	7 m²	2005	>99%	Increase (0.3 m²)
23i: Strawberry Cove	9/14; 9/26	Backpack	0		0.2 m²	0	0.2 m²	7 m²	2007	>99%	71%
23j: Bothin Marsh	8/10; 10/10	Backpack	0		0.2 m²	0	0.2 m²	21 m²	2006	>99%	Increase (0.2 m²)
23k: Sausalito	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2004	100%	n/a
23l: Starkweather Park	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2006	100%	n/a
23m: Novato	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2006	100%	n/a
23n: Triangle Marsh and shoreline	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2007	100%	n/a
23o: China Camp	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2010	100%	n/a
REGION 1 TOTAL			0.03 m² 0.13 m²		31 m²	0.3 m²	32 m²	604 m²	2005	>99%	39%

The Marin infestation of *S. densiflora* remains the largest in the Estuary, because this region was the original introduction site; this species was detected in only one other region in 2022 (Region 12: Outer Coast). In 2022, *S. densiflora* was detected in only 4 of the 32 sub-areas while it flourished in most ten years ago. The ISP mapped a total of 0.28 m² net cover, which amounts to 96% of the 2022 project area total, which includes the Outer Coast Region, the only other within the project area where this species as found in either 2021 or 2022. Every instance of *S. densiflora* found in 2021 and 2022 was subsequently treated by manual removal. Hybrid *S. densiflora × foliosa* was detected in four sub- areas and totaled 0.13 m^2 of net cover. All patches of hybrid *S. densiflora* were sprayed and subsequently tarped in 2021 and 2022. The Marin Region is also the only region where *S. anglica* has ever been detected. It was again found in a single historical sub-area, Creekside Park (04g), in 2022 and totaled 0.03 m^2 net cover.

The Marin region also had two sub-areas that were zero-detection in 2021 in which invasive *Spartina* was re-detected in 2022 (**Table 4**). Piper Park-East (04c) historically had a large presence of *S. densiflora* that has been almost locally eradicated. In 2022 two seedlings were detected within one meter of historic locations and are most likely the result of the delayed-sprouting seed bank, which is believed to remain viable for 5 years or more. Loch Lomond Marina (23c) had been zero-detection since 2019, but a newly established clone of hybrid *S. alterniflora* was discovered and verified by genetic testing in 2022. It was then subsequently treated.

Surveys for Ridgway's rails conducted by the ISP and Point Blue Conservation Science (PBCS) have shown a slight decline in the Marin Region, with a decrease in rail detections at surveyed sub-areas from 2020 to 2021 and little change between 2021 to 2022.

The Marin Region contains several large intact native marshes that support Ridgway's rail populations that are not expected to be impacted by the removal of the remaining non-native *Spartina*. With the abundance of native marsh, the ISP has not targeted Region 1 for significant habitat enhancement, except for nine constructed high tide refuge islands installed at the Corte Madera Ecological Reserve to provide cover for rails from predators during the highest of tides. In addition, ISP and Friends of Corte Madera Creek have planted *Grindelia stricta* for nesting substrate and cover at Creekside Park, where the previously large infestation of multiple non-native *Spartina* species had displaced many native marsh plants.

The low invasion pressure in this region and the locally abundant *S. foliosa* have allowed the ISP to harvest plant material for amplification in nursery propagation beds and outplanting to other regions that do not have suitable native cordgrass propagule sources. The ISP currently maintains two propagation beds at The Watershed Nursery of genetically verified *S. foliosa* from two Marin County marshes, Coyote Creek (a part of Bothin Marsh [23j]) and Starkweather Park (23l). Plants from these beds have been outplanted into five regions: Region 2: San Francisco Peninsula, Region 5: Union City, Region 6: Hayward, Region 7: San Leandro Bay, and Region 10: Vallejo.

Region 2: San Francisco Peninsula

The San Francisco Peninsula Region (Region 2) extends from the Golden Gate Bridge south to the San Mateo Bridge and includes 35 sub-areas. Once very heavily infested by hybrid *S. alterniflora*, successful treatment has largely returned the shorelines to mudflat, as they were prior to invasion. The three most prominent marsh habitats in the region are found at the confluence of Colma Creek and San Bruno Creek (site 18) in South San Francisco, the shoreline of the San Francisco International Airport (SFO, 19h), and the mouth of Seal Slough (19p) in San Mateo County. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 7** and **Table 7**. Treatment dates and methods are included in Table 7.

The ISP inventoried 34 of the 35 sub-areas in this region in both 2021 and 2022–on foot when the shoreline was accessible, assisted by motorized boat or kayak to access difficult shorelines. Only Yerba Buena Island (12h) was surveyed in neither year due to suboptimal habitat for *Spartina* establishment. Several sub-areas received partial inventory in one or both years: the outer islands of San Bruno Marsh (18g) were inaccessible in 2021 due to tides; the northern marsh of Seaplane Harbor (19g) was blocked by construction in both years; and a 300-meter stretch of the San Mateo Creek/Ryder Park Shoreline (19o) was also blocked by construction in 2022. These areas have had no infestation within the last three years.

A total of <17 m^2 of invasive cordgrass was mapped and treated in 2022, all of which was hybrid *S. alterniflora*. This is a reduction of 2 m^2 (12%) from 2021 infestation, and the current footprint represents 0.003% of the peak 125.5- acre infestation in 2004 (**Table 7**). Multiple sub-areas in this Region were previously infested with two other types of invasive *Spartina*: *S. densiflora* and hybrid *S. densiflora* both of which had spread from their original introduction sites in Marin (Region 1). Neither of these species types have been detected in Region 2 for multiple years due to ISP treatment efforts.

Hybrid *S. alterniflora* is also now scarce or absent in most sub-areas in the San Francisco Peninsula Region, with 26 of the sub-areas being "zero detect" (**Table 4**) in 2022. Only two sub-areas contain >1 m^2 of invasive *Spartina*: SFO (19h) and Sanchez Marsh (19k), which respectively account for 14% And 79% of the regional total infestation (93% in total), and the region contains 0.02% of the Estuary infestation.

Hybrid *S. alterniflora* was detected in 2022 in two sub-areas that were zero-detection in prior years (**Table 4**), both of which seem to be due to resurgence of previously treated plants: Yosemite Slough (12e) had regrowth of a 0.1 m^2 patch within one meter of the footprint of a clone treated in 2019, and Oyster Point Park (19e) had a few small plants (0.23 m^2) adjacent to a clone found in 2020. These isolated instances of hybrid *S. alterniflora* were treated in 2022. The urban shoreline in the San Francisco Peninsula Region offers little habitat for Ridgway's rails. Six rails were detected in 2021 at SFO (19h) but no rails were detected in the Region in 2022. The major reduction in hybrid *S. alterniflora* in the San Francisco Peninsula Region since 2005 resulted in reduced numbers of California Ridgway's rails, because there was little native habitat available after the successful control effort. Most areas that were invaded by hybrid *S. alterniflora* in the region were at low elevations that did not support native tidal marsh vegetation prior to invasion and are now restored to mudflats.

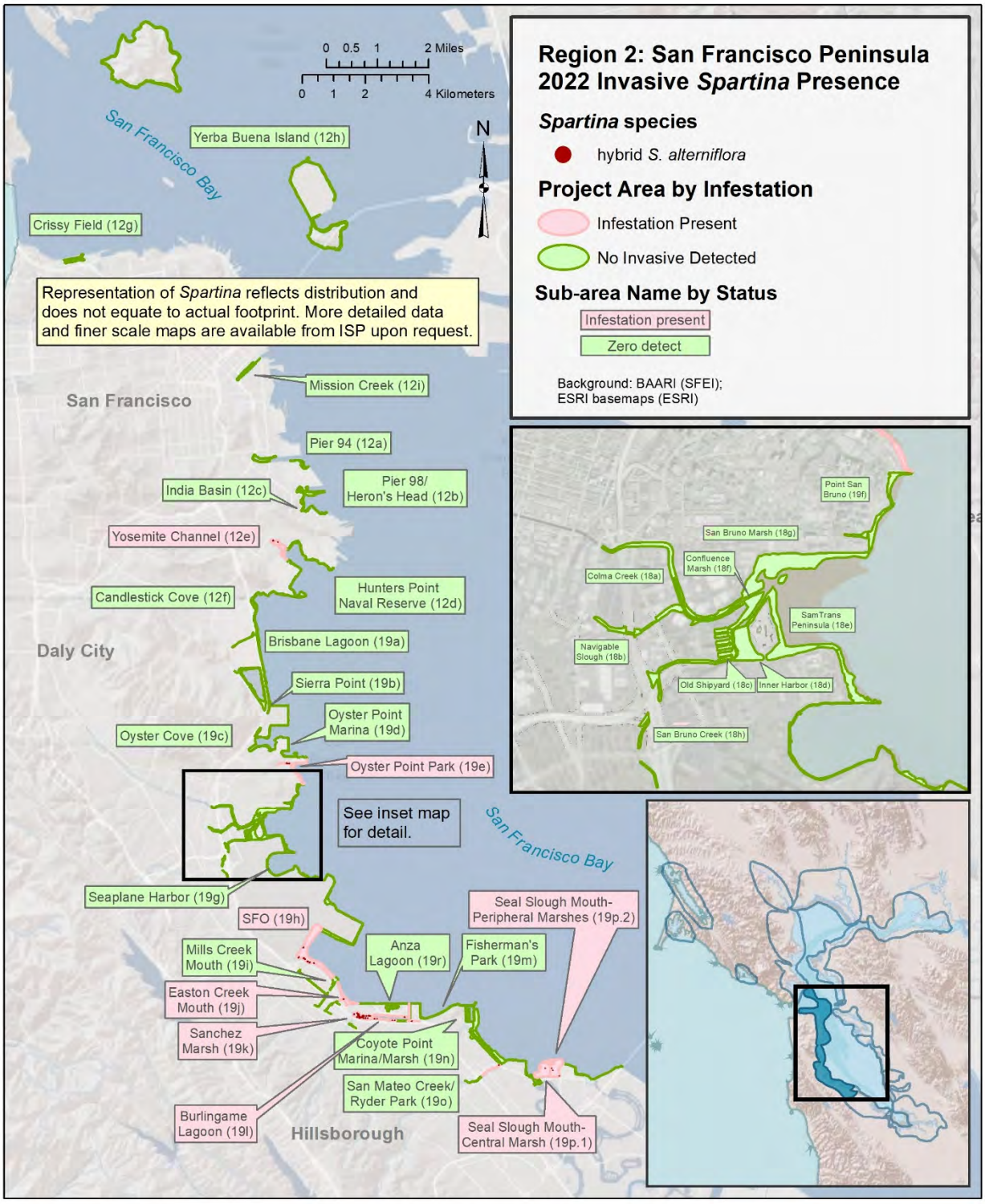

Figure 7. Distribution of invasive *Spartina* in 2022 across the 35 sub-areas of Reporting Region 2: San Francisco Peninsula. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 7. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 2: San Francisco Peninsula. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Since Peak	Since 2021
REGION 2: SAN FRANCISCO PENINSULA											
12a: Pier 94	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2005	100%	n/a
12b: Pier 98 / Heron's Head	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2008	100%	n/a
12c: India Basin	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2005	100%	n/a
12d: Hunters Point Naval Reserve	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2008	100%	n/a
12e: Yosemite Channel	9/30	Backpack	0		0.1 m^2	0	0.1 m^2	8 m^2	2004	>99%	n/a
12f: Candlestick Cove	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2006	100%	n/a
12g: Crissy Field	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2008	100%	n/a
12h: Yerba Buena Island	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2006	100%	n/a
12i: Mission Creek	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2009	100%	n/a
18a: Colma Creek	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2005	100%	n/a
18b: Navigable Slough	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2006	100%	n/a
18c: Old Shipyard	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2006	100%	n/a
18d: Inner Harbor	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2006	100%	n/a
18e: Sam Trans Peninsula	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2004	100%	n/a
18f: Confluence Marsh	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2004	100%	n/a
18g: San Bruno Marsh	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2004	100%	n/a
18h: San Bruno Creek	No Invasive Spartina 2022		0		0	0	0	0	2006	100%	100%
19a: Brisbane Lagoon	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2006	100%	n/a
19b: Sierra Point	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2004	100%	n/a
19c: Oyster Cove	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2006	100%	n/a
19d: Oyster Point Marina	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2006	100%	n/a
19e: Oyster Point Park	8/31	Backpack	0		0.2 m^2	0	0.2 m^2	2 m^2	2005	>99%	n/a
19f: Point San Bruno	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
19g: Seaplane Harbor	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2004	100%	n/a
19h: SFO	9/8; 10/3	Backpack	0		2 m^2	0	2 m^2	61 m^2	2004	>99%	51%
19i: Mills Creek Mouth	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
19j: Easton Creek Mouth	9/8	Backpack	0		0.01 m^2	0	0.01 m^2	0.5 m^2	2004	>99%	98%
19k: Sanchez Marsh	9/15; 9/30	Backpack	0		13 m^2	0	13 m^2	403 m^2	2004	>99%	Increase (3 m^2)
19l: Burlingame Lagoon	8/31; 9/15; 9/30	Backpack	0		0.7 m^2	0	0.7 m^2	59 m^2	2004	>99%	40%
19m: Fisherman's Park	11 years with No Invasive Spartina (2012-2022)		0		0	0	0	0	2005	100%	n/a
19n: Coyote Point Marina / Marsh	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2004	100%	n/a
19o: San Mateo Creek / Ryder Park	9/7	Backpack	0		0.004 m^2	0	0.004 m^2	0.4 m^2	2006	>99%	100%
19p.1: Seal Slough Mouth - Central Marsh	9/7	Backpack	0		0.008 m^2	0	0.008 m^2	1 m^2	2004	>99%	84%
19p.2: Seal Slough Mouth - Peripheral Marshes	9/7	Backpack	0		0.06 m^2	0	0.06 m^2	5 m^2	2004	>99%	81%
19r: Anza Lagoon	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2004	100%	n/a
REGION 2 TOTAL			0		17 m^2	0	17 m^2	540 m^2	2004	>99%	35%

The San Francisco Peninsula bay edge is heavily urbanized with very few opportunities to enhance habitat that could support sustainable Ridgway's rail populations. The ISP's habitat enhancement efforts have been limited to three sub-areas within the Colma Creek/San Bruno complex. ISP partnered with SFSU to reintroduce *S. foliosa* along Colma Creek (18a) and in San Bruno Marsh (18g) from 2011-13 and has continued planting efforts at San Bruno Marsh and at Confluence Marsh (18f) from 2016-21. The planting effort has focused on re-establishing the fringe of native *S. foliosa* that was present near the mouth of Colma Creek prior to hybrid *S. alterniflora* invasion. A fringe of native *S. foliosa* also provides much needed habitat cover for Ridgway's rails using the San Francisco Peninsula as a movement corridor.

Region 3: San Mateo

The San Mateo Region (Region 3) consists of 26 sub-areas on the western South Bay shoreline between the San Mateo and Dumbarton Bridges and contains many tracts managed by USFWS as part of Don Edwards National Wildlife Refuge (DENWR). Control of hybrid *S. alterniflora* in this region is essential to protect some large historic tracts of native marsh (Greco Island [02f, 02h]), extensive tracts of restored marsh (Bair Island [02c, 02d, 02k, 02m, 02o]), and remaining large commercial salt ponds that are slated for restoration to tidal habitat. This region was heavily impacted by hybrid *S. alterniflora* invasion, which colonized the shoreline and marshes, and quickly invaded newly breached areas undergoing restoration to tidal marsh. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 8** and **Table 8**. Treatment dates and methods are included in Table 8.

All 26 sub-areas in the San Mateo Region were inventoried in 2021, and inventory in both years was conducted primarily on foot, often with assistance from boats (e.g. kayak, whaler, Achilles inflatable boat, or airboat) for access. In 2022 three sub-areas with known infestations in DENWR—Bird Island (02a.3), B2 North East (02c.1b), and B2 North South (02c.2)—were only partially surveyed due to staffing constraints mentioned in **Section 2.1**, and another four sub-areas were not visited at all:

- Bird Island was treated in 2022 using 2021 data, and exhaustive inventory was not completed throughout the sub-area.
- B2 North East (02c.1b) was mapped coarsely in both 2021 and 2022: by grid in 2021 and then incompletely mapped in 2022, but partially by grid and partially by standard mapping methods (point, line, polygon) concurrently with treatment that year. More than 85% of the sub-area was mapped in 2022 and grid data from 2021 was carried over for the remaining <15% that got neither mapped nor treated in 2022. This shift in inventory methods in 2022 arose from the culmination of the staffing limitations that year coupled with dramatically increased on-the-ground treatment effort, as compared to coarse treatment conducted by helicopter broadcast that had been utilized since 2018 (**Figure 9**). Inventory and treatment efforts in 2023 and beyond will be ground-based, and complete inventory and treatment will be prioritized. See **Section 3.1** for more information on resuming treatment at formerly restricted sites.
- B2 North South was thoroughly mapped and treated across 20% of its area and the remaining 80% was neither inventoried nor treated in 2022.
- The four sub-areas that comprise B2 South (02d.1a-b, 02d.2, 02d.3) were neither inventoried nor treated in 2022.

Two sub-areas (Pond B3 [02m] and Central Bair [02o]) within DENWR were surveyed solely by airboat during treatment with assistance from SOLitude Lake Management and San Mateo County Mosquito and Vector Control District, respectively. Level of effort increased in both

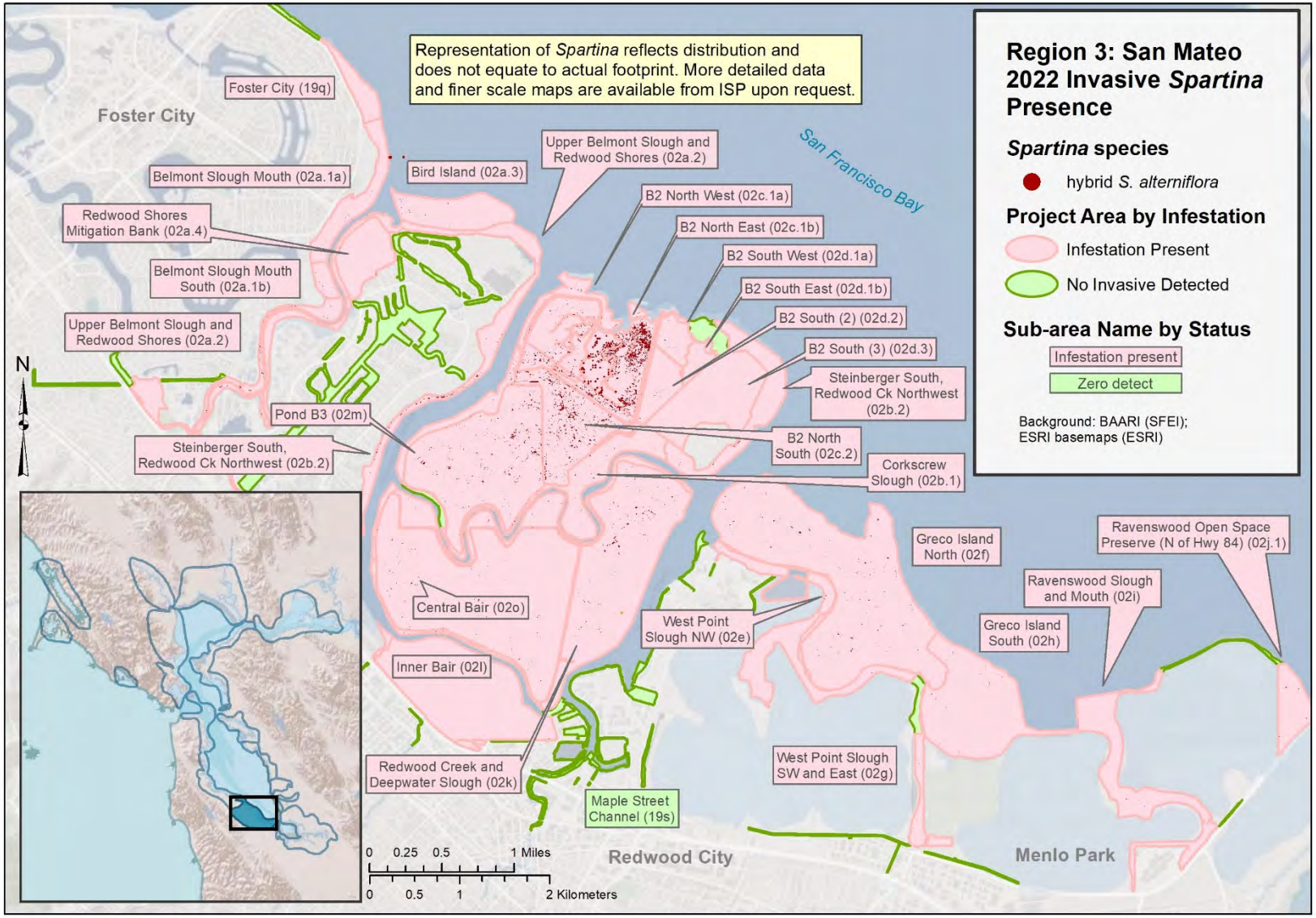

Figure 8. Distribution of invasive *Spartina* in 2022 across the 26 sub-areas of Reporting Region 3: San Mateo. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 8. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 3: San Mateo. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
REGION 3: SAN MATEO											
02a.1a: Belmont Slough Mouth	8/15	Backpack, Airboat	0		8 m^2	0	8 m^2	261 m^2	2004	>99%	Increase (3 m^2)
02a.1b: Belmont Slough Mouth South	8/15; 9/19	Backpack, Airboat	0		3 m^2	0	3 m^2	130 m^2	2004	>99%	Increase (0.5 m^2)
02a.2: Upper Belmont Slough and Redwood Shores	8/15; 8/19; 9/1; 9/12; 9/13; 9/14; 9/19; 10/6; 10/31	Backpack, Airboat	0		38 m^2	0	38 m^2	0.3 acres	2004	>99%	Increase (16 m^2)
02a.3: Bird Island	8/15	Backpack, Airboat	0		10 m^2	0	10 m^2	271 m^2	2006	>99%	Increase (2 m^2)
02a.4: Redwood Shores Mitigation Bank	9/19; 9/26; 10/6	Backpack	0		0.7 m^2	0	0.7 m^2	42 m^2	2015	94%	Increase (0.7 m^2)
02b.1: Corkscrew Slough	8/18; 9/29; 10/4; 10/15; 10/18; 10/19	Backpack, Airboat	0		27 m^2	0	27 m^2	786 m^2	2004	>99%	6%
02b.2: Steinberger Slough South, Redwood Creek Northwest	7/22; 8/4; 8/18; 9/13; 10/4; 10/18; 10/19	Backpack, Airboat	0		42 m^2	0	42 m^2	0.4 acres	2004	>99%	28%
02c.1a: B2 North West	8/16-8/18; 10/4	Backpack, Airboat	0		98 m^2	0	98 m^2	0.8 acres	2005	>99%	45%
02c.1b: B2 North East	8/3-8/4; 8/16-8/18; 9/2; 9/17; 10/1; 10/18; 10/31; 11/14 11/15	Backpack, Airboat	0		1.5 acres	0	1.5 acres	20.6 acres	2005	94%	32%
02c.2: B2 North South	8/16-8/17; 9/1; 9/29; 11/11; 11/24	Backpack, Airboat	0		755 m^2	0	755 m^2	5.4 acres	2006	98%	18%
02d.1a: B2 South West	Not Treated in 2022		0		2 m^2	0	2 m^2	62 m^2	2004	>99%	No change detected
02d.1b: B2 South East	Not Treated in 2022		0		0.08 m^2	0	0.08 m^2	2 m^2	2004	>99%	No change detected
02d.2: B2 South (2)	Not Treated in 2022		0		3 m^2	0	3 m^2	104 m^2	2006	>99%	No change detected
02d.3: B2 South (3)	Not Treated in 2022		0		1 m^2	0	1 m^2	46 m^2	2009	>99%	No change detected
02e: West Point Slough NW	9/15	Backpack, Airboat	0		1 m^2	0	1 m^2	35 m^2	2005	>99%	81%
02f: Greco Island North	9/15-9/16; 9/30; 11/16	Backpack, Airboat	0		108 m^2	0	108 m^2	0.6 acres	2008	>99%	Increase (16 m^2)
02g: West Point Slough SW and East	8/19; 11/16	Backpack, Airboat	0		1 m^2	0	1 m^2	55 m^2	2005	>99%	89%
02h: Greco Island South	8/19; 9/16; 9/30; 10/12; 11/3	Backpack, Airboat	0		8 m^2	0	8 m^2	344 m^2	2005	>99%	53%
02i: Ravenswood Slough and Mouth	10/12; 10/13	Backpack	0		1 m^2	0	1 m^2	54 m^2	2004	>99%	84%
02j.1: Ravenswood Open Space Preserve (N of Hwy 84)	8/31; 9/28	Backpack	0		17 m^2	0	17 m^2	277 m^2	2006	97%	Increase (14 m^2)
02k: Redwood Creek and Deepwater Slough	8/18; 9/1; 9/15; 9/29	Backpack, Airboat	0		104 m^2	0	104 m^2	0.8 acres	2009	>99%	22%
02l: Inner Bair	10/14; 10/18	Backpack	0		3 m^2	0	3 m^2	70 m^2	2006	>99%	Increase (2 m^2)
02m: Pond B3	7/22; 8/19; 8/22; 9/6; 10/4; 10/19	Airboat	0		0.3 acres	0	0.3 acres	2.7 acres	2014	8%	Increase (571 m^2)
02o: Central Bair	7/21; 7/22; 9/20	Airboat	0		83 m^2	0	83 m^2	0.6 acres	2021	41%	41%
19q: Foster City	9/27	Backpack	0		0.001 m^2	0	0.001 m^2	0.1 m^2	2004	>99%	87%
19s: Maple Street Channel	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2011	100%	n/a
REGION 3 TOTAL			0		2.1 acres	0	2.1 acres	32.6 acres	2004	98%	23%

sub-areas in 2022 as these younger restoration marshes mature making both access and vegetative complexity more challenging. See **Section 3.2** for more information on developing marshes.

A total of 2.1 net acres of hybrid *S. alterniflora* was mapped and treated in the San Mateo Region, a 0.62-acre (23%) reduction since 2021 (Figure 10, Table 8). Region 3 has the third largest remaining infestation in the Estuary (10.3% of total) behind Region 6: Hayward and Region 7: San Leandro Bay, where there continue to be treatment restrictions on most of the remaining hybrid *S. alterniflora* infestations. Most treatment in this region must be conducted using airboats, either applying imazapyr herbicide directly from the spray rig or, for areas beyond the reach of the hose, deploying personnel with backpack sprayers.

Two sub-areas within the Bair Island Ecological Reserve—B2 North East (02c.1b) and Pond B3 (02m)—maintain infestations of greater than 0.25 acre and account for 85% of the region's remaining infestation. B2 North East continues to have by far the largest remnant infestation (1.5 acres), 68% of the region total. The site was restricted from full treatment from 2012 to 2017 and then treated by aerial broadcast from helicopter up until 2021. The shift to ground-based treatment in 2022 is expected to rapidly bring this infestation level down, especially when treatment can be completed each season over the entirety of the sub-area (**Figure 9**). Inventory and treatment methods are still developing for Pond B3, but new approaches will be implemented over the next couple years. **Figure 10** shows a patch of robust hybrid *S. alterniflora* at Pond B3.

Figure 9. In 2022, ISP continued to transition treatment methodology at Bair Island's B2 North East (02c.1b) from aerial helicopter application to airboat and backpack treatment. These ground-based methods were expanded to cover approximately 75% of the 134-acre site in 2022, with plans to achieve 100% coverage in 2023.

Figure 10. Airboat-assisted treatment of a substantial hybrid *S. alterniflora* clone that stood out prominently on the marshplain.at Bair Island's Pond B3 (02m).

Annual surveys for Ridgway's rails by the ISP and Don Edwards National Wildlife Refuge (DENWR) indicate a downward trend in the region. The number of rails detected declined by 35% between 2021 and 2022. At the formerly restricted sub-area B2 North East (02c.1b), Ridgway's rail numbers have declined from nine birds detected in 2020 to three birds in 2022.

With abundant *S. foliosa* within most sub-areas and hybrid *S. alterniflora* persisting throughout the region, native cordgrass has not been considered for planting in this region. Habitat enhancements to date have included construction of high tide refuge islands and planting extensive *Grindelia stricta*. Both types of enhancement are intended to provide Ridgway's rails with taller vegetative cover for protection from predators. High tide refuge islands, intended to provide cover during extreme tide events, have been constructed at seven sub-areas: two along Belmont Slough (02a.1-2), one on Bird Island (02a.3), four in Corkscrew Slough (02b.1), nine within B2 North (02c.1a-b), and four in Deepwater Slough (02k). Additionally, the ISP has installed over 43,800 *Grindelia stricta* plants across seven sub-areas.

Region 4: Dumbarton South

The Dumbarton South Region (Region 4) includes 26 sub-areas and is comprised of all tidal wetlands south of the Dumbarton Bridge. The region includes newly breached restoration sites, salt evaporator ponds that are slated for restoration to tidal marsh, large expanses of marsh protected and managed by the USFWS as part of DENWR, and fringe marsh that provides connectivity between the larger marshes. Much of this region is a focus for large-scale tidal restoration by the South Bay Salt Pond Restoration Project (SBSPRP), and control of invasive *Spartina* here is required for SBSPRP to achieve its long-term goals. Phase 1 tidal restorations included: Island Ponds (05i), Knapp Tract (15a.6), and Pond 17 (15a.7), all of which are located within the Coyote Creek Watershed and are consistently monitored by the ISP. SBSPRP Phase 2 began in 2021 and will include Mountain View Ponds A1 and A2W. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 11** and **Table 9**. Treatment dates and methods are included in Table 9.

All 26 sub-areas of the Dumbarton South Region were inventoried in 2021 and all but one were inventoried and treated in 2022; Mowry Slough and Marsh (05a.1) was neither inventoried nor treated in 2022 due to staffing limitations for that year (see **Section 2.1**). In 2021 a new sub-area, Sunnyvale Baylands (15d), was created within Region 4 to account for a new 2.7 m^2 hybrid *S. alterniflora* clone detected and treated within salt pond AB1; no hybrid *S. alterniflora* was detected within the sub-area in 2022.

In 2021, approximately twelve former salt ponds that had never been inventoried by ISP were thoroughly assessed for tidal action salt and potential for hybrid *S. alterniflora* establishment. These ponds are currently owned and managed by various public agencies, and many are slated for future tidal marsh restoration. They are not inventoried for *Spartina* because they were all considered not suitable habitat, but failing or open tide control structures and degraded levees have potentially opened some to tidal transfer with open bay and a source hybrid *S. alterniflora* seed to enter the system. Conditions for most remain unsuitable for *Spartina* to invade, but ISP will re-assess and monitor them regularly as conditions change.

Hybrid *S. alterniflora* is the only species of invasive cordgrass that has been found in the Dumbarton South Region, and in 2022, ISP mapped a total of 0.20 acres, a 0.17-acre (46%) reduction since 2021. The hybrid *S. alterniflora* infestation in the Dumbarton South Region amounts to 1.0% of the Estuary total, placing this region as the fourth most infested behind Hayward, San Leandro Bay, and San Mateo Regions respectively.

Despite its relatively low amount of infestation, this region is challenging for conducting inventory and treatment work due to its size, complexity of habitats, and the continued large-scale restoration efforts. Most of the region is fed by Coyote Creek, which provides nutrients for plants to flourish, including abundant native cordgrass. *Spartina foliosa* is widespread and robust in this region, which makes identification of the hybrid *S. alterniflora* more challenging. This is also one of the most dynamic regions within the Project Area, largely due to restoration efforts, but also because Coyote Creek is one of the only tributaries remaining in the bay that transports adequate

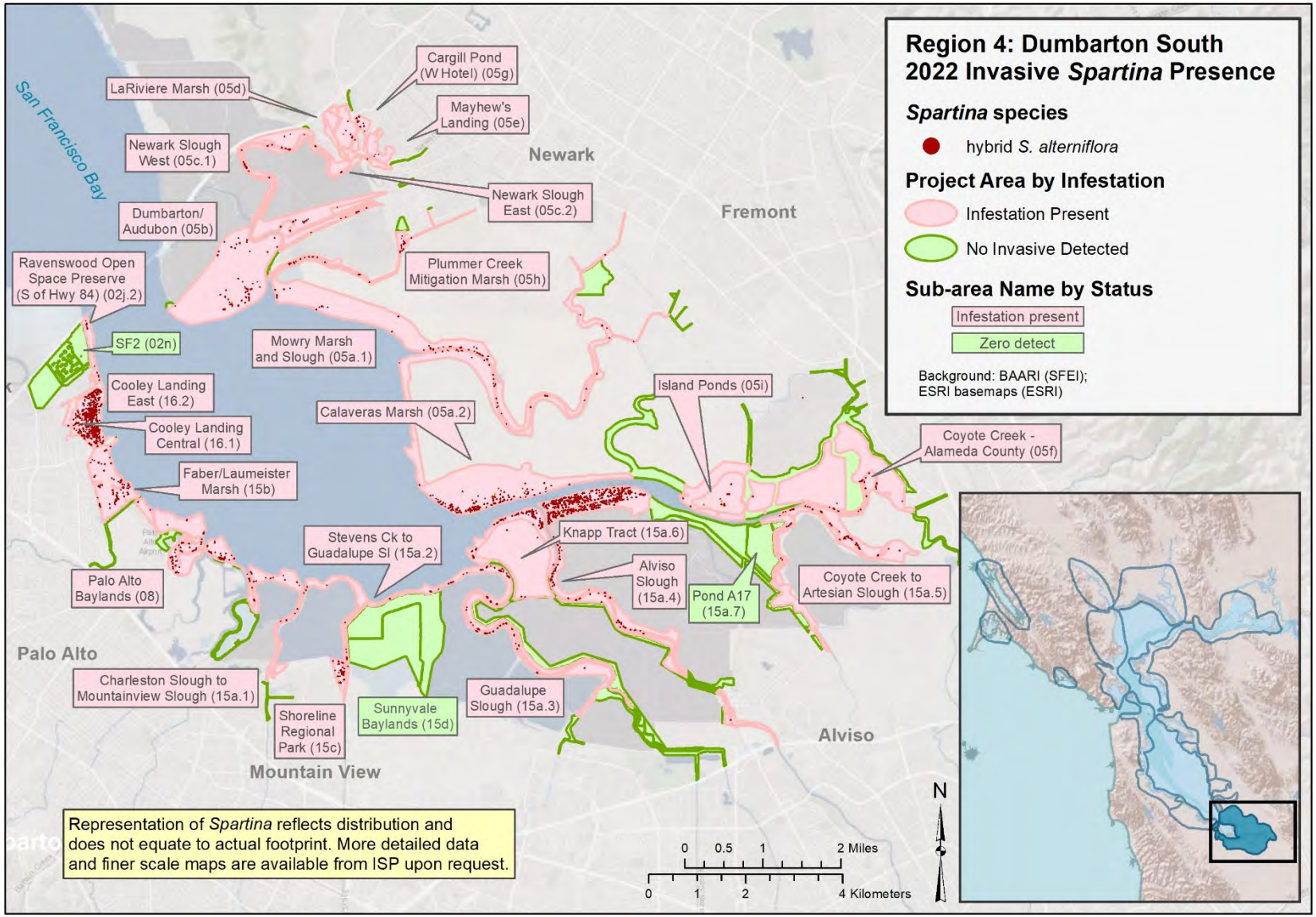

Figure 11. Distribution of invasive *Spartina* in 2022 across the 26 sub-areas of Reporting Region 4: Dumbarton South. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 9. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 4: Dumbarton South. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
REGION 4: DUMBARTON SOUTH											
02j.2: Ravenswood Open Space Preserve (S of Hwy 84)	8/31	Backpack	0		5 m^2	0	5 m^2	132 m^2	2006	>99%	Increase (3 m^2)
02n: SF2	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2013	100%	n/a
05a.1: Mowry Marsh and Slough	Not Treated in 2022		0		24 m^2	0	24 m^2	678 m^2	2008	>99%	No change detected
05a.2: Calaveras Marsh	8/5; 9/16	Backpack, Airboat	0		53 m^2	0	53 m^2	765 m^2	2007	>99%	31%
05b: Dumbarton/Audubon	9/2; 9/6; 10/6; 10/13; 10/17	Backpack, Airboat	0		55 m^2	0	55 m^2	0.3 acres	2006	>99%	Increase (8 m^2)
05c.1: Newark Slough West	9/20; 9/28	Backpack, Airboat	0		10 m^2	0	10 m^2	231 m^2	2004	>99%	64%
05c.2: Newark Slough East	9/20; 11/15	Backpack, Airboat	0		2 m^2	0	2 m^2	27 m^2	2005	>99%	75%
05d: LaRiviere Marsh	10/13	Backpack	0		0.9 m^2	0	0.9 m^2	33 m^2	2006	>99%	77%
05e: Mayhew's Landing	9/28	Backpack	0		0.02 m^2	0	0.02 m^2	1 m^2	2004	>99%	99%
05f: Coyote Creek - Alameda County	9/21; 10/20	Backpack, Airboat	0		7 m^2	0	7 m^2	224 m^2	2008	96%	42%
05g: Cargill Pond (W Hotel)	9/23; 9/28	Backpack	0		3 m^2	0	3 m^2	206 m^2	2010	>99%	Increase (0.1 m^2)
05h: Plummer Creek Mitigation Marsh	10/13; 10/28	Backpack	0		2 m^2	0	2 m^2	59 m^2	2011	99%	40%
05i: Island Ponds	9/20; 9/21; 10/18	Airboat	0		6 m^2	0	6 m^2	141 m^2	2017	97%	Increase (0.9 m^2)
08: Palo Alto Baylands	10/3; 11/2	Truck, Backpack, Airboat	0		21 m^2	0	21 m^2	669 m^2	2009	>99%	12%
15a.1: Charleston Slough to Mountainview Slough	8/17; 10/4	Backpack	0		7 m^2	0	7 m^2	132 m^2	2004	>99%	67%
15a.2: Stevens Ck to Guadalupe Sl	8/17-8/18; 9/29	Backpack	0		3 m^2	0	3 m^2	113 m^2	2008	>99%	73%
15a.3: Guadalupe Slough	8/18; 9/1; 9/26; 10/17	Backpack, Airboat	0		31 m^2	0	31 m^2	518 m^2	2008	>99%	52%
15a.4: Alviso Slough	9/1; 9/15-9/16; 10/17; 11/14	Backpack, Airboat	0		355 m^2	0	355 m^2	1.8 acres	2007	96%	59%
15a.5: Coyote Creek to Artesian Slough	9/15; 9/20-9/21; 10/17	Backpack, Airboat	0		24 m^2	0	24 m^2	886 m^2	2017	97%	49%
15a.6: Knapp Tract	9/7	Airboat	0		2 m^2	0	2 m^2	44 m^2	2017	90%	82%
15a.7: Pond 17	No Invasive Spartina Ever Detected		0		0	0	0	0	0	n/a	n/a
15b: Faber / Laumeister Marsh	9/14; 9/19; 9/28; 9/29	Backpack	0		33 m^2	0	33 m^2	610 m^2	2008	98%	Increase (18 m^2)
15c: Shoreline Regional Park	9/29; 10/31	Backpack	0		6 m^2	0	6 m^2	298 m^2	2006	>99%	46%
15d: Sunnyvale Baylands	No Invasive Spartina 2022		0		0	0	0	0	2021	100%	100%
16.1: Cooley Landing Central	9/1-9/2	Truck, Backpack, Airboat	0		24 m^2	0	24 m^2	595 m^2	2008	>99%	24%
16.2: Cooley Landing East	9/1-9/2; 9/19	Truck, Backpack, Airboat	0		136 m^2	0	136 m^2	1 acres	2008	>99%	30%
REGION 4 TOTAL			0		809 m^2	0	809 m^2	4.7 acres	2008	>99%	54%

sediment from upstream. Deposition of sediment along Coyote Creek shorelines and within recently breached former salt ponds leads to accretion and development of new tidal marsh habitats. These newly developed tidal marsh tracts are difficult to access because the substrate is still young and not fully consolidated, which makes access on foot nearly impossible. Access by airboat helps for a period, but as the marsh plain develops more vegetation, access by airboat is also impossible. See **Section 3.2** for more information on ISP's methods for conducting fieldwork in these areas. **Figure 12** shows an example of accreting sediment at the mouth of Coyote Creek fostering native marsh vegetation.

Four sub-areas, Calaveras Marsh (05a.2), Dumbarton/Audubon (05b), Alviso Slough (15a.4), and Cooley Landing East (16.2), maintain a combined 0.15-acre infestation, 74% of the region total. These are the only sub-areas in the region with >50 m^2 of hybrid *S. alterniflora* and averaged a combined reduction of 49% cover in 2022 from 2021 levels, though Dumbarton/Audubon experienced an 8 m^2 increase during this period. Alviso Slough (including Ogilvie Island) experienced the greatest reduction of 55 m^2 (59%) cover between 2021 and 2022.

The Dumbarton South Region includes some of the highest quality Ridgway's rail habitat in the Estuary. However, surveys conducted by ISP, PBCS, and DENWR have shown a decline in detections by 20% between 2021 and 2022. Marshes in this region generally have abundant *S. foliosa*, however, there is opportunity to enhance available habitat cover with *G. stricta* plantings and high tide refuge islands. Two high tide refuge islands were constructed at Cooley Landing (16.2), eight at Palo Alto Baylands (08), and six at Dumbarton/Audubon (05b), and more than 8,400 *G. stricta* were planted at Dumbarton/Audubon (05b).

Figure 12. Calaveras Marsh (05a.2) at the mouth of Coyote Creek is one of a handful of marshes around the Estuary that is expanding through natural sediment deposition and plant colonization. Native *Spartina foliosa* (pictured) acts as an ecosystem engineer to secure substrate and assist in marshplain development.

Region 5: Union City

The Union City Region (Region 5) extends along the East Bay shoreline from the San Mateo Bridge to the Dumbarton Bridge and includes 21 sub-areas. This region includes the original introduction site for *S. alterniflora* to San Francisco Bay – Pond 3 adjacent to the north bank of the Alameda Flood Control Channel (AFCC; 01f, also known as Ecology Marsh). Planted *S. alterniflora* later hybridized with native *S. foliosa* and eventually resulted in the bay-wide spread of their highly invasive progeny. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 13** and **Table 10**. Treatment dates and methods are included in Table 10.

All 21 sub-areas in this region were inventoried in 2021, and 15 were surveyed in 2022, though three of those were partially surveyed. In 2022, two sub-areas in Old Alameda Creek—North Bank (13a) and South Bank (13c)—were surveyed only in zones with recent infestation, and Ponds E8A, E9, and E8X (13m) in Eden Landing Ecological Reserve was partially surveyed due to multiple mechanical boat issues that precluded access to the complete sub-area. The remaining sub-areas where neither inventory nor treatment were conducted in 2022 were: AFCC's Lower Channel (01b), Upper Channel (01c), and Upper Channel-Union City Blvd to I-880 (01d), Pond 3-AFCC (01f), and Upstream of 20 Tide Gates (13g) and OAC Island (13b) along Old Alameda Creek. Most inventory was completed on foot, though the lower elevation portions of Eden Landing's North Creek (13h), North Creek Marsh (13k), and Ponds E8A, E9, and E8x were assisted by either airboat or jon boat.

The younger restoration marshes of Eden Landing Ecological Reserve (ELER) have experienced fluctuating levels of hybrid *S. alterniflora* infestation over the last five years with sporadic years of increase. These increases were attributed to ELER's location directly south of, and hydrological connection to the Cogswell Complex (Region 6), where one sub-area, Cogswell Marsh B Main (20n.3) has been restricted from full treatment since 2011. Consultation with U.S. Fish and Wildlife Service in 2018 resulted in re-authorization for treatment in this marsh, though only for a sub-lethal dose of herbicide with the intent of reducing seed production while maintaining vegetation for Ridgway's rail habitat. Despite re-initiation of this level of treatment, it seems that seed was still produced, and resulted in colonization of the previously unvegetated mudflats in the younger restoration marshes in ELER. This phenomenon is the same as was seen when these sites were first breached for tidal restoration in the mid-2000s. Each of the sub-areas still contain open mudflat where sediment has not sufficiently accreted to support most vegetation but is appropriate for *Spartina* colonization and establishment.

In 2022, a total of 0.03 acres net cover of hybrid *S. alterniflora* was detected and all but 4.2 m^2 of which was treated. This represents 0.1% of the bay wide infestation and a 9% increase from 2021 regional infestation. Of the region total, 87% is found within three sub-areas, all of which are former salt ponds restored to tidal flow since 2006: Eden Landing-North Creek Marsh (13k), Eden Landing-Mt Eden Creek Marsh (13l), and Eden Landing-Ponds E8A, E9, and E8X (13m). North Creek Marsh contained 52% of the regional total and experienced a 51% decline since 2021 levels. One patch of hybrid *S. alterniflora* totaling 0.008 m^2 was detected in Cargill Mitigation Marsh (13f), which was zero-detection in 2021 (**Table 4**). This plant had been genetically tested in 2020 and

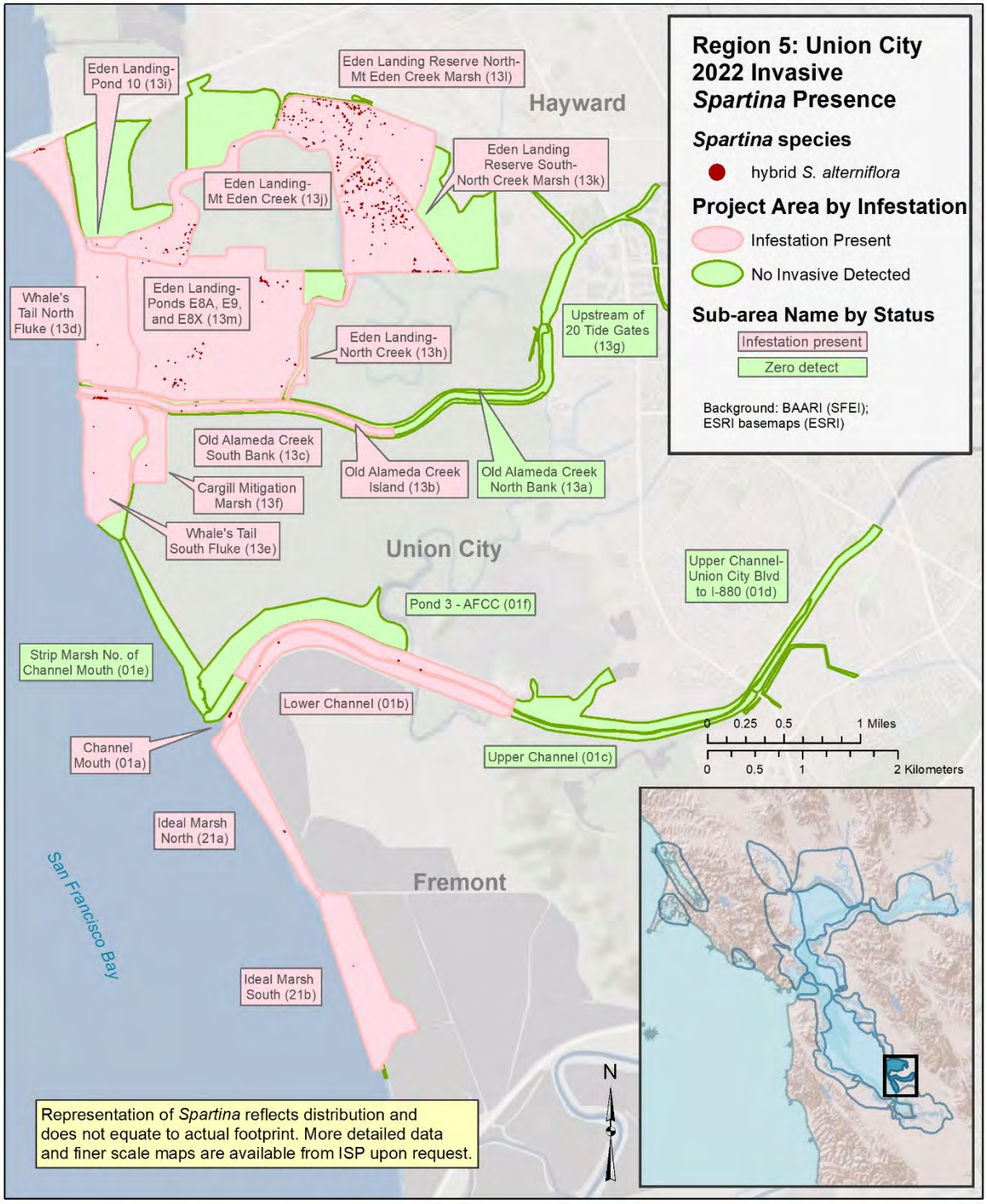

Figure 13. Distribution of invasive *Spartina* in 2022 across the 21 sub-areas of Reporting Region 5: Union City. Sub- areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 10. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 5: Union City. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Since Peak	Since 2021
REGION 5: UNION CITY											
01a: Channel Mouth	9/27	Backpack	0		3 m²	0	3 m²	192 m²	2004	>99%	Increase (2 m²)
01b: Lower Channel	Not Treated in 2022		0		5 m²	0	5 m²	73 m²	2004	>99%	No change detected
01c: Upper Channel	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2004	100%	n/a
01d: Upper Channel - Union City Blvd to I-880	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2005	100%	n/a
01e: Strip Marsh No. of Channel Mouth	No Invasive Spartina 2022		0		0	0	0	0	2004	100%	100%
01f: Pond 3 - AFCC	3 years with No Invasive Spartina (2020-2022)		0		0	0	0	0	2005	100%	n/a
13a: Old Alameda Creek North Bank	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
13b: Old Alameda Creek Island	8/23	Backpack	0		0.04 m²	0	0.04 m²	4 m²	2005	>99%	Increase (0.02 m²)
13c: Old Alameda Creek South Bank	10/5	Backpack	0		2 m²	0	2 m²	114 m²	2005	>99%	Increase (0.6 m²)
13d: Whale's Tail North Fluke	8/31; 9/21	Backpack	0		0.2 m²	0	0.2 m²	15 m²	2005	>99%	87%
13e: Whale's Tail South Fluke	10/5	Backpack	0		0.2 m²	0	0.2 m²	7 m²	2005	>99%	81%
13f: Cargill Mitigation Marsh	10/5	Backpack	0		0.008 m²	0	0.008 m²	0.7 m²	2004	>99%	n/a
13g: Upstream of 20 Tide Gates	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
13h: Eden Landing - North Creek	8/23	Backpack	0		0.02 m²	0	0.02 m²	2 m²	2007	>99%	75%
13i: Eden Landing - Pond 10	8/31	Backpack	0		0.001 m²	0	0.001 m²	0.1 m²	2008	>99%	100%
13j: Eden Landing - Mt Eden Creek	8/31	Backpack	0		3 m²	0	3 m²	189 m²	2009	>99%	17%
13k: Eden Landing Reserve South - North Creek Marsh	8/23; 9/16	Backpack	0		56 m²	0	56 m²	0.4 acres	2009	87%	Increase (19 m²)
13l: Eden Landing Reserve North - Mt Eden Creek Marsh	8/22	Backpack	0		27 m²	0	27 m²	956 m²	2010	84%	17%
13m: Eden Landing - Ponds E8A, E9, and E8X	8/23	Backpack, Airboat	0		11 m²	0	11 m²	380 m²	2014	67%	51%
21a: Ideal Marsh North	9/27	Backpack	0		0.03 m²	0	0.03 m²	1 m²	2005	>99%	94%
21b: Ideal Marsh South	9/27	Backpack	0		0.001 m²	0	0.001 m²	0.03 m²	2006	>99%	94%
REGION 5 TOTAL			0		108 m²	0	108 m²	0.9 acres	2004	>99%	Increase (3 m²)

yielded inconclusive results late in the season and was not treated that year; the plant was absent in 2021 but was re-detected in 2022 and was treated as possible hybrid *S. alterniflora* without resampling.

Annual surveys for Ridgway's rails have shown variable results at sub-areas surveyed by ISP and DENWR in the Union City Region. Rail numbers increased from 2020 to 2021 by ten rails and decreased from 2021 to 2022 by twelve rails. Overall, however, the number of rails detected in the region has risen over the past five years, nearly doubling since 2018.

The objective of the ISP Restoration Program in this region is to establish rail habitat cover where control efforts have removed or precluded hybrid *S. alterniflora*. To date, the program has installed more than 237,000 plantings across thirteen sub-areas along the Alameda Flood Control Channel (1a, 1b, 1c) and within the Eden Landing Ecological Reserve (13b, 13d, 13e, 13f, 13h, 13j, 13k, 13l, 13m, 21b). Planted *S. foliosa* has established and expanded extensively in this region, now covering acres of tidal wetlands at appropriate elevations, especially in the former salt ponds. The amount of *S. foliosa* present in the region resulting from plantings is orders of magnitude greater than the minor amount of remaining hybrid *S. alterniflora*. The Ridgway's rails now present at Eden Landing-North Creek Marsh (13k) are largely reliant on the established *S. foliosa* from ISP plantings there. Habitat enhancements in this region have also included 800 marsh-upland transition zone plantings at Cargill Mitigation Marsh (13f).

Region 6: Hayward

The Hayward Region (Region 6) extends from the San Mateo Bridge to Oakland Airport on the east side of the San Francisco Bay. The region is heavily urbanized and consists of 30 sub-areas clustered around three relatively young but sizeable restoration marsh complexes: Robert's Landing, Oro Loma, and Cogswell Marsh. Cogswell Marsh (20m-o) is the oldest and was restored in 1980. The 2022 distribution and abundance of invasive *Spartina* within each sub- area are presented in **Figure 14** and **Table 11**.

Full treatment at three sub-areas, Cogswell Marsh B Main (20n.3), North Marsh (20f) and Citation Marsh Central (20d.2b), has been halted since 2011 out of concern for local Ridgway's rail populations. Another six sub-areas were restricted from treatment in 2011 but were re-authorized in 2018 after consultation with U.S. Fish and Wildlife Service. Treatment restrictions in this region allowed hybrid *S. alterniflora* to expand, spread into adjacent marshes, disperse seed to the Estuary, and halt or reverse progress toward eradication in many sub-areas.

All 30 sub-areas in the Hayward Region were inventoried on foot in 2021 and 27 sub-areas were inventoried on foot in 2022. The three sub-areas not inventoried in 2022 have continued treatment restrictions and are inventoried by grid every other year. These include Citation Marsh Central (20d.2b), North Marsh (20f), and Cogswell Marsh B Main (20n.3), the last of which is authorized for seed suppression treatment only. Due to extremely tall and dense plants that precluded successful movement through the marsh during inventory, portions of North Marsh and Citation Marsh Central were not inventoried in 2021 and data was extrapolated from neighboring grids and prior years' data.

A total of 10.5 acres of non-native cordgrass, all hybrid *S. alterniflora*, was detected in 2022 (**Figure 15**). This accounts for 51% of the Estuary total and places Region 6 as the most heavily infested region, a fact largely due to the historic and continuing treatment restrictions. Despite this, major reductions were observed, especially within the formerly restricted sub-areas, which saw reductions ranging from 47% in Cogswell Marsh C (20o) and 95% in Citation Marsh Upper (20d.2a) between 2021 and 2022 (See **Section 3.1** for more information on resuming treatment in Phase 1 sub-areas). Continued reductions in infestation are expected in the formerly restricted sub-areas of Robert's Landing and Cogswell as well as in their neighbors as seed production consequently also declines.

Twenty-nine of 30 sub-area in this region contained hybrid *S. alterniflora* in 2021 and 2022, and though annual treatment keeps infestation levels low in many sub-areas, their proximity to sub-areas where treatment is restricted makes eradication impossible while restrictions are in place. Annual inventory and treatment remain necessary to ensure that these marshes and mudflats do not evolve into hybrid *S. alterniflora* meadows and further impact the Estuary with increased propagules. A new 0.2 m^2 patch of hybrid *S. alterniflora* was detected at Hayward Landing (20k), which was zero detect for the first time in 2021 (**Table 4**). This sub-area is directly connected to the Cogswell Complex and this plant is undoubtedly a recruit from the infestation that remains in restricted treatment sub-area Cogswell Marsh B Main.

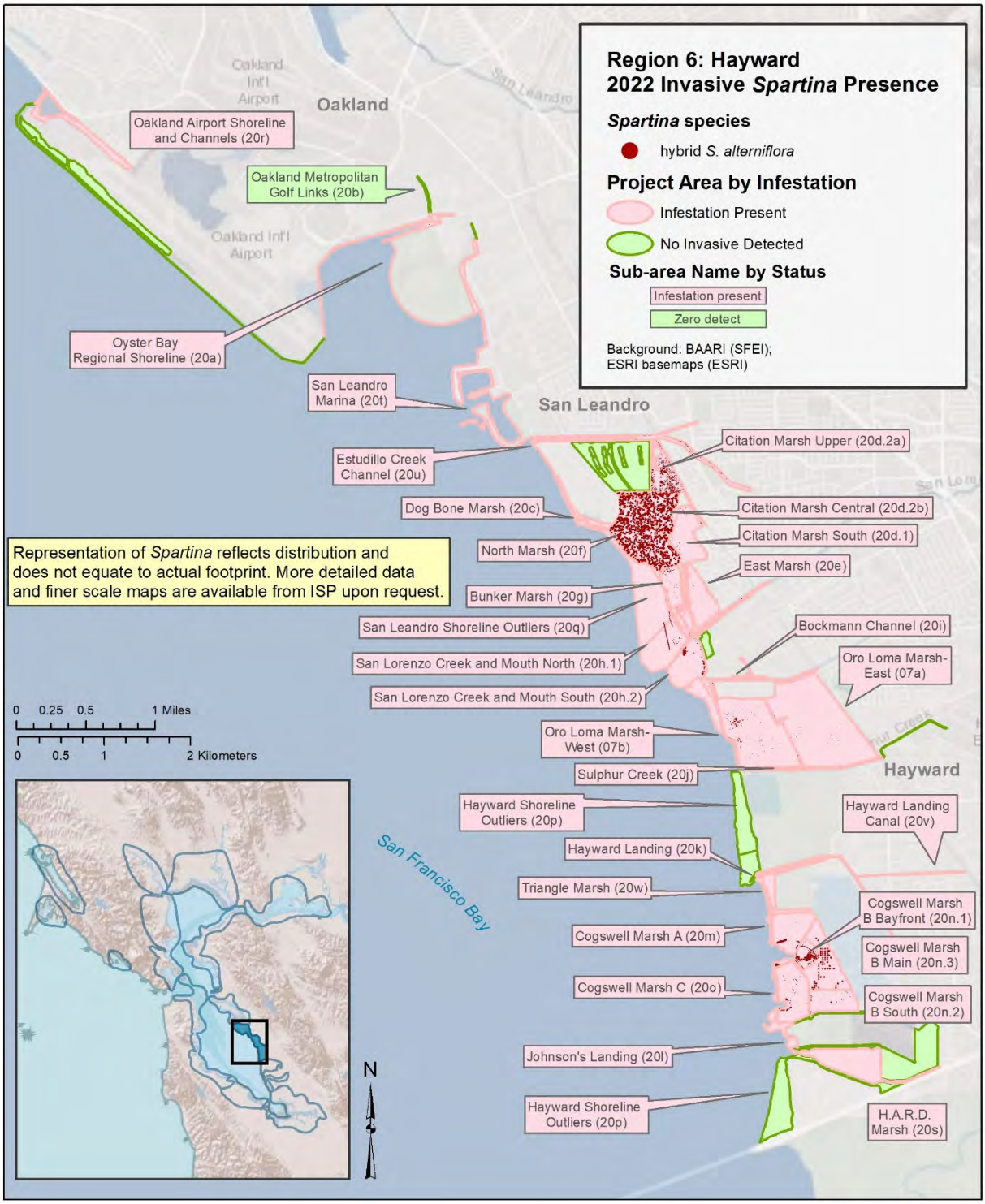

Figure 14. Distribution of invasive *Spartina* in 2022 across the 30 sub-areas of Reporting Region 6: Hayward. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 11. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 6: Hayward. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Since Peak	Since 2021
REGION 6: HAYWARD											
07a: Oro Loma Marsh - East	10/20-10/21	Backpack, Airboat	0		6 m²	0	6 m²	326 m²	2008	>99%	67%
07b: Oro Loma Marsh - West	10/20-10/21	Backpack, Airboat	0		46 m²	0	46 m²	976 m²	2005	>99%	55%
20a: Oyster Bay Regional Shoreline	7/5; 7/22	Backpack	0		0.6 m²	0	0.6 m²	43 m²	2004	>99%	16%
20b: Oakland Metropolitan Golf Links	No Invasive Spartina 2022		0		0	0	0	0	2009	100%	100%
20c: Dog Bone Marsh	7/8; 7/22	Backpack	0		0.5 m²	0	0.5 m²	13 m²	2006	>99%	82%
20d.1: Citation Marsh South	8/29	Truck, Backpack	0		33 m²	0	33 m²	431 m²	2004	>99%	51%
20d.2a: Citation Marsh Upper	8/12; 8/15-8/16; 8/29	Truck, Backpack	0		222 m²	0	222 m²	1 acres	2006	>99%	91%
20d.2b: Citation Marsh Central	No Treatment Authorized since 2010		0		2.7 acres	0	2.7 acres	23.5 acres	2006	61%	No change detected
20e: East Marsh	10/18	Backpack	0		4 m²	0	4 m²	82 m²	2006	>99%	66%
20f: North Marsh	No Treatment Authorized since 2010		0		6.9 acres	0	6.9 acres	59.9 acres	2006	61%	No change detected
20g: Bunker Marsh	8/30; 10/18; 11/3	Truck, Backpack	0		18 m²	0	18 m²	555 m²	2004	>99%	95%
20h.1: San Lorenzo Creek and Mouth North	8/18; 10/18; 11/3	Backpack	0		1 m²	0	1 m²	43 m²	2004	>99%	91%
20h.2: San Lorenzo Creek and Mouth South	8/18; 10/18; 11/3	Backpack	0		103 m²	0	103 m²	0.4 acres	2004	>99%	65%
20i: Bockmann Channel	7/22	Backpack	0		1 m²	0	1 m²	20 m²	2004	>99%	Increase (1 m²)
20j: Sulphur Creek	7/22	Backpack	0		0.5 m²	0	0.5 m²	14 m²	2004	>99%	Increase (0.3 m²)
20k: Hayward Landing	9/29	Backpack	0		0.2 m²	0	0.2 m²	3 m²	2004	>99%	n/a
20l: Johnson's Landing	8/16	Backpack	0		0.03 m²	0	0.03 m²	0.5 m²	2005	>99%	89%
20m: Cogswell Marsh A	7/22; 8/16; 9/28	Backpack	0		21 m²	0	21 m²	263 m²	2005	>99%	Increase (20 m²)
20n.1: Cogswell Marsh B Bayfront	8/17; 8/31	Truck, Backpack	0		124 m²	0	124 m²	0.8 acres	2005	>99%	72%
20n.2: Cogswell Marsh B South	8/31	Truck	0		55 m²	0	55 m²	745 m²	2005	>99%	51%
20n.3: Cogswell Marsh B Main	8/12; 10/20; 11/18	Aerial Broadcast for Seed Suppression; Backpack as permitted around revegetation plantings	0		0.7 acres	0	0.7 acres	9.9 acres	2005	98%	No change detected
20o: Cogswell Marsh C	8/31; 9/30	Truck, Backpack	0		61 m²	0	61 m²	0.3 acres	2005	>99%	47%
20p: Hayward Shoreline Outliers	7/22; 8/16; 8/18	Backpack	0		5 m²	0	5 m²	29 m²	2008	>99%	Increase (5 m²)
20q: San Leandro Shoreline Outliers	7/22	Backpack	0		7 m²	0	7 m²	29 m²	2006	>99%	19%
20r: Oakland Airport Shoreline and Channels	7/5; 8/5; 10/5	Backpack	0		1 m²	0	1 m²	34 m²	2006	>99%	36%
20s: H.A.R.D. Marsh	8/16; 9/29	Backpack	0		0.4 m²	0	0.4 m²	7 m²	2006	>99%	61%
20t: San Leandro Marina	7/8	Backpack	0		0.03 m²	0	0.03 m²	0.4 m²	2009	>99%	Increase (0.01 m²)
20u: Estudillo Creek Channel	7/8; 7/22	Truck, Backpack	0		31 m²	0	31 m²	704 m²	2010	96%	Increase (12 m²)
20v: Hayward Landing Canal	7/22; 8/16	Backpack	0		0.9 m²	0	0.9 m²	22 m²	2006	>99%	Increase (0.7 m²)
20w: Triangle Marsh	7/22; 9/28; 9/29	Backpack	0		3 m²	0	3 m²	25 m²	2007	78%	Increase (3 m²)
REGION 6 TOTAL			0		10.5 acres	0	10.5 acres	96.9 acres	2005	95%	43%

Note: several sub-areas in this Region are restricted from full treatment and were inventoried by grid in 2021 only and not all in 2022. Inventory data for 2022 reported for the following sub-areas reflect those of 2021 hybrid *S. alterniflora*: Citation Marsh Central (20d.2b), North Marsh (20f), and Cogswell Marsh B Main (20n.2)

The number of California Ridgway's rail detected in the Hayward Region decreased by 32% between 2020 and 2021 and did not change much between 2021 and 2022. The decline can be partially attributed to the reduction of hybrid *S. alterniflora* at the Phase 1 sub-areas where treatment was permitted with the 2018 Biological Opinion. However, declines were also observed in sub-areas where treatment has not occurred for over a decade, such as North Marsh (20f), which declined by over 40% (nearly 30 rails) between 2020 and 2021.

The large amount of hybrid *S. alterniflora* remaining in this region has delayed the reintroduction of *S. foliosa* at sub-areas with treatment restrictions. The ISP Restoration Program has cautiously tested planting *S. foliosa* at sub-areas with relatively less invasion pressure near restricted treatment sub-areas with the goal of enhancing suitable habitat prior to resuming control efforts in the future. Sub-areas that have undergone some level of *S. foliosa* planting include Oro Loma Marsh-East (07a), H.A.R.D. Marsh (20s), Triangle Marsh (20w), and Cogswell Marsh A (20m). Habitat enhancements have also included planting over 45,000 marshplain *Grindelia stricta*, (sometimes paired with *Distichlis spicata*), across twelve sub-areas. Habitat enhancements that provide cover during high tides, especially during extreme high tides (king tides) include 13 high tide refuge islands installed in Cogswell Marsh B South (20n.2), Cogswell Marsh B Main (20n.3), Cogswell Marsh C (20o), and Bunker Marsh (20g) as well as 5,400 marsh-upland transition zone plantings on existing large higher elevation islands at Cogswell (20m, 20n.1, 20n.3, 20o), Citation Marsh (20d.2a, 20d.2b), and the transition zone along the east side of Bunker Marsh (20g).

Region 7: San Leandro Bay

The San Leandro Bay Region (Region 7) is an exceptionally urbanized portion of the East Bay that extends north from the Oakland Airport to the Bay Bridge. Its 20 sub-areas consist of long, thin tidal areas along rip-rap shorelines and open mudflats, punctuated by fragmented areas of marsh habitat. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 15** and **Table 12**. Treatment dates and methods are included in Table 12**.**

This region contains three sub-areas where treatment has not been conducted since 2010 out of concern for the local Ridgway's rail population: Arrowhead Marsh East (17c.2), MLK New Marsh (17h), and Fan Marsh Main (17j.2). All sub-areas in this region were mapped on foot or by boat. The sub-areas where treatment is restricted were inventoried by grid in only 2021 and not in 2022, and in those cases, 2021 data has been carried over and reported in 2022 for summary. Hybrid *S. alterniflora* was the only non-native cordgrass species found in Region 7, with a net cover of 7.8 acres in 2022, which reflects a 0.2-acre decrease (2.6%) from 2021 levels.

More than 99% of hybrid *S. alterniflora* found in Region 7 is located in the three un-treated sub-areas and in Arrowhead Marsh West (17c.1), which is directly adjacent to Arrowhead Marsh East, from which it receives annual influx of propagules. Data from grid surveys in 2019 and 2021 show stable or decreasing levels of infestation at these treatment-restricted sites, which suggest that hybrid *S. alterniflora* levels may be reaching maximum amounts and plateauing while also negatively responding to prolonged drought conditions. The two formerly restricted marshes where full treatment resumed in 2018 experienced dramatic declines between 2021 and 2022: Damon Marsh (17d.4) declined by 74% and Fan Marsh Wings (17j.1) saw an 84% reduction (see **Section 3.1** for more information on resuming treatment at Phase 1 sub-areas).

The infestation in Region 7 comprises 38% of the total amount of invasive *Spartina* remaining in the Estuary. Every sub-area in the San Leandro Bay Region contained invasive *Spartina* in 2021, and only one, Coast Guard Island (17g), achieved zero-detection status in 2022 (**Table 4**). Annual treatment in the San Leandro Bay Region by ISP facilitates the control of the proliferation of hybrid *S. alterniflora*, but constant establishment of new plants from nearby seed sources makes it unlikely that any sub-area will achieve and maintain zero detect status while treatment restrictions remain in place.

The number of Ridgway's rail detected during surveys declined by 17% between 2021 and 2022. Two previously restricted Phase 1 sub-areas were permitted for treatment in 2018 and no rails were detected at either of these sub-areas in 2022. However, sub-areas where treatment is still restricted also exhibited fewer detections of Ridgway's rails in 2021 and 2022, declining by 22% since 2020 surveys. The high level of hybrid *S. alterniflora* infestation in San Leandro Bay marshes has supported a local high-density Ridgway's rail population for the past two decades, and the lack of appropriate native marsh structure in these marshes makes the rails here dependent upon hybrid *S. alterniflora*.

Opportunities for rail habitat enhancement in this region are limited by treatment restrictions at all main marshes. The presence of uncontrolled hybrid *S. alterniflora* significantly increases the risk of *S. foliosa* plantings becoming infested and then requiring treatment. As a result, the ISP

Restoration Program has so far limited efforts to enhance habitat in this region. From 2011 to 2016, more than 3,000 *Grindelia* plantings were installed at the key marshes. *Spartina foliosa* has been planted at Elsie Roemer (17a), with caution due to the high risk of re-infestation. Additionally, a total of five high tide refuge islands were constructed in 2012-13 within Arrowhead Marsh West (17c.1) and MLK New Marsh (17h) to provide potential protective cover for rails during extreme high tides when they are most exposed to predators.

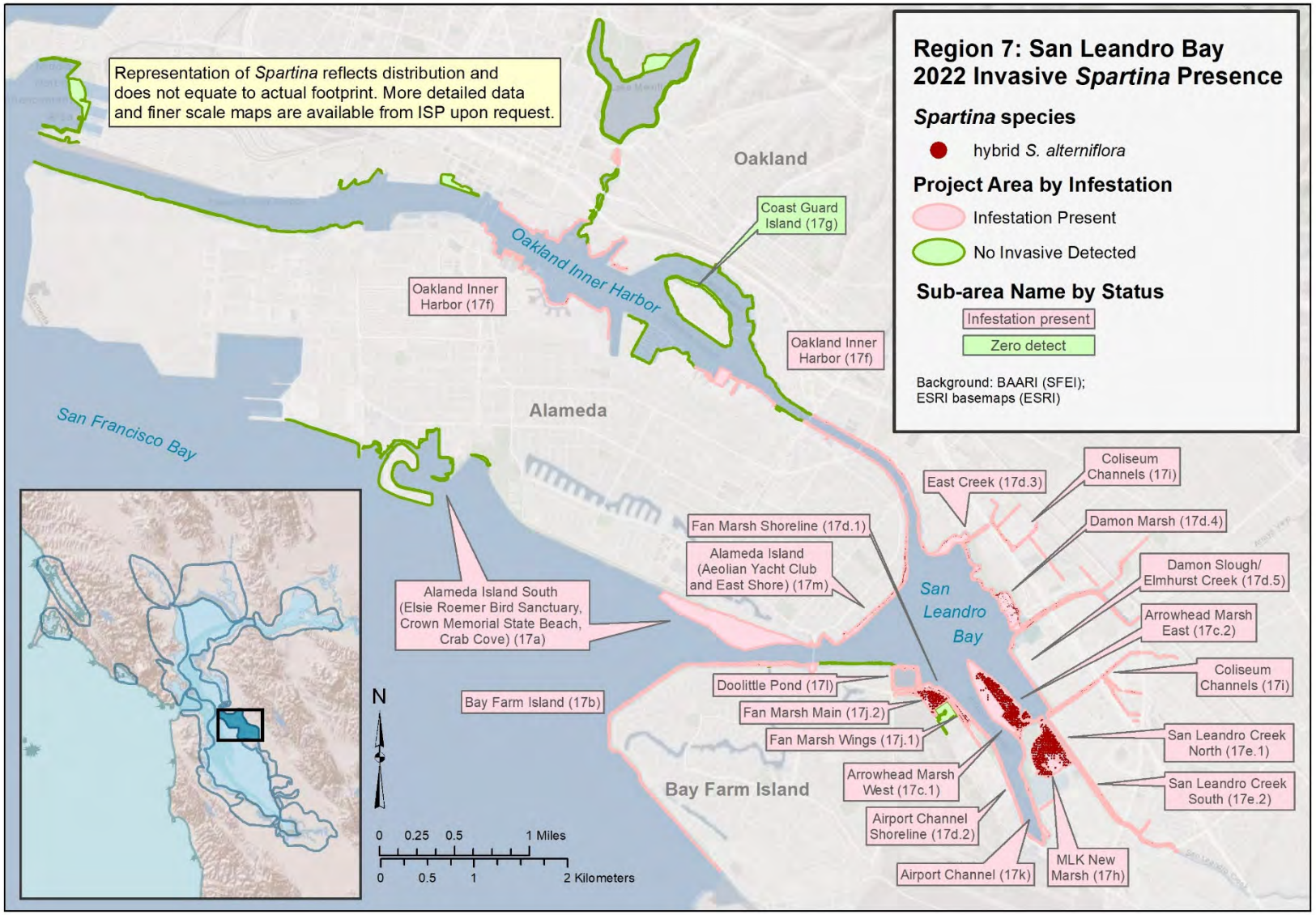

Figure 15. Distribution of invasive *Spartina* in 2022 across the 20 sub-areas of Reporting Region 7: San Leandro Bay. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 12. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 7: San Leandro Bay. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
REGION 7: SAN LEANDRO BAY											
17a: Alameda Island South (Elsie Roemer Bird Sanctuary, Crown Memorial State Beach, Crab Cove)	8/5; 9/29	Backpack	0		0.6 m²	0	0.6 m²	38 m²	2006	>99%	84%
17b: Bay Farm Island	8/5	Backpack	0		0.8 m²	0	0.8 m²	16 m²	2005	>99%	52%
17c.1: Arrowhead Marsh West	11/2; 11/16	Backpack, Airboat	0		693 m²	0	693 m²	5.6 acres	2005	98%	49%
17c.2: Arrowhead Marsh East	No Treatment Authorized since 2010		0		3.3 acres	0	3.3 acres	19.8 acres	2006	80%	No change detected
17d.1: Fan Marsh Shoreline	7/20	Airboat	0		5 m²	0	5 m²	119 m²	2004	>99%	56%
17d.2: Airport Channel Shoreline	7/20; 7/22	Backpack	0		16 m²	0	16 m²	155 m²	2005	>99%	33%
17d.3: East Creek	7/20	Backpack	0		17 m²	0	17 m²	280 m²	2004	>99%	8%
17d.4: Damon Marsh	10/17	Truck, Backpack	0		56 m²	0	56 m²	0.3 acres	2006	>99%	74%
17d.5: Damon Slough / Elmhurst Creek	7/20; 10/17	Backpack	0		26 m²	0	26 m²	145 m²	2005	>99%	Increase (21 m²)
17e.1: San Leandro Creek North	7/20	Backpack	0		0.2 m²	0	0.2 m²	5 m²	2005	>99%	Increase (0.1 m²)
17e.2: San Leandro Creek South	7/20	Backpack	0		9 m²	0	9 m²	124 m²	2005	>99%	Increase (6 m²)
17f: Oakland Inner Harbor	7/21; 8/2	Backpack	0		7 m²	0	7 m²	106 m²	2007	>99%	Increase (2 m²)
17g: Coast Guard Island	No Invasive Spartina 2022		0		0	0	0	0	2007	100%	100%
17h: MLK New Marsh	No Treatment Authorized since 2010		0		3.5 acres	0	3.5 acres	23.9 acres	2006	53%	No change detected
17i: Coliseum Channels	7/7; 10/14	Backpack	0		24 m²	0	24 m²	601 m²	2005	>99%	Increase (5 m²)
17j.1: Fan Marsh Wings	7/20	Backpack	0		4 m²	0	4 m²	118 m²	2005	>99%	84%
17j.2: Fan Marsh Main	No Treatment Authorized since 2010		0		0.8 acres	0	0.8 acres	8.5 acres	2006	88%	No change detected
17k: Airport Channel	7/22	Backpack, Airboat	0		0.4 m²	0	0.4 m²	21 m²	2005	>99%	66%
17l: Doolittle Pond	7/20	Backpack	0		0.4 m²	0	0.4 m²	21 m²	2004	>99%	Increase (0.4 m²)
17m: Alameda Island (Aeolian Yacht Club and East Shore)	8/5; 9/29	Backpack	0		12 m²	0	12 m²	98 m²	2006	>99%	9%
REGION 7 TOTAL			0		7.8 acres	0	7.8 acres	58.5 acres	2006	91%	31%

Note: several sub-areas in this Region are restricted from treatment and were inventoried by grid in 2021 only and not all in 2022. Inventory data for 2022 reported for the following sub-areas reflect those of 2021 hybrid *S. alterniflora*: Arrowhead Marsh East (17c.2), MLK New Marsh (17h), and Fan Marsh Main (17j.2).

Region 8: Bay Bridge North

The Bay Bridge North Region (Region 8) is composed of 13 sub-areas including all East Bay shoreline marshes north of the Bay Bridge and southwest of the Carquinez Strait. This region is typified by riprap shorelines and fragmented marshes with little or no room for expansion due to urban development to their upland edge. The exceptions are intact historic Whittell Marsh (10a) and Giant Marsh (10c), and the large and partially brackish Wildcat Marsh (22a) and San Pablo Marsh (22b). The 2022 distribution and abundance of invasive *Spartina* within each sub- area are presented in **Figure 16** and **Table 13**. Treatment dates and methods are included in **Table 13**.

ISP surveyed all 13 sub-areas in both 2021 and 2022, though an interior portion of Wildcat Marsh (22a) was not inventoried in 2021, and portions of the Richmond/Albany/Pinole Shoreline (22f) were not surveyed in either year due to low invasion pressure. All inventory was completed on foot, except for the shorelines and ponds adjacent to Wildcat Marsh, which were surveyed by kayak. In 2022 a total of 0.02 acres of invasive cordgrass, (all hybrid *S. alterniflora*) was found in Region 8, which represents 0.1% of the Estuary total and a 0.002-acre increase (15%) from 2021 levels.

Three sub-areas—Emeryville Crescent West (06b), Wildcat Marsh (22a), and San Pablo East (22b.1)—contain 66% of the regional total, though none have more than 30 m^2 of hybrid *S. alterniflora*. Wildcat Marsh has by far the greatest infestation with 25 m^2, which more than doubled between 2021 and 2022 and drove the regional increase between the two years. Most of the infestation at Wildcat Marsh is adjacent to the Chevron Richmond Refinery in a secluded cove ("Castro Cove") that was opened to tidal flow in 2012. In the following years of sediment accretion and marsh plant colonization, new hybrid *S. alterniflora* patches have established and have been verified by genetic sampling. These patches are at low elevation and begin to senesce early in the season, sometimes before ISP can access them and conduct effective treatment. This area was prioritized for early detection and treatment in 2022 and will continue to be in future years.

Spartina densiflora was continuously present in this region since its discovery here in 2004 to 2014, during which time it was manually removed from four sub-areas: Whittell Marsh (10a), Southern Marsh (10b), Giant Marsh (10c), and Richmond/Albany/Pinole Shoreline (22f). No *S. densiflora* had been detected in any sub-area in the Bay Bridge North Region between 2014 and 2018, when a single plant was found and removed from Whittell Marsh. No *S. densiflora* has been detected in this region since 2018. However, persistent inventory monitoring will continue for a couple more years since *S. densiflora* seed bank can remain viable for an estimated five years.

Surveys for Ridgway's rails in the Bay Bridge North Region have been conducted by a coalition of survey organizations including ISP, PBCS, and East Bay Regional Park District (EBRPD). Collectively, results from these surveys have shown a decrease in the number of rails detected over the past two years, similar to all other regions in the Estuary. There were about 20 fewer rails detected in the Bay Bridge North Region in 2022 than were detected in 2020. Most of this region is highly urbanized, riprap shoreline or steep upland edge with few opportunities for tidal marsh habitat enhancement. The two largest marshes in this region, Wildcat Marsh (22a) and San Pablo Marsh (22b), have high quality habitat and extensive *S. foliosa* and *G. stricta* throughout. Consequently,

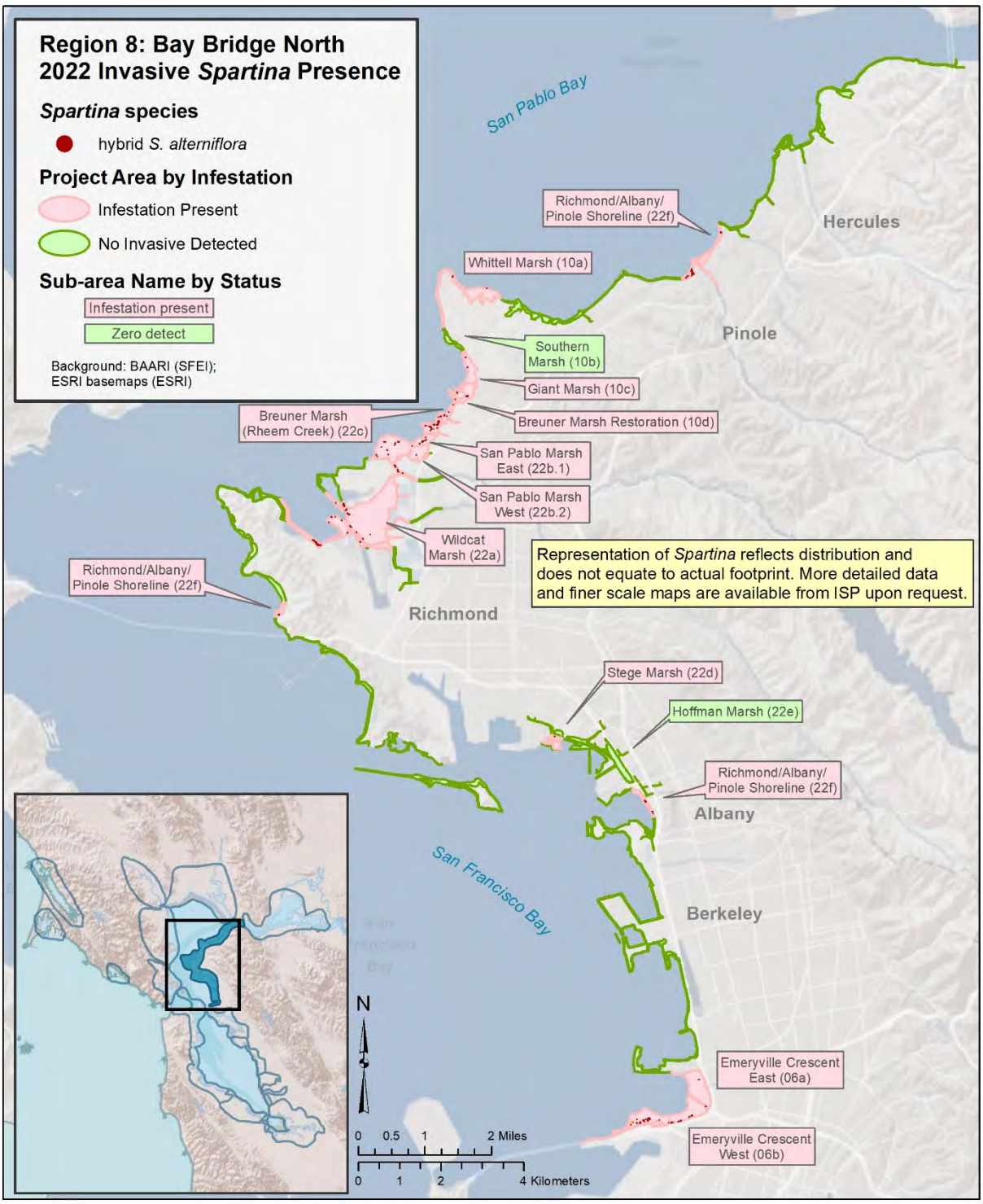

Figure 16. Distribution of invasive *Spartina* in 2022 across the 13 sub-areas of Reporting Region 8: Bay Bridge North. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 13. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 8: Bay Bridge North. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Since Peak	Since 2021
REGION 8: BAY BRIDGE NORTH											
06a: Emeryville Crescent East	9/19	Backpack	0		4 m^2	0	4 m^2	153 m^2	2005	>99%	14%
06b: Emeryville Crescent West	9/2; 10/3	Backpack	0		10 m^2	0	10 m^2	205 m^2	2004	>99%	21%
10a: Whittell Marsh	8/26; 9/22	Backpack	0		3 m^2	0	3 m^2	96 m^2	2005	>99%	Increase (3 m^2)
10b: Southern Marsh	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2010	100%	n/a
10c: Giant Marsh	8/30; 10/28	Backpack	0		3 m^2	0	3 m^2	38 m^2	2005	>99%	Increase (3 m^2)
10d: Breuner Marsh Restoration	8/30	Backpack	0		0.04 m^2	0	0.04 m^2	0.3 m^2	2016	99%	95%
22a: Wildcat Marsh	8/3; 9/1; 10/7; 10/25	Backpack, Airboat	0		25 m^2	0	25 m^2	608 m^2	2010	98%	Increase (14 m^2)
22b.1: San Pablo Marsh East	9/1	Backpack, Airboat	0		4 m^2	0	4 m^2	96 m^2	2009	>99%	40%
22b.2: San Pablo Marsh West	8/30; 9/1; 9/8; 9/27	Backpack, Airboat	0		9 m^2	0	9 m^2	123 m^2	2006	>99%	Increase (2 m^2)
22c: Breuner Marsh (Rheem Creek)	8/30; 9/1	Backpack, Airboat	0		4 m^2	0	4 m^2	155 m^2	2009	>99%	40%
22d: Stege Marsh	9/19	Backpack	0		0.01 m^2	0	0.01 m^2	0.3 m^2	2009	>99%	98%
22e: Hoffman Marsh	No Invasive Spartina 2022		0		0	0	0	0	2004	100%	100%
22f: Richmond / Albany / Pinole Shoreline	8/26; 9/9; 9/19 11/3	Backpack	0		4 m^2	0	4 m^2	200 m^2	2004	>99%	32%
REGION 8 TOTAL			0		68 m^2	0	68 m^2	0.4 acres	2009	>99%	58%

to date, the ISP Restoration Program has not planned any habitat enhancements in this region, except to support the Giant Marsh Living Shorelines Project by conducting inventory and treatment of hybrid *S. alterniflora* in this region. The Living Shorelines Project tested plantings of cordgrass in areas where the marsh is substantially eroding due to wave energy, both in combination with artificial oyster reefs and plantings alone.

Region 9: Suisun

The Suisun Region (Region 9) is bounded on the west by the Carquinez Strait and extends east approximately to Antioch, where the salinity level transitions to freshwater within the San Joaquin-Sacramento Delta. The Suisun Region consists of five sub-areas including Southampton Marsh (11) and four sub-areas further east in Suisun Bay: Point Buckler (27a), MOTCO Islands (27b), Honker Bay (27c), and MOTCO Mainland (27d). An infestation by hybrid *S. alterniflora* was discovered on Point Buckler in 2016, resulting in the extension of this Region to the east to incorporate most of Suisun Bay. High wind and wave conditions frequently make boat operation very challenging and unsafe in large portions of this region. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 17** and **Table 14**. Treatment dates and methods are included in Table 14.

All five sub-areas in the Suisun Region were inventoried in both 2021 and 2022, though portions of MOTCO Mainland (27d) were not accessed in either year due to access issues. Southampton Marsh was surveyed for hybrid *S. alterniflora* thoroughly on foot and by kayak in 2021 and 2022. Point Buckler, MOTCO Islands, and Honker Bay were primarily inventoried by whaler with foot support where possible, and MOTCO Mainland was partially surveyed by kayak in 2021 and 2022. Unsafe conditions due to high winds and waves precluded kayak access to MOTCO Mainland's Seal Islands in 2021 and most of the mainland shoreline in 2022. The extensive side channels and back sloughs of MOTCO Islands and Honker Bay have never been fully inventoried due to difficulty of access and the sheer amount of ground to cover; each and every year new areas are explored and assessed, frequently resulting in new detections of isolated hybrid *S. alterniflora* patches. The long rocky shoreline of the Carquinez Strait provides minimal opportunity for *Spartina* establishment and is surveyed every few years so that resources can be focused elsewhere with more infestation pressure. This stretch was mostly surveyed by kayak in 2021, whaler in 2022, and on foot most recently in 2020.

In 2022, ISP detected and treated a total of 32.2 m^2 of hybrid *S. alterniflora*, which accounts for 0.04% of the Estuary total and reflects a 5% increase over 2021 amounts. While most sub-areas experienced declines ranging from 68-99% between 2021 and 2022, the infestation in Honker Bay more than doubled from 10 m^2 to 27 m^2 and accounted for 83% of the regional total. Increases in Honker Bay were predominantly driven by three newly detected patches >1 m^2 (the only ones of this size found in the region), all of which were in very shallow areas that biologists gained access to for the first time in 2022. This is the result of continued further exploration and assessment by the ISP each year, which will continue in future years.

The Suisun Region's extensive brackish and freshwater marshes have a very low density of Ridgway's rails, and the nominal infestation by and treatment of invasive cordgrass is not anticipated to have any impact on rail populations. Very few organizations conduct rail surveys in this region and data are sparse, but OEI has conducted surveys for the Military Ocean Terminal Concord (MOTCO) since 2020 at several offshore islands (including portions of ISP sub-area 27b), and no Ridgway's rails have been detected. As such, the ISP Restoration Program has not implemented habitat enhancements within this region.

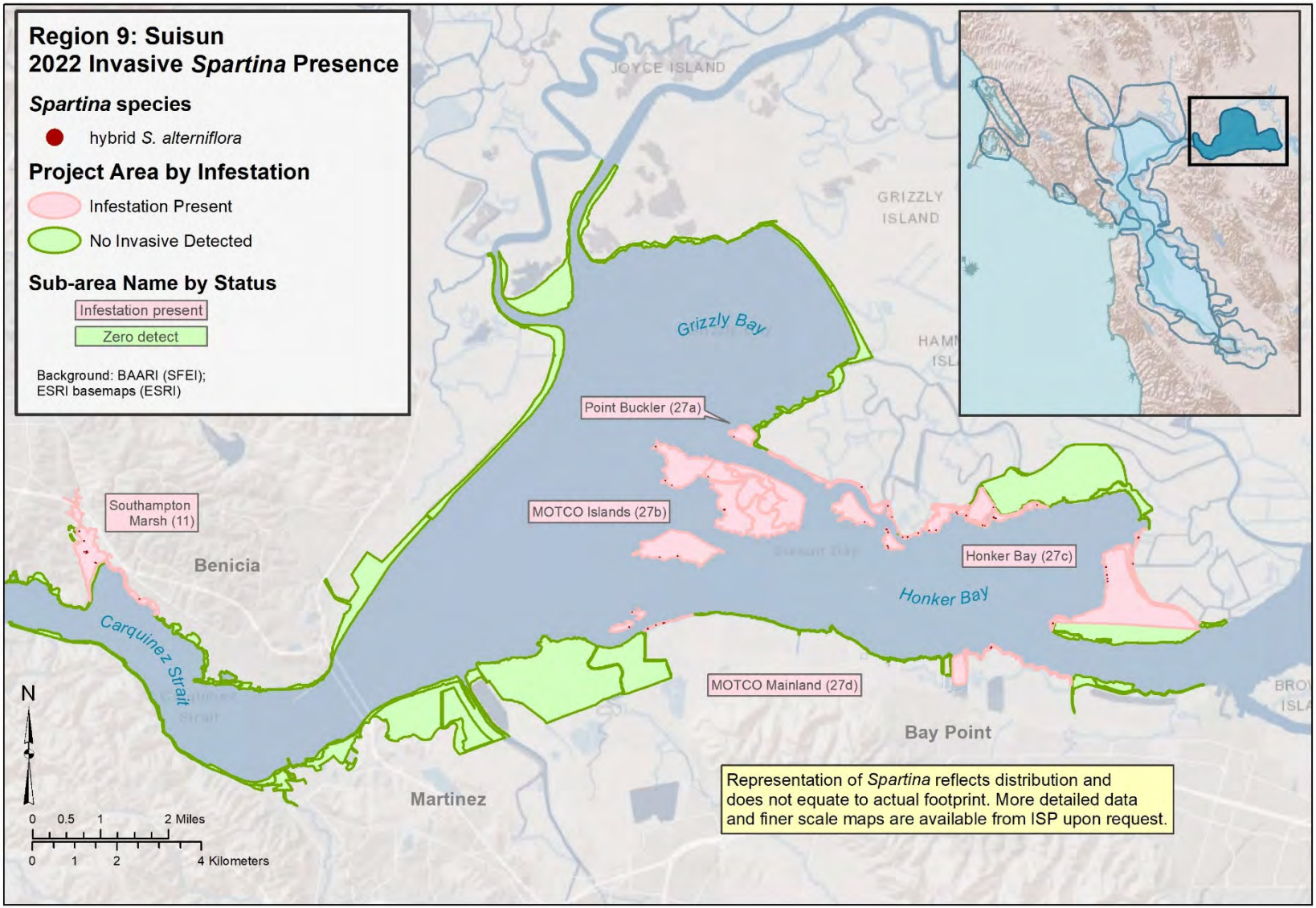

Figure 17. Distribution of invasive *Spartina* in 2022 in the five sub-areas of Reporting Region 9: Suisun. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 14. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 9: Suisun. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treat-ment Area	Peak Year	Since Peak	Since 2021
REGION 9: SUISUN											
11: Southampton Marsh	9/13; 10/7	Backpack	0		2 m^2	0	2 m^2	46 m^2	2005	>99%	4%
27a: Point Buckler	6/8	Backpack	0		0.01 m^2	0	0.01 m^2	1 m^2	2016	>99%	99%
27b: MOTCO Islands	6/7-6/8	Backpack	0		2 m^2	0	2 m^2	39 m^2	2017	>99%	68%
27c: Honker Bay	6/8; 6/20	Backpack	0		27 m^2	0	27 m^2	202 m^2	2022	n/a	Increase (17 m^2)
27d: MOTCO Mainland	6/7; 6/20; 7/6	Backpack	0		1 m^2	0	1 m^2	34 m^2	2020	90%	86%
REGION 9 TOTAL			0		32 m^2	0	32 m^2	321 m^2	2005	99%	21%

Region 10: Vallejo

The Vallejo Region (Region 10) is comprised of four sub-areas and covers the northern portion of San Pablo Bay, bounded by the mouth of the Petaluma River to the west and the City of Vallejo to the east, and extending eight miles inland to the north. Due to the region's large size and limited invasion pressure over much of its extent, it is not surveyed in entirety each year, and methods vary depending on resources. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 18** and **Table 15**. Treatment dates and methods are included in Table 15.

All four sub-areas of the Vallejo Region were surveyed in both 2021 and 2022. The entirety of the San Pablo Bay bayfront including Mare Island (26b), Sonoma Baylands (26d), and the bayfront of Sonoma Creek mouth (26c), was surveyed in both 2021 and 2022 with airboat support from California Department of Food and Agriculture (CDFA). Interior portions of White Slough/Napa River (26a) were surveyed by whaler in 2021, and then extensively surveyed in 2022 with CDFA airboat support. Historic infestation zones of Mare Island and Sonoma Creek were inventoried on foot both years.

In 2022 a total of 1.9 m^2 of hybrid *S. alterniflora* was detected in this region, which reflects a 48% reduction since 2021. It was congregated along a 350-meter stretch of the Sonoma Creek at the Highway 37 overpass and straddles two sub-areas: Sonoma Creek and San Pablo Bay NWR/ Mare Island. This area is a continuing historic infestation that gets regularly trampled by anglers, which reduces efficacy of treatment. The primary historic infestation in this region was within the Mare Island sub-area, but approximately eight kilometers southeast of the current infestation. It has been on the decline from an uptick to 193 m^2 in 2014, and no invasive cordgrass was detected here in 2022 for the first time.

The San Pablo Bay NWR and Mare Island sub-area has also historically contained both *S. densiflora* and hybrid *S. densiflora*, though neither have been detected here since 2018. Persistent inventory monitoring will continue for a couple more years because *S. densiflora* seed bank can remain viable for an estimated five years.

Annual rail surveys by PBCS and San Pablo Bay NWR show declines in the number of Ridgway's rails detected in 2021 and 2022, in a similar trend seen around the Bay, but here are not impacted by the infestation or treatment of hybrid *S. alterniflora*. There is extensive *S. foliosa* throughout the Region, and it has quickly colonized and become established in various tidal restoration projects. The ISP Restoration Program has planted *S. foliosa* on 59 constructed islands and other elevated features located within the Sears Point-Dickson Unit restoration project within the Sonoma Baylands (26d) sub-area of San Pablo Bay NWR. These interior features within the restoration site were planted to speed up vegetation establishment to help reduce erosion observed there by project partners, SFSU, San Francisco Bay NERR, SPBNWR, and Sonoma Land Trust. The ISP Restoration Program has collected *S. foliosa* plant material from several of the fringe marsh areas along the Napa River for amplification in propagation beds at a nursery. Propagated *S. foliosa* from this region has been planted in four other Regions: Region 2: San Francisco Peninsula, Region 5: Union City, Region 6: Hayward, and Region 7: San Leandro Bay.

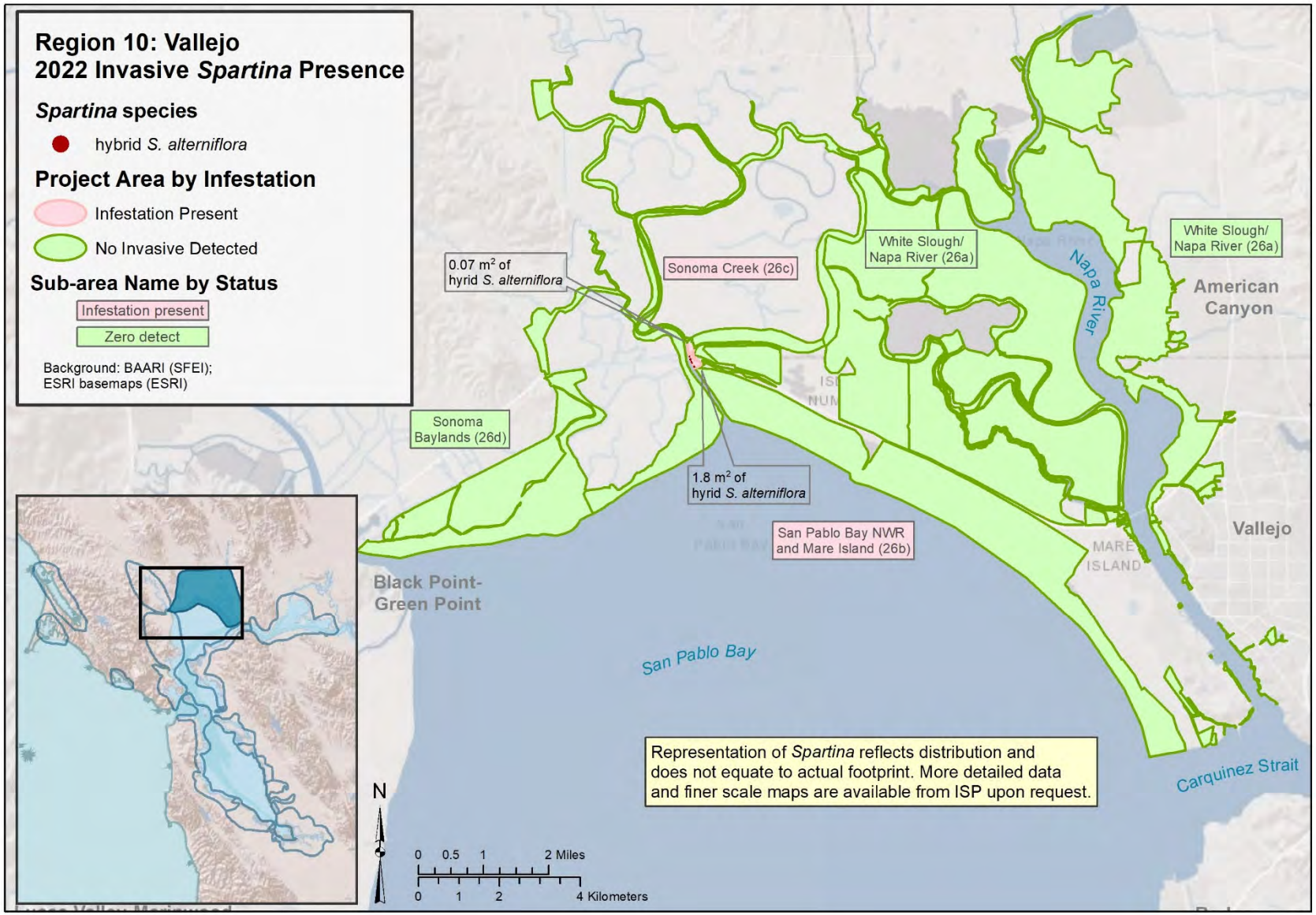

Figure 18. Distribution of invasive *Spartina* in 2022 across the four sub-areas of Reporting Region 10: Vallejo. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 15. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 10: Vallejo.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora x foliosa*	*alterniflora x foliosa*	*densiflora*	2022 Net Area	2022 Treat-ment Area	Peak Year	Since Peak	Since 2021
REGION 10: VALLEJO											
26a: White Slough / Napa River	12 years with No Invasive Spartina (2011-2022)		0		0	0	0	0	2008	100%	n/a
26b: San Pablo Bay NWR and Mare Island	10/6	Dug, Backpack	0		2 m^2	0	2 m^2	69 m^2	2009	>99%	50%
26c: Sonoma Creek	7/19	Backpack	0		0.07 m^2	0	0.07 m^2	5 m^2	2010	>99%	Increase (0.05 m^2)
26d: Sonoma Baylands	12 years with No Invasive Spartina (2011-2022)		0		0	0	0	0	2008	100%	n/a
REGION 10 TOTAL			0		2 m^2	0	2 m^2	74 m^2	2009	>99%	92%

Region 11: Petaluma

The Petaluma Region (Region 11) is composed of four sub-areas and includes the wetlands lining the tidal portions of the Petaluma River and its tributaries in Marin and Sonoma Counties, from downtown Petaluma to the river's mouth in northwestern San Pablo Bay. The historic infestation of hybrid *S. alterniflora* in this region peaked in 2007 at 0.15 acre and has been fairly localized to the upper reaches of the Petaluma River. It is suspected that hybrid *S. alterniflora* was introduced here by propagules transported via uncleaned dredge or construction equipment. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 19** and **Table 16**. Treatment dates and methods are included in Table 16.

All four of this region's sub-areas were inventoried at least in part in both 2021 and 2022. The primary infestation has been within Upper Petaluma-Upstream of Grey's Field (24a), which was surveyed thoroughly on foot with whaler assistance in both years. Grey's Field (24b) was inventoried thoroughly in both years with airboat assistance provided by either SOLitude Lake Management (2021) or CDFA (2022). The southern two sub-areas, Petaluma Marsh (24c) and Lower Petaluma River-Downstream of San Antonio Creek (24d) were surveyed only in specific portions in each year and were surveyed with airboat assistance provided by CDFA in both years.

The 2022 inventory of this region yielded 3.9 m^2 of hybrid *S. alterniflora* and no other non-native cordgrass species. This represents a 72% reduction from 2021 levels. Most of the infestation (73%) was within 24a (Upper Petaluma River-Upstream of Grey's Field), and no invasive *Spartina* of any species has ever been found in the lower portions of Petaluma River.

The infestation in the Petaluma Region exists along the narrow shoreline of upstream Petaluma River, while most rails in the region are detected further downstream within Lower Petaluma River-Downstream of San Antonio Creek (24d). Surveys for Ridgway's rails within Region 11 are conducted by PBCS, which detected about 200 Ridgway's rails in the Petaluma Region during surveys in 2021 and 2022 (PBCS, 2022). Based on their survey results, rail populations in the region have declined slightly since 2020 but are not impacted by the infestation or treatment of hybrid *S. alterniflora*.

No ISP habitat enhancements have been implemented in Region 11 because the northern reaches of the Petaluma River have abundant *S. foliosa* and *G. stricta* throughout the extensive tidal marsh habitat. ISP's Restoration Program has collected *S. foliosa* from Port Sonoma Marina for amplification in nursery propagation beds. Native cordgrass collected from this region has been planted into five Reporting Regions: Region 2: San Francisco Peninsula, Region 5: Union City, Region 6: Hayward, Region 7: San Leandro Bay, and Region 10: Vallejo.

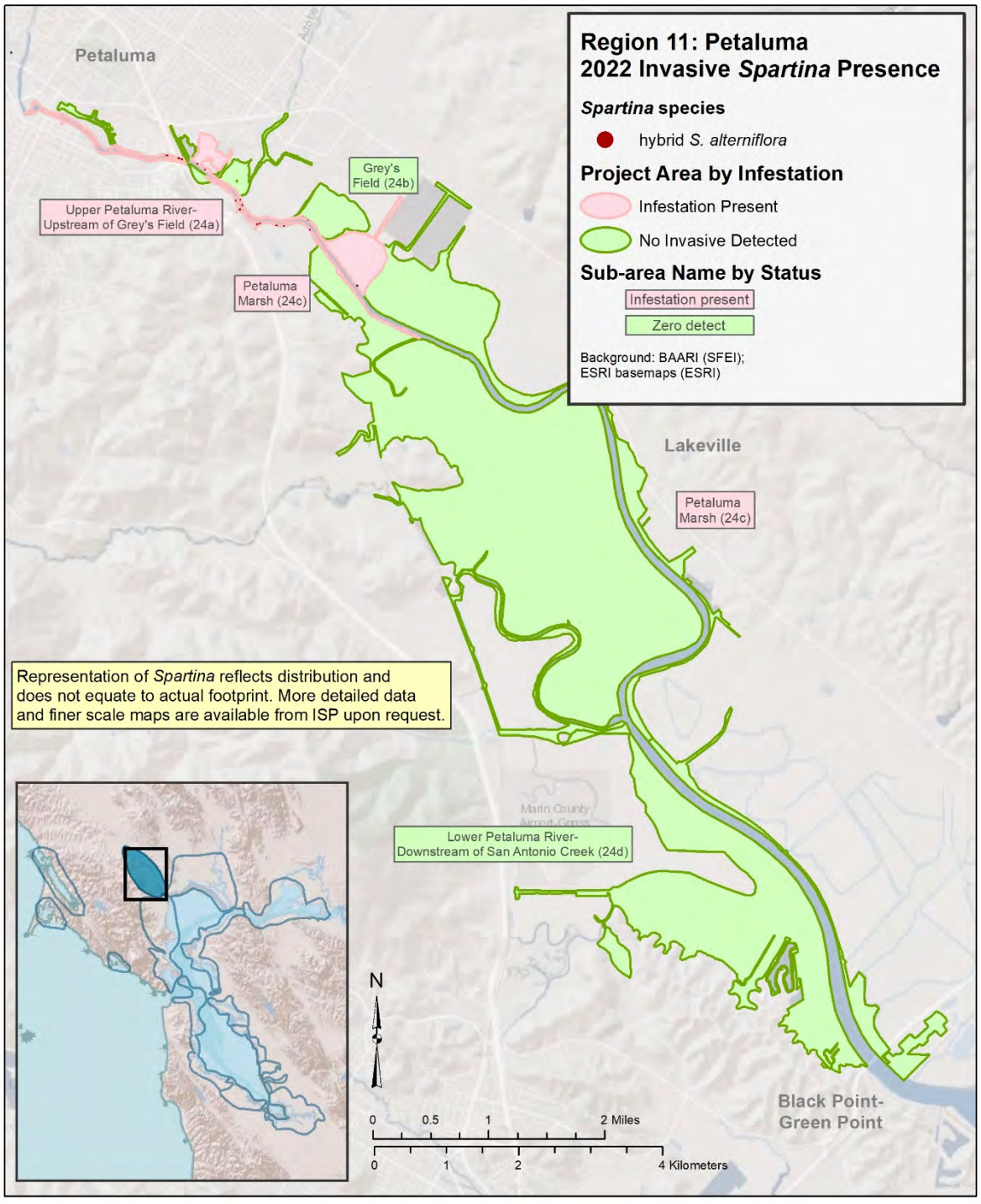

Figure 19. Distribution of invasive *Spartina* in 2022 across the four sub-areas of Reporting Region 11: Petaluma. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 16. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 11: Petaluma. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treat-ment Area	Peak Year	Since Peak	Since 2021
REGION 11: PETALUMA											
24a: Upper Petaluma River - Upstream of Grey's Field	8/31	Backpack, Airboat	0		3 m^2	0	3 m^2	69 m^2	2007	>99%	78%
24b: Grey's Field	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2009	100%	n/a
24c: Petaluma Marsh	8/31	Backpack, Airboat	0		1 m^2	0	1 m^2	27 m^2	2010	96%	Increase (0.4 m^2)
24d: Lower Petaluma River - Downstream of San Antonio Creek	No Invasive Spartina ever detected		0		0	0	0	0	n/a	n/a	n/a
REGION 11 TOTAL			0		4 m^2	0	4 m^2	96 m^2	2007	>99%	84%

Region 12: Outer Coast

The Outer Coast Region (Region 12) includes the geographically isolated watersheds on the western side of Marin County. This region is composed of remote coastal estuaries and bays, most within Point Reyes National Seashore, several of which were colonized by hybrid *S. alterniflora* in the late 2000s. The 2022 distribution and abundance of invasive *Spartina* within each sub-area are presented in **Figure 20** and **Table 17**. Treatment dates and methods are included in Table 17.

All five sub-areas in Region 12 were inventoried in 2021; Limantour Estero (25b), Drakes Estero (25c) and Bolinas Lagoon South (25e) were thoroughly inventoried, while Tom's Point/Tomales (25a) and Bolinas Lagoon North (25d) were surveyed only in the zones of recent infestation. In 2022, the same zones of recent infestation were surveyed in Tom's Point and Bolinas Lagoon North, and no inventory was conducted in the other three sub-areas. Inventory was completed on foot except for 2021 inventory of Limantour Estero and Drakes Estero, which was completed by kayak for the first time since 2014.

Spartina densiflora is the only species of invasive *Spartina* that remains in the Outer Coast Region and it is limited to two small fragmented marshes, Tom's Point Marsh and Hog Island Oyster Company, within the Tom's Point/Tomales sub-area. Hybrid *S. alterniflora* was present in Bolinas Lagoon North until 2018 but has not been detected since. No invasive *Spartina* has been found in Limantour Estero and Drakes Estero for a decade.

Spartina densiflora persisted at Tom's Point Marsh in 2022 with a single seedling totaling 0.0006 m^2, and two instances totaling 0.01 m^2 found at Hog Island Oyster Company for the first time since 2015. All three plants were manually removed in 2022. ISP conducts two rounds of surveys at both marshes each year to ensure that all detections are removed before they can set seed. With virtually no re-invasion potential since these sites are far removed from other infestations, it is simply a matter of time until the *S. densiflora* seed bank has been exhausted and local eradication achieved.

Ridgway's rails do not occur in the region, as their observed geographic range is limited to the tidal marshes of the San Francisco Estuary, except for occasional fall and winter observations along the Outer Coast. As such, no annual Ridgway's rail surveys have been conducted in the Outer Coast Region. No ISP habitat enhancements have been implemented in this region to date.

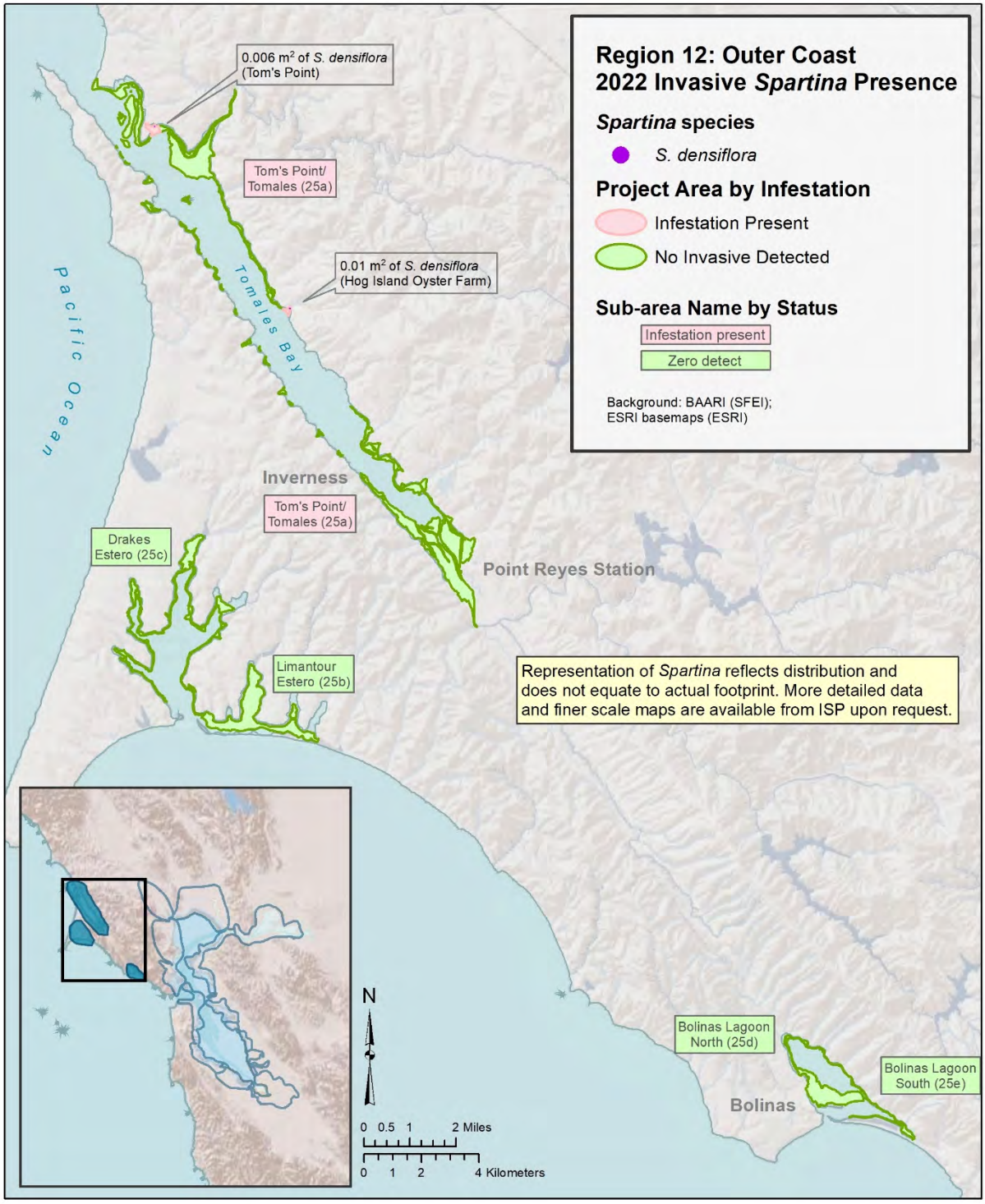

Figure 20. Distribution of invasive *Spartina* in 2022 across the five sub-areas of Reporting Region 12: Outer Coast. Sub-areas with current infestation are labeled in pink, while those with no detection of invasive *Spartina* are labeled in green.

Table 17. Summary of 2022 invasive *Spartina* mapped and treated by sub-area within Reporting Region 12: Outer Coast. Summary tables for 2021 are provided in Appendix V.

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By Species				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treat-ment Area	Peak Year	Since Peak	Since 2021
REGION 12: OUTER COAST											
25a: Tom's Point, Tomales	3/8/23	Dug	0		0	0.01 m^2	0.01 m^2	0.3 m^2	2010	>99%	Increase (0.01 m^2)
25b: Limantour Estero	11 years with No Invasive Spartina (2012-2022)		0		0	0	0	0	2010	100%	n/a
25c: Drakes Estero	10 years with No Invasive Spartina (2013-2022)		0		0	0	0	0	2007	100%	n/a
25d: Bolinas Lagoon, North	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2012	100%	n/a
25e: Bolinas Lagoon, South	10 years with No Invasive Spartina (2013-2022)		0		0	0	0	0	2004	100%	n/a
REGION 12 TOTAL			0		0	0.01 m^2	0.01 m^2	0.3 m^2	2007	>99%	Increase (0.009 m^2)

3. SPECIAL TOPICS

3.1 Implementation of a Plan for Resuming Treatment at Previously Restricted Sites

In late 2018, the USFWS issued a Biological Opinion authorizing the ISP to initiate a phased treatment plan at sub-areas where it had restricted treatment since 2010 out of concern for the endangered California Ridgway's rail. The first phase of the plan (referred to hereafter as the "Phase 1 Plan") resumed treatment within four marsh complexes across three ISP Regions over a three-year period. Being untreated for more than seven years, the hybrid *S. alterniflora* in the Phase 1 sites had expanded into meadows that dominated most of the intertidal zone and had become the largest and densest infestations remaining in the Estuary. The objective of the Phase 1 Plan was to work toward full treatment of these large infestations while minimizing negative impacts to Ridgway's rail.

To effectively implement the Phase 1 Plan, some sub-areas were split into smaller sub-areas so that treatment could begin in portions of the marshes while preserving vegetative cover for Ridgway's rail in adjacent restricted portions. Ultimately there were 10 sub-areas included in the Phase 1 Plan: B2 North East (2c.1b), Damon Marsh (17d.4), Fan Marsh Wings (17j.1), Citation Marsh Upper (20d.2a), Bunker Marsh (20g), San Lorenzo Creek & Mouth North (20h.1), Cogswell Marsh B Bayfront (20n.1), Cogswell Marsh B South (20n.2), Cogswell Marsh B Main (20n.3; seed suppression treatment only), and Cogswell Marsh C (20o) (**Figure 21**). The Phase 1 Plan also included enhancements to benefit Ridgway's rails, such as planting native marsh plants along tidal channels and in the marsh-upland transition zones, controlling predators, and constructing elevated "islands" in the marsh plain to provide refuge for Ridgway's rails during very high tide events.

The Biological Opinion for 2018-2022 was signed late in 2018, and treatment was re-initiated at most of the Phase 1 sub-areas that year. Treatment at Bunker Marsh (20g) and Cogswell Marsh B Bayfront (20n.1) was delayed until 2019, and work at Citation Marsh Upper (20d.2a) was delayed until mid-2020, when the Biological Opinion was amended to adjust sub-area boundaries and permit expanded treatment there.

Once treatment was resumed, significant progress was quickly made reducing hybrid *S. alterniflora* at most of the Phase 1 sub-areas. By 2022, seven of the 10 sub-areas showed reductions of greater than 94% since re-initiation of treatment, as exemplified in Figure 22 at Cogswell Marsh B South. The average reduction in hybrid *S. alterniflora* across all Phase 1 sites was 83%, totaling 11.1 acres of hybrid *S. alterniflora* removed within two to four treatment seasons. Phase 1 sub-areas now contain a total of 2.3 acres of hybrid *S. alterniflora*, which amounts to 11% of the Estuary total infestation.

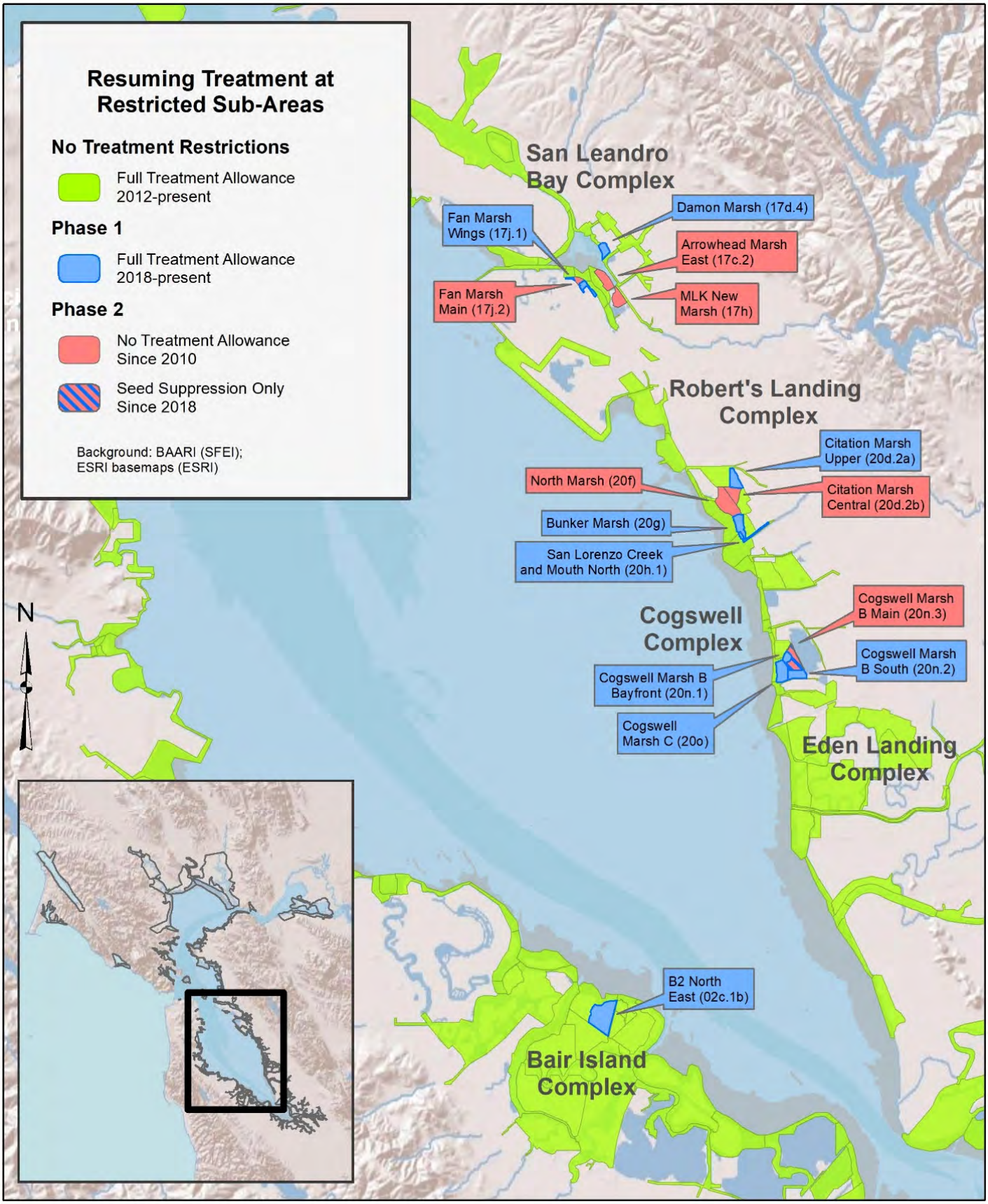

Figure 21. Distribution map of ISP Sub-areas in Phase 1 and Phase 2 of resuming treatment Plan after restrictions were put in place in 2011.

Figure 22. The presence of hybrid *S. alterniflora* at Cogswell Marsh B South (20n.2) has been reduced by 97% since treatment resumed in 2018. This channel was once clogged with hybrid *S. alterniflora* and is now clear of infestation and is lined with native *Grindelia stricta* planted by ISP years ago. The natives are thriving and provide Ridgway's rail nesting habitat and cover from predators.

Only a single Phase 1 site authorized for full treatment had not realized substantial reductions by 2022 — Bair Island's B2 North East (02c.1b) in Region 3. This is the largest marsh in the Phase 1 Plan and contains an extensive natural channel network and native *S. foliosa*, which presents challenges for the detection and treatment of hybrid *S. alterniflora*. B2 North East received broadcast treatment by helicopter from 2019 through 2021 to reduce the infestation prior to beginning ground-based treatment. Those three seasons of aerial treatment had highly variable efficacy across the sub-area with some good reductions on marshplain hybrid *S. alterniflora* patches, but sometimes poor results on tall stands lining the major channels. In 2021, the ISP pivoted to ground-based treatment by airboat on some of the outskirts (e.g., along major channels) of this sub-area, and inventory in 2022 showed much higher treatment efficacy in these areas. In 2022, ground-based treatment was conducted directly by airboat and with the addition of backpack sprayers deployed by airboats (**Figure 23**). Approximately 75% of the sub-area was treated using ground-based methods in 2022. Inventory monitoring in 2023 will reveal whether continued ground-based treatment yields stronger reductions in infestation, and it is anticipated that B2 North East will realize reduction levels similar to those seen in other Phase 1 sub-areas over the next couple seasons.

Figure 23. A High Tide Refuge Island constructed at Bair Island's B2 North East (02c.1b). The dense hybrid *S. alterniflora* clogging the channel in the foreground has just been treated by the airboat crew visible in the background. These habitat enhancements installed by the ISP are intended to provide cover and refuge for Ridgway's rails during the highest of tides when they are most susceptible to predation.

Table 18 summarizes the hybrid *S. alterniflora* status and treatment progress at the Phase 1 sites, and describes the marsh restoration enhancements installed to benefit Ridgway's rail and bolster the transition to a native marsh plant assemblage.

Table 18. Status of activities in Phase 1 sub-areas, including 2022 hybrid *S. alterniflora* infestation and associated restoration enhancement activities conducted onsite and in adjacent tidal marsh habitat.

REGION	Sub-Area Code	Sub-Area Name	Estimated Invasive and Native *Spartina* Habitat Within Sub-Area	Hybrid *Spartina alterniflora* Area (net cover)			Year of Phase 1 Full Treatment Initiation	REVEGETATION ENHANCEMENT ACTIVITIES
				2017	2022	% Reduction 2017-2022		
03: San Mateo	02c.1b	B2 North East	134 acres	2.5 acres	1.45 acres	-42%	2018	Installed three artificial floating islands in 2012 and removed in fall 2013 (USGS) Installed over 1,200 *Grindelia stricta* along channels in 2022-23 Constructed seven high tide refuge islands planted with *Grindelia stricta* (two in winter 2012-13 and five in 2020-21) Habitat enhancements also installed in adjacent subareas
06: Hayward	20d.2a	Citation Marsh Upper	33 acres	3.7 acres	222 m²	-99%	2020	In all of Citation Marsh: installed over 3,000 *Grindelia stricta* along channels from 2012-16, 1,000 *Grindelia stricta* and over 3,000 native plants in the marsh-upland transition zone for high tide refuge from 2021-23
	20g	Bunker Marsh	34 acres	1.5 acres	17.8 m²	-99.7%	2019	Installed over 1,800 *Grindelia stricta* along channels and on berm/island edges from 2012-16, 600 *Grindelia stricta* in winter 2021-22, and over 2,200 native plants in the marsh-upland transition zone for high tide refuge from 2021-23 Installed two high tide refuge islands planted with *Grindelia stricta* in winter 2013-14
	20h.1	San Lorenzo Cr & Mouth North	6.7 acres	2.7 m²	1.1 m²	-59%	2018	Installed 400 *Grindelia stricta* and *Distichlis spicata* along channel in winter 2012-13
	20n.1	Cogswell Marsh B Bayfront	16.8 acres	0.5 acre	124.2 m²	-94%	2019	In all of Cogswell Marsh B: Installed over 10,000 *Grindelia stricta* , *Triglochin maritima* and *Distichlis spicata* along channel and island edges 2012-2016 and over 2,500 *Grindelia stricta* along channels from 2019-2022 Installed over 1,600 native plants in the marsh-upland transition zone for high tide refuge from 2021-23 Predator control Habitat enhancements also installed in adjacent subareas In Cogswell Marsh B Main: Constructed six high tide refuge islands planted with *Grindelia stricta* .
	20n.2	Cogswell Marsh B South	34 acres	0.6 acre	55.4 m²	-98%	2018	
	20n.3	Cogswell Marsh B Main	55 acres	3.1 acres	0.7 acre	-77%	2019 (Seed Suppression Only)	
	20o	Cogswell Marsh C	52 acres	0.8 acre	61 m²	-98%	2018	Installed over 7,400 *Grindelia stricta* , *Triglochin maritima* and *Distichlis spicata* along channel and island edges between winters 2011-16. An additional 800 *Grindelia stricta* were planted in winter 2018-19. Installed over 1,700 native plants in the marsh-upland transition zone for high tide refuge from 2021-23 Three high tide refuge islands planted with *Grindelia stricta* were constructed in winter 2013-14 Predator control actions Habitat enhancements also installed in adjacent subareas
07: San Leandro Bay	17d.4	Damon Marsh	12 acres	0.65 acre	56.4 m²	-98%	2018	*Grindelia stricta* and marsh-upland transition zone species installed by Save the Bay in 2011 and 2012 Installed 470 Grindelia stricta along channel edges in winter 2012-13 (plantings overwhelmed by hybrid Spartina)
	17j.1	Fan Marsh Wings	11.6 acres	91.1 m²	3.8 m²	-96%	2018	N/A

3.2 Large Scale Restoration and the South Bay Salt Pond Restoration Project

Tidal marsh restoration in the San Francisco Estuary has proceeded at a rapid pace over the past 20 years. The South Bay Salt Pond Restoration Project (SBSPRP; www.southbayrestoration.org) restored greater than 3,000 acres of tidal marsh since it was initiated in 2003, and there are plans to restore 4,000-10,000 more acres in the coming decades (USFWS/CDFG 2017). The San Francisco Bay Joint Venture (SFBJV; https://sfbayjv.org) restored 11,000 acres of tidal marsh between 2001 and 2021 and has a goal to restore an additional 76,000 acres of tidal marsh and mudflat (SFBJV 2022). The work of the ISP plays a key role in the ultimate success of this landscape-scale restoration by protecting these vulnerable sites from hybrid *S. alterniflora* invasion and allowing them time to develop a resilient native plant assemblage that will provide high-quality wildlife habitat and ecosystem functions.

Tidal marsh restoration near hybrid *S. alterniflora* infestations has added thousands of acres to the ISP's annual monitoring (and potential treatment) Project Area. *Spartina foliosa* is a foundational species and is typically the first native species to colonize a restoration site once it has been breached and sediment has accreted to suitable levels to support cordgrass. However, hybrid *S. alterniflora* can establish at lower elevations than *S. foliosa*, can produce a greater quantity of seed, and frequently colonizes young restoration sites first when they are near existing infestations. Thus, hybrid *S. alterniflora* is often easy to detect when a newly tidal site is first developing vegetation. However, as other vegetation fills in, it becomes more difficult detect *Spartina*, and to identify that *Spartina* as either native or invasive. To further complicate matters, a hybrid *S. alterniflora* plant may take multiple growing seasons to display morphological traits that are distinct from *S. foliosa*, especially if it is the product of backcrossing with the native species.

In the experience of the ISP in recent years, there are three general phases of vegetation development as it relates to the work of managing hybrid *S. alterniflora*:

1. Initially, there is a scattered colonization by *Spartina* and/or pickleweed across the site. The high visibility of the colonizing plants allows for thorough detection. Typically, a survey requires airboat access but a low number of biologists.
2. After the initial stage, vegetation becomes more widespread but a large amount of open space remains between established patches. The density of the vegetation begins to obscure visibility and can hinder detection of hybrid *S. alterniflora*, and airboats can no longer reach all areas. Walking surveys become necessary for thorough detection in portions of the marsh. The time and level of effort required to adequately monitor developing restoration sites for hybrid *S. alterniflora* increases substantially as the marsh progresses through the first and second phases.
3. In the later stage, the restoration matures into continuous vegetation across most of the site as individual established patches merge and new colonizers continue to arrive. *Spartina* in various stages of growth across the site presents major detection challenges,

and instances of cryptic hybrid *S. alterniflora* may proliferate undetected for several seasons. Although walking surveys are necessary to conduct thorough inventory, navigation on foot is not feasible across the entire site (especially at high tide) due to channel complexity and remaining stretches of soft substrate, and only an airboat can reach the edges of the marsh on a low or moderate tide. The requisite survey effort ramps up even more once the marsh reaches the later phases of maturation.

By the second stage of maturation, an airboat can facilitate a faster survey and utilize fewer biologists, but this approach allows a lower level of scrutiny compared to a walking survey, at a point in marsh maturation when the highest scrutiny may be necessary to prevent or contain an infestation. In a mature native marsh, one or a few morphologies of *Spartina foliosa* will typically become dominant, and the subtle differences exhibited by hybrid *S. alterniflora* are more readily noticeable to a trained biologist. At younger restoration sites, however, competition has not yet sorted out which morphologies of *S. foliosa* proliferate, making it more difficult to quickly determine which of the many forms present are *S. foliosa* and which are hybrid *S. alterniflora*. During these transitional times of early marsh development, there is a tradeoff between the effectiveness of covering the ground quickly and efficiently by airboat and conducting inventory on foot for a more focused and time-consuming survey.

The ISP continually adjusts monitoring methodologies to allow an appropriate level of scrutiny for surveying these maturing marshes, and more ground-based inventory is inevitably required in areas that previously had low demands on inventory time and effort. Maturing restored marsh with increased demands on inventory resources are now spread across thousands of acres of newly developing marsh, such that it is challenging for the limited number of qualified personnel to conduct annual *Spartina* surveys with the desired level of scrutiny.

In the past few years, four large tidal marsh restoration sites have reached a level of maturation that requires a shift in monitoring methods to perform effective *Spartina* inventory. These four sub-areas are: Knapp Tract (15a.6), Central Bair (02o), Island Ponds (05i), and Ponds E8A, E9, and E8X (13m) (**Figure 24**). The ISP is experimenting with new surveying strategies at these four sub-areas, striving for methods that will achieve the best level of scrutiny in a cost-effective manner, working within logistical constraints such as the limited number of appropriate tides during the growing season that will allow biologists to access the sites.

Knapp Tract (15a.6, aka Pond A6) was breached in 2010 and encompasses 375 acres. Over the past couple years, a large proportion of Knapp Tract has developed continuous vegetative cover (**Figure 25**). In 2022, the annual airboat inventory day (sometimes paired with treatment for efficiency) utilized two biologists as spotters to increase the potential for hybrid detection. During a portion of the day, one biologist was deployed for a walking survey in a previously infested area while the second biologist used the airboat to access un-walkable areas and check previously treated patches for regrowth.

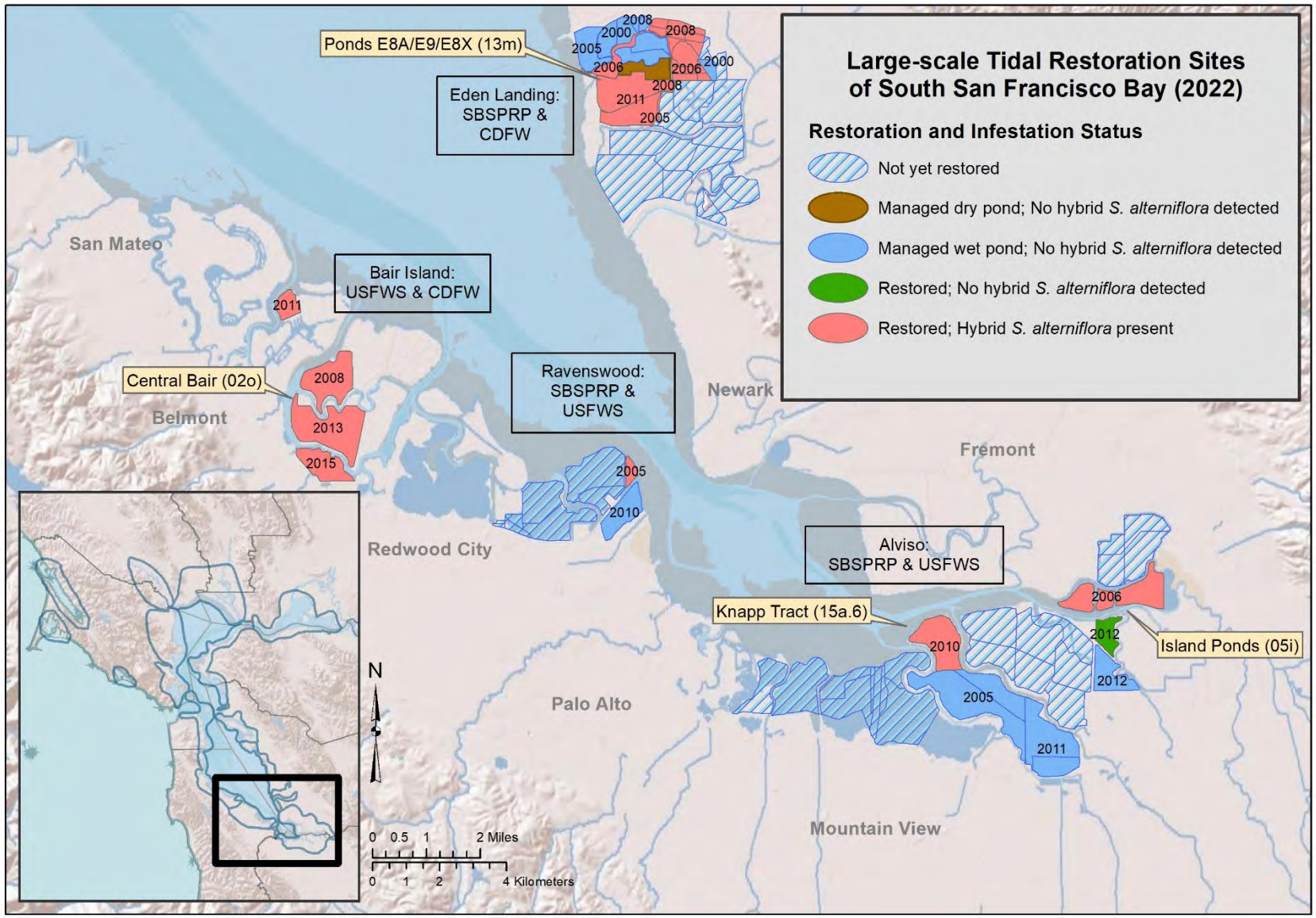

Figure 24. Distribution map of large scale restoration marshes of South San Francisco Bay

Figure 25. Knapp Tract (aka Pond A6 [15a.6]) during airboat-assisted inventory and treatment on September 7, 2022. This northern sector of the marsh now supports virtually continuous tidal marsh vegetation, including the robust stands of native *S foliosa* shown here.

Central Bair (02o) was breached in 2013 and encompasses 672 acres. While the sub-area still has some large unvegetated areas, much of it is continuously vegetated. This site is adjacent to some large remaining infestations of hybrid *S. alterniflora*, including one in the previously restricted B2 North East (02c.1b), and hybrid propagules established here shortly after breaching. In recent years, the ISP was utilizing a single biologist over two or three days onboard an airboat to conduct simultaneous inventory and treatment. In 2022, this survey effort increased to utilize two surveyors on the boat over three days and shifted to conduct more inventory on foot with the airboat providing access. This allowed for higher scrutiny of the increasing level of vegetation while conducting treatment of the infestation that had developed.

The **Island Ponds (05i)** are a complex of three sites (A19, A20 and A21) that were breached in 2006 and encompass a total of 489 acres. Vegetation colonized earliest at A21, which reached the third phase of development approximately 4-5 years ago. A20 reached that stage more recently, and still has some small unvegetated areas, whereas A19 has extensive unvegetated mudplain still remaining. A21 and A20 receive full walking surveys, with airboat assistance during very specific tide windows to allow for safe access to the site at a water level that is conducive to biologists moving across the site. A19 was inventoried in a single day by a single biologist onboard an airboat from 2019 to 2021. In 2022, this survey effort increased to include six biologists and shifted to much more inventory on foot in the continuously vegetated areas.

The Eden Landing complex of **Ponds E8A, E9, and E8X (13m)** was breached in 2011 and encompasses 666 acres. These three adjoined former saltponds are varied in their vegetation development and access challenges. Pond E8X is the smallest pond and can be fully walked for

inventory, but both E9 and E8A require access by boat. Access at Pond E9 requires an airboat and a specific tide that must be high enough to allow for boat movement, but low enough to not impede thorough inventory and treatment. For several years, inventory and simultaneous treatment was conducted at Pond E9 in a single day by two biologists onboard the airboat. In 2022, the amount of inventory conducted on foot increased dramatically to provide higher scrutiny where the vegetation has become continuous. ISP will be increasing the number of airboat-assisted inventory days, including those to provide access for strictly walking surveys, here in 2023.

Prevention is the best form of invasive species management. In the context of the ISP, prevention is accomplished on two fronts: through treatment of known infestations to minimize or eliminate propagule dispersal to other sites, and early detection of new infestations to treat them before they can escalate to greater impact. The ISP strives to support tidal restoration efforts and protect these vulnerable new restoration sites. However, as they become more vegetated, new restoration sites require an ever-increasing level of time and effort to prevent and control infestation by hybrid *S. alterniflora*.

3.3 New Infestations and Sub-Areas Added in 2021-2022

ISP defines a "new infestation" as a newly discovered instance of invasive *Spartina* greater than one kilometer from any historic location. A new "sub-area" within a previously existing site may also be created; in most cases, this would be associated with an area that was breached and returned to tidal action that subsequently became infested. A new "site" needs to be added if it is completely outside of previously codified treatment or inventory areas. One new treatment sub-area was created in 2021: Sunnyvale Baylands (15d) was added to the South Bay Marshes Complex (Site 15) in Dumbarton South (Region 4) (**Figure 26**). A single patch of hybrid *S. alterniflora* was discovered in Alviso Salt Pond AB1 adjacent to a failed tide control structure that allowed for tidal flow into this pond. The patch totaled 2.7 m^2 and was treated that year. No invasive *Spartina* was found during inventory of the sub-area in 2022.

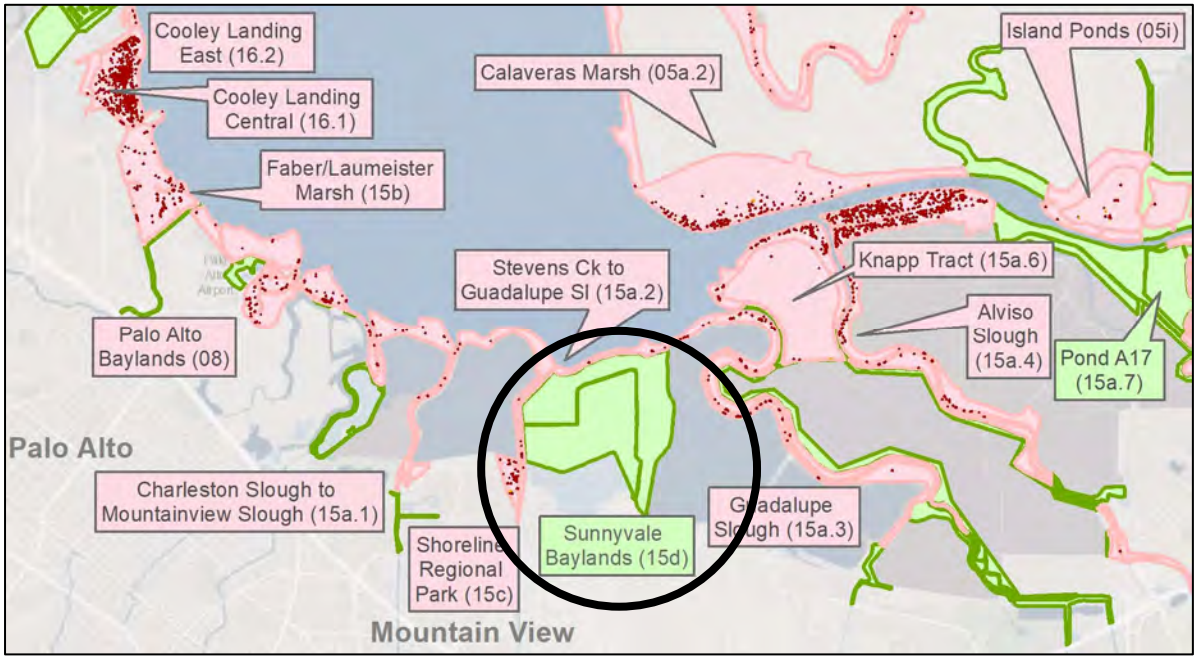

Figure 26. Map showing the location of Sunnyvale Baylands Sub-area (15d), established in 2021.

4. CONSIDERATIONS FOR 2023

The primary considerations for the 2023 *Spartina* Monitoring and Treatment field season are 1) the response by tidal marsh vegetation to the record-breaking rainfall over the winter of 2022-2023 after multiple years of extreme drought, and 2) an anticipated increase in treatment work to be conducted by ISP.

There are multiple potential effects of the wet winter, the most obvious being an increase in the shear amount of invasive *Spartina* in the Estuary. *Spartina* seed recruitment may increase with the cold and wet winter, conditions that are beneficial to *Spartina* seed germination and establishment. This could yield increases in *S. foliosa* as well as hybrid *S. alterniflora*, which may complicate identification of and differentiation between the two in marshes with a mix of both species.

There is also the possibility that hybrid *S. alterniflora* plants that were treated in previous years may rebound with the relief of stress from drought. Some plants may not have been killed by initial treatment but may have been weakened enough to lie somewhat dormant underground. Stress from multiple years of severe drought may have kept them in this underground stasis, thus making them undetectable. With the substantial influx of freshwater that they received through the winter, it is possible that some plants may respond with renewed above-ground growth. However, this may also serve to increase detection of hybrid *S. alterniflora* plants that have not been seen recently because they persisted only as below-ground biomass.

The rain is likely to yield an increase in other marsh vegetation (e.g., *Bolbschoenus* and *Schoenoplectus*) not seen in recent years. These plants respond positively to increased rainfall and can grow in tall, dense stands that then conceal and reduce detection of hybrid *S. alterniflora* in the understory. Increases in these species' growth impedes movement through the marsh and makes inventory and treatment more physically challenging for ISP biologists.

The final potential result of the wet winter is more indirect; California wildfires may increase due to the vegetation boom from a wet winter and spring. This may or may not impact Bay Area air quality and ISP's ability to conduct field work safely, but it has in the past. Cancellations of field work due to poor air quality from wildfires became a reality in 2018, with the most dramatic occurring in September and October of 2020, when unhealthy air quality necessitated cancelation of three weeks of field work.

The other major consideration for 2023 centers on the anticipated increase to ISP's inventory and treatment commitments in portions of the central East Bay and far South Bay, which were noted in Section 3.2. The South Bay Salt Pond Restoration Project has entered Phase 2 of its construction activities and is expected to breach levees of former salt ponds to tidal action in 2023. These activities are integral to meeting Estuary-wide tidal marsh restoration goals, but also inherently increase ISP's efforts to monitor and protect these new tidal tracts from invasion. Additionally, in late 2022 the ISP re-entered consultation with the U.S. Fish & Wildlife

Service to obtain an updated Section 7 Biological Opinion. The new Biological Opinion is expected to be executed in 2023 and may allow treatment to resume in some marshes that have not been treated since 2010. Similar to when the Project's 2018 Biological Opinion was rendered (see **Section 3.2**), this will allow the Project to make tremendous progress towards the eradication of invasive *Spartina* from the Estuary, but that progress will come with steep increases in the necessary fieldwork to conduct the inventory and treatment. The increased workload will likely not be accompanied by a commensurate increase in work force, so the Project will carefully plan for and prioritize this work so all monitoring and treatment goals can be met without straining staff, partners, and contractors. Additionally, resuming treatment in some of these marshes will likely require increased coordination and consultation with the many agencies, landowners, stewards, and public that engage with these lands.

The expected increases to ISP inventory and treatment in 2023 mark a new chapter for the ISP to propel the Project towards achieving eradication of invasive *Spartina* from the Estuary. The rainfall of winter 2022-2023 may increase the amount of hybrid *S. alterniflora* present, but it can also increase detection of these patches and allow for earlier detection and treatment, which will limit the impact of the infestation on further reaches of the Estuary. The anticipated increases to areas where treatment is authorized will dramatically reduce the amount of hybrid *S. alterniflora* in the Estuary (as most remaining infestation occurs in these currently restricted sub-areas), which will further limit its ability to spread by seed and lower its impact. These considerations pose short-term challenges, but addressing and overcoming them will advance the long-term goals of Estuary-wide native tidal marsh restoration.

Photo by Simon Gunner

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APPENDICES

Appendix I. Target Species Descriptions

ISP Target Species Descriptions

There are one native and four non-native species of cordgrass in the San Francisco Estuary. Key aspects of the cordgrass species found in the Estuary are contrasted below. All species and hybrids are perennial, salt-tolerant grasses, and most spread both sexually and asexually[1]. The roles these species play in their native habitats give ecologists an indication of their potential to alter the salt marsh ecosystem of San Francisco Bay.

NATIVE: PACIFIC CORDGRASS (*SPARTINA FOLIOSA*)

California's only native cordgrass, *S. foliosa*, grows in a narrow range of the tidal spectrum due to its relatively short stature and intolerance for drought. *Spartina foliosa* is a vital component of the salt marsh plant community, occurring at the lowest intertidal elevation of any native macrophyte. This lower tidal marsh zone occurs at the upper elevation of the mudflat and along channel banks and benches. Native cordgrass is also found scattered throughout the next zone in the elevational gradient, the middle tidal marsh zone, or pickleweed (*Salicornia virginica*) marsh plain. *Spartina foliosa's* slender leafy shoots seldom exceed five feet in height including seed heads, with most shoots ranging from approximately one to three feet tall. Cordgrass height correlates with its tolerance of submersion, and as such *S. foliosa* can occupy only a limited range in the lower and middle tidal marsh zones (Cain and Harvey 1983). Its leaves and stems wither in fall and are shed in winter, as the clones die back to the mud substrate.

Spartina foliosa is particularly valued as habitat for the endangered California Ridgway's rail (*Rallus obsoletus obsoletus*), which spends most of its time foraging for food within, or close to, the protective canopy of cordgrass. California Ridgway's rails can move within S. *foliosa* stands, and they spend most of their time under cover of the cordgrass foliar canopy, usually selecting prey items such as benthic and aquatic invertebrates inhabiting the cordgrass stands and their edges. The benthic invertebrate community found in the substrate at the base of *S. foliosa* is also an important food source to a variety of other consumers including both resident and migratory shorebirds.

While it was widely recognized that hybrid *S. alterniflora* (discussed next) could potentially threaten the existence of native *S. foliosa*, control of the hybrids began sufficiently early that *S. foliosa* still anchors thousands of acres of tidal marsh throughout the Estuary. Most of the North Bay was relatively unimpacted by hybrid *S. alterniflora*, and more than 99% of the cordgrass in the remnant marshes throughout the Estuary is still intact *S. foliosa*. However, *S. foliosa* was assimilated into the hybrid swarm, and even locally extirpated, in some of the largest infestations around South San Francisco Bay, including the

[1] Although academic researchers speculated early on that that hybrid *S. foliosa* × *densiflora* might reproduce sexually like hybrid *S. foliosa* × *alterniflora* was known to do, biologists working on the ISP have seen no evidence of this occurring.

Alameda Flood Control Channel (Site 1) and Eden Landing (Site 13). These sites were the focus of an extensive reintroduction effort by the Conservancy that began in 2010, establishing stands of *S. foliosa* that disperse seeds throughout these sites, leveraging the investment in direct planting.

ATLANTIC SMOOTH CORDGRASS (*SPARTINA ALTERNIFLORA*) AND ITS HYBRIDS

Atlantic smooth cordgrass is unique among the world's cordgrass species in terms of its growth potential and ecological breadth. *Spartina alterniflora* is genetically similar to *S. foliosa*, but the two species have significant differences. In size, growth rate, pollen and seed production, culm (stem) density and ecological tolerances, *S. alterniflora* is more robust than *S. foliosa* (Smart and Barko 1978; Boyer, Callaway et al. 2000). The San Francisco Estuary population of *S. alterniflora* was introduced from seed collected in Maryland in the early-1970s to aid in a dredge spoils stabilization and marsh restoration experiment (Faber 2000). Genetic similarity to *S. foliosa* allowed multiple hybridization and eventual backcrossing events that produced the "hybrid swarm" that has posed the most widespread and intrusive threat to the Estuary (Daehler and Strong 1997). Pollen production, higher fertility, greater tolerance for both inundation and drought, and increased timeframe for flowering make these hybrids a prominent threat to native cordgrass by out-competition, pollen swamping, and hybrid assimilation (Rhymer and Simberloff 1996; Ayres, Garcia-Rossi et al. 1999; Anttila, King et al. 2000; Levin, Neira et al. 2006). Levin et al. (2006) reported that when stands of *S. foliosa* are displaced by hybrid *S. alterniflora*, the biomass of the benthic invertebrates declines by more than 70%, and the benthic community shifts from surface feeders to belowground feeders that are inaccessible to foraging birds.

Hybrid *S. alterniflora* was well established and widely distributed in the Central and South Bay at the start of the ISP Control Program, and the population peaked at 805 net acres[2] in 2005, just prior to initiation of the bay-wide treatment program. Between 2005 and 2022, the population was reduced by greater than 97% bay-wide, down to 20.7 net acres.

CHILEAN CORDGRASS (*SPARTINA DENSIFLORA*) AND ITS HYBRID WITH PACIFIC CORDGRASS (*S. FOLIOSA*)

Chilean cordgrass (also called dense-flowered cordgrass) is a distinctive cordgrass species native to South America that grows as a bunchgrass in the middle marsh plain, eventually forming tussocks and meadows (Spicher and Josselyn 1985; Kittelson and Boyd 1997). *Spartina densiflora* was introduced to California in Humboldt Bay by dry ship ballast containing propagules from South American ports that

[2] The ISP uses the term "net area" to define the extent of non-native *Spartina*. *Net area* refers to the size of the infestation if the space between stems were subtracted from the overall footprint of the plant or clump of plants. Net area is the metric typically used in botanical surveys.

traded lumber (Spicher and Josselyn 1985). Thought for most of the 20th century to be a form of Pacific cordgrass, *S. densiflora* was deliberately transplanted to a salt marsh restoration project at Creekside Park (4g) along Corte Madera Creek in Marin County in the 1970s. Within the salt marshes fringing Corte Madera Creek, it became a locally dominant component of the middle and high salt marsh vegetation, displacing even robust pickleweed.

Rapid and coordinated work by the ISP contained the bulk of the *S. densiflora* invasion within the Corte Madera Creek watershed, although populations were detected (and eliminated) in other areas of the bay, including Redwood City and Burlingame (San Mateo County), Point Pinole Regional Shoreline (Contra Costa County), the San Pablo Bay National Wildlife Refuge (Sonoma and Solano counties), and Tomales Bay (outer coast of Marin County). When established in close proximity to *S. foliosa*, *S. densiflora* has produced infertile hybrids with the native cordgrass that spread solely via vegetative growth (Ayres, Zaremba et al. 2008).

Spartina densiflora and hybrid *S. densiflora* x *foliosa* have been nearly eradicated from the Estuary and outer shore marshes following persistent implementation of an adaptive Integrated Vegetation Management (IVM) strategy that includes multiple treatment methods, including twice annual digging, or herbicide application and covering with black plastic. Because of the unique biology of this form of *Spartina*, including its dense, in rolled bunch-styled leaves (that reduces the plants ability to absorb herbicide treatment), and longer (3-5 year) seed viability, single-tooled approaches proved to be ineffective. Since 2020 virtually all detected *S. densiflora* plants were found and removed prior to their setting seed, which has led to greatly reduced infestation pressure while the seedbank has steadily depleted.

ENGLISH CORDGRASS (*SPARTINA ANGLICA*)

English cordgrass is an aggressive invader of mudflats and salt marshes in Britain, New Zealand, Australia, and the Pacific Northwest. It originated in Britain as a fertile hybrid derived from introduced Atlantic smooth cordgrass and common cordgrass (*S. maritima*). It was introduced to the San Francisco Estuary at Creekside Park (4g) along Corte Madera Creek in Marin County, along with Chilean cordgrass (*S. densiflora*), in 1976. Unlike Atlantic smooth cordgrass and Chilean cordgrass, this species failed to disperse from its point of introduction to expand the infestation beyond Corte Madera Creek. It may be at or near its southern climatic limit on the Pacific Coast in the Estuary.

Spartina anglica is nearly eradicated from San Francisco Bay, and it is not known to occur in any other location in California. The ISP mapped just 0.03 m^2 of *S. anglica* in 2022.

SALT-MEADOW CORDGRASS (*SPARTINA PATENS*)

In its native range on the Atlantic coast, salt-meadow cordgrass is naturally restricted to the well-drained high salt marsh and relatively moist sandy depressions at or above tidal influence. However, in the San Francisco Estuary, it has thrived along channel banks and on the pickleweed plain. *Spartina patens* arrived in the Estuary by the early 1960s in Southampton Marsh (Site 11; Benicia State Recreation Area), as evidenced by a sample present in the California Academy of Science's collection from circa 1962. At the initiation of treatment by ISP and the California Department of Parks and Recreation (State Parks) in 2005, 0.65 net acre of salt-meadow cordgrass was present in large, discrete patches at Southampton Marsh.

Monitoring and treatment of *S. patens* at Southampton Marsh is complicated by the presence of special status species, including a population of an endangered hemi-parasitic plant, soft bird's-beak (*Chloropyron molle* ssp. *Molle*), that can be adversely affected if its host plant, in this case *S. patens*, is killed. Also present are endangered California Ridgway's rails (intermittently) and State-listed California black rails.

ISP biologists assisted State Parks with monitoring and treatment during several years, and in 2016 a net cover of 35 m^2 was mapped. In 2020, State Parks assumed responsibility for the site, and ISP is not currently assisting with work on this species.

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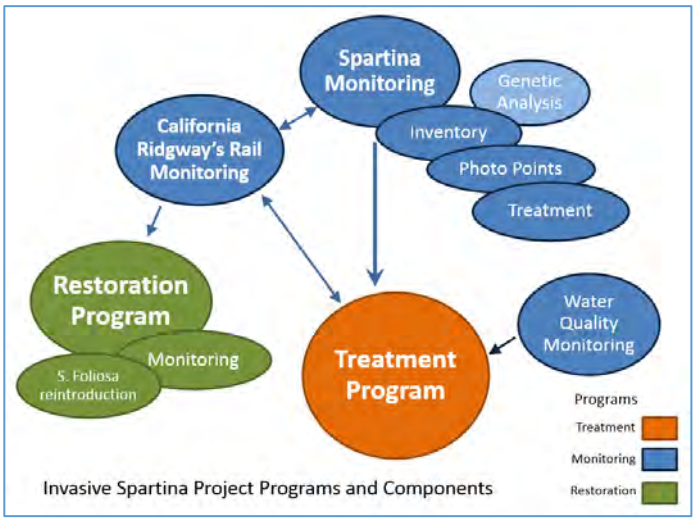
Appendix II. ISP Program Areas

Invasive *Spartina* Project Programs

The ISP is comprised of three broad programs– treatment, monitoring, and restoration, which coordinate closely to achieve the ISP goals. Monitoring is comprised of several programs including *Spartina* inventory monitoring, treatment monitoring, California Ridgway's rail monitoring, and water quality monitoring. Important tools within the monitoring programs are genetic sampling and analysis of *Spartina,* and photo point monitoring. The programs work together to assure and document an effective regional treatment effort, while protecting water quality, wildlife, and the ecosystem structure. Information about each of the programs ais provided below.



TREATMENT PROGRAM

The Treatment Program coordinates a multitude of contractors, agencies, landowners, and staff to plan and conduct annual treatment of non-native *Spartina* species found throughout the Estuary. The key to the Treatment Program has been its ability to rapidly adapt methods as target plants and marsh conditions evolved. Pilot efforts to test herbicide methods and coordination mechanisms began in 2004, when the total known footprint of non-native *Spartina* was at that time 758 acres. In 2005, the footprint expanded to 805 acres and ISP partners began coordinated, Estuary-wide treatment. Treatment initially focused on large infestations and areas where partners were most ready to begin work and expanded to include all sub-areas in 2006 and 2007. Aerial broadcast treatment by helicopter at several of the large hybrid *Spartina* monocultures of the central and south bay soon effectively reversed the spread of hybrid *Spartina* and established control over the infestations. Once continuous meadows of hybrid *S. alterniflora* were reduced to patches, treatment methods shifted away from aerial broadcast to ground-based methods, such as using amphibious tracked vehicles on the mudflats and marsh plain, and hauling hose from spray rigs on trucks staged on levees surrounding accessible marshes. As the infestation areas reduced, ground-based treatment methods shifted to application by backpack sprayers walking through the marsh. *Spartina densiflora*, a species that grows in a bunchgrass form and doesn't spread significantly by rhizome, was effectively controlled by a strategic combination of herbicide application and mechanical mowing or manual digging.

After several years of regionally coordinated treatment, very large meadows of non-native *Spartina* were rare, replaced by sparse infestations spread over larger areas that were more difficult to locate and access, and new outlier populations were discovered in more remote areas of the Estuary. By 2008, the ISP began utilizing airboats on the open mud to allow treatment during low tide, thus maximizing herbicide dry time. The airboats were also used to deploy personnel with backpacks onto the marshplain of islands and other sites that were inaccessible on foot alone. By 2009, this approach was employed for treatment throughout Don Edwards San Francisco Bay National Wildlife Refuge (DENWR), and by 2012

there were as many as four airboats on a given day working on hybrid *Spartina* treatment around the Estuary. While the use of airboats in this way is essential for accessing difficult areas at this stage, the vast majority of herbicide treatment is conducted by trained personnel walking through the marsh with backpack herbicide sprayers.

Similarly, there have been shifts in methodology for *S. densiflora* treatment. By 2012, all sites were using manual removal as the primary technique, with only two sub-areas still requiring an early season application of herbicide to stop seed production until digging could be implemented after California Ridgway's rail breeding season.

MONITORING PROGRAM

Inventory Monitoring

The ISP began Estuary-wide inventory monitoring of invasive *Spartina* in 2000, with annual monitoring of all known infestations beginning in 2004 and expanding in scope each year since. The original geographic scope of inventory monitoring was limited to the bayward side of most major highways (Hogle 2008). In 2006, the ISP Project Area included 50,000 acres of tidal marsh and mudflat throughout the Estuary and Outer Coast. Since then, the Project Area has expanded to 70,000 acres Estuary-wide as tidal habitats have increased and the reach of hybrid *S. alterniflora* impact has also increased.

Inventory monitoring is conducted for two purposes: to track change in the extent and net cover of the infestation over time for analyzing and reporting, and to locate and map patches of invasive *Spartina* to inform management and coordination of Treatment Program operations. The ISP typically completes inventory of marshes prior to treatment (generally from June through October) to allow for the most efficient use of time and personnel during limited treatment windows. Minimizing time in the marsh during treatment also serves to minimize potential disturbance to marsh plants and animals. Data is collected using global positioning system (GPS) and managed using a Geographic Information System (GIS).

Since 2012, all monitoring has been conducted on the ground. Ground mapping is done mostly on foot, but also by numerous types of boats when surveying islands, extensive shorelines, and lengthy waterways.

Genetic Sampling and Analysis

A genetic sampling plan is developed internally each season to address questions posed by the Treatment and Restoration programs and assure efficient use of laboratory resources. Genetic sampling is most frequently used to confirm the species identity of a plant that is difficult to identify based on morphology – at least on the day of the site visit – and that represents a patch of plants large enough to warrant verification before committing treatment resources to its eradication. Other reasons for genetic sampling include: to verify suspicious plants in what would otherwise be a zero-detect or approaching zero-detect site; to verify plants that appear to be infiltrating *S. foliosa* revegetation plots; to identify plant morphologies that are new, unusual, or confusing in a particular site; and to confirm species identity when collecting *S. foliosa* for nursery propagation beds.

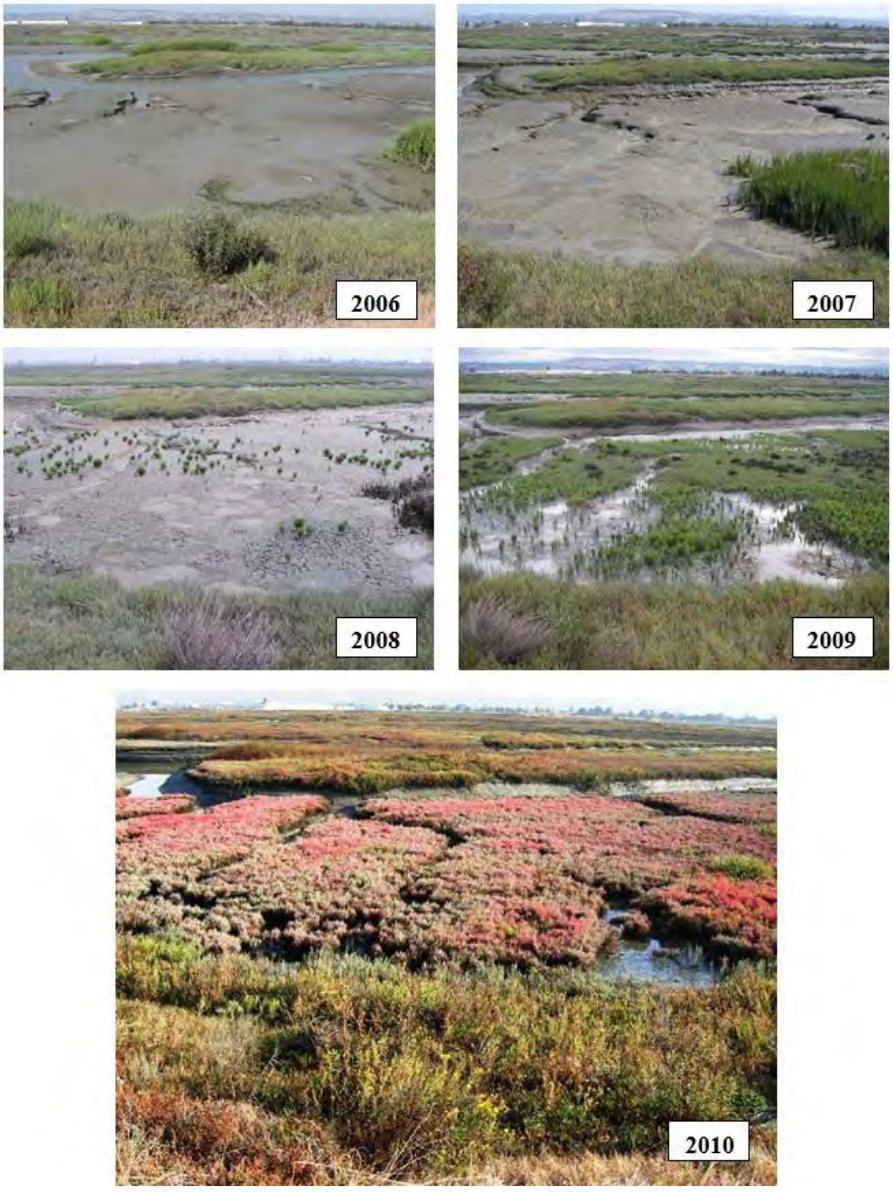
Leaf samples are collected in the field, cleaned, packaged, and sent to a commercial laboratory (Genome Advisors) for extraction of DNA and genetic analysis at fifteen simple sequence repeat (SSR) markers, or microsatellites. ISP staff run the results through the population genetics statistical analysis package, Structure (Pritchard et al. 2000), to obtain an estimate of the proportions of each plant's genome that descended from *S. foliosa* and *S. alterniflora*. If more than 10% of a plant's genome is estimated to have

come from *S. alterniflora*, that plant and the patch it represents are slated for treatment. The results are frequently extrapolated so that other patches with similar morphology may also be treated. The ISP incorporates these results into the program's GIS layers for further analysis and for reference in the field during future treatment and inventory events. Over 7,200 genetic samples have been collected and analyzed since 2010.

Photo Point Monitoring

Another tool used by the Treatment and Monitoring Programs is photo point monitoring. The ISP established and has maintained 93 permanent locations within 51 sub-areas from which staff take consistent photos twice annually to qualitatively monitor marsh changes between seasons and years. Photo points are used to inform the extent of the next treatment effort and to visually document the changes in vegetation occurring at the sites. Visible changes often include rapid disappearance of large areas of non-native *Spartina* within one to three seasons of treatment, passive (and frequently rapid) establishment of native vegetation, and expansion or "rebounding" of hybrid *Spartina* populations when treatment is missed or restricted for one or more seasons.

The intra- and inter-annual visual comparisons of marsh composition are useful to the ISP for monitoring treatment efficacy and for presenting local trends to outside parties. These photos are especially useful to illustrate different marsh trajectories when comparing sites with continuous full treatment with those where treatment was absent or incomplete, as has happened since 2011 in 11 sub-areas a result of permit restrictions. An example of photo point data is shown in the photo to the right. Also, ISP Photo Point photos taken 2006-2014 may be viewed on the web through Google Maps.



An example of photo point monitoring data showing habitat transition over several years.

Treatment Monitoring

The ISP began monitoring all treatment events in 2009. Treatment monitoring involves pairing ISP personnel with the agency or private contractor treatment crews to accomplish the following important objectives: (1) assure protection of California Ridgway's rails and other sensitive species during treatment activities; (2) enhance conservation of native *S. foliosa* that may be present by delimiting it in no-treatment areas for the crew; (3) substantially improve the ability for crews to locate and target plants for treatment by leading them to less obvious plants requiring treatment; and (4) document completed treatment in real time at the patch level. As previously mapped *Spartina* locations are revisited, ISP staff update the map features using GPS data loggers to reflect the day's treatment action (e.g., "treated," "not treated," "sub-optimally treated" etc.). This data is uploaded daily to the ISP's ArcGIS geodatabase for use in the field the next day. Accompanying treatment crews also allows ISP staff to identify, map, and concurrently record treatment of patches of invasive *Spartina* that had not been detected during initial inventory monitoring. Treatment monitoring is a critical initiative of the Spartina treatment program, greatly accelerating the rate at which eradication may be achieved at all sites.

Since the timing of inventory and treatment overlap from mid-July through November, the ISP hires additional seasonal staff to conduct treatment monitoring at suitable sites – that is, at sites where native *Spartina* is not present, where hybrid *Spartina* has been recently mapped by more experienced staff, or where native and hybrid morphologies are sufficiently distinct to allow the interns to make consistently correct determinations. More experienced biologists are thus reserved to inventory and monitor treatment at more complex sites.

California Ridgway's Rail Monitoring

Implementation of *Spartina* control measures requires annual breeding season surveys of the endangered California Ridgway's rail (*Rallus obsoletus obsoletus*) in marshes affected by the invasion and management of non-native *Spartina*. Annual surveys provide a standardized measure of Ridgway's rail presence and distribution in affected areas, and the information guides the planning, permitting, and implementation of treatment strategies, helping minimize the impacts of *Spartina* control on rail populations. Results from California Ridgway's rail surveys help determine the time of year in which ISP monitoring staff and treatment contractors will enter a site so as to not disturb birds present during their breeding season, and are used by USFWS and others for making decisions regarding the ISP program.

Water Quality Monitoring

The application of herbicide for *Spartina* control is covered under the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Application of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States (General Permit No. CAG990005; www.swrcb.ca.gov/water_issues/programs/npdes/docs/aquatic/permit.pdf). To obtain coverage under this permit, each grantee or other ISP partner that will be applying herbicide submits a Notice of Intent (NOI) to comply with the terms of the General Permit and an pays annual fee to the Regional Water Quality Control Board (RWQCB). The permit requires preparation of an Aquatic Pesticide Application Plan (APAP) that includes a Water Quality Monitoring Plan (WQMP), which must be updated annually as needed. The ISP arranged with the State Water Resources Control Board and the San Francisco Bay RWQCB to allow the ISP to prepare and implement a programmatic APAP and WQMP on behalf of the ISP partners who submitted NOIs. The ISP prepared a programmatic APAP in 2006 and updated it in 2015 (http://www.spartina.org/documents/2015_ISP_APAP_wAppendices.pdf).

As with many substances, there are no State or Federal numeric water quality objectives or limits established for imazapyr herbicide; therefore, concentrations are compared to tested toxicity and effects levels found in the literature. In 2013, concentrations of imazapyr herbicide measured immediately following treatment events were two to four orders of magnitude below those reported in the literature as a concern to humans or the animals that inhabit the tidal marsh ecosystem. Imazapyr is rapidly degraded by sunlight and is not persistent in the aquatic environment; thus, samples taken one-week post-treatment typically show a reduction of 90 to 100 percent compared to treatment event levels. Details regarding sampling and analysis methods and the monitoring results are provided in the 2017 Water Quality Monitoring Report (Kerr 2013).

The ISP commissioned a focused review of imazapyr herbicide in 2005, prior to adopting it into the Treatment Program. The review, *The use of Imazapyr Herbicide to Control Invasive Cordgrass (Spartina spp.) in the San Francisco Estuary: Water Quality, Biological Resources, and Human Health and Safety (Leson & Associates 2005)*, is on the ISP website at www.spartina.org/project_documents. The Conservancy's findings under CEQA may be found at www.spartina.org/2005Addendum.htm.

RESTORATION PROGRAM

The Restoration Program was initiated in 2011 to rapidly establish habitat features to benefit California Ridgway's rails in areas where recent removal of non-native *Spartina* has caused decreases in Ridgway's rail habitat. The plan for the program is contained in the California Clapper Rail Habitat Enhancement, Restoration and Monitoring Plan (Olofson Environmental, Inc. 2012). As part of the plan, the Conservancy and other regional ISP partners are employing several habitat enhancement methods including construction of high tide refuge islands, deployment of artificial floating nesting islands, and extensive revegetation, focusing on native tidal marsh plant species that provide foraging, breeding, and high tide refuge cover.

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Appendix III. 2021 Post-season Inventory Plan Update

2021 Post-season Update to the Plan for *Spartina* Inventory & Treatment Monitoring

Below is a complete list of ISP sub-areas, organized by Reporting Region, showing the level of inventory intended and completed at each during the 2021 Spartina Inventory Monitoring Season. This list was first developed in June 2021 as the Inventory Plan for the season, and was updated at the end of season to reflect deviations from the June Plan. FOR UPDATE: Colors on the list indicate where inventory was completed at a level that ***deviated*** from the Plan: "Complete" (**green**) inventory where none or partial was planned; "Partial" (**blue**) inventory where none or complete was planned; "None" (**orange**) where inventory was not completed as planned in 2021; and new "Assessment" (**yellow**) inventory where wetlands were assessed for the first time by ISP. Inventory in uncolored sub-areas was completed at the level anticipated in the original Plan.

5/5/2022

Sub-area	REGION 1: MARIN	2021 Planned Inventory Coverage	2021 Completed Inventory Coverage	2021 Inventory Approach Completed	Inventory Boundary Detail (where needed) and Notes
03a	Blackie's Creek (above bridge)	Complete	Complete	Thorough Inventory	
03b	Blackie's Creek Mouth	Complete	Complete	Thorough Inventory	
04a	Corte Madera Ecological Reserve	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
04b	College of Marin Ecological Study Area	Complete	Complete	Thorough Inventory	Very little infestation pressure; complete during densi
04c	Piper Park East	Complete	Complete	Thorough Inventory	
04d	Piper Park West	Complete	Complete	Thorough Inventory	
04e	Larkspur Ferry Landing Area	Complete	Complete	Thorough Inventory	Complete in prime growing season
04f	Riviera Circle	Complete	Complete	Thorough Inventory	
04g	Creekside Park	Complete	Complete	Thorough Inventory	
04h	Upper Corte Madera Creek (Above Bon Air Rd)	Complete	Complete	Thorough Inventory	Complete in prime growing season
04i	Lower Corte Madera Creek (Bon Air Rd to HWY 101)	Complete	Complete	Thorough Inventory	Complete in prime growing season
04j.1	Corte Madera Creek Mouth - North Bank	Complete		Thorough Inventory	Complete in prime growing season
04j.2	Corte Madera Creek Mouth - South Bank	Complete	Complete	Thorough Inventory	Complete in prime growing season
04k	Boardwalk No. 1 (Arkites)	Complete	Complete	Thorough Inventory	Very little infestation pressure; complete during densi
04l	Murphy Creek	Complete	Complete	Thorough Inventory	Very little infestation pressure; complete during densi
09	Tiscornia Marsh / Pickleweed Park	Complete	Complete	Thorough Inventory	Complete in prime growing season
23a	Brickyard Cove	Partial	Partial	Historics Only	**Knight Drive** Complete **Northern Marsh** None; assessed in 2020
23b	Beach Drive	Complete	Complete	Thorough Inventory	Complete in prime growing season
23c	Loch Lomond Marina	Complete	Complete	Thorough Inventory	Complete in prime growing season
23d.1	San Rafael Canal Mouth East	Complete	Complete	Thorough Inventory	Complete at prime time with combo of boat, walking
23d.2	San Rafael Canal Mouth West	Complete	Complete	Thorough Inventory	**Mainland** Complete at prime time with combo of boat, walking **Marin Islands** Completed by whaler
23e	Muzzi and Martas Marsh	Complete	Complete	Thorough Inventory; +R2	
23f	Paradise Cay	Partial	Partial	Historics Only	Thorough inventory for densi
23g	Greenwood Cove	Complete		Thorough Inventory	
23h	Strawberry Point	Complete	Complete	Thorough Inventory	
23i	Strawberry Cove	Complete	Complete	Thorough Inventory; +R2	
23j	Bothin Marsh	Complete	Partial	Thorough Inventory	**Northern marsh sections** Complete **Southern portions** Not done; surveyed 2020
23k	Sausalito	Partial	Partial	Historics Only	Zero detect since 2015. Thorough inventory in 2019.
23l	Starkweather Park	None	Complete	n/a	
23m	Novato	Partial	Partial	Thorough Inventory	**Gallinas Creek** Watershed thoroughly surveyed on foot 2016; 2020 foot and kayak. None 2021 **Novato Shoreline-North** Surveyed by CDFA airboat 2018; 2020 CDFA airboat support. Foot and boat 2021 **Novato Shoreline - South and McInnis** Surveyed by CDFA airboat 2018; 2020 CDFA airboat support; Foot and boat 2021
23n	Triangle Marsh and shoreline	Complete	Complete	Thorough Inventory	
23o	China Camp	Complete	Complete	Thorough Inventory	
n/a	Hamilton Airforce Base	Complete	Complete	Thorough Inventory	Surveyed by CDFA airboat 2018; 2020 & 2021 CDFA airboat support
n/a	Fort Baker	None	None	n/a	Not inventoried since 2012
n/a	Tiburon	None	None	n/a	Surveyed 2017 by whaler
n/a	Bel Marin Keys	None	None	n/a	Surveyed 2017 by whaler
n/a	Point San Pedro	None	None	n/a	Surveyed 2017 by whaler
n/a	Point San Quentin	Complete	None	Thorough Inventory	Not surveyed since 2011; suboptimal habitat and limited COVID access
	REGION 2: SAN FRANCISCO PENINSULA	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
12a	Pier 94	Complete	Partial	Thorough Inventory	**Tidal marsh bayfront** Complete 2021 **Interior lagoon** Not surveyed 2021 (suboptimal habitat)
12b	Pier 98 / Heron's Head	Complete	Complete	Thorough Inventory	
12c	India Basin	Complete	Partial	Thorough Inventory	**Southeast shoreline** Not surveyed 2021
12d	Hunters Point Naval Reserve	Complete	Partial	Thorough Inventory	**Western embayment** (historical zone) scanned with binoculars from across cove **Southeast shoreline** Not surveyed 2021
12e	Yosemite Channel	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
12f	Candlestick Cove	Complete	Complete	Thorough Inventory	Zero Detect since 2015
12g	Crissy Field	None	Complete	Thorough Inventory	**Main lagoon** Thoroughly surveyed 2021; Zero Detect since 2013 **Quartermaster Reach** Surveyed on foot first time 2021
12h	Yerba Buena Island	None	None	None	**Angel Island** Spartina never detected; suboptimal habitat **Yerba Buena Island** Partial survey of habitat zone 2020; Zero Detect since 2011

12i	Mission Creek	Complete	Complete	Thorough Inventory	Zero Detect since 2014
18a	Colma Creek	Complete	Complete	Thorough Inventory	Zero Detect since 2018
18b	Navigable Slough	Complete	Complete	Thorough Inventory	Zero Detect since 2017
18c	Old Shipyard	Complete	Complete	Thorough Inventory	Zero Detect since 2019
18d	Inner Harbor	Complete	Complete	Thorough Inventory	Zero Detect since 2014
18e	Sam Trans Peninsula	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
18f	Confluence Marsh	Complete	Complete	Thorough Inventory	Zero Detect since 2017
18g	San Bruno Marsh	Complete	Partial	Thorough Inventory	Zero Detect since 2019; No R2 2021 but inventoried during prime time **Outer islands** Scanned 2021
18h	San Bruno Creek	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
19a	Brisbane Lagoon	Complete	Complete	Thorough Inventory	
19b	Sierra Point	Complete	Complete	Thorough Inventory	Zero Detect since 2015
19c	Oyster Cove	Complete	Complete	Thorough Inventory	Zero Detect since 2015
19d	Oyster Point Marina	Complete	Complete	Thorough Inventory	Zero Detect since 2015
19e	Oyster Point Park	Complete	Complete	Thorough Inventory	Zero Detect since 2015
19f	Point San Bruno	Complete	Complete	Thorough Inventory	
19g	Seaplane Harbor	Complete	Partial	Thorough Inventory	Zero Detect since 2018 **Main Marsh** Complete **Riprap shoreline** Scanned 2021
19h	SFO	Complete	Partial	Thorough Inventory	**Main Marsh** Complete **Riprap shoreline** Scanned 2021
19i	Mills Creek Mouth	Partial	Partial	Historics Only	**Bayward/downstream side of US-101** Complete since 2018 **Upstream** None
19j	Easton Creek Mouth	Partial	Partial	Historics Only	**Bayward/downstream side of US-101** Complete since 2018 **Upstream** None
19k	Sanchez Marsh	Complete	Complete	Thorough Inventory; +R2 (coarse)	High scrutiny R1; Coarse R2
19l	Burlingame Lagoon	Partial	Complete	Historics Only	**Northern shoreline** None **Southern shoreline** Historic zones
19m	Fisherman's Park	Complete	Complete	Thorough Inventory	Complete w/densi in June; Zero Detect since 2012
19n	Coyote Point Marina / Marsh	Complete	Complete	Thorough Inventory; +R2	
19o	San Mateo Creek / Ryder Park	Complete	Complete	Thorough Inventory	
19p	Seal Slough Mouth - Central Marsh	Complete	Complete	Thorough Inventory; +R2	
19p	Seal Slough Mouth - Peripheral Marshes	Complete	Complete	Thorough Inventory; +R2	
19r	Anza Lagoon	Complete	Complete	Thorough Inventory	Zero Detect since 2016
	REGION 3: SAN MATEO	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
02a.1a	Belmont Slough Mouth	Complete	Complete	Thorough Inventory	
02a.1b	Belmont Slough Mouth South	Complete	Complete	Thorough Inventory	
02a.2	Upper Belmont Slough and Redwood Shores	Partial	Partial	Recent historic zone only	**Interior shorelines** None (thoroughly inventoried in 2017). Spartina never detected here
02a.3	Bird Island	Complete	Complete	Thorough Inventory	
02a.4	Redwood Shores Mitigation Bank	Complete	Complete	Thorough Inventory	
02b.1	Corkscrew Slough	Complete	Complete	Thorough Inventory	
02b.2	Steinberger Slough South, Redwood Creek Northwest	Complete	Complete	Thorough Inventory	
02c.1a	B2 North Quadrant West	Complete	Complete	Thorough Inventory	**Eastern islands** Not inventoried 2018 **Interior tracking polys** Not inventoried 2018
02c.1b	B2 North Quadrant East	Complete	Complete	Grids	
02c.2	B2 North Quadrant South	Complete	Complete	Thorough Inventory	
02d.1a	B2 South Quadrant West	Complete	Complete	Thorough Inventory	
02d.1b	B2 South Quadrant East	Complete	Complete	Thorough Inventory	
02d.2	B2 South Quadrant (2)	Complete	Complete	Thorough Inventory	
02d.3	B2 South Quadrant (3)	Partial	Partial	Historics Only	Inventory focus on the channel complexes entering from the west
02e	West Point Slough NW	Complete	Complete	Thorough Inventory	
02f	Greco Island North	Complete	Complete	Thorough Inventory	
02g	West Point Slough SW and East	Complete	Complete	Thorough Inventory	
02h	Greco Island South	Complete	Complete	Thorough Inventory	
02i	Ravenswood Slough and Mouth	Complete	Complete	Thorough Inventory	
02j.1	Ravenswood Open Space Preserve (N of Hwy 92)	Complete	Complete	Thorough Inventory	
02k	Redwood Creek and Deepwater Slough	Complete	Complete	Thorough Inventory	
02l	Inner Bair	Complete	Complete	Thorough Inventory	
02m	Pond B3	Complete	Complete	Coarse Mapping	Surveyed with SOLitude airboat during treatment
02o	Central Bair	Complete	Complete	Coarse Mapping	Surveyed with SMCMVCD and SOLitude airboats during treatment
19q	Foster City	Complete	Complete	Thorough Inventory	
19s	Maple Street Channel	Partial	Complete	Historics Only	Densi dig in June
	REGION 4: DUMBARTON SOUTH	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
02j.2	Ravenswood Open Space Preserve (S of Hwy 92)	Complete	Complete	Thorough Inventory	
02n	SF2	Complete	Complete	Thorough Inventory	**Interior** by jon boat **Perimeter** on foot

05a.1	Mowry Marsh and Slough	Complete	Complete	Thorough Inventory	**ALL:** Prioritize for early season inventory and treatment **Mowry Marsh** Complete **Mowry Slough** Complete **Mowry-Calaveras Strip Marsh** Complete
05a.2	Calaveras Marsh	Complete	Complete	Thorough Inventory	**Fringe** early season inventory during treatment **Interior** Complete
05b	Dumbarton/Audubon	Complete	Complete	Coarse Mapping during prime time; Fringe inventory during early season treatment	
05c.1	Newark Slough West	Complete	Complete	Thorough Inventory	
05c.2	Newark Slough East	Complete	Complete	Thorough Inventory	
05d	LaRiviere Marsh	Complete	Complete	Thorough Inventory	
05e	Mayhew's Landing	Complete	Complete	Thorough Inventory	
05f	Coyote Creek - Alameda County	Partial	Partial	Thorough Inventory	**Coyote Creek/Warm Springs Lagoon** Complete w/SOLitude airboat; first time ever **Coyote Creek** Complete **Mud Slough** East of Amtrak tracks not done 2021
05g	Cargill Pond (W Hotel)	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
05h	Plummer Creek Mitigation Marsh	Complete	Complete	Thorough Inventory	Extended into new restoration marsh to the north
05i	Island Ponds	Partial	Complete	Thorough Inventory	**A19** Complete with airboat at higher tide **A20** Complete on foot **A21** Complete on foot
08	Palo Alto Baylands	Complete	Complete	Coarse Mapping	**SE Hooks** Complete **Embarcadero Islands** Complete + early fringe **Palo Alto Harbor** Complete + early fringe **Harriet Mundy** Complete on foot
15a.1	Charleston Slough to Mountainview Slough	Complete	Complete	Coarse Mapping	
15a.2	Stevens Ck to Guadalupe Sl	Complete	Complete	Coarse Mapping	
15a.3	Guadalupe Slough	Partial	Partial	Coarse Mapping; Historics Only (2019 features)	1 km upstream beyond historic infestation not to be surveyed
15a.4	Alviso Slough	Partial	Complete	Thorough Inventory	**Ogilvie** Complete coarse inventory early season **Coyote Mainland** Complete **Knapp Tract Outboard** Complete **Alviso Slough** Complete
15a.5	Coyote Creek to Artesian Slough	Partial	Complete	Thorough Inventory	Complete for first time ever; Surveyed with SOLitude airboat
15a.6	Knapp Tract	Complete	Complete	Thorough Inventory	Surveyed with SOLitude airboat
15a.7	Pond A17	Complete	Complete	Thorough Inventory	Surveyed with SOLitude airboat
15b	Faber / Laumeister Marsh	Complete	Complete	Thorough Inventory	Prioritize for early season inventory and treatment
15c	Shoreline Regional Park	Complete	Complete	Thorough Inventory	**Charleston Slough pond** Survey from perimeter on foot **Steven's Creek Marsh** Complete inventory
15d	Sunnyvale Baylands	Assessment	Assessment	Coarse Mapping	New sub-area 2021 due to hybrid detected inside failed tide control structure to open bay; limited habitat availability
16.1	Cooley Landing Central	Complete	Complete	Thorough Inventory	
16.2	Cooley Landing East	Complete	Complete	Coarse Mapping	
n/a	Ponds A5, A7, A8, A8S	Partial	Complete	Coarse Mapping	Perimeter walked 2021; new limited tidal action detected
n/a	Mountainview Salt Ponds	Assessment	Assessment	Coarse Mapping	Levees walked for the first time 2021; No spartina found; limited tidal action detected
n/a	Alviso Salt Ponds	Assessment	Assessment	Coarse Mapping	Levees walked for the first time 2021; No spartina found; limited tidal action detected
	REGION 5: UNION CITY	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
01a	Channel Mouth	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
01b	Lower Channel	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
01c	Upper Channel	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
01d	Upper Channel - Union City Blvd to I-880	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
01e	Strip Marsh No. of Channel Mouth	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
01f	Pond 3 - AFCC	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
13a	Old Alameda Creek North Bank	Complete	Complete	Thorough Inventory	
13b	Old Alameda Creek Island	Complete	Complete	Thorough Inventory	
13c	Old Alameda Creek South Bank	Complete	Complete	Thorough Inventory	
13d	Whale's Tail North Fluke	Complete	Complete	Thorough Inventory	
13e	Whale's Tail South Fluke	Complete	Complete	Thorough Inventory	
13f	Cargill Mitigation Marsh	Complete	Complete	Thorough Inventory	
13g	Upstream of 20 Tide Gates	Complete	Complete	Thorough Inventory	
13h	Eden Landing - North Creek	Complete	Complete	Thorough Inventory	
13i	Eden Landing - Pond 10	Partial	Partial	Historics Only	**Southern Portion** Complete inventory where now hydrologically connected to Mt Eden Creek **Main Pond** None; Zero Detect here since 2014
13j	Eden Landing - Mt Eden Creek	Complete	Complete	Thorough Inventory	
13k	Eden Landing Reserve South - North Creek Marsh	Complete	Complete	Thorough Inventory	
13l	Eden Landing Reserve North - Mt Eden Creek Marsh	Complete	Complete	Thorough Inventory	
13m	Eden Landing - Ponds E8A, E9, and E8X	Complete	Complete	Thorough Inventory	survey by SOLitude airboat + jon boat

21a	Ideal Marsh North	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
21b	Ideal Marsh South	Complete	Complete	Thorough Inventory	
n/a	Eden Landing Salt Ponds	Assessment	Assessment	Coarse Mapping	Levees walked for the first time 2021; No spartina found; limited tidal action detected
	REGION 6: HAYWARD	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
07a	Oro Loma Marsh - East	Complete	Complete	Thorough Inventory	
07b	Oro Loma Marsh - West	Complete	Complete	Coarse Mapping	
20a	Oyster Bay Regional Shoreline	Complete	Complete	Coarse Mapping	
20b	Oakland Metropolitan Golf Links	Complete	Complete	Coarse Mapping	
20c	Dog Bone Marsh	Complete	Complete	Coarse Mapping	
20d.1	Citation Marsh South	Complete	Complete	Coarse Mapping	
20d.2a	Citation Marsh Upper	Complete	Complete	Grids	
20d.2b	Citation Marsh Central	Partial grid and extrapolation	Partial grid and extrapolation	Partial Grids	Subset of marsh mapped by grid, extrapolated to remainder of marsh in relation to 2017-19 grid mapping
20e	East Marsh	Complete		Coarse Mapping	
20f	North Marsh	Partial grid and extrapolation	Partial grid and extrapolation	Partial Grids	Subset of marsh mapped by grid, extrapolated to remainder of marsh in relation to 2017-19 grid mapping
20g	Bunker Marsh	Complete	Complete	Coarse Mapping	**Main Marsh** Grids **Channe**l Complete **Southern Lobe** Complete
20h.1	San Lorenzo Creek and Mouth North	Complete	Complete	Coarse Mapping	
20h.2	San Lorenzo Creek and Mouth South	Complete	Complete	Coarse Mapping	
20i	Bockmann Channel	Complete	Complete	Thorough Inventory	
20j	Sulphur Creek	Complete	Complete	Coarse Mapping	
20k	Hayward Landing	Complete	Complete	Thorough Inventory	
20l	Johnson's Landing	Complete	Complete	Thorough Inventory	
20m	Cogswell Marsh A	Complete	Complete	Thorough Inventory	
20n.1	Cogswell Marsh B Bayfront	Complete	Complete	Grids	
20n.2	Cogswell Marsh B South	Complete	Complete	Coarse Mapping	
20n.3	Cogswell Marsh B Main	Complete	Complete	Grids	
20o	Cogswell Marsh C	Complete	Complete	Thorough Inventory	
20p	Hayward Shoreline Outliers	Complete	Complete	Coarse Mapping	
20q	San Leandro Shoreline Outliers	Complete	Complete	Coarse Mapping	
20r	Oakland Airport Shoreline and Channels	Complete	Complete	Thorough Inventory	
20s	H.A.R.D. Marsh	Complete	Complete	Thorough Inventory	
20t	San Leandro Marina	Complete	Complete	Thorough Inventory	
20u	Estudillo Creek Channel	Complete	Complete	Thorough Inventory	
20v	Hayward Landing Canal	Complete	Complete	Thorough Inventory	
20w	Triangle Marsh	Complete	Complete	Thorough Inventory	
	REGION 7: SAN LEANDRO BAY	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
17a	Alameda Island South (Elsie Roemer Bird Sanctuary, Crown Memorial State Beach, Crab Cove)	Complete	Complete	Coarse Mapping; +Partial R2	**Elsie Roemer:** Complete inventory around foliosa plantings + R2
17b	Bay Farm Island	Complete	Complete	Coarse Mapping	OEI treatment during inventory
17c.1	Arrowhead Marsh West	Complete	Complete	Grids	Infestation wide spread enough to not warrant point/line/poly inventory
17c.2	Arrowhead Marsh East	Complete	Complete	Grids	
17d.1	Fan Marsh Shoreline	Complete	Complete	Coarse Mapping	
17d.2	Airport Channel	Complete	Complete	Coarse Mapping	
17d.3	East Creek	Complete	Complete	Coarse Mapping	
17d.4	Damon Marsh	Complete	Complete	Coarse Mapping	
17d.5	Damon Slough / Elmhurst Creek	Complete	Complete	Coarse Mapping	
17e.1	San Leandro Creek North	Complete	Complete	Coarse Mapping	
17e.2	San Leandro Creek South	Complete	Complete	Coarse Mapping	
17f	Oakland Inner Harbor	Complete	Complete	Coarse Mapping	Complete survey by Whaler, foot, and kayak 2021
17g	Coast Guard Island	Complete	Complete	Coarse Mapping	OEI treatment during inventory
17h	MLK New Marsh	Complete	Complete	Grids	
17i	Coliseum Channels	Complete	Complete	Coarse Mapping	
17j.1	Fan Marsh Wings	Complete	Complete	Coarse Mapping	
17j.2	Fan Marsh Main	Complete	Complete	Grids	
17k	Airport Channel	Complete	Complete	Coarse Mapping	
17l	Doolittle Pond	Complete	Complete	Coarse Mapping	
17m	Alameda Island (Aeolian Yacht Club and East Shore)	Complete	Complete	Coarse Mapping	
	REGION 8: BAY BRIDGE NORTH	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
06a	Emeryville Crescent East	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
06b	Emeryville Crescent West	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
10a	Whittel Marsh	Partial	Complete	Thorough Inventory	
10b	Southern Marsh	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
10c	Giant Marsh	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time

10d	Breuner Marsh Restoration	Complete	Complete	Thorough Inventory	
22a	Wildcat Marsh	Partial	Partial	Historics [Zone] Only	**Shorelines and peninsula** Complete by kayak and on foot **Main marsh interior** Not done 2021
22b.1	San Pablo Marsh East	Complete	Complete	Thorough Inventory	
22b.2	San Pablo Marsh West	Complete	Complete	Thorough Inventory	
22c	Breuner Marsh (Rheem Creek)	Complete	Complete	Thorough Inventory	No R2 2021, but inventoried during prime time
22d	Stege Marsh	Complete	Complete	Thorough Inventory	
22e	Hoffman Marsh	Complete	Complete	Thorough Inventory	
22f	Richmond / Albany / Pinole Shoreline	Partial	Partial	Historics [Zone] Only	**Pinole, Rodeo, Crocket Shorelines** Recent historics only; Thoroughly surveyed 2020 **Brooks Island** Complete survey during annual shorebird surveys **Albany Shoreline** Historics only **San Pablo Yacht Harbor** Complete **Stege Marsh Channels** Complete **Point Richmond Marina** Complete **Point Molate & Western Shoreline** Not done; Completed in 2018 **Castro Cove** historics only
n/a	Berkeley Aquatic Park	None	Complete	Thorough Inventory	suboptimal habitat
	REGION 9: SUISUN	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
11	Southampton Marsh	Complete	Complete	Thorough Inventory	
27a	Point Buckler	Complete	Complete	Thorough Inventory	
27b	MOTCO Islands	Complete	Complete	Thorough Inventory	
27c	Honker Bay	Complete	Partial	Thorough Inventory	Need to gain access 2022 to duck clubs for assessment
n/a	MOTCO mainland shoreline	Complete	Partial	Thorough Inventory	**MOTCO shoreline** Complete **Point Edith** Not done; completed 2020 and no spartina found **Seal Islands** Not done due to wind and access by kayak
n/a	Suisun Bay Marshes	None	None	n/a	Shoreline surveyed 2017 by whaler; Prioritize for 2022
n/a	Benicia Shoreline	Complete	Complete	Thorough Inventory	
	REGION 10: VALLEJO	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
26a	White Slough / Napa River	Complete	Partial	Thorough Inventory	**American Canyon** Not done; Survryed thoroughly 2020 **Napa River** Complete **Napa River Mouth** Complete **Vallejo** Complete **White Slough** Not done; Thorough survey 2020 **Napa Sonoma Marshes** Partial survey; low risk but not thoroughly surveyed since 2015
26b	San Pablo Bay NWR and Mare Island	Partial	Complete	Historics [Zone] Only	**Mare Island** Survey entirely on foot 2021 and w/airboat support **San Pablo Bayfront** Surveyed 2021 w/CDFA airboat
26c	Sonoma Creek	Complete	Partial	Thorough Inventory	**Sonoma Creek** partially surveyed 2021 within 500m of 2020 infestation; thorough airboat surveys not since 2015 **Creek Mouth Restoration** Shoreline survryed by airboat 2021; Surveyed by airboat and on foot 2019
26d	Sonoma Baylands	Complete	Complete	Thorough Inventory	Surveyed 2021 w/CDFA airboat support
n/a	Cullinan Ranch	None	None	n/a	Not done; Surveyed 2019 w/USFWS airboat
	REGION 11: PETALUMA	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes and Notes**
24a	Upper Petaluma River - Upstream of Grey's Field	Complete		Thorough Inventory	Survey on foot with Whaler support
24b	Grey's Field	Complete		Thorough Inventory	Complete inventory needed 2019 due to increased infestation
24c	Petaluma Marsh	Partial		Historics [Zone] Only	Survey main Slough and possible channels w/small airboat
24d	Lower Petaluma River - Downstream of San Antonio Creek	Partial		Thorough Inventory	**Point Sonoma Marina** Thorough survey needed to support foliosa collection; completed 2018 w/CDFA airboat **Bahia Restoration, Petaluma River Black John Slough-North, Petaluma River Black John Slough-South, Petaluma River Carl's Marsh, Rush Creek** All No survey: Low Risk of Infestation >3.5 km
	REGION 12: OUTER COAST	**2021 Planned Inventory Coverage**	**2021 Completed Inventory Coverage**	**2021 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
25a	Tom's Point, Tomales	Partial	Partial	Historics only	**Tom's Point** surveyed for *S. densiflora* only **Hog Island Oyster Farm** surveyed for *S. densiflora* only
25b	Limantour Estero	Complete	Complete	Thorough Inventory	Complete inventory by kayak 2021. Zero detect since 2012.
25c	Drakes Estero	Complete	Complete	Thorough Inventory	Complete inventory by kayak 2021. Zero detect since 2013.
25d	Bolinas Lagoon, North	Partial	Partial	Historics only	**Northern and Eastern shorelines** Complete inventory **Western shoreline** None; no infestation history
25e	Bolinas Lagoon, South	None	Complete	n/a	**Southern Marsh** Completed in 2019 **Housing shoreline** Last completed in 2017
n/a	Bodega Bay	None	None	n/a	
n/a	Dillon Beach	None	None	n/a	

Appendix IV. 2022 Post-season Inventory Plan Update

2022 Post-season Update to the Plan for *Spartina* Inventory & Treatment Monitoring

Below is a complete list of ISP sub-areas, organized by Reporting Region, showing the level of inventory intended at each during the 2022 Spartina Inventory Monitoring Season. This list was first developed in July 2022 and updated in August 2022 as the Inventory Plan for the season; it was then updated at the end of season to reflect deviations from the August Plan. FOR UPDATE--Colors on the list indicate where inventory was completed at a level that deviated from the Plan: "Complete" (**green**) inventory where none or partial was planned; "Partial" (**blue**) inventory where none or complete was planned; "None" (**orange**) where no inventory was completed as planned in 2022.

updated 12/6/2022

Sub-area	REGION 1: MARIN	2022 Planned Inventory Coverage	2022 Completed Inventory Coverage	2022 Inventory Approach Completed	Inventory Boundary Detail (where needed) and Notes
03a	Blackie's Creek (above bridge)	Complete	Complete	Thorough Inventory	
03b	Blackie's Creek Mouth	Complete	Complete	Thorough Inventory	
04a	Corte Madera Ecological Reserve	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
04b	College of Marin Ecological Study Area	Complete	Complete	Thorough Inventory	Very little infestation pressure; complete during densi
04c	Piper Park East	Complete	Partial	Densi only	
04d	Piper Park West	Complete	Partial	Densi only	
04e	Larkspur Ferry Landing Area	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
04f	Riviera Circle	Complete	Complete	Thorough Inventory	
04g	Creekside Park	Complete	Complete	Thorough Inventory	
04h	Upper Corte Madera Creek (Above Bon Air Rd)	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
04i	Lower Corte Madera Creek (Bon Air Rd to HWY 101)	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
04j.1	Corte Madera Creek Mouth - North Bank	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
04j.2	Corte Madera Creek Mouth - South Bank	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
04k	Boardwalk No. 1 (Arkites)	Complete	Complete	Densi only	Very little infestation pressure; complete during densi
04l	Murphy Creek	Complete	Complete	Thorough Inventory	Very little infestation pressure; complete during densi
09	Tiscornia Marsh / Pickleweed Park	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
23a	Brickyard Cove	Partial	Partial	Historics Only	**Knight Drive** Complete **Northern Marsh** None. Sup-optimal habitat assessed 2020
23b	Beach Drive	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
23c	Loch Lomond Marina	Complete	Partial	Partial (restr. Construction access)	Complete in prime growing season; breakwater spit blocked
23d.1	San Rafael Canal Mouth East	Complete	Complete	Thorough Inventory	Complete at prime time with combo of boat, walking
23d.2	San Rafael Canal Mouth West	Complete	Complete	Thorough Inventory	Complete at prime time with combo of boat, walking
23e	Muzzi and Martas Marsh	Complete	Complete	Thorough Inventory	Complete in prime growing season; possible R2
23f	Paradise Cay	Complete	Complete	Historics Only	Thorough survey for densi
23g	Greenwood Cove	Complete	Complete	Thorough Inventory	
23h	Strawberry Point	Complete	Complete	Thorough Inventory	
23i	Strawberry Cove	Complete	Complete	Thorough Inventory	
23j	Bothin Marsh	Partial	Complete	Historics Only	**Northern Marsh Sections** Complete **Southern Marsh** None. Thorough survey 2020
23k	Sausalito	Complete	Complete	Thorough Inventory	
23l	Starkweather Park	Complete	Complete	Thorough Inventory	
23m	Novato	Partial	Complete	Thorough Inventory	**Gallinas Creek** Watershed thoroughly surveyed on foot 2016; 2020 foot and kayak. None 2021-22 **Novato Shoreline-North** Partial if CDFA airboat available. Surveyed by CDFA airboat 2018, 2020, 2021 **Novato Shoreline - South and McInnis** None. Surveyed by CDFA airboat 2018, 2020, 2021
23n	Triangle Marsh and shoreline	Complete	Complete	Thorough Inventory	
23o	China Camp	None	Partial	Historics only	Thorough survey 2021
n/a	Hamilton Wetlands	Complete	Complete	Thorough Inventory	Complete if CDFA airboat available. Surveyed by CDFA airboat 2018, 2020, 2021
n/a	Fort Baker	None	Complete	Thorough Inventory	Not inventoried since 2012, suboptimal habitat and very low infestation pressure
n/a	Tiburon	None	None	n/a	Surveyed 2017 by whaler
n/a	Bel Marin Keys	None	Complete	Thorough Inventory	Surveyed 2017 by whaler
n/a	East Marin Island	None	None	n/a	Surveyed 2021 by whaler
n/a	Point San Pedro	None	None	n/a	Surveyed 2017 by whaler
n/a	Point San Quentin	Complete	None	None--No Access	Not surveyed since 2011; suboptimal habitat
	REGION 2: SAN FRANCISCO PENINSULA	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
12a	Pier 94	Complete	Complete	Thorough Inventory	
12b	Pier 98 / Heron's Head	Complete	Complete	Thorough Inventory	
12c	India Basin	Complete	Complete	Thorough Inventory	
12d	Hunters Point Naval Reserve	Complete	Complete	Thorough Inventory	**Western embayment** (historical zone) scanned with binoculars from across cove
12e	Yosemite Channel	Complete	Complete	Thorough Inventory	
12f	Candlestick Cove	Complete	Complete	Thorough Inventory	
12g	Crissy Field	Complete	Complete	Thorough Inventory	Zero Detect since 2015; Checked new Quartermaster Reach
12h	Yerba Buena Island	None	None	None	**Angel Island** Spartina never detected; suboptimal habitat **Yerba Buena Island** Zero Detect since 2011

12i	Mission Creek	Complete	Complete	Thorough Inventory	
18a	Colma Creek	Complete	Complete	Thorough Inventory	
18b	Navigable Slough	Complete	Complete	Thorough Inventory	
18c	Old Shipyard	Complete	Complete	Thorough Inventory	
18d	Inner Harbor	Complete	Complete	Thorough Inventory	
18e	Sam Trans Peninsula	Complete	Complete	Thorough Inventory	
18f	Confluence Marsh	Complete	Complete	Thorough Inventory	
18g	San Bruno Marsh	Complete	Complete	Thorough Inventory	
18h	San Bruno Creek	Complete	Complete	Thorough Inventory	
19a	Brisbane Lagoon	Complete	Complete	Thorough Inventory	
19b	Sierra Point	Complete	Complete	Thorough Inventory	
19c	Oyster Cove	Complete	Complete	Thorough Inventory	
19d	Oyster Point Marina	Complete	Complete	Thorough Inventory	
19e	Oyster Point Park	Complete	Complete	Thorough Inventory	
19f	Point San Bruno	Complete	Complete	Thorough Inventory	
19g	Seaplane Harbor	Complete	Partial	Partial (restr. Construction access)	Pocket marsh access blocked. Not completely inventoried 2021-22
19h	SFO	Complete	Complete	Thorough Inventory	
19i	Mills Creek Mouth	Complete	Complete	Thorough Inventory	
19j	Easton Creek Mouth	Complete	Complete	Thorough Inventory	
19k	Sanchez Marsh	Complete	Complete	Thorough Inventory	
19l	Burlingame Lagoon	Partial	Complete	Thorough Inventory	
19m	Fisherman's Park	Complete	Complete	Thorough Inventory	Zero Detect since 2012
19n	Coyote Point Marina / Marsh	Complete	Complete	Thorough Inventory	
19o	San Mateo Creek / Ryder Park	Complete	Partial	Partial (restr. Construction access)	Northern 350 meters blocked
19p	Seal Slough Mouth - Central Marsh	Complete	Complete	Thorough Inventory	
19p	Seal Slough Mouth - Peripheral Marshes	Complete	Complete	Thorough Inventory	
19r	Anza Lagoon	Complete	Complete	Thorough Inventory	
	REGION 3: SAN MATEO	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
02a.1a	Belmont Slough Mouth	Partial	Complete	Focused mostly on 2021 features only, but thorough inventory	Thorough survey 2021, but not treated. Treat 2021 features 2022
02a.1b	Belmont Slough Mouth South	Partial	Complete	Focused mostly on 2021 features only, but thorough inventory	Thorough survey 2021, but not treated. Treat 2021 features 2022
02a.2	Upper Belmont Slough and Redwood Shores	Partial	Complete	Recent historic zone only	**Interior shorelines** None. Thorough survey 2017
02a.3	Bird Island	Partial	Partial	2021 features only	Thorough survey 2021, but not treated. Treat 2021 features 2022
02a.4	Redwood Shores Mitigation Bank	Complete	Complete	Thorough Inventory	
02b.1	Corkscrew Slough	Complete	Complete	Thorough Inventory	
02b.2	Steinberger Slough South, Redwood Creek Northwest	Complete	Complete	Thorough Inventory	
02c.1a	B2 North Quadrant West	Complete	Complete	Thorough Inventory	
02c.1b	B2 North Quadrant East	Partial	Partial	Coarse Mapping; Grids	**Southwest 1/3** Coarse mapping for ground treatment **Eastern 2/3** Coarse mapping during treatment **Low elevation Fringe** Coarse mapping during fringe treatment
02c.2	B2 North Quadrant South	Partial	Partial	Coarse Mapping	**Boardwalk Zone** Coarse mapping **Southern Tip** Coarse mapping **Interior** None
02d.1a	B2 South Quadrant West	None	None	None	
02d.1b	B2 South Quadrant East	None	None	None	
02d.2	B2 South Quadrant (2)	None	None	None	
02d.3	B2 South Quadrant (3)	None	None	None	
02e	West Point Slough NW	Complete	Complete	Thorough Inventory	
02f	Greco Island North	Complete	Complete	Thorough Inventory	
02g	West Point Slough SW and East	Complete	Complete	Thorough Inventory	
02h	Greco Island South	Complete	Complete	Thorough Inventory	
02i	Ravenswood Slough and Mouth	Complete	Complete	Thorough Inventory	
02j.1	Ravenswood Open Space Preserve (N of Hwy 92)	Complete	Complete	Thorough Inventory	
02k	Redwood Creek and Deepwater Slough	Complete	Complete	Thorough Inventory	
02l	Inner Bair	Complete	Complete	Thorough Inventory	
02m	Pond B3	Complete	Complete	Coarse Mapping	survey with SOLitude airboat during treatment
02o	Central Bair	Complete	Complete	Coarse Mapping	survey with SMC airboat during treatment
19q	Foster City	Complete	Complete	Thorough Inventory	
19s	Maple Street Channel	Complete	Complete	Thorough Inventory	Densi dig in June
	REGION 4: DUMBARTON SOUTH	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
02j.2	Ravenswood Open Space Preserve (S of Hwy 92)	Complete	Complete	Thorough Inventory	
02n	SF2	Complete	Complete	Thorough Inventory	**Interior** scanned from levees **Perimeter** on foot
05a.1	Mowry Marsh and Slough	None	None	n/a	
05a.2	Calaveras Marsh	Complete	Complete	Thorough Inventory	**Fringe** early season inventory during treatment
05b	Dumbarton/Audubon	Complete	Complete	Thorough Inventory	
05c.1	Newark Slough West	Complete	Complete	Thorough Inventory	
05c.2	Newark Slough East	Complete	Complete	Thorough Inventory	
05d	LaRiviere Marsh	Complete	Complete	Thorough Inventory	

05e	Mayhew's Landing	Complete	Complete	Thorough Inventory	
05f	Coyote Creek - Alameda County	Complete	Complete	Thorough Inventory	
05g	Cargill Pond (W Hotel)	Complete	Complete	Thorough Inventory	
05h	Plummer Creek Mitigation Marsh	Complete	Complete	Thorough Inventory	
05i	Island Ponds	Complete	Complete	Thorough Inventory	**A19** Complete with airboat and walking at higher tide **A20** Complete **A21** Complete
08	Palo Alto Baylands	Complete	Complete	Thorough Inventory	
15a.1	Charleston Slough to Mountainview Slough	Complete	Complete	Coarse Mapping	
15a.2	Stevens Ck to Guadalupe Slough	Complete	Complete	Coarse Mapping	
15a.3	Guadalupe Slough	Complete	Complete	Coarse Mapping	
15a.4	Alviso Slough	Complete	Complete	Coarse Mapping	
15a.5	Coyote Creek to Artesian Slough	Complete	Complete	Thorough Inventory	
15a.6	Knapp Tract	Complete	Complete	Thorough Inventory	Complete at 8" tide w/airboat
15a.7	Pond A17	Complete	Complete	Thorough Inventory	Complete at >6" tide w/airboat
15b	Faber / Laumeister Marsh	Complete	Complete	Thorough Inventory	
15c	Shoreline Regional Park	Complete	Complete	Thorough Inventory	
15d	Sunnyvale Baylands	Partial	Partial	Historics Only	**AB1:AB2** Complete **A2-A3** None
16.1	Cooley Landing Central	Complete	Complete	Thorough Inventory	
16.2	Cooley Landing East	Complete	Complete	Coarse Mapping	
n/a	Ponds A5, A7, A8, A8S	None	None	n/a	Perimeter walked 2021; no tidal action since 2015
	REGION 5: UNION CITY	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
01a	Channel Mouth	Complete	Complete	Thorough Inventory	
01b	Lower Channel	None	None	n/a	
01c	Upper Channel	None	None	n/a	
01d	Upper Channel - Union City Blvd to I-880	None	None	n/a	
01e	Strip Marsh No. of Channel Mouth	Complete	Complete	Thorough Inventory	
01f	Pond 3 - AFCC	None	None	n/a	
13a	Old Alameda Creek North Bank	Partial	Partial	Thorough Inventory	Downstream of E8A breach only
13b	Old Alameda Creek Island	None	Partial	Historics Only	Downstream of E8A breach; north bank only
13c	Old Alameda Creek South Bank	Partial	Partial	Thorough Inventory	Downstream of Cargill Mitigation only
13d	Whale's Tail North Fluke	Complete	Complete	Thorough Inventory	
13e	Whale's Tail South Fluke	Complete	Complete	Thorough Inventory	
13f	Cargill Mitigation Marsh	Complete	Complete	Thorough Inventory	
13g	Upstream of 20 Tide Gates	None	None	n/a	
13h	Eden Landing - North Creek	Complete	Complete	Thorough Inventory	
13i	Eden Landing - Pond 10	Partial	Partial	Historics Only	**Southern Portion** Complete inventory where now hydrologically connected to Mt Eden Creek **Main Pond** Scan from southern and western levees
13j	Eden Landing - Mt Eden Creek	Complete	Complete	Thorough Inventory	
13k	Eden Landing Reserve South - North Creek Marsh	Complete	Complete	Thorough Inventory	
13l	Eden Landing Reserve North - Mt Eden Creek Marsh	Complete	Complete	Thorough Inventory	
13m	Eden Landing - Ponds E8A, E9, and E8X	Complete	Partial	Thorough Inventory	**E9** thorough inventory by airboat and foot **E8A** partially by boat, foot (boat failure) **E8X** eastern bank walked
21a	Ideal Marsh North	Complete	Complete	Thorough Inventory	
21b	Ideal Marsh South	Complete	Complete	Thorough Inventory	
	REGION 6: HAYWARD	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
07a	Oro Loma Marsh - East	Complete	Complete	Thorough Inventory	R2 in reveg zone
07b	Oro Loma Marsh - West	Complete	Complete	Coarse Mapping	
20a	Oyster Bay Regional Shoreline	Complete	Complete	Thorough Inventory	
20b	Oakland Metropolitan Golf Links	Complete	Complete	Thorough Inventory	
20c	Dog Bone Marsh	Complete	Complete	Coarse Mapping	
20d.1	Citation Marsh South	Complete	Complete	Coarse Mapping	
20d.2a	Citation Marsh Upper	Complete	Complete	Coarse Mapping	
20d.2b	Citation Marsh Central	None	None	n/a	Partially inventoried by grid 2021
20e	East Marsh	Complete	Complete	Coarse Mapping	
20f	North Marsh	None	None	n/a	Partially inventoried by grid 2021
20g	Bunker Marsh	Complete	Complete	Coarse Mapping	
20h.1	San Lorenzo Creek and Mouth North	Complete	Complete	Coarse Mapping	
20h.2	San Lorenzo Creek and Mouth South	Complete	Complete	Coarse Mapping	
20i	Bockmann Channel	Complete	Complete	Thorough Inventory	
20j	Sulphur Creek	Complete	Complete	Thorough Inventory	
20k	Hayward Landing	Complete	Complete	Thorough Inventory	
20l	Johnson's Landing	Complete	Complete	Thorough Inventory	
20m	Cogswell Marsh A	Complete	Complete	Thorough Inventory	
20n.1	Cogswell Marsh B Bayfront	Complete	Complete	Coarse Mapping	
20n.2	Cogswell Marsh B South	Complete	Complete	Coarse Mapping	
20n.3	Cogswell Marsh B Main	None	None	n/a	Inventoried by grid 2021
20o	Cogswell Marsh C	Complete	Complete	Coarse Mapping	
20p	Hayward Shoreline Outliers	Complete	Complete	Coarse Mapping	
20q	San Leandro Shoreline Outliers	Complete	Complete	Coarse Mapping	
20r	Oakland Airport Shoreline and Channels	Complete	Complete	Thorough Inventory	
20s	H.A.R.D. Marsh	Complete	Complete	Thorough Inventory	
20t	San Leandro Marina	Complete	Complete	Thorough Inventory	

20u	Estudillo Creek Channel	Complete	Complete	Thorough Inventory	
20v	Hayward Landing Canal	Complete	Complete	Thorough Inventory	
20w	Triangle Marsh	Complete	Complete	Thorough Inventory	
	REGION 7: SAN LEANDRO BAY	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
17a	Alameda Island South (Elsie Roemer Bird Sanctuary, Crown Memorial State Beach, Crab Cove)	Complete	Complete	Thorough Inventory	**Elsie Roemer:** Complete inventory around foliosa plantings + R2
17b	Bay Farm Island	Complete	Complete	Coarse Mapping	
17c.1	Arrowhead Marsh West	Complete	Complete	Grids	Infestation wide spread enough to not warrant point/line/poly inventory
17c.2	Arrowhead Marsh East	None	None	n/a	Inventoried by grid 2021
17d.1	Fan Marsh Shoreline	Complete	Complete	Coarse Mapping	
17d.2	Airport Channel	Complete	Complete	Coarse Mapping	
17d.3	East Creek	Complete	Complete	Coarse Mapping	
17d.4	Damon Marsh	Complete	Complete	Coarse Mapping	
17d.5	Damon Slough / Elmhurst Creek	Complete	Complete	Coarse Mapping	
17e.1	San Leandro Creek North	Complete	Complete	Coarse Mapping	
17e.2	San Leandro Creek South	Complete	Complete	Coarse Mapping	
17f	Oakland Inner Harbor	Complete	Complete	Thorough Inventory	
17g	Coast Guard Island	Complete	Complete	Thorough Inventory	
17h	MLK New Marsh	None	None	n/a	Inventoried by grid 2021
17i	Coliseum Channels	Complete	Complete	Coarse Mapping	
17j.1	Fan Marsh Wings	Complete	Complete	Coarse Mapping	
17j.2	Fan Marsh Main	None	None	n/a	Inventoried by grid 2021
17k	Airport Channel	Complete	Complete	Coarse Mapping	
17l	Doolittle Pond	Complete	Complete	Coarse Mapping	
17m	Alameda Island (Aeolian Yacht Club and East Shore)	Complete	Complete	Coarse Mapping	
	REGION 8: BAY BRIDGE NORTH	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
06a	Emeryville Crescent East	Complete	Complete	Thorough Inventory	
06b	Emeryville Crescent West	Complete	Complete	Thorough Inventory	
10a	Whittel Marsh	Complete	Complete	Thorough Inventory	
10b	Southern Marsh	Complete	Complete	Thorough Inventory	
10c	Giant Marsh	Complete	Complete	Thorough Inventory	
10d	Breuner Marsh Restoration	Complete	Complete	Thorough Inventory	
22a	Wildcat Marsh	Complete	Complete	Thorough Inventory	
22b.1	San Pablo Marsh East	Complete	Complete	Thorough Inventory	
22b.2	San Pablo Marsh West	Complete	Complete	Thorough Inventory	
22c	Breuner Marsh (Rheem Creek)	Complete	Complete	Thorough Inventory	
22d	Stege Marsh	Complete	Complete	Thorough Inventory	
22e	Hoffman Marsh	Partial	Complete	Thorough Inventory	
22f	Richmond / Albany / Pinole Shoreline	Partial	Partial	Historics Only	**Pinole, Rodeo, Hercules** walked, boated by whaler **Crockett Shorelines** West of Caquinez Bridge completed by whaler **Brooks Island** Complete during annual shorebird surveys **Albany Shoreline** Complete **San Pablo Yacht Harbor** Complete **Stege Marsh Channels** None. Thorough survey 2021 **Point Richmond Marina** None. Thorough survey 2021 **Point Molate & Western Shoreline** None. Thorough survey 2020 **Castro Cove** Historics only
n/a	Berkeley Aquatic Park	None	None	n/a	Thorough survey 2021
	REGION 9: SUISUN	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
11	Southampton Marsh	Complete	Complete	Thorough Inventory	
27a	Point Buckler	Complete	Complete	Thorough Inventory	
27b	MOTCO Islands	Complete	Complete	Thorough Inventory	Explore interior channels denoted by ToDo points and Generic lines
27c	Honker Bay	Complete	Complete	Thorough Inventory	Explore interior channels denoted by ToDo points and Generic lines
27d	MOTCO mainland shoreline	Complete	Partial	Historics only	Winded out for kayak surveys
n/a	Suisun Bay Marshes	Partial	None	Thorough Inventory	**Grizzly Bay** Complete. Not surveyed since 2017
n/a	Benicia Shoreline	None	None	n/a	Thorough survey 2021
	REGION 10: VALLEJO	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
26a	White Slough / Napa River	Partial	Partial	Thorough Inventory	**American Canyon** None. Thorough survey 2020 **Napa River** Complete **Napa River Mouth** Complete **Vallejo** Complete **White Slough** None. Thorough survey 2020 **Napa Sonoma Marshes** Extensive survey w/CDFA airboat
26b	San Pablo Bay NWR and Mare Island	Partial	Complete	Thorough Inventory	Completed on foot and w/CDFA airboat
26c	Sonoma Creek	Complete	Complete	Thorough Inventory	Completed w/CDFA airboat
26d	Sonoma Baylands	Complete	Complete	Thorough Inventory	Completed w/CDFA airboat
n/a	Cullinan Ranch	Partial	None	None	Surveyed 2019 w/USFWS airboat

	REGION 11: PETALUMA	2022 Planned Inventory Coverage	2022 Completed Inventory Coverage	2022 Inventory Approach Completed	Inventory Boundary Detail (where needed) and Notes and Notes
24a	Upper Petaluma River - Upstream of Grey's Field	Complete	Complete	Thorough Inventory	Survey on foot with whaler support
24b	Grey's Field	Complete	Complete	Thorough Inventory	Complete inventory needed since 2019 due to new clone detection
24c	Petaluma Marsh	Partial	Partial	Historics [Zone] Only	Surveyed main slough and all accessible channels w/CDFA airboat
24d	Lower Petaluma River - Downstream of San Antonio Creek	Partial	Partial	Thorough Inventory	**Point Sonoma Marina** Complete **Bahia Restoration, Petaluma River Black John Slough-North, Petaluma River Black John Slough-South, Petaluma River Carl's Marsh, Rush Creek** All No survey: Low Risk of Infestation >3.5 km
	REGION 12: OUTER COAST	**2022 Planned Inventory Coverage**	**2022 Completed Inventory Coverage**	**2022 Inventory Approach Completed**	**Inventory Boundary Detail (where needed) and Notes**
25a	Tom's Point, Tomales	Complete	Partial	Historics only	**Tom's Point** surveyed for *S. densiflora* only **Hog Island Oyster Farm** surveyed for *S. densiflora* only **Tomales Bay, Walker Creek, Giacomini, Bivalve** Complete. Not surveyed since 2015
25b	Limantour Estero	None	None	n/a	Thorough survey 2021
25c	Drakes Estero	None	None	n/a	Thorough survey 2021
25d	Bolinas Lagoon, North	Partial	Partial	Historics only	**Northern and Eastern shorelines** Complete inventory **Western shoreline** None; no infestation history
25e	Bolinas Lagoon, South	None	None	n/a	**Southern Marsh** Thorough survey 2021 **Housing shoreline** Last completed in 2019
n/a	Bodega Bay	None	None	n/a	
n/a	Dillon Beach	None	None	n/a	

Appendix V. 2021 Regional Inventory & Treatment Summary Tables

Split	2021 Treatment Dates	2021 Treatment Method	2021 Net *Spartina* Coverage By Species					All Invasive *Spartina* Cover				
											Net Area Decline	
			anglica	*patens*	*densiflora x foliosa*	*alterniflora x foliosa*	*densiflora*	2021 Net Area	2021 Treatment Area	Peak Year	Since Peak	Since 2020
REGION 1: MARIN												
03a: Blackie's Creek (above bridge)	3 years with No Invasive Spartina (2019-2021)			0		0	0	0	0	2005	100%	n/a
03b: Blackie's Creek Mouth	5 years with No Invasive Spartina (2017-2021)			0		0	0	0	0	2005	100%	n/a
04a: Corte Madera Ecological Reserve	10/19	Dug, Backpack		0		0.05 m²	0	0.05 m²	2 m²	2005	>99%	93%
04b: College of Marin Ecological Study Area	4/7/22	Dug		0		0	0.001 m²	0.001 m²	0.07 m²	2004	>99%	n/a
04c: Piper Park East	No Invasive Spartina 2021			0		0	0	0	0	2005	100%	100%
04d: Piper Park West	1/10/22	Dug		0		0	0.009 m²	0.009 m²	0.1 m²	2005	>99%	n/a
04e: Larkspur Ferry Landing Area	10/19	Backpack		0		0.1 m²	0	0.1 m²	11 m²	2005	>99%	72%
04f: Riviera Circle	6/4	Dug, Backpack		0		0	0.01 m²	0.01 m²	0.05 m²	2005	>99%	89%
04g: Creekside Park	6/8; 7/30; 9/3; 1/10/22; 2/24/22	Dug, Backpack		0.13 m² 0.01 m²		0	0.1 m²	0.2 m²	0	2005	>99%	80%
04h: Upper Corte Madera Creek (Above Bon Air Rd)	7/30; 9/8; 4/7/22	Dug, Backpack		0.172 m²		0.07 m²	0	0.2 m²	7 m²	2006	>99%	Increase (0.08 m²)
04i: Lower Corte Madera Creek (Bon Air Rd to HWY 101)	6/9; 7/30; 9/8; 10/19; 1/11/22; 2/25/22; 4/7/22	Dug, Backpack		0.02 m²		1 m²	0.03 m²	1 m²	39 m²	2005	>99%	Increase (0.6 m²)
04j.1: Corte Madera Creek Mouth - North Bank	7/30; 10/19; 1/25/22	Dug, Backpack		0.004 m²		3 m²	0.001 m²	3 m²	78 m²	2007	>99%	Increase (2 m²)
04j.2: Corte Madera Creek Mouth - South Bank	10/19	Dug, Backpack		0		0.4 m²	0	0.4 m²	11 m²	2007	>99%	Increase (0.3 m²)
04k: Boardwalk No. 1 (Arkites)	6/10; 1/12/22	Dug		0		0	0.04 m²	0.04 m²	0.1 m²	2006	>99%	n/a
04l: Murphy Creek	No Invasive Spartina 2021			0		0	0	0	0	2007	100%	100%
09: Tiscornia Marsh / Pickleweed Park	9/2; 10/5	Backpack		0		2 m²	0	2 m²	69 m²	2004	99%	24%
23a: Brickyard Cove	8/25	Backpack		0		0.2 m²	0	0.2 m²	1 m²	2008	>99%	22%
23b: Beach Drive	8/25	Backpack		0		1 m²	0	1 m²	84 m²	2006	>99%	82%
23c: Loch Lomond Marina	3 years with No Invasive Spartina (2019-2021)			0		0	0	0	0	2004	100%	n/a
23d.1: San Rafael Canal Mouth East	9/24	Backpack		0		4 m²	0	4 m²	255 m²	2007	98%	35%
23d.2: San Rafael Canal Mouth West	9/2	Backpack		0		0.8 m²	0	0.8 m²	38 m²	2004	>99%	Increase (0.6 m²)
23e: Muzzi and Martas Marsh	6/4; 9/8; 9/15; 1/25/22	Dug, Backpack		0		38 m²	0.06 m²	38 m²	0.3 acres	2007	93%	Increase (36 m²)
23f: Paradise Cay	11/3; 2/3/22	Dug, Backpack		0		0.1 m²	0.02 m²	0.2 m²	4 m²	2005	>99%	n/a
23g: Greenwood Cove	4/7/22	Dug		0.004 m²		0	0	0.004 m²	0.1 m²	2006	>99%	82%
23h: Strawberry Point	11/2; 1/18/22	Dug		0		0.03 m²	0.001 m²	0.03 m²	3 m²	2005	>99%	76%
23i: Strawberry Cove	8/25	Backpack		0		0.8 m²	0	0.8 m²	25 m²	2007	>99%	66%
23j: Bothin Marsh	Not Treated (Disappeared) in 2021			0		0.002 m²	0	0.002 m²	0.03 m²	2006	>99%	96%
23k: Sausalito	7 years with No Invasive Spartina (2015-2021)			0		0	0	0	0	2004	100%	n/a
23l: Starkweather Park	6 years with No Invasive Spartina (2016-2021)			0		0	0	0	0	2006	100%	n/a
23m: Novato	6 years with No Invasive Spartina (2016-2021)			0		0	0	0	0	2006	100%	n/a
23n: Triangle Marsh and shoreline	3 years with No Invasive Spartina (2019-2021)			0		0	0	0	0	2007	100%	n/a
23o: China Camp	5 years with No Invasive Spartina (2017-2021)			0		0	0	0	0	2010	100%	n/a
REGION 1 TOTAL				0.13 m² 0.213 m²		52 m²	0.3 m²	52 m²	0.4 acres	2005	>99%	112% increase (28 m²)
REGION 2: SAN FRANCISCO PENINSULA												
12a: Pier 94	6 years with No Invasive Spartina (2016-2021)			0		0	0	0	0	2005	100%	n/a
12b: Pier 98 / Heron's Head	4 years with No Invasive Spartina (2018-2021)			0		0	0	0	0	2008	100%	n/a
12c: India Basin	8 years with No Invasive Spartina (2014-2021)			0		0	0	0	0	2005	100%	n/a

Split	2021 Treatment Dates	2021 Treatment Method	2021 Net *Spartina* Coverage By Species					All Invasive *Spartina* Cover				
											Net Area Decline	
			anglica	*patens*	*densiflora x foliosa*	*alterniflora x foliosa*	*densiflora*	2021 Net Area	2021 Treatment Area	Peak Year	Since Peak	Since 2020
12d: Hunters Point Naval Reserve	5 years with No Invasive Spartina (2017-2021)		0			0	0	0	0	2008	100%	n/a
12e: Yosemite Channel	No Invasive Spartina 2021		0			0	0	0	0	2004	100%	100%
12f: Candlestick Cove	7 years with No Invasive Spartina (2015-2021)		0			0	0	0	0	2006	100%	n/a
12g: Crissy Field	8 years with No Invasive Spartina (2014-2021)		0			0	0	0	0	2008	100%	n/a
12h: Yerba Buena Island	8 years with No Invasive Spartina (2014-2021)		0			0	0	0	0	2006	100%	n/a
12i: Mission Creek	8 years with No Invasive Spartina (2014-2021)		0			0	0	0	0	2009	100%	n/a
18a: Colma Creek	4 years with No Invasive Spartina (2018-2021)		0			0	0	0	0	2005	100%	n/a
18b: Navigable Slough	5 years with No Invasive Spartina (2017-2021)		0			0	0	0	0	2006	100%	n/a
18c: Old Shipyard	3 years with No Invasive Spartina (2019-2021)		0			0	0	0	0	2006	100%	n/a
18d: Inner Harbor	8 years with No Invasive Spartina (2014-2021)		0			0	0	0	0	2006	100%	n/a
18e: Sam Trans Peninsula	No Invasive Spartina 2021		0			0	0	0	0	2004	100%	100%
18f: Confluence Marsh	5 years with No Invasive Spartina (2017-2021)		0			0	0	0	0	2004	100%	n/a
18g: San Bruno Marsh	3 years with No Invasive Spartina (2019-2021)		0			0	0	0	0	2004	100%	n/a
18h: San Bruno Creek	9/29	Backpack	0			0.05 m²	0	0.05 m²	1 m²	2006	>99%	76%
19a: Brisbane Lagoon	No Invasive Spartina 2021		0			0	0	0	0	2006	100%	100%
19b: Sierra Point	7 years with No Invasive Spartina (2015-2021)		0			0	0	0	0	2004	100%	n/a
19c: Oyster Cove	7 years with No Invasive Spartina (2015-2021)		0			0	0	0	0	2006	100%	n/a
19d: Oyster Point Marina	7 years with No Invasive Spartina (2015-2021)		0			0	0	0	0	2006	100%	n/a
19e: Oyster Point Park	No Invasive Spartina 2021		0			0	0	0	0	2005	100%	100%
19f: Point San Bruno	No Invasive Spartina 2021		0			0	0	0	0	2005	100%	100%
19g: Seaplane Harbor	4 years with No Invasive Spartina (2018-2021)		0			0	0	0	0	2004	100%	n/a
19h: SFO	9/23; 9/29	Backpack	0			5 m²	0	5 m²	153 m²	2004	>99%	Increase (2 m²)
19i: Mills Creek Mouth	No Invasive Spartina 2021		0			0	0	0	0	2005	100%	100%
19j: Easton Creek Mouth	9/23	Backpack	0			0.5 m²	0	0.5 m²	15 m²	2004	>99%	Increase (0.3 m²)
19k: Sanchez Marsh	7/28	Backpack	0			11 m²	0	11 m²	404 m²	2004	>99%	48%
19l: Burlingame Lagoon	7/28	Backpack	0			1 m²	0	1 m²	37 m²	2004	>99%	7%
19m: Fisherman's Park	10 years with No Invasive Spartina (2012-2021)		0			0	0	0	0	2005	100%	n/a
19n: Coyote Point Marina / Marsh	No Invasive Spartina 2021		0			0	0	0	0	2004	100%	100%
19o: San Mateo Creek / Ryder Park	8/12	Backpack	0			1 m²	0	1 m²	28 m²	2006	>99%	n/a
19p.1: Seal Slough Mouth - Central Marsh	8/12	Backpack	0			0.05 m²	0	0.05 m²	1 m²	2004	>99%	68%
19p.2: Seal Slough Mouth - Peripheral Marshes	8/12	Backpack	0			0.3 m²	0	0.3 m²	13 m²	2004	>99%	Increase (0.08 m²)
19r: Anza Lagoon	6 years with No Invasive Spartina (2016-2021)		0			0	0	0	0	2004	100%	n/a
REGION 2 TOTAL			0			19 m²	0	19 m²	652 m²	2004	>99%	28%
REGION 3: SAN MATEO												
02a.1a: Belmont Slough Mouth	Not Treated in 2021		0			5 m²	0	5 m²	191 m²	2004	>99%	Increase (3 m²)
02a.1b: Belmont Slough Mouth South	Not Treated in 2021		0			2 m²	0	2 m²	105 m²	2004	>99%	31%
02a.2: Upper Belmont Slough and Redwood Shores	9/1; 9/13-9/15; 10/5	Truck, Backpack, Airboat	0			22 m²	0	22 m²	794 m²	2004	>99%	9%
02a.3: Bird Island	Not Treated in 2021		0			8 m²	0	8 m²	252 m²	2006	>99%	Increase (4 m²)
02a.4: Redwood Shores Mitigation Bank	9/14	Backpack	0			0.002 m²	0	0.002 m²	0.1 m²	2015	>99%	98%
02b.1: Corkscrew Slough	8/14; 9/10; 9/29	Backpack, Airboat	0			29 m²	0	29 m²	843 m²	2004	>99%	50%
02b.2: Steinberger Slough South, Redwood Creek Northwest	8/2; 9/27; 9/29; 11/24	Backpack, Airboat	0			58 m²	0	58 m²	0.5 acres	2004	>99%	64%
02c.1a: B2 North West	9/27-9/28; 11/10	Backpack, Airboat	0			179 m²	0	179 m²	1.1 acres	2005	>99%	39%
02c.1b: B2 North East	8/24	Airboat, Aerial: Broadcast	0			2.1 acres	0	2.1 acres	27.3 acres	2005	91%	Increase (0.4 acres)

Split	2021 Treatment Dates	2021 Treatment Method	2021 Net *Spartina* Coverage By Species					All Invasive *Spartina* Cover				
			anglica	*patens*	*densiflora x foliosa*	*alterniflora x foliosa*	*densiflora*	2021 Net Area	2021 Treatment Area	Peak Year	Net Area Decline	
											Since Peak	Since 2020
02c.2: B2 North South	8/12-8/13; 8/25-8/26; 11/10-11/11; 11/24	Backpack, Airboat	0			927 m²	0	927 m²	6.7 acres	2006	98%	43%
02d.1a: B2 South West	10/27	Backpack	0			2 m²	0	2 m²	62 m²	2004	>99%	65%
02d.1b: B2 South East	10/27	Backpack	0			0.08 m²	0	0.08 m²	2 m²	2004	>99%	29%
02d.2: B2 South (2)	10/27	Backpack	0			3 m²	0	3 m²	104 m²	2006	>99%	23%
02d.3: B2 South (3)	10/27	Backpack	0			1 m²	0	1 m²	46 m²	2009	>99%	68%
02e: West Point Slough NW	9/10	Backpack, Airboat	0			6 m²	0	6 m²	107 m²	2005	>99%	20%
02f: Greco Island North	8/25; 8/26; 9/10-9/11; 10/26	Backpack, Airboat	0			93 m²	0	93 m²	0.8 acres	2008	>99%	57%
02g: West Point Slough SW and East	7/30; 8/27; 9/27	Backpack, Airboat	0			12 m²	0	12 m²	326 m²	2005	>99%	66%
02h: Greco Island South	8/27; 9/11; 11/8	Backpack, Airboat	0			17 m²	0	17 m²	462 m²	2005	>99%	Increase (3 m²)
02i: Ravenswood Slough and Mouth	9/16; 11/8	Backpack	0			9 m²	0	9 m²	305 m²	2004	>99%	39%
02j.1: Ravenswood Open Space Preserve (N of Hwy 84)	9/9; 10/12	Backpack	0			3 m²	0	3 m²	105 m²	2006	>99%	Increase (0.2 m²)
02k: Redwood Creek and Deepwater Slough	8/14; 8/25; 9/10; 11/24	Backpack, Airboat	0			133 m²	0	133 m²	0.8 acres	2009	99%	51%
02l: Inner Bair	9/14	Backpack	0			0.5 m²	0	0.5 m²	23 m²	2006	>99%	84%
02m: Pond B3	8/30; 9/14-9/15; 9/30; 10/14	Airboat	0			825 m²	0	825 m²	1.7 acres	2014	46%	43%
02o: Central Bair	8/2-8/3; 10/15	Airboat	0			140 m²	0	140 m²	0.7 acres	2016	35% increase (36.1 m²)	Increase (78 m²)
19q: Foster City	12/2	Backpack	0			0.01 m²	0	0.01 m²	0.9 m²	2004	>99%	100%
19s: Maple Street Channel	3 years with No Invasive Spartina (2019-2021)		0			0	0	0	0	2011	100%	n/a
REGION 3 TOTAL			0			2.7 acres	0	2.7 acres	40.6 acres	2004	98%	0.3%
REGION 4: DUMBARTON SOUTH												
02j.2: Ravenswood Open Space Preserve (S of Hwy 84)	9/14	Backpack	0			2 m²	0	2 m²	67 m²	2006	>99%	82%
02n: SF2	4 years with No Invasive Spartina (2018-2021)		0			0	0	0	0	2013	100%	n/a
05a.1: Mowry Marsh and Slough	8/27; 11/12	Backpack, Airboat	0			24 m²	0	24 m²	678 m²	2008	>99%	75%
05a.2: Calaveras Marsh	7/30; 9/29; 11/12	Backpack, Amphibious vehicle, Airboat	0			77 m²	0	77 m²	0.3 acres	2007	>99%	68%
05b: Dumbarton/Audubon	8/27; 9/28; 9/30; 11/12	Backpack, Airboat	0			47 m²	0	47 m²	989 m²	2006	>99%	26%
05c.1: Newark Slough West	9/28	Backpack, Airboat	0			27 m²	0	27 m²	628 m²	2004	>99%	Increase (14 m²)
05c.2: Newark Slough East	9/29; 9/30	Backpack, Airboat	0			7 m²	0	7 m²	42 m²	2005	>99%	17%
05d: LaRiviere Marsh	9/29; 11/8	Backpack	0			4 m²	0	4 m²	278 m²	2006	>99%	Increase (0.02 m²)
05e: Mayhew's Landing	9/29	Backpack	0			3 m²	0	3 m²	85 m²	2004	>99%	Increase (2 m²)
05f: Coyote Creek - Alameda County	9/30; 11/30	Backpack, Airboat	0			12 m²	0	12 m²	298 m²	2008	93%	65%
05g: Cargill Pond (W Hotel)	9/29	Backpack	0			3 m²	0	3 m²	178 m²	2010	>99%	49%
05h: Plummer Creek Mitigation Marsh	9/30; 11/8	Backpack	0			3 m²	0	3 m²	111 m²	2011	98%	Increase (2 m²)
05i: Island Ponds	10/1; 10/13	Airboat	0			5 m²	0	5 m²	183 m²	2017	97%	54%
08: Palo Alto Baylands	9/1; 10/13; 11/8	Truck, Backpack, Airboat	0			24 m²	0	24 m²	803 m²	2009	>99%	79%
15a.1: Charleston Slough to Mountainview Slough	7/29	Backpack	0			21 m²	0	21 m²	286 m²	2004	>99%	Increase (5 m²)
15a.2: Stevens Ck to Guadalupe Sl	8/13	Backpack	0			11 m²	0	11 m²	283 m²	2008	>99%	26%

Split	2021 Treatment Dates	2021 Treatment Method	2021 Net *Spartina* Coverage By Species					All Invasive *Spartina* Cover				
			anglica	*patens*	*densiflora x foliosa*	*alterniflora x foliosa*	*densiflora*	2021 Net Area	2021 Treatment Area	Peak Year	Net Area Decline Since Peak	Net Area Decline Since 2020
15a.3: Guadalupe Slough	8/13; 9/2; 10/12; 10/29	Backpack, Airboat	0			66 m²	0	66 m²	0.4 acres	2008	98%	Increase (16 m²)
15a.4: Alviso Slough	8/3; 8/20; 8/31; 9/13; 9/27-9/28; 10/12; 10/13; 11/12	Backpack, Airboat	0			856 m²	0	856 m²	4 acres	2007	91%	Increase (267 m²)
15a.5: Coyote Creek to Artesian Slough	9/30	Backpack, Airboat	0			48 m²	0	48 m²	0.3 acres	2017	94%	67%
15a.6: Knapp Tract	9/2	Airboat	0			12 m²	0	12 m²	141 m²	2017	44%	0%
15a.7: Pond 17	No Invasive Spartina Ever Detected		0			0	0	0	0	0	n/a	n/a
15b: Faber / Laumeister Marsh	8/26; 9/1; 11/8	Backpack	0			15 m²	0	15 m²	447 m²	2008	>99%	70%
15c: Shoreline Regional Park	9/28; 11/8	Backpack	0			11 m²	0	11 m²	453 m²	2006	>99%	78%
15d: Sunnyvale Baylands	8/13	Backpack	0			3 m²	0	3 m²	27 m²	n/a	n/a	n/a
16.1: Cooley Landing Central	8/25-8/26; 9/1	Truck, Backpack, Airboat	0			32 m²	0	32 m²	0.4 acres	2008	>99%	38%
16.2: Cooley Landing East	8/25-8/26; 9/1	Truck, Backpack, Airboat	0			195 m²	0	195 m²	1.9 acres	2008	>99%	11%
REGION 4 TOTAL			0			0.4 acres	0	0.4 acres	8.7 acres	2008	>99%	15%
REGION 5: UNION CITY												
01a: Channel Mouth	9/28; 10/1	Backpack	0			1 m²	0	1 m²	19 m²	2004	>99%	Increase (0.9 m²)
01b: Lower Channel	10/1	Backpack	0			5 m²	0	5 m²	73 m²	2004	>99%	Increase (3 m²)
01c: Upper Channel	No Invasive Spartina 2021		0			0	0	0	0	2004	100%	100%
01d: Upper Channel - Union City Blvd to I-880	5 years with No Invasive Spartina (2017-2021)		0			0	0	0	0	2005	100%	n/a
01e: Strip Marsh No. of Channel Mouth	10/1	Backpack	0			0.06 m²	0	0.06 m²	3 m²	2004	>99%	89%
01f: Pond 3 - AFCC	2 years with No Invasive Spartina (2020-2021)		0			0	0	0	0	2005	100%	n/a
13a: Old Alameda Creek North Bank	No Invasive Spartina 2021		0			0	0	0	0	2005	100%	100%
13b: Old Alameda Creek Island	10/14	Backpack	0			0.02 m²	0	0.02 m²	1 m²	2005	>99%	48%
13c: Old Alameda Creek South Bank	9/10; 10/14	Backpack	0			2 m²	0	2 m²	60 m²	2005	>99%	18%
13d: Whale's Tail North Fluke	8/27; 9/10	Backpack	0			2 m²	0	2 m²	65 m²	2005	>99%	Increase (0.2 m²)
13e: Whale's Tail South Fluke	9/10	Backpack	0			0.9 m²	0	0.9 m²	28 m²	2005	>99%	Increase (0.5 m²)
13f: Cargill Mitigation Marsh	No Invasive Spartina 2021		0			0	0	0	0	2004	100%	100%
13g: Upstream of 20 Tide Gates	No Invasive Spartina 2021		0			0	0	0	0	2005	100%	100%
13h: Eden Landing - North Creek	10/14	Backpack	0			0.09 m²	0	0.09 m²	8 m²	2007	>99%	95%
13i: Eden Landing - Pond 10	8/27	Backpack	0			0.5 m²	0	0.5 m²	13 m²	2008	>99%	n/a
13j: Eden Landing - Mt Eden Creek	8/27	Backpack	0			4 m²	0	4 m²	135 m²	2009	>99%	26%
13k: Eden Landing Reserve South - North Creek Marsh	8/2; 8/25; 11/2	Backpack, Airboat	0			37 m²	0	37 m²	0.4 acres	2009	91%	25%
13l: Eden Landing Reserve North - Mt Eden Creek Marsh	8/17; 8/25; 8/27; 11/2	Backpack	0			32 m²	0	32 m²	1011 m²	2010	80%	Increase (7 m²)
13m: Eden Landing - Ponds E8A, E9, and E8X	8/2; 10/14	Backpack, Airboat	0			22 m²	0	22 m²	290 m²	2014	34%	Increase (9 m²)
21a: Ideal Marsh North	9/28	Backpack	0			0.5 m²	0	0.5 m²	28 m²	2005	>99%	Increase (0.05 m²)
21b: Ideal Marsh South	9/28	Backpack	0			0.02 m²	0	0.02 m²	0.8 m²	2006	>99%	98%
REGION 5 TOTAL			0			107 m²	0	107 m²	0.8 acres	2004	>99%	2% increase (2 m²)
REGION 6: HAYWARD												
07a: Oro Loma Marsh - East	10/28-10/29	Backpack, Airboat	0			19 m²	0	19 m²	418 m²	2008	>99%	15%
07b: Oro Loma Marsh - West	10/28-10/29	Backpack, Airboat	0			101 m²	0	101 m²	0.6 acres	2005	>99%	22%
20a: Oyster Bay Regional Shoreline	7/16	Backpack	0			0.7 m²	0	0.7 m²	32 m²	2004	>99%	71%
20b: Oakland Metropolitan Golf Links	7/16	Backpack	0			0.6 m²	0	0.6 m²	29 m²	2009	>99%	Increase (0.2 m²)

Split	2021 Treatment Dates	2021 Treatment Method	2021 Net *Spartina* Coverage By Species					All Invasive *Spartina* Cover				
											Net Area Decline	
			anglica	*patens*	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2021 Net Area	2021 Treatment Area	Peak Year	Since Peak	Since 2020
20c: Dog Bone Marsh	11/10	Backpack	0			3 m²	0	3 m²	158 m²	2006	>99%	Increase (3 m²)
20d.1: Citation Marsh South	11/10	Truck, Backpack	0			66 m²	0	66 m²	758 m²	2004	98%	34%
20d.2a: Citation Marsh Upper	8/23-8/24; 9/23-9/24; 10/8; 10/11	Truck, Backpack	0			0.6 acres	0	0.6 acres	5.5 acres	2006	90%	76%
20d.2b: Citation Marsh Central	No Treatment Authorized since 2010		0			2.7 acres	0	2.7 acres	23.5 acres	2006	61%	23%
20e: East Marsh	10/15	Backpack	0			10 m²	0	10 m²	285 m²	2006	>99%	Increase (7 m²)
20f: North Marsh	No Treatment Authorized since 2010		0			6.9 acres	0	6.9 acres	59.9 acres	2006	61%	14%
20g: Bunker Marsh	10/12; 10/27; 11/10	Truck, Backpack	0			363 m²	0	363 m²	2.1 acres	2004	>99%	68%
20h.1: San Lorenzo Creek and Mouth North	10/15	Backpack	0			12 m²	0	12 m²	287 m²	2004	>99%	Increase (9 m²)
20h.2: San Lorenzo Creek and Mouth South	10/12	Backpack	0			292 m²	0	292 m²	0.5 acres	2004	>99%	Increase (245 m²)
20i: Bockmann Channel	7/29	Backpack	0			0.3 m²	0	0.3 m²	13 m²	2004	>99%	82%
20j: Sulphur Creek	7/29	Backpack	0			0.2 m²	0	0.2 m²	9 m²	2004	>99%	97%
20k: Hayward Landing	No Invasive Spartina 2021		0			0	0	0	0	2004	100%	100%
20l: Johnson's Landing	7/29	Backpack	0			0.3 m²	0	0.3 m²	17 m²	2005	>99%	Increase (0.08 m²)
20m: Cogswell Marsh A	8/16	Backpack	0			0.7 m²	0	0.7 m²	14 m²	2005	>99%	82%
20n.1: Cogswell Marsh B Bayfront	11/24	Truck, Backpack	0			451 m²	0	451 m²	1.8 acres	2005	98%	38%
20n.2: Cogswell Marsh B South	11/12	Truck	0			114 m²	0	114 m²	0.5 acres	2005	>99%	16%
20n.3: Cogswell Marsh B Main	8/24; 12/2	Aerial Broadcast for Seed Suppression; Backpack as permitted around revegetation plantings	0			0.7 acres	0	0.7 acres	9.9 acres	2005	98%	80%
20o: Cogswell Marsh C	10/28; 11/24	Truck, Backpack	0			116 m²	0	116 m²	0.9 acres	2005	>99%	75%
20p: Hayward Shoreline Outliers	7/29	Backpack	0			0.04 m²	0	0.04 m²	1 m²	2008	>99%	96%
20q: San Leandro Shoreline Outliers	11/12	Backpack	0			9 m²	0	9 m²	24 m²	2006	>99%	Increase (7 m²)
20r: Oakland Airport Shoreline and Channels	10/5	Backpack	0			2 m²	0	2 m²	77 m²	2006	>99%	15%
20s: H.A.R.D. Marsh	8/16	Backpack	0			1 m²	0	1 m²	34 m²	2006	>99%	10%
20t: San Leandro Marina	7/20	Backpack	0			0.02 m²	0	0.02 m²	0.2 m²	2009	>99%	96%
20u: Estudillo Creek Channel	7/20; 11/29	Truck, Backpack	0			19 m²	0	19 m²	558 m²	2010	98%	73%
20v: Hayward Landing Canal	7/29	Backpack	0			0.2 m²	0	0.2 m²	6 m²	2006	>99%	90%
20w: Triangle Marsh	7/29	Backpack	0			0.02 m²	0	0.02 m²	1 m²	2007	>99%	99%
REGION 6 TOTAL			0			11.3 acres	0	11.3 acres	106 acres	2005	95%	39%
REGION 7: SAN LEANDRO BAY												
17a: Alameda Island South (Elsie Roemer Bird Sanctuary, Crown Memorial State Beach, Crab Cove)	8/10; 10/4; 11/8 (R2)	Backpack	0			4 m²	0	4 m²	112 m²	2006	>99%	Increase (2 m²)
17b: Bay Farm Island	8/10	Backpack	0			2 m²	0	2 m²	29 m²	2005	>99%	4%
17c.1: Arrowhead Marsh West	11/2-11/3	Backpack, Airboat	0			0.3 acres	0	0.3 acres	6.3 acres	2005	97%	52%
17c.2: Arrowhead Marsh East	No Treatment Authorized since 2010		0			3.3 acres	0	3.3 acres	19.8 acres	2006	80%	26%
17d.1: Fan Marsh Shoreline	7/19	Airboat	0			10 m²	0	10 m²	474 m²	2004	>99%	82%
17d.2: Airport Channel Shoreline	7/19; 8/10	Backpack	0			24 m²	0	24 m²	687 m²	2005	>99%	67%
17d.3: East Creek	7/19	Backpack	0			18 m²	0	18 m²	381 m²	2004	>99%	12%
17d.4: Damon Marsh	11/2	Truck, Backpack, Airboat	0			216 m²	0	216 m²	0.8 acres	2006	>99%	55%
17d.5: Damon Slough / Elmhurst Creek	7/19	Backpack	0			4 m²	0	4 m²	292 m²	2005	>99%	26%
17e.1: San Leandro Creek North	7/19	Backpack	0			0.08 m²	0	0.08 m²	6 m²	2005	>99%	94%
17e.2: San Leandro Creek South	7/19	Backpack	0			3 m²	0	3 m²	83 m²	2005	>99%	67%

Split	2021 Treatment Dates	2021 Treatment Method	2021 Net *Spartina* Coverage By Species					All Invasive *Spartina* Cover				
											Net Area Decline	
			anglica	*patens*	*densiflora x foliosa*	*alterniflora x foliosa*	*densiflora*	2021 Net Area	2021 Treatment Area	Peak Year	Since Peak	Since 2020
17f: Oakland Inner Harbor	8/30; 10/4; 11/30	Backpack, Airboat	0			6 m²	0	6 m²	118 m²	2007	>99%	Increase (5 m²)
17g: Coast Guard Island	11/30	Backpack	0			1 m²	0	1 m²	3 m²	2007	>99%	Increase (1 m²)
17h: MLK New Marsh	No Treatment Authorized since 2010		0			3.5 acres	0	3.5 acres	23.9 acres	2006	53%	33%
17i: Coliseum Channels	11/29	Backpack	0			19 m²	0	19 m²	559 m²	2005	>99%	9%
17j.1: Fan Marsh Wings	7/20	Backpack	0			23 m²	0	23 m²	374 m²	2005	>99%	Increase (13 m²)
17j.2: Fan Marsh Main	No Treatment Authorized since 2010		0			0.8 acres	0	0.8 acres	8.5 acres	2006	88%	4%
17k: Airport Channel	7/19	Backpack, Airboat	0			1 m²	0	1 m²	52 m²	2005	>99%	10%
17l: Doolittle Pond	7/19	Backpack	0			0.01 m²	0	0.01 m²	0.1 m²	2004	>99%	98%
17m: Alameda Island (Aeolian Yacht Club and East Shore)	8/10	Backpack	0			14 m²	0	14 m²	155 m²	2006	>99%	Increase (8 m²)
REGION 7 TOTAL			0			8 acres	0	8 acres	60.1 acres	2006	91%	29%
REGION 8: BAY BRIDGE NORTH												
06a: Emeryville Crescent East	10/14	Backpack	0			5 m²	0	5 m²	143 m²	2005	>99%	Increase (1 m²)
06b: Emeryville Crescent West	10/14; 10/27	Backpack	0			13 m²	0	13 m²	440 m²	2004	>99%	Increase (8 m²)
10a: Whittell Marsh	8/19	Backpack	0			0.3 m²	0	0.3 m²	8 m²	2005	>99%	99%
10b: Southern Marsh	No Invasive Spartina 2021		0			0	0	0	0	2010	100%	100%
10c: Giant Marsh	9/30	Backpack	0			0.1 m²	0	0.1 m²	15 m²	2005	>99%	95%
10d: Breuner Marsh Restoration	9/30	Backpack	0			0.7 m²	0	0.7 m²	23 m²	2016	81%	Increase (0.7 m²)
22a: Wildcat Marsh	9/9; 9/27	Backpack, Airboat	0			12 m²	0	12 m²	351 m²	2010	>99%	41%
22b.1: San Pablo Marsh East	9/27; 9/30; 10/1	Backpack, Airboat	0			7 m²	0	7 m²	320 m²	2009	>99%	38%
22b.2: San Pablo Marsh West	9/27; 9/30; 11/2	Backpack, Airboat	0			7 m²	0	7 m²	52 m²	2006	>99%	46%
22c: Breuner Marsh (Rheem Creek)	9/30; 10/4	Backpack	0			7 m²	0	7 m²	310 m²	2009	>99%	44%
22d: Stege Marsh	11/2	Backpack	0			0.5 m²	0	0.5 m²	14 m²	2009	>99%	n/a
22e: Hoffman Marsh	10/5	Backpack	0			0.1 m²	0	0.1 m²	0.7 m²	2004	>99%	Increase (0.003 m²)
22f: Richmond / Albany / Pinole Shoreline	8/11; 10/5	Backpack	0			6 m²	0	6 m²	207 m²	2004	>99%	90%
REGION 8 TOTAL			0			59 m²	0	59 m²	0.5 acres	2009	>99%	64%
REGION 9: SUISUN												
11: Southampton Marsh	9/22	Backpack	1 m²			0.6 m²	0	2 m²	45 m²	2005	>99%	22%
27a: Point Buckler	7/28	Backpack	0			0.9 m²	0	0.9 m²	31 m²	2016	99%	Increase (0.6 m²)
27b: MOTCO Islands	7/27-7/28	Backpack	0			7 m²	0	7 m²	402 m²	2017	97%	34%
27c: Honker Bay	7/27-7/28; 8/11; 8/16	Backpack	0			10 m²	0	10 m²	448 m²	2018	47%	11%
27d: MOTCO Mainland	8/11; 12/6	Backpack	0			10 m²	0	10 m²	197 m²	2020	32%	32%
REGION 9 TOTAL			1 m²			29 m²	0	31 m²	0.3 acres	2005	99%	25%
REGION 10: VALLEJO												
26a: White Slough / Napa River	11 years with No Invasive Spartina (2011-2021)		0			0	0	0	0	2008	100%	n/a
26b: San Pablo Bay NWR and Mare Island	7/30; 10/13	Backpack	0			4 m²	0	4 m²	106 m²	2009	>99%	86%
26c: Sonoma Creek	7/30	Backpack	0			0.02 m²	0	0.02 m²	0.1 m²	2010	>99%	n/a
26d: Sonoma Baylands	11 years with No Invasive Spartina (2011-2021)		0			0	0	0	0	2008	100%	n/a
REGION 10 TOTAL			0			4 m²	0	4 m²	106 m²	2009	>99%	85%
REGION 11: PETALUMA												
24a: Upper Petaluma River - Upstream of Grey's Field	8/24	Backpack, Airboat	0			13 m²	0	13 m²	504 m²	2007	98%	36%
24b: Grey's Field	No Invasive Spartina 2021		0			0	0	0	0	2009	100%	100%
24c: Petaluma Marsh	8/24	Backpack, Airboat	0			0.6 m²	0	0.6 m²	28 m²	2010	98%	80%
24d: Lower Petaluma River - Downstream of San Antonio Creek	No Invasive Spartina ever detected		0			0	0	0	0	n/a	n/a	n/a

Split	2021 Treatment Dates	2021 Treatment Method	2021 Net *Spartina* Coverage By Species					All Invasive *Spartina* Cover				
											Net Area Decline	
			anglica	*patens*	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2021 Net Area	2021 Treatment Area	Peak Year	Since Peak	Since 2020
REGION 11 TOTAL			0			14 m²	0	14 m²	532 m²	2007	98%	42%
REGION 12: OUTER COAST												
25a: Tom's Point, Tomales	6/11	Dug	0			0	0.002 m²	0.002 m²	0.2 m²	2010	>99%	2%
25b: Limantour Estero	**10 years with No Invasive Spartina (2012-2021)**		0			0	0	0	0	2010	100%	n/a
25c: Drakes Estero	**9 years with No Invasive Spartina (2013-2021)**		0			0	0	0	0	2007	100%	n/a
25d: Bolinas Lagoon, North	**3 years with No Invasive Spartina (2019-2021)**		0			0	0	0	0	2012	100%	n/a
25e: Bolinas Lagoon, South	**9 years with No Invasive Spartina (2013-2021)**		0			0	0	0	0	2004	100%	n/a
REGION 12 TOTAL			0			0	0.002 m²	0.002 m²	0.2 m²	2007	>99%	2%

Appendix VI. 2022 Regional Inventory & Treatment Summary Tables

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treat-ment Area	Peak Year	Since Peak	Since 2021
REGION 1: MARIN											
03a: Blackie's Creek (above bridge)	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2005	100%	n/a
03b: Blackie's Creek Mouth	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2005	100%	n/a
04a: Corte Madera Ecological Reserve	6/6; 10/10; 11/9	Dug, Backpack	0		0.7 m²	0.0002 m²	0.7 m²	14 m²	2005	>99%	Increase (0.6 m²)
04b: College of Marin Ecological Study Area	No Invasive Spartina 2022		0		0	0	0	0	2004	100%	100%
04c: Piper Park East	6/7; 2/3/23	Dug	0		0	0.003 m²	0.003 m²	0.02 m²	2005	>99%	n/a
04d: Piper Park West	No Invasive Spartina 2022		0		0	0	0	0	2005	100%	100%
04e: Larkspur Ferry Landing Area	10/11	Backpack	0		0.06 m²	0	0.06 m²	1 m²	2005	>99%	57%
04f: Riviera Circle	No Invasive Spartina 2022		0		0	0	0	0	2005	100%	100%
04g: Creekside Park	6/2; 8/25; 1/30/23	Dug, Backpack, Tarped	0.03 m² 0.04 m²		0	0.1 m²	0.2 m²	2 m²	2005	>99%	Increase (0.02 m²)
04h: Upper Corte Madera Creek (Above Bon Air Rd)	8/25; 10/14	Dug, Backpack, Tarped	0.08 m²		0.005 m²	0	0.09 m²	2 m²	2006	>99%	64%
04i: Lower Corte Madera Creek (Bon Air Rd to HWY 101)	10/10; 10/14; 1/12/23	Dug, Backpack	0		0.8 m²	0.004 m²	0.8 m²	23 m²	2005	>99%	23%
04j.1: Corte Madera Creek Mouth - North Bank	8/25; 9/14; 10/11	Tarped, Backpack	0.009 m²		12 m²	0	12 m²	100 m²	2007	>99%	Increase (9 m²)
04j.2: Corte Madera Creek Mouth - South Bank	10/10; 10/11	Backpack	0		1 m²	0	1 m²	49 m²	2007	>99%	Increase (0.5 m²)
04k: Boardwalk No. 1 (Arkites)	No Invasive Spartina 2022		0		0	0	0	0	2006	100%	100%
04l: Murphy Creek	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2007	100%	n/a
09: Tiscornia Marsh / Pickleweed Park	9/2; 9/14	Backpack	0		8 m²	0	8 m²	127 m²	2004	97%	Increase (6 m²)
23a: Brickyard Cove	No Invasive Spartina 2022		0		0	0	0	0	2008	100%	100%
23b: Beach Drive	9/2; 9/26	Backpack	0		0.5 m²	0	0.5 m²	16 m²	2006	>99%	53%
23c: Loch Lomond Marina	9/26	Backpack	0		0.6 m²	0	0.6 m²	18 m²	2004	>99%	n/a
23d.1: San Rafael Canal Mouth East	9/2	Backpack	0		1 m²	0	1 m²	45 m²	2007	>99%	78%
23d.2: San Rafael Canal Mouth West	11/4	Backpack	0		0.07 m²	0	0.07 m²	7 m²	2004	>99%	91%
23e: Muzzi and Martas Marsh	9/14; 9/20; 9/27; 10/10	Backpack	0		6 m²	0	6 m²	143 m²	2007	99%	84%
23f: Paradise Cay	11/9	Backpack	0		0.5 m²	0	0.5 m²	23 m²	2005	>99%	Increase (0.3 m²)
23g: Greenwood Cove	No Invasive Spartina 2022		0		0	0	0	0	2006	100%	100%
23h: Strawberry Point	6/14; 11/2	Dug, Backpack	0		0.1 m²	0.2 m²	0.3 m²	7 m²	2005	>99%	Increase (0.3 m²)
23i: Strawberry Cove	9/14; 9/26	Backpack	0		0.2 m²	0	0.2 m²	7 m²	2007	>99%	71%
23j: Bothin Marsh	8/10; 10/10	Backpack	0		0.2 m²	0	0.2 m²	21 m²	2006	>99%	Increase (0.2 m²)
23k: Sausalito	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2004	100%	n/a
23l: Starkweather Park	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2006	100%	n/a
23m: Novato	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2006	100%	n/a
23n: Triangle Marsh and shoreline	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2007	100%	n/a
23o: China Camp	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2010	100%	n/a
REGION 1 TOTAL			0.03 m² 0.13 m²		31 m²	0.3 m²	32 m²	604 m²	2005	>99%	39%
REGION 2: SAN FRANCISCO PENINSULA											
12a: Pier 94	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2005	100%	n/a
12b: Pier 98 / Heron's Head	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2008	100%	n/a
12c: India Basin	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2005	100%	n/a
12d: Hunters Point Naval Reserve	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2008	100%	n/a
12e: Yosemite Channel	9/30	Backpack	0		0.1 m²	0	0.1 m²	8 m²	2004	>99%	n/a

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treat-ment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
12f: Candlestick Cove	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2006	100%	n/a
12g: Crissy Field	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2008	100%	n/a
12h: Yerba Buena Island	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2006	100%	n/a
12i: Mission Creek	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2009	100%	n/a
18a: Colma Creek	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2005	100%	n/a
18b: Navigable Slough	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2006	100%	n/a
18c: Old Shipyard	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2006	100%	n/a
18d: Inner Harbor	9 years with No Invasive Spartina (2014-2022)		0		0	0	0	0	2006	100%	n/a
18e: Sam Trans Peninsula	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2004	100%	n/a
18f: Confluence Marsh	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2004	100%	n/a
18g: San Bruno Marsh	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2004	100%	n/a
18h: San Bruno Creek	No Invasive Spartina 2022		0		0	0	0	0	2006	100%	100%
19a: Brisbane Lagoon	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2006	100%	n/a
19b: Sierra Point	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2004	100%	n/a
19c: Oyster Cove	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2006	100%	n/a
19d: Oyster Point Marina	8 years with No Invasive Spartina (2015-2022)		0		0	0	0	0	2006	100%	n/a
19e: Oyster Point Park	8/31	Backpack	0		0.2 m²	0	0.2 m²	2 m²	2005	>99%	n/a
19f: Point San Bruno	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
19g: Seaplane Harbor	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2004	100%	n/a
19h: SFO	9/8; 10/3	Backpack	0		2 m²	0	2 m²	61 m²	2004	>99%	51%
19i: Mills Creek Mouth	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
19j: Easton Creek Mouth	9/8	Backpack	0		0.01 m²	0	0.01 m²	0.5 m²	2004	>99%	98%
19k: Sanchez Marsh	9/15; 9/30	Backpack	0		13 m²	0	13 m²	403 m²	2004	>99%	Increase (3 m²)
19l: Burlingame Lagoon	8/31; 9/15; 9/30	Backpack	0		0.7 m²	0	0.7 m²	59 m²	2004	>99%	40%
19m: Fisherman's Park	11 years with No Invasive Spartina (2012-2022)		0		0	0	0	0	2005	100%	n/a
19n: Coyote Point Marina / Marsh	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2004	100%	n/a
19o: San Mateo Creek / Ryder Park	9/7	Backpack	0		0.004 m²	0	0.004 m²	0.4 m²	2006	>99%	100%
19p.1: Seal Slough Mouth - Central Marsh	9/7	Backpack	0		0.008 m²	0	0.008 m²	1 m²	2004	>99%	84%
19p.2: Seal Slough Mouth - Peripheral Marshes	9/7	Backpack	0		0.06 m²	0	0.06 m²	5 m²	2004	>99%	81%
19r: Anza Lagoon	7 years with No Invasive Spartina (2016-2022)		0		0	0	0	0	2004	100%	n/a
REGION 2 TOTAL			0		17 m²	0	17 m²	540 m²	2004	>99%	35%
REGION 3: SAN MATEO											
02a.1a: Belmont Slough Mouth	8/15	Backpack, Airboat	0		8 m²	0	8 m²	261 m²	2004	>99%	Increase (3 m²)
02a.1b: Belmont Slough Mouth South	8/15; 9/19	Backpack, Airboat	0		3 m²	0	3 m²	130 m²	2004	>99%	Increase (0.5 m²)
02a.2: Upper Belmont Slough and Redwood Shores	8/15; 8/19; 9/1; 9/12; 9/13; 9/14; 9/19; 10/6; 10/31	Backpack, Airboat	0		38 m²	0	38 m²	0.3 acres	2004	>99%	Increase (16 m²)
02a.3: Bird Island	8/15	Backpack, Airboat	0		10 m²	0	10 m²	271 m²	2006	>99%	Increase (2 m²)
02a.4: Redwood Shores Mitigation Bank	9/19; 9/26; 10/6	Backpack	0		0.7 m²	0	0.7 m²	42 m²	2015	94%	Increase (0.7 m²)
02b.1: Corkscrew Slough	8/18; 9/29; 10/4; 10/15; 10/18; 10/19	Backpack, Airboat	0		27 m²	0	27 m²	786 m²	2004	>99%	6%
02b.2: Steinberger Slough South, Redwood Creek Northwest	7/22; 8/4; 8/18; 9/13; 10/4; 10/18; 10/19	Backpack, Airboat	0		42 m²	0	42 m²	0.4 acres	2004	>99%	28%
02c.1a: B2 North West	8/16-8/18; 10/4	Backpack, Airboat	0		98 m²	0	98 m²	0.8 acres	2005	>99%	45%

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
02c.1b: B2 North East	8/3-8/4; 8/16-8/18; 9/2; 9/17; 10/1; 10/18; 10/31; 11/14-11/15	Backpack, Airboat	0		1.5 acres	0	1.5 acres	20.6 acres	2005	94%	32%
02c.2: B2 North South	8/16-8/17; 9/1; 9/29; 11/11; 11/24	Backpack, Airboat	0		755 m²	0	755 m²	5.4 acres	2006	98%	18%
02d.1a: B2 South West	Not Treated in 2022		0		2 m²	0	2 m²	62 m²	2004	>99%	No change detected
02d.1b: B2 South East	Not Treated in 2022		0		0.08 m²	0	0.08 m²	2 m²	2004	>99%	No change detected
02d.2: B2 South (2)	Not Treated in 2022		0		3 m²	0	3 m²	104 m²	2006	>99%	No change detected
02d.3: B2 South (3)	Not Treated in 2022		0		1 m²	0	1 m²	46 m²	2009	>99%	No change detected
02e: West Point Slough NW	9/15	Backpack, Airboat	0		1 m²	0	1 m²	35 m²	2005	>99%	81%
02f: Greco Island North	9/15-9/16; 9/30; 11/16	Backpack, Airboat	0		108 m²	0	108 m²	0.6 acres	2008	>99%	Increase (16 m²)
02g: West Point Slough SW and East	8/19; 11/16	Backpack, Airboat	0		1 m²	0	1 m²	55 m²	2005	>99%	89%
02h: Greco Island South	8/19; 9/16; 9/30; 10/12; 11/3	Backpack, Airboat	0		8 m²	0	8 m²	344 m²	2005	>99%	53%
02i: Ravenswood Slough and Mouth	10/12; 10/13	Backpack	0		1 m²	0	1 m²	54 m²	2004	>99%	84%
02j.1: Ravenswood Open Space Preserve (N of Hwy 84)	8/31; 9/28	Backpack	0		17 m²	0	17 m²	277 m²	2006	97%	Increase (14 m²)
02k: Redwood Creek and Deepwater Slough	8/18; 9/1; 9/15; 9/29	Backpack, Airboat	0		104 m²	0	104 m²	0.8 acres	2009	>99%	22%
02l: Inner Bair	10/14; 10/18	Backpack	0		3 m²	0	3 m²	70 m²	2006	>99%	Increase (2 m²)
02m: Pond B3	7/22; 8/19; 8/22; 9/6; 10/4; 10/19	Airboat	0		0.3 acres	0	0.3 acres	2.7 acres	2014	8%	Increase (571 m²)
02o: Central Bair	7/21; 7/22; 9/20	Airboat	0		83 m²	0	83 m²	0.6 acres	2021	41%	41%
19q: Foster City	9/27	Backpack	0		0.001 m²	0	0.001 m²	0.1 m²	2004	>99%	87%
19s: Maple Street Channel	4 years with No Invasive Spartina (2019-2022)		0		0	0	0	0	2011	100%	n/a
REGION 3 TOTAL			0		2.1 acres	0	2.1 acres	32.6 acres	2004	98%	23%
REGION 4: DUMBARTON SOUTH											
02j.2: Ravenswood Open Space Preserve (S of Hwy 84)	8/31	Backpack	0		5 m²	0	5 m²	132 m²	2006	>99%	Increase (3 m²)
02n: SF2	5 years with No Invasive Spartina (2018-2022)		0		0	0	0	0	2013	100%	n/a
05a.1: Mowry Marsh and Slough	Not Treated in 2022		0		24 m²	0	24 m²	678 m²	2008	>99%	No change detected
05a.2: Calaveras Marsh	8/5; 9/16	Backpack, Airboat	0		53 m²	0	53 m²	765 m²	2007	>99%	31%
05b: Dumbarton/Audubon	9/2; 9/6; 10/6; 10/13; 10/17	Backpack, Airboat	0		55 m²	0	55 m²	0.3 acres	2006	>99%	Increase (8 m²)
05c.1: Newark Slough West	9/20; 9/28	Backpack, Airboat	0		10 m²	0	10 m²	231 m²	2004	>99%	64%
05c.2: Newark Slough East	9/20; 11/15	Backpack, Airboat	0		2 m²	0	2 m²	27 m²	2005	>99%	75%
05d: LaRiviere Marsh	10/13	Backpack	0		0.9 m²	0	0.9 m²	33 m²	2006	>99%	77%
05e: Mayhew's Landing	9/28	Backpack	0		0.02 m²	0	0.02 m²	1 m²	2004	>99%	99%
05f: Coyote Creek - Alameda County	9/21; 10/20	Backpack, Airboat	0		7 m²	0	7 m²	224 m²	2008	96%	42%
05g: Cargill Pond (W Hotel)	9/23; 9/28	Backpack	0		3 m²	0	3 m²	206 m²	2010	>99%	Increase (0.1 m²)
05h: Plummer Creek Mitigation Marsh	10/13; 10/28	Backpack	0		2 m²	0	2 m²	59 m²	2011	99%	40%
05i: Island Ponds	9/20; 9/21; 10/18	Airboat	0		6 m²	0	6 m²	141 m²	2017	97%	Increase (0.9 m²)
08: Palo Alto Baylands	10/3; 11/2	Truck, Backpack, Airboat	0		21 m²	0	21 m²	669 m²	2009	>99%	12%
15a.1: Charleston Slough to Mountainview Slough	8/17; 10/4	Backpack	0		7 m²	0	7 m²	132 m²	2004	>99%	67%
15a.2: Stevens Ck to Guadalupe Sl	8/17-8/18; 9/29	Backpack	0		3 m²	0	3 m²	113 m²	2008	>99%	73%
15a.3: Guadalupe Slough	8/18; 9/1; 9/26; 10/17	Backpack, Airboat	0		31 m²	0	31 m²	518 m²	2008	>99%	52%
15a.4: Alviso Slough	9/1; 9/15-9/16; 10/17; 11/14	Backpack, Airboat	0		355 m²	0	355 m²	1.8 acres	2007	96%	59%

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
15a.5: Coyote Creek to Artesian Slough	9/15; 9/20-9/21; 10/17	Backpack, Airboat	0		24 m²	0	24 m²	886 m²	2017	97%	49%
15a.6: Knapp Tract	9/7	Airboat	0		2 m²	0	2 m²	44 m²	2017	90%	82%
15a.7: Pond 17	No Invasive Spartina Ever Detected		0		0	0	0	0	0	n/a	n/a
15b: Faber / Laumeister Marsh	9/14; 9/19; 9/28; 9/29	Backpack	0		33 m²	0	33 m²	610 m²	2008	98%	Increase (18 m²)
15c: Shoreline Regional Park	9/29; 10/31	Backpack	0		6 m²	0	6 m²	298 m²	2006	>99%	46%
15d: Sunnyvale Baylands	No Invasive Spartina 2022		0		0	0	0	0	2021	100%	100%
16.1: Cooley Landing Central	9/1-9/2	Truck, Backpack, Airboat	0		24 m²	0	24 m²	595 m²	2008	>99%	24%
16.2: Cooley Landing East	9/1-9/2; 9/19	Truck, Backpack, Airboat	0		136 m²	0	136 m²	1 acres	2008	>99%	30%
REGION 4 TOTAL			0		809 m²	0	809 m²	4.7 acres	2008	>99%	54%
REGION 5: UNION CITY											
01a: Channel Mouth	9/27	Backpack	0		3 m²	0	3 m²	192 m²	2004	>99%	Increase (2 m²)
01b: Lower Channel	Not Treated in 2022		0		5 m²	0	5 m²	73 m²	2004	>99%	No change detected
01c: Upper Channel	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2004	100%	n/a
01d: Upper Channel - Union City Blvd to I-880	6 years with No Invasive Spartina (2017-2022)		0		0	0	0	0	2005	100%	n/a
01e: Strip Marsh No. of Channel Mouth	No Invasive Spartina 2022		0		0	0	0	0	2004	100%	100%
01f: Pond 3 - AFCC	3 years with No Invasive Spartina (2020-2022)		0		0	0	0	0	2005	100%	n/a
13a: Old Alameda Creek North Bank	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
13b: Old Alameda Creek Island	8/23	Backpack	0		0.04 m²	0	0.04 m²	4 m²	2005	>99%	Increase (0.02 m²)
13c: Old Alameda Creek South Bank	10/5	Backpack	0		2 m²	0	2 m²	114 m²	2005	>99%	Increase (0.6 m²)
13d: Whale's Tail North Fluke	8/31; 9/21	Backpack	0		0.2 m²	0	0.2 m²	15 m²	2005	>99%	87%
13e: Whale's Tail South Fluke	10/5	Backpack	0		0.2 m²	0	0.2 m²	7 m²	2005	>99%	81%
13f: Cargill Mitigation Marsh	10/5	Backpack	0		0.008 m²	0	0.008 m²	0.7 m²	2004	>99%	n/a
13g: Upstream of 20 Tide Gates	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2005	100%	n/a
13h: Eden Landing - North Creek	8/23	Backpack	0		0.02 m²	0	0.02 m²	2 m²	2007	>99%	75%
13i: Eden Landing - Pond 10	8/31	Backpack	0		0.001 m²	0	0.001 m²	0.1 m²	2008	>99%	100%
13j: Eden Landing - Mt Eden Creek	8/31	Backpack	0		3 m²	0	3 m²	189 m²	2009	>99%	17%
13k: Eden Landing Reserve South - North Creek Marsh	8/23; 9/16	Backpack	0		56 m²	0	56 m²	0.4 acres	2009	87%	Increase (19 m²)
13l: Eden Landing Reserve North - Mt Eden Creek Marsh	8/22	Backpack	0		27 m²	0	27 m²	956 m²	2010	84%	17%
13m: Eden Landing - Ponds E8A, E9, and E8X	8/23	Backpack, Airboat	0		11 m²	0	11 m²	380 m²	2014	67%	51%
21a: Ideal Marsh North	9/27	Backpack	0		0.03 m²	0	0.03 m²	1 m²	2005	>99%	94%
21b: Ideal Marsh South	9/27	Backpack	0		0.001 m²	0	0.001 m²	0.03 m²	2006	>99%	94%
REGION 5 TOTAL			0		108 m²	0	108 m²	0.9 acres	2004	>99%	Increase (3 m²)
REGION 6: HAYWARD											
07a: Oro Loma Marsh - East	10/20-10/21	Backpack, Airboat	0		6 m²	0	6 m²	326 m²	2008	>99%	67%
07b: Oro Loma Marsh - West	10/20-10/21	Backpack, Airboat	0		46 m²	0	46 m²	976 m²	2005	>99%	55%
20a: Oyster Bay Regional Shoreline	7/5; 7/22	Backpack	0		0.6 m²	0	0.6 m²	43 m²	2004	>99%	16%
20b: Oakland Metropolitan Golf Links	No Invasive Spartina 2022		0		0	0	0	0	2009	100%	100%
20c: Dog Bone Marsh	7/8; 7/22	Backpack	0		0.5 m²	0	0.5 m²	13 m²	2006	>99%	82%
20d.1: Citation Marsh South	8/29	Truck, Backpack	0		33 m²	0	33 m²	431 m²	2004	>99%	51%
20d.2a: Citation Marsh Upper	8/12; 8/15-8/16; 8/29	Truck, Backpack	0		222 m²	0	222 m²	1 acres	2006	>99%	91%
20d.2b: Citation Marsh Central	No Treatment Authorized since 2010		0		2.7 acres	0	2.7 acres	23.5 acres	2006	61%	No change detected
20e: East Marsh	10/18	Backpack	0		4 m²	0	4 m²	82 m²	2006	>99%	66%

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline Since Peak	Net Area Decline Since 2021
20f: North Marsh	No Treatment Authorized since 2010		0		6.9 acres	0	6.9 acres	59.9 acres	2006	61%	No change detected
20g: Bunker Marsh	8/30; 10/18; 11/3	Truck, Backpack	0		18 m²	0	18 m²	555 m²	2004	>99%	95%
20h.1: San Lorenzo Creek and Mouth North	8/18; 10/18; 11/3	Backpack	0		1 m²	0	1 m²	43 m²	2004	>99%	91%
20h.2: San Lorenzo Creek and Mouth South	8/18; 10/18; 11/3	Backpack	0		103 m²	0	103 m²	0.4 acres	2004	>99%	65%
20i: Bockmann Channel	7/22	Backpack	0		1 m²	0	1 m²	20 m²	2004	>99%	Increase (1 m²)
20j: Sulphur Creek	7/22	Backpack	0		0.5 m²	0	0.5 m²	14 m²	2004	>99%	Increase (0.3 m²)
20k: Hayward Landing	9/29	Backpack	0		0.2 m²	0	0.2 m²	3 m²	2004	>99%	n/a
20l: Johnson's Landing	8/16	Backpack	0		0.03 m²	0	0.03 m²	0.5 m²	2005	>99%	89%
20m: Cogswell Marsh A	7/22; 8/16; 9/28	Backpack	0		21 m²	0	21 m²	263 m²	2005	>99%	Increase (20 m²)
20n.1: Cogswell Marsh B Bayfront	8/17; 8/31	Truck, Backpack	0		124 m²	0	124 m²	0.8 acres	2005	>99%	72%
20n.2: Cogswell Marsh B South	8/31	Truck	0		55 m²	0	55 m²	745 m²	2005	>99%	51%
20n.3: Cogswell Marsh B Main	8/12; 10/20; 11/18	Aerial Broadcast for Seed Suppression; Backpack as permitted around revegetation plantings	0		0.7 acres	0	0.7 acres	9.9 acres	2005	98%	No change detected
20o: Cogswell Marsh C	8/31; 9/30	Truck, Backpack	0		61 m²	0	61 m²	0.3 acres	2005	>99%	47%
20p: Hayward Shoreline Outliers	7/22; 8/16; 8/18	Backpack	0		5 m²	0	5 m²	29 m²	2008	>99%	Increase (5 m²)
20q: San Leandro Shoreline Outliers	7/22	Backpack	0		7 m²	0	7 m²	29 m²	2006	>99%	19%
20r: Oakland Airport Shoreline and Channels	7/5; 8/5; 10/5	Backpack	0		1 m²	0	1 m²	34 m²	2006	>99%	36%
20s: H.A.R.D. Marsh	8/16; 9/29	Backpack	0		0.4 m²	0	0.4 m²	7 m²	2006	>99%	61%
20t: San Leandro Marina	7/8	Backpack	0		0.03 m²	0	0.03 m²	0.4 m²	2009	>99%	Increase (0.01 m²)
20u: Estudillo Creek Channel	7/8; 7/22	Truck, Backpack	0		31 m²	0	31 m²	704 m²	2010	96%	Increase (12 m²)
20v: Hayward Landing Canal	7/22; 8/16	Backpack	0		0.9 m²	0	0.9 m²	22 m²	2006	>99%	Increase (0.7 m²)
20w: Triangle Marsh	7/22; 9/28; 9/29	Backpack	0		3 m²	0	3 m²	25 m²	2007	78%	Increase (3 m²)
REGION 6 TOTAL			0		10.5 acres	0	10.5 acres	96.9 acres	2005	95%	43%
REGION 7: SAN LEANDRO BAY											
17a: Alameda Island South (Elsie Roemer Bird Sanctuary, Crown Memorial State Beach, Crab Cove)	8/5; 9/29	Backpack	0		0.6 m²	0	0.6 m²	38 m²	2006	>99%	84%
17b: Bay Farm Island	8/5	Backpack	0		0.8 m²	0	0.8 m²	16 m²	2005	>99%	52%
17c.1: Arrowhead Marsh West	11/2; 11/16	Backpack, Airboat	0		693 m²	0	693 m²	5.6 acres	2005	98%	49%
17c.2: Arrowhead Marsh East	No Treatment Authorized since 2010		0		3.3 acres	0	3.3 acres	19.8 acres	2006	80%	No change detected
17d.1: Fan Marsh Shoreline	7/20	Airboat	0		5 m²	0	5 m²	119 m²	2004	>99%	56%
17d.2: Airport Channel Shoreline	7/20; 7/22	Backpack	0		16 m²	0	16 m²	155 m²	2005	>99%	33%
17d.3: East Creek	7/20	Backpack	0		17 m²	0	17 m²	280 m²	2004	>99%	8%
17d.4: Damon Marsh	10/17	Truck, Backpack	0		56 m²	0	56 m²	0.3 acres	2006	>99%	74%
17d.5: Damon Slough / Elmhurst Creek	7/20; 10/17	Backpack	0		26 m²	0	26 m²	145 m²	2005	>99%	Increase (21 m²)
17e.1: San Leandro Creek North	7/20	Backpack	0		0.2 m²	0	0.2 m²	5 m²	2005	>99%	Increase (0.1 m²)
17e.2: San Leandro Creek South	7/20	Backpack	0		9 m²	0	9 m²	124 m²	2005	>99%	Increase (6 m²)
17f: Oakland Inner Harbor	7/21; 8/2	Backpack	0		7 m²	0	7 m²	106 m²	2007	>99%	Increase (2 m²)
17g: Coast Guard Island	No Invasive Spartina 2022		0		0	0	0	0	2007	100%	100%
17h: MLK New Marsh	No Treatment Authorized since 2010		0		3.5 acres	0	3.5 acres	23.9 acres	2006	53%	No change detected
17i: Coliseum Channels	7/7; 10/14	Backpack	0		24 m²	0	24 m²	601 m²	2005	>99%	Increase (5 m²)
17j.1: Fan Marsh Wings	7/20	Backpack	0		4 m²	0	4 m²	118 m²	2005	>99%	84%
17j.2: Fan Marsh Main	No Treatment Authorized since 2010		0		0.8 acres	0	0.8 acres	8.5 acres	2006	88%	No change detected

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By				All Invasive *Spartina* Cover				
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treatment Area	Peak Year	Net Area Decline	
										Since Peak	Since 2021
17k: Airport Channel	7/22	Backpack, Airboat	0		0.4 m²	0	0.4 m²	21 m²	2005	>99%	66%
17l: Doolittle Pond	7/20	Backpack	0		0.4 m²	0	0.4 m²	21 m²	2004	>99%	Increase (0.4 m²)
17m: Alameda Island (Aeolian Yacht Club and East Shore)	8/5; 9/29	Backpack	0		12 m²	0	12 m²	98 m²	2006	>99%	9%
REGION 7 TOTAL			0		7.8 acres	0	7.8 acres	58.5 acres	2006	91%	31%
REGION 8: BAY BRIDGE NORTH											
06a: Emeryville Crescent East	9/19	Backpack	0		4 m²	0	4 m²	153 m²	2005	>99%	14%
06b: Emeryville Crescent West	9/2; 10/3	Backpack	0		10 m²	0	10 m²	205 m²	2004	>99%	21%
10a: Whittell Marsh	8/26; 9/22	Backpack	0		3 m²	0	3 m²	96 m²	2005	>99%	Increase (3 m²)
10b: Southern Marsh	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2010	100%	n/a
10c: Giant Marsh	8/30; 10/28	Backpack	0		3 m²	0	3 m²	38 m²	2005	>99%	Increase (3 m²)
10d: Breuner Marsh Restoration	8/30	Backpack	0		0.04 m²	0	0.04 m²	0.3 m²	2016	99%	95%
22a: Wildcat Marsh	8/3; 9/1; 10/7; 10/25	Backpack, Airboat	0		25 m²	0	25 m²	608 m²	2010	98%	Increase (14 m²)
22b.1: San Pablo Marsh East	9/1	Backpack, Airboat	0		4 m²	0	4 m²	96 m²	2009	>99%	40%
22b.2: San Pablo Marsh West	8/30; 9/1; 9/8; 9/27	Backpack, Airboat	0		9 m²	0	9 m²	123 m²	2006	>99%	Increase (2 m²)
22c: Breuner Marsh (Rheem Creek)	8/30; 9/1	Backpack, Airboat	0		4 m²	0	4 m²	155 m²	2009	>99%	40%
22d: Stege Marsh	9/19	Backpack	0		0.01 m²	0	0.01 m²	0.3 m²	2009	>99%	98%
22e: Hoffman Marsh	No Invasive Spartina 2022		0		0	0	0	0	2004	100%	100%
22f: Richmond / Albany / Pinole Shoreline	8/26; 9/9; 9/19 11/3	Backpack	0		4 m²	0	4 m²	200 m²	2004	>99%	32%
REGION 8 TOTAL			0		68 m²	0	68 m²	0.4 acres	2009	>99%	58%
REGION 9: SUISUN											
11: Southampton Marsh	9/13; 10/7	Backpack	0		2 m²	0	2 m²	46 m²	2005	>99%	4%
27a: Point Buckler	6/8	Backpack	0		0.01 m²	0	0.01 m²	1 m²	2016	>99%	99%
27b: MOTCO Islands	6/7-6/8	Backpack	0		2 m²	0	2 m²	39 m²	2017	>99%	68%
27c: Honker Bay	6/8; 6/20	Backpack	0		27 m²	0	27 m²	202 m²	2022	n/a	Increase (17 m²)
27d: MOTCO Mainland	6/7; 6/20; 7/6	Backpack	0		1 m²	0	1 m²	34 m²	2020	90%	86%
REGION 9 TOTAL			0		32 m²	0	32 m²	321 m²	2005	99%	21%
REGION 10: VALLEJO											
26a: White Slough / Napa River	12 years with No Invasive Spartina (2011-2022)		0		0	0	0	0	2008	100%	n/a
26b: San Pablo Bay NWR and Mare Island	10/6	Dug, Backpack	0		2 m²	0	2 m²	69 m²	2009	>99%	50%
26c: Sonoma Creek	7/19	Backpack	0		0.07 m²	0	0.07 m²	5 m²	2010	>99%	Increase (0.05 m²)
26d: Sonoma Baylands	12 years with No Invasive Spartina (2011-2022)		0		0	0	0	0	2008	100%	n/a
REGION 10 TOTAL			0		2 m²	0	2 m²	74 m²	2009	>99%	92%
REGION 11: PETALUMA											
24a: Upper Petaluma River - Upstream of Grey's Field	8/31	Backpack, Airboat	0		3 m²	0	3 m²	69 m²	2007	>99%	78%
24b: Grey's Field	2 years with No Invasive Spartina (2021-2022)		0		0	0	0	0	2009	100%	n/a
24c: Petaluma Marsh	8/31	Backpack, Airboat	0		1 m²	0	1 m²	27 m²	2010	96%	Increase (0.4 m²)
24d: Lower Petaluma River - Downstream of San Antonio Creek	No Invasive Spartina ever detected		0		0	0	0	0	n/a	n/a	n/a
REGION 11 TOTAL			0		4 m²	0	4 m²	96 m²	2007	>99%	84%

Split Sub-Area	2022 Treatment Dates	2022 Treatment Method	2022 Net *Spartina* Coverage By				All Invasive *Spartina* Cover				
										Net Area Decline	
			anglica	*densiflora* x *foliosa*	*alterniflora* x *foliosa*	*densiflora*	2022 Net Area	2022 Treat-ment Area	Peak Year	Since Peak	Since 2021
REGION 12: OUTER COAST											
25a: Tom's Point, Tomales	3/8/23	Dug	0		0	0.01 m²	0.01 m²	0.3 m²	2010	>99%	Increase (0.01 m²)
25b: Limantour Estero	**11 years with No Invasive Spartina (2012-2022)**		0		0	0	0	0	2010	100%	n/a
25c: Drakes Estero	**10 years with No Invasive Spartina (2013-2022)**		0		0	0	0	0	2007	100%	n/a
25d: Bolinas Lagoon, North	**4 years with No Invasive Spartina (2019-2022)**		0		0	0	0	0	2012	100%	n/a
25e: Bolinas Lagoon, South	**10 years with No Invasive Spartina (2013-2022)**		0		0	0	0	0	2004	100%	n/a
REGION 12 TOTAL			0		0	0.01 m²	0.01 m²	0.3 m²	2007	>99%	Increase (0.009 m²)

Appendix VII. 2021 End-of-Season Treatment Schedule

2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
1	Alameda Flood Control Channel	01a	Channel Mouth	9/28; 10/1	Yes		X				
		01b	Lower Channel (not including mouth)	10/1	Yes		X				
		01c	Upper Channel	No Invasive Spartina 2021							
		01d	Upper Channel - Union City Blvd to I-880	5 years with no invasive Spartina (2017-2021)							
		01e	Strip Marsh No. of Channel Mouth	10/1	Yes		X				
		01f	Pond 3-AFCC	2 years with no invasive Spartina (2020-2021)							
2	Bair/Greco Islands	02a.1a	Belmont Slough Mouth	Not Treated 2021	Yes	X	X		X		
		02a.1b	Belmont Slough Mouth South	Not Treated 2021	Yes	X	X		X		
		02a.2	Upper Belmont Slough and Redwood Shores	9/1; 9/13-9/15; 10/5	Yes	X	X		X		
		02a.3	Bird Island	Not Treated 2021	Yes		X				
		02a.4	Redwood Shores Mitigation Bank	9/14	Yes		X				
		02b.1	Corkscrew Slough	8/14; 9/10; 9/29	Yes		X		X		
		02b.2	Steinberger Slough South, Redwood Creek Northwest	8/2; 9/27; 9/29; 11/24	Yes		X		X		
		02c.1a	B2 North Quadrant West	9/27-9/28; 11/10	Yes		X		X		
		02c.1b	B2 North Quadrant East	8/24	Yes				X	X	
		02c.2	B2 North Quadrant South	8/12-8/13; 8/25-8/26; 11/10-11/11; 11/24	Yes		X		X		
		02d.1a	B2 South Quadrant West	10/27	Yes		X				
		02d.1b	B2 South Quadrant East	10/27	Yes		X				
		02d.2	B2 South Quadrant (2)	10/27	Yes		X				
		02d.3	B2 South Quadrant (3)	10/27	Yes		X				
		02e	Westpoint Slough NW	9/10	Yes		X		X		
		02f	Greco Island North	8/25; 8/26; 9/10-9/11; 10/26	Yes		X		X		
		02g	Westpoint Slough SW and East	7/30; 8/27; 9/27	Yes		X		X		
		02h	Greco Island South	8/27; 9/11; 11/8	Yes		X		X		
		02i	Ravenswood Slough & Mouth	9/16; 11/8	Yes		X				
		02j.1	Ravenswood Open Space Preserve (north Hwy 84)	9/9; 10/12	Yes		X				

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		02j.2	Ravenswood Open Space Preserve (south Hwy 84)	9/14	Yes		X				
		02k	Redwood Creek and Deepwater Slough	8/14; 8/25; 9/10; 11/24	Yes		X		X		
		02l	Inner Bair Island Restoration	9/14	Yes		X				
		02m	Pond B3 - Middle Bair Island Restoration	8/30; 9/14-9/15; 9/30; 10/14	Yes				X		
		02n	SF2	4 years with no Invasive Spartina (2018-2021)							
		02o	Central Bair	8/2-8/3; 10/15	Yes				X		
3	Blackie's Pasture	03a	Blackie's Creek (above bridge)	3 years with no Invasive Spartina (2019-2021)							
		03b	Blackie's Creek Mouth	5 years with no Invasive Spartina (2017-2021)							
4	Corte Madera Creek Complex	04a	Corte Madera Ecological Reserve (CMER)	10/19	Yes		X				X
		04b	College of Marin Ecology Study Area	4/7/22 (COI)	Yes						X
		04c	Piper Park East	No invasive Spartina 2021							
		04d	Piper Park West	1/10/22 (COI)	Yes						X
		04e	Larkspur Ferry Landing Area	10/19			X				
		04f	Riviera Circle	6/4 (COI)	Yes		X				X
		04g	Creekside Park	6/8 (COI); 7/30; 9/3; 1/10/22 (COI); 2/24/22 (COI)	Yes		X				X
		04h	Upper Corte Madera Creek (Above Bon Air Road)	7/30; 9/8; 4/7/22	Yes		X				X
		04i	Lower Corte Madera Creek (between Bon Air Rd & HWY 101)	6/9 (COI); 7/30; 9/8; 10/19; 1/11/22 (COI); 2/25/22 (COI); 4/7/22	Yes		X				X
		04j.1	Corte Madera Creek Mouth - North Bank	7/30; 10/19; 1/25/22 (COI)	Yes		X				X
		04j.2	Corte Madera Creek Mouth - South Bank	10/19	Yes		X				X
		04k	Boardwalk No. 1 (Arkites)	6/10 (COI); 1/12/22 (COI)	Yes						X
		04l	Murphy Creek	No invasive Spartina 2021							
		05a.1	Mowry Marsh & Slough	8/27; 11/12	Yes		X		X		
		05a.2	Calaveras Marsh	7/30; 9/29; 11/12	Yes		X	X	X		
		05b	Dumbarton/Audubon	8/27; 9/28; 9/30; 11/12	Yes		X		X		

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2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
5	Coyote Creek/Mowry Complex	05c.1	Newark Slough West	9/28	Yes		X		X		
		05c.2	Newark Slough East	9/29; 9/30	Yes		X		X		
		05d	LaRiviere Marsh	9/29; 11/8	Yes		X				
		05e	Mayhew's Landing	9/29	Yes		X				
		05f	Coyote Creek- Alameda County	9/30; 11/30	Yes		X		X		
		05g	Cargill Pond (W Hotel)	9/29	Yes		X				
		05h	Plummer Creek Mitigation	9/30; 11/8	Yes		X				
		05i	Island Ponds	10/1; 10/13	Yes				X		
6	Emeryville Crescent	06a	Emeryville Crescent East	10/14	Yes		X				
		06b	Emeryville Crescent West	10/14; 10/27	Yes		X				
7	Oro Loma Marsh	07a	Oro Loma Marsh-East	10/28-10/29	Yes		X		X		
		07b	Oro Loma Marsh-West	10/28-10/29	Yes		X		X		
8	Palo Alto Baylands	8	Palo Alto Baylands	9/1; 10/13; 11/8	Yes	X	X		X		
9	Tiscornia Marsh	9	Tiscornia Marsh	9/2; 10/5	Yes		X				
10	Point Pinole Marshes	10a	Whittell Marsh	8/19	Yes		X				
		10b	Southern Marsh	No invasive Spartina 2021							
		10c	Giant Marsh	9/30	Yes		X				
		10d	Breuner Marsh	9/30	Yes		X				
11	Southampton Marsh	11	Southampton Marsh	9/22	Yes		X				
12	Southeast San Franciso	12a	Pier 94	6 years with no invasive Spartina (2016-2021)							
		12b	Pier 98/Heron's Head	4 years with no Invasive Spartina (2018-2021)							
		12c	India Basin	8 years with no invasive Spartina (2014-2021)							
		12d	Hunters Point Naval Reserve	5 years with no Invasive Spartina (2017-2021)							
		12e	Yosemite Channel	No invasive Spartina 2021							
		12f	Candlestick Cove	7 years with no invasive Spartina (2015-2021)							

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2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		12g	Crissy Field	8 years with no invasive Spartina (2014-2021)							
		12h	Yerba Buena Island	8 years with no invasive Spartina (2014-2021)							
		12i	Mission Creek	8 years with no invasive Spartina (2014-2021)							
13	Whale's Tail Complex	13a	Old Alameda Creek North Bank	No invasive Spartina 2021							
		13b	Old Alameda Creek Island	10/14	Yes		X				
		13c	Old Alameda Creek South Bank	9/10; 10/14	Yes		X				
		13d	Whale's Tail North Fluke	8/27; 9/10	Yes		X				
		13e	Whale's Tail South Fluke	9/10	Yes		X				
		13f	Cargill Mitigation Marsh	No invasive Spartina 2021							
		13g	Upstream of 20 Tide Gates	No invasive Spartina 2021							
		13h	Eden Landing-North Creek	10/14	Yes		X				
		13i	Eden Landing-Pond 10	8/27	Yes		X				
		13j	Eden Landing-Mt Eden Creek	8/27	Yes		X				
		13k	Eden Landing Reserve South-North Creek Marsh	8/2; 8/25; 11/2	Yes		X				
		13l	Eden Landing Reserve North- Mt Eden Creek Marsh	8/17; 8/25; 8/27; 11/2	Yes		X				
		13m	Eden Landing - Pond E8A, E9, and E8X	8/2; 10/14	Yes		X		X		
15	South Bay Marshes	15a.1	Charleston Slough to Mountain View Slough	7/29	Yes		X				
		15a.2	Stevens Ck to Guadalupe Sl	8/13	Yes		X				
		15a.3	Guadalupe Slough	8/13; 9/2; 10/12; 10/29	Yes		X		X		
		15a.4	Alviso Slough	8/3; 8/20; 8/31; 9/13; 9/27-9/28; 10/12; 10/13; 11/12	Yes		X		X		
		15a.5	Coyote Creek to Artesian Slough	9/30	Yes		X		X		
		15a.6	Knapp Tract (Pond A6)	9/2	Yes				X		
		15b	Faber/Laumeister Marsh	8/26; 9/1; 11/8	Yes		X				
		15c	Shoreline Regional Park	9/28; 11/8	Yes		X				
		15d	Sunnyvale Baylands	8/13	Yes		X				
16	Cooley Landing Salt Pond	16.1	Cooley Landing Central	8/25-8/26; 9/1	Yes	X	X		X		

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2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
~~16~~	~~San Pond Restoration~~	16.2	Cooley Landing East	8/25-8/26; 9/1	Yes	X	X		X		
17	Alameda/ San Leandro Bay Complex	17a	Alameda Island South (Elsie Roemer Bird Sanctuary, Crown Memorial State Beach, Crab Cove)	8/10; 10/4; 11/8 (R2)	Yes		X				
		17b	Bay Farm Island	8/10	Yes		X				
		17c.1	Arrowhead Marsh West	11/2-11/3	Yes		X		X		
		17c.2	Arrowhead Marsh East			WILL NOT BE TREATED IN 2021					
		17d.1	MLK Regional Shoreline - Fan Marsh Shoreline	7/19	Yes				X		
		17d.2	Airport Channel - MLK Shoreline	7/19; 8/10	Yes		X				
		17d.3	East Creek -MLK Shoreline	7/19	Yes		X				
		17d.4	MLK Regional Shoreline-Damon Marsh	11/2	Yes			X	X		
		17d.5	Damon Sl/Elmhurst Cr - MLK Shoreline	7/19	Yes		X				
		17e.1	San Leandro Creek North	7/19	Yes		X				
		17e.2	San Leandro Creek South	7/19	Yes		X				
		17f	Oakland Inner Harbor	8/30; 10/4; 11/30	Yes		X		X		
		17g	Coast Guard Island	11/30	Yes		X				
		17h	MLK New Marsh			WILL NOT BE TREATED IN 2021					
		17i	Coliseum Channels	11/29	Yes		X				
		17j.1	Fan Marsh Wings	7/20	Yes		X				
		17j.2	Fan Marsh Main			WILL NOT BE TREATED IN 2021					
		17k	Airport Channel	7/19	Yes		X		X		
		17l	Doolittle Pond	7/19	Yes		X				
		17m	Alameda Island East: Aeolian Yacht Club & Eastern Shoreline	8/10	Yes		X				
18	Colma Creek/ San Bruno Marsh	18a	Colma Creek	4 years with no invasive Spartina (2018-2021)							
		18b	Navigable Slough	5 years with no invasive Spartina (2017-2021)							
		18c	Old Shipyard	3 years with no invasive Spartina (2019-2021)							
		18d	Inner Harbor	8 years with no invasive Spartina (2014-2021)							

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
[illegible]	[illegible] Complex	18e	Sam Trans Peninsula	No invasive Spartina 2021							
		18f	Confluence Marsh	5 years with no invasive Spartina (2017-2021)							
		18g	San Bruno Marsh	3 years with no invasive Spartina (2019-2021)							
		18h	San Bruno Creek	9/29	Yes		X				
19	West San Francisco Bay	19a	Brisbane Lagoon	No invasive Spartina 2021							
		19b	Sierra Point	7 years with no invasive Spartina (2015-2021)							
		19c	Oyster Cove	7 years with no invasive Spartina (2015-2021)							
		19d	Oyster Point Marina	7 years with no invasive Spartina (2015-2021)							
		19e	Oyster Point Park	No invasive Spartina 2021							
		19f	Point San Bruno	No invasive Spartina 2021							
		19g	Seaplane Harbor	4 years with no invasive Spartina (2018-2021)							
		19h	SFO	9/23; 9/29	Yes		X		X		
		19i	Mills Creek Mouth	No invasive Spartina 2021							
		19j	Easton Creek Mouth	9/23	Yes		X		X		
		19k	Sanchez Marsh	7/28	Yes		X				X
		19l	Burlingame Lagoon	7/28	Yes		X				X
		19m	Fisherman's Park	10 years with no invasive Spartina (2012-2021)							
		19n	Coyote Point Marina / Marsh	No invasive Spartina 2021							
		19o	San Mateo Creek / Ryder Park	8/12	Yes		X				
		19p.1	Seal Slough Mouth - Central Marsh	8/12	Yes		X				
		19p.2	Seal Slough Mouth - Peripheral Marshes	8/12	Yes		X				
		19q	Foster City	12/2	Yes		X				
		19r	Anza Lagoon	6 years with no invasive Spartina (2016-2021)							

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		19s	Maple Street Channel	3 years with no invasive Spartina (2019-2021)							
20	San Leandro / Hayward Shoreline	20a	Oyster Bay Regional Shoreline	7/16	Yes		X				
		20b	Oakland Metropolitan Golf Links	7/16	Yes		X				
		20c	Dog Bone Marsh	11/10	Yes		X				
		20d.1	Citation Marsh South	11/10	Yes	X	X				
		20d.2a	Citation Marsh Upper	8/23-8/24; 9/23-9/24; 10/8; 10/11	Yes	X	X				
		20d.2b	Citation Marsh Central			WILL NOT BE TREATED IN 2021					
		20e	East Marsh	10/15	Yes		X				
		20f	North Marsh			WILL NOT BE TREATED IN 2021					
		20g	Bunker Marsh	10/12; 10/27; 11/10	Yes	X	X	X			
		20h.1	San Lorenzo Creek & Mouth North	10/15	Yes		X				
		20h.2	San Lorenzo Creek & Mouth South	10/12	Yes		X				
		20i	Bockmann Channel	7/29	Yes		X				
		20j	Sulphur Creek	7/29	Yes		X				
		20k	Hayward Landing	No invasive Spartina 2021							
		20l	Johnson's Landing	7/29	Yes		X				
		20m	Cogswell Marsh, Quadrant A	8/16	Yes		X				
		20n.1	Cogswell Marsh, Quadrant B Bayfront	11/24	Yes	X	X				
		20n.2	Cogswell Marsh, Quadrant B South	11/12	Yes	X		X			
		20n.3	Cogswell Marsh, Quadrant B Main	8/24	Yes		X			X	
		20o	Cogswell Marsh, Quadrant C	10/28; 11/24	Yes	X	X	X			
		20p	Hayward Shoreline Outliers	7/29	Yes		X				
		20q	San Leandro Shoreline Outliers	11/12	Yes		X				
		20r	Oakland Airport Shoreline and Channels	10/5	Yes		X				
		20s	H.A.R.D. Marsh	8/16	Yes		X				
		20t	San Leandro Marina	7/20	Yes		X				

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		20u	Estudillo Creek Channel	7/20; 11/29	Yes	X	X				
		20v	Hayward Landing Canal	7/29	Yes		X				
		20w	Triangle Marsh	7/29	Yes		X				
21	Ideal Marsh	21a	Ideal Marsh North	9/28	Yes		X				
		21b	Ideal Marsh South	9/28	Yes		X				
22	Two Points Complex	22a	Wildcat Marsh	9/9; 9/27	Yes		X		X		
		22b.1	San Pablo Marsh East	9/27; 9/30; 10/1	Yes		X		X		
		22b.2	San Pablo Marsh West	9/27; 9/30; 11/2	Yes		X		X		
		22c	Rheem Creek	9/30; 10/4	Yes		X				
		22d	Stege Marsh	11/2	Yes		X				
		22e	Hoffman Marsh	10/5	Yes		X				
		22f	Richmond/ Albany /Pinole Shoreline	8/11; 10/5	Yes		X				
23	Marin Outliers	23a	Brickyard Cove	8/25	Yes		X				
		23b	Beach Drive	8/25	Yes		X				
		23c	Loch Lomond Marina	3 years with no invasive Spartina (2019-2021)							
		23d.1	San Rafael Canal Mouth East	9/24	Yes		X				
		23d.2	San Rafael Canal Mouth West	9/2	Yes		X				
		23e	Muzzi & Marta's Marsh	6/4 (COI); 9/8; 9/15; 1/25/22 (COI)	Yes		X				X
		23f	Paradise Cay	11/3; 2/3/22 (COI)	Yes		X				X
		23g	Greenwood Cove	4/7/22	Yes						X
		23h	Strawberry Point	11/2; 1/18/22 (COI)	Yes						X
		23i	Strawberry Cove	8/25	Yes		X				
		23j	Bothin Marsh	Not Treated 2021	Yes		X				
		23k	Sausalito	7 years with no invasive Spartina (2015-2021)							
		23l	Starkweather Park	6 years with no invasive Spartina (2016-2021)							

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2021 Invasive Spartina Project Treatment Schedule

Updated: 5/22/22

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2021?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		23m	Novato	6 years with no invasive Spartina (2016-2021)							
		23n	Triangle Marsh & shoreline	3 years with no invasive Spartina (2019-2021)							
		23o	China Camp	5 years with no invasive Spartina (2017-2021)							
24	Petaluma River	24a	Upper Petaluma River- Upstream of Grey's Field	8/24	Yes		X		X		
		24b	Grey's Field	No invasive Spartina 2021							
		24c	Petaluma Marsh	8/24	Yes		X		X		
25	Outer Coast	25a	Tom's Point (Tomales Bay)	6/11 (COI)	Yes						X
		25b	Limantour Estero	10 years with no invasive Spartina (2012-2021)							
		25c	Drakes Estero	9 years with no invasive Spartina (2013-2021)							
		25d	Bolinas Lagoon north	3 years with no invasive Spartina (2019-2021)							
		25e	Bolinas Lagoon south	9 years with no invasive Spartina (2013-2021)							
26	North San Pablo Bay	26a	White Slough / Napa River	11 years with no invasive Spartina (2011-2021)							
		26b	San Pablo Bay NWR & Mare Island	7/30; 10/13	Yes		X				X
		26c	Sonoma Creek	7/30	Yes		X				
		26d	Sonoma Baylands	11 years with no invasive Spartina (2011-2021)							
27	Suisun Bay	27a	Point Buckler	7/28	Yes		X				
		27b	MOTCO Islands	7/27-7/28	Yes		X				
		27c	Honker Bay	7/27-7/28; 8/11; 8/16	Yes		X				
		27d	MOTCO mainland	8/11; 12/6	Yes		X				

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

Appendix VII. 2022 End-of-Season Treatment Schedule

2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
1	Alameda Flood Control Channel	01a	Channel Mouth	9/27	Yes		X				
		01b	Lower Channel (not including mouth)	NOT TREATED IN 2022							
		01c	Upper Channel	2 years with no invasive Spartina (2021-2022)							
		01d	Upper Channel - Union City Blvd to I-880	6 years with no invasive Spartina (2017-2022)							
		01e	Strip Marsh No. of Channel Mouth	No Invasive Spartina 2022							
		01f	Pond 3-AFCC	3 years with no invasive Spartina (2020-2022)							
2	Bair/Greco Islands	02a.1a	Belmont Slough Mouth	8/15	Yes		X		X		
		02a.1b	Belmont Slough Mouth South	8/15; 9/19	Yes		X		X		
		02a.2	Upper Belmont Slough and Redwood Shores	8/15; 8/19; 9/1; 9/12; 9/13; 9/14; 9/19; 10/6; 10/31	Yes		X		X		
		02a.3	Bird Island	8/15	Yes		X				
		02a.4	Redwood Shores Mitigation Bank	9/19; 9/26; 10/6	Yes		X				
		02b.1	Corkscrew Slough	8/18; 9/29; 10/4; 10/15; 10/18; 10/19	Yes		X		X		
		02b.2	Steinberger Slough South, Redwood Creek Northwest	7/22; 8/4; 8/18; 9/13; 10/4; 10/18; 10/19	Yes		X		X		
		02c.1a	B2 North Quadrant West	8/16-8/18; 10/4	Yes		X		X		
		02c.1b	B2 North Quadrant East	8/3-8/4; 8/16-8/18; 9/2; 9/17; 10/1; 10/18; 10/31; 11/14-11/15	Yes		X		X		
		02c.2	B2 North Quadrant South	8/16-8/17; 9/1; 9/29; 11/11; 11/24	Yes		X		X		
		02d.1a	B2 South Quadrant West	NOT TREATED IN 2022							
		02d.1b	B2 South Quadrant East	NOT TREATED IN 2022							
		02d.2	B2 South Quadrant (2)	NOT TREATED IN 2022							
		02d.3	B2 South Quadrant (3)	NOT TREATED IN 2022							
		02e	Westpoint Slough NW	9/15	Yes		X		X		
		02f	Greco Island North	9/15-9/16; 9/30; 11/16	Yes		X		X		
		02g	Westpoint Slough SW and East	8/19; 11/16	Yes		X		X		

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		02h	Greco Island South	8/19; 9/16; 9/30; 10/12; 11/3	Yes		X		X		
		02i	Ravenswood Slough	10/12; 10/13	Yes		X				
		02j.1	Ravenswood Open Space Preserve (north Hwy 84)	8/31; 9/28	Yes		X				
		02j.2	Ravenswood Open Space Preserve (south Hwy 84)	8/31	Yes		X				
		02k	Redwood Creek and Deepwater Slough	8/18; 9/1; 9/15; 9/29	Yes		X		X		
		02l	Inner Bair Island Restoration	10/14; 10/18	Yes		X				
		02m	Pond B3 - Middle Bair Island Restoration	7/22; 8/19; 8/22; 9/6; 10/4; 10/19	Yes				X		
		02n	SF2	5 years with no Invasive Spartina (2018-2022)							
		02o	Central Bair	7/21; 7/22; 9/20	Yes				X		
3	Blackie's Pasture	03a	Blackie's Creek (above bridge)	4 years with no Invasive Spartina (2019-2022)							
		03b	Blackie's Creek Mouth	6 years with no Invasive Spartina (2017-2022)							
4	Corte Madera Creek Complex	04a	Corte Madera Ecological Reserve (CMER)	6/6 (COI); 10/10; 11/9	Yes		X				X
		04b	College of Marin Ecology Study Area	No Invasive Spartina 2022							
		04c	Piper Park East	6/7 (COI); 2/3/23 (COI)	Yes						X
		04d	Piper Park West	No Invasive Spartina 2022							
		04e	Larkspur Ferry Landing Area	10/11	Yes		X				
		04f	Riviera Circle	No Invasive Spartina 2022							
		04g	Creekside Park	6/2 (COI); 8/25; 1/30/23 (COI)	Yes		X				X
		04h	Upper Corte Madera Creek (Above Bon Air Road)	8/25; 10/14	Yes		X				X
		04i	Lower Corte Madera Creek (between Bon Air Rd & HWY 101)	10/10; 10/14; 1/12/23 (COI)	Yes		X				X
		04j.1	Corte Madera Creek Mouth - North Bank	8/25; 9/14; 10/11	Yes		X				X
		04j.2	Corte Madera Creek Mouth - South Bank	10/10; 10/11	Yes		X				X
		04k	Boardwalk No. 1 (Arkites)	No Invasive Spartina 2022							
		04l	Murphy Creek	2 years with no Invasive Spartina (2021-2022)							
		05a.1	Mowry Marsh & Slough	NOT TREATED IN 2022							
		05a.2	Calaveras Marsh	8/5; 9/16	Yes		X		X		

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
5	Coyote Creek/Mowry Complex	05b	Dumbarton/Audubon	9/2; 9/6; 10/6; 10/13; 10/17	Yes		X		X		
		05c.1	Newark Slough West	9/20; 9/28	Yes		X		X		
		05c.2	Newark Slough East	9/20; 11/15	Yes		X		X		
		05d	LaRiviere Marsh	10/13	Yes		X				
		05e	Mayhew's Landing	9/28	Yes		X				
		05f	Coyote Creek- Alameda County	9/21; 10/20	Yes		X		X		
		05g	Cargill Pond (W Hotel)	9/23; 9/28	Yes		X				
		05h	Plummer Creek Mitigation	10/13; 10/28	Yes		X				
		05i	Island Ponds	9/20; 9/21; 10/18	Yes				X		
6	Emeryville Crescent	06a	Emeryville Crescent East	9/19	Yes		X				
		06b	Emeryville Crescent West	9/2; 10/3	Yes		X				
7	Oro Loma Marsh	07a	Oro Loma Marsh-East	10/20-10/21	Yes		X		X		
		07b	Oro Loma Marsh-West	10/20-10/21	Yes		X		X		
8	Palo Alto Baylands	8	Palo Alto Baylands	10/3; 11/2	Yes	X	X		X		
9	Tiscornia Marsh	9	Tiscornia Marsh	9/2; 9/14	Yes		X				
10	Point Pinole Marshes	10a	Whittell Marsh	8/26; 9/22	Yes		X				
		10b	Southern Marsh	2 years with no Invasive Spartina (2021-2022)							
		10c	Giant Marsh	8/30; 10/28	Yes		X				
		10d	Breuner Marsh	8/30	Yes		X				
11	Southampton Marsh	11	Southampton Marsh	9/13; 10/7	Yes		X				
12	Southeast San Franciso	12a	Pier 94	7 years with no invasive Spartina (2016-2022)							
		12b	Pier 98/Heron's Head	5 years with no Invasive Spartina (2018-2022)							
		12c	India Basin	9 years with no invasive Spartina (2014-2022)							
		12d	Hunters Point Naval Reserve	6 years with no Invasive Spartina (2017-2022)							
		12e	Yosemite Channel	9/30	Yes		X				

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		12f	Candlestick Cove	8 years with no invasive Spartina (2015-2022)							
		12g	Crissy Field	9 years with no invasive Spartina (2014-2022)							
		12h	Yerba Buena Island	9 years with no invasive Spartina (2014-2022)							
		12i	Mission Creek	9 years with no invasive Spartina (2014-2022)							
13	Whale's Tail Complex	13a	Old Alameda Creek North Bank	2 years with no invasive Spartina (2021-2022)							
		13b	Old Alameda Creek Island	8/23	Yes		X				
		13c	Old Alameda Creek South Bank	10/5	Yes		X				
		13d	Whale's Tail North Fluke	8/31; 9/21	Yes		X				
		13e	Whale's Tail South Fluke	10/5	Yes		X				
		13f	Cargill Mitigation Marsh	10/5	Yes		X				
		13g	Upstream of 20 Tide Gates	2 years with no invasive Spartina (2021-2022)							
		13h	Eden Landing-North Creek	8/23	Yes		X				
		13i	Eden Landing-Pond 10	8/31	Yes		X				
		13j	Eden Landing-Mt Eden Creek	8/31	Yes		X				
		13k	Eden Landing Reserve South-North Creek Marsh	8/23; 9/16	Yes		X				
		13l	Eden Landing Reserve North- Mt Eden Creek Marsh	8/22	Yes		X				
		13m	Eden Landing - Pond E8A, E9, and E8X	8/23	Yes		X		X		
15	South Bay Marshes	15a.1	Charleston Slough to Mountain View Slough	8/17; 10/4	Yes		X				
		15a.2	Stevens Ck to Guadalupe Sl	8/17-8/18; 9/29	Yes		X				
		15a.3	Guadalupe Slough	8/18; 9/1; 9/26; 10/17	Yes		X		X		
		15a.4	Alviso Slough	9/1; 9/15-9/16; 10/17; 11/14	Yes		X		X		
		15a.5	Coyote Creek to Artesian Slough	9/15; 9/20-9/21; 10/17	Yes		X		X		
		15a.6	Knapp Tract (Pond A6)	9/7	Yes				X		
		15b	Faber/Laumeister Marsh	9/14; 9/19; 9/28; 9/29	Yes		X				
		15c	Shoreline Regional Park	9/29; 10/31	Yes		X				
		15d	Sunnyvale Baylands	No invasive Spartina 2022							

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
16	Cooley Landing Salt Pond Restoration	16.1	Cooley Landing Central	9/1-9/2	Yes	X	X		X		
		16.2	Cooley Landing East	9/1-9/2; 9/19	Yes	X	X		X		
17	Alameda/ San Leandro Bay Complex	17a	Alameda Island South (Elsie Roemer Bird Sanctuary, Crown Memorial State Beach, Crab Cove)	8/5; 9/29	Yes		X				
		17b	Bay Farm Island	8/5	Yes		X				
		17c.1	Arrowhead Marsh West	11/2; 11/16	Yes		X		X		
		17c.2	Arrowhead Marsh East			WILL NOT BE TREATED IN 2022					
		17d.1	MLK Regional Shoreline - Fan Marsh Shoreline	7/20	Yes				X		
		17d.2	Airport Channel - MLK Shoreline	7/20; 7/22	Yes		X				
		17d.3	East Creek -MLK Shoreline	7/20	Yes		X				
		17d.4	MLK Regional Shoreline-Damon Marsh	10/17	Yes			X	X		
		17d.5	Damon Sl/Elmhurst Cr - MLK Shoreline	7/20; 10/17	Yes		X				
		17e.1	San Leandro Creek North	7/20	Yes		X				
		17e.2	San Leandro Creek South	7/20	Yes		X				
		17f	Oakland Inner Harbor	7/21; 8/2	Yes		X		X		
		17g	Coast Guard Island	No invasive Spartina 2022							
		17h	MLK New Marsh			WILL NOT BE TREATED IN 2022					
		17i	Coliseum Channels	7/7; 10/14	Yes		X				
		17j.1	Fan Marsh Wings	7/20	Yes		X				
		17j.2	Fan Marsh Main			WILL NOT BE TREATED IN 2022					
		17k	Airport Channel	7/22	Yes		X		X		
		17l	Doolittle Pond	7/20	Yes		X				
		17m	Alameda Island East: Aeolian Yacht Club & Eastern Shoreline	8/5; 9/29	Yes		X				
		18a	Colma Creek	5 years with no invasive Spartina (2018-2022)							
		18b	Navigable Slough	6 years with no invasive Spartina (2017-2022)							
		18c	Old Shipyard	4 years with no invasive Spartina (2019-2022)							

* Scheduling occurs throughout the treatment season. Additions and changes are regularly posted.

2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
18	Colma Creek/ San Bruno Marsh Complex	18d	Inner Harbor	9 years with no invasive Spartina (2014-2022)							
		18e	Sam Trans Peninsula	2 years with no invasive Spartina (2021-2022)							
		18f	Confluence Marsh	6 years with no invasive Spartina (2017-2022)							
		18g	San Bruno Marsh	4 years with no invasive Spartina (2019-2022)							
		18h	San Bruno Creek	No invasive Spartina 2022							
19	West San Francisco Bay	19a	Brisbane Lagoon	2 years with no invasive Spartina (2021-2022)							
		19b	Sierra Point	8 years with no invasive Spartina (2015-2022)							
		19c	Oyster Cove	8 years with no invasive Spartina (2015-2022)							
		19d	Oyster Point Marina	8 years with no invasive Spartina (2015-2022)							
		19e	Oyster Point Park	8/31	Yes		X				
		19f	Point San Bruno	2 years with no invasive Spartina (2021-2022)							
		19g	Seaplane Harbor	5 years with no invasive Spartina (2018-2022)							
		19h	SFO	9/8; 10/3	Yes		X		X		
		19i	Mills Creek Mouth	2 years with no invasive Spartina (2021-2022)							
		19j	Easton Creek Mouth	9/8	Yes		X		X		
		19k	Sanchez Marsh	9/15; 9/30	Yes		X				X
		19l	Burlingame Lagoon	8/31; 9/15; 9/30	Yes		X				X
		19m	Fisherman's Park	11 years with no invasive Spartina (2012-2022)							
		19n	Coyote Point Marina / Marsh	2 years with no invasive Spartina (2021-2022)							
		19o	San Mateo Creek / Ryder Park	9/7	Yes		X				
		19p.1	Seal Slough Mouth - Central Marsh	9/7	Yes		X				
		19p.2	Seal Slough Mouth - Peripheral Marshes	9/7	Yes		X				

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2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		19q	Foster City	9/27	Yes		X				
		19r	Anza Lagoon	7 years with no invasive Spartina (2016-2022)							
		19s	Maple Street Channel	4 years with no invasive Spartina (2019-2022)							
20	San Leandro / Hayward Shoreline	20a	Oyster Bay Regional Shoreline	7/5; 7/22	Yes		X				
		20b	Oakland Metropolitan Golf Links	No invasive Spartina 2022							
		20c	Dog Bone Marsh	7/8; 7/22	Yes		X				
		20d.1	Citation Marsh South	8/29	Yes	X	X				
		20d.2a	Citation Marsh Upper	8/12; 8/15-8/16; 8/29	Yes	X	X				
		20d.2b	Citation Marsh Central	WILL NOT BE TREATED IN 2022							
		20e	East Marsh	10/18	Yes		X				
		20f	North Marsh	WILL NOT BE TREATED IN 2022							
		20g	Bunker Marsh	8/30; 10/18; 11/3	Yes	X	X	X			
		20h.1	San Lorenzo Creek & Mouth North	8/18; 10/18; 11/3	Yes		X				
		20h.2	San Lorenzo Creek & Mouth South	8/18; 10/18; 11/3	Yes		X				
		20i	Bockmann Channel	7/22	Yes		X				
		20j	Sulphur Creek	7/22	Yes		X				
		20k	Hayward Landing	9/29	Yes		X				
		20l	Johnson's Landing	8/16	Yes		X				
		20m	Cogswell Marsh, Quadrant A	7/22; 8/16; 9/28	Yes		X				
		20n.1	Cogswell Marsh, Quadrant B Bayfront	8/17; 8/31	Yes	X	X				
		20n.2	Cogswell Marsh, Quadrant B South	8/31	Yes	X		X			
		20n.3	Cogswell Marsh, Quadrant B Main	8/12	Yes		X			X	
		20o	Cogswell Marsh, Quadrant C	8/31; 9/30	Yes	X	X	X			
		20p	Hayward Shoreline Outliers	7/22; 8/16; 8/18	Yes		X				
		20q	San Leandro Shoreline Outliers	7/22	Yes		X				
		20r	Oakland Airport Shoreline and Channels	7/5; 8/5; 10/5	Yes		X				

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2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		20s	H.A.R.D. Marsh	8/16; 9/29	Yes		X				
		20t	San Leandro Marina	7/8	Yes		X				
		20u	Estudillo Creek Channel	7/8; 7/22	Yes	X	X				
		20v	Hayward Landing Canal	7/22; 8/16	Yes		X				
		20w	Triangle Marsh	7/22; 9/28; 9/29	Yes		X				
21	Ideal Marsh	21a	Ideal Marsh North	9/27	Yes		X				
		21b	Ideal Marsh South	9/27	Yes		X				
22	Two Points Complex	22a	Wildcat Marsh	8/3; 9/1; 10/7; 10/25	Yes		X		X		
		22b.1	San Pablo Marsh East	9/1	Yes		X		X		
		22b.2	San Pablo Marsh West	8/30; 9/1; 9/8; 9/27	Yes		X		X		
		22c	Rheem Creek	8/30; 9/1	Yes		X				
		22d	Stege Marsh	9/19	Yes		X				
		22e	Hoffman Marsh	No invasive Spartina 2022							
		22f	Richmond/ Albany /Pinole Shoreline	8/26; 9/9; 9/19 11/3	Yes		X				
23	Marin Outliers	23a	Brickyard Cove	No invasive Spartina 2022							
		23b	Beach Drive	9/2; 9/26	Yes		X				
		23c	Loch Lomond Marina	9/26	Yes		X				
		23d.1	San Rafael Canal Mouth East	9/2	Yes		X				
		23d.2	San Rafael Canal Mouth West	11/4	Yes		X				
		23e	Muzzi & Marta's Marsh	9/14; 9/20; 9/27; 10/10	Yes		X				X
		23f	Paradise Cay	11/9	Yes		X				X
		23g	Greenwood Cove	No invasive Spartina 2022							
		23h	Strawberry Point	6/14/22 (COI); 11/2	Yes						X
		23i	Strawberry Cove	9/14; 9/26	Yes		X				
		23j	Bothin Marsh	8/10; 10/10	Yes		X				
		23k	Sausalito	8 years with no invasive Spartina (2015-2022)							

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2022 Invasive Spartina Project Treatment Schedule

Updated: 3/8/23

Where: Site Locations (map) **How:** Treatment Methods **Herbicide Use:** Environmental Review of Imazapyr

Treatment Location				Treatment Dates*		Treatment Method					
						Imazapyr Herbicide					Manual
Site #	Site Name	Sub-Area Number	Sub-Area Name	*(COI=Dug during course of inventory)	Complete for 2022?	Truck	Backpack	Amphibious vehicle	Airboat	Aerial: Broadcast	Digging, Mowing, and/or Covering
		23l	Starkweather Park	7 years with no invasive Spartina (2016-2022)							
		23m	Novato	7 years with no invasive Spartina (2016-2022)							
		23n	Triangle Marsh & shoreline	4 years with no invasive Spartina (2019-2022)							
		23o	China Camp	6 years with no invasive Spartina (2017-2022)							
24	Petaluma River	24a	Upper Petaluma River- Upstream of Grey's Field	8/31	Yes		X		X		
		24b	Grey's Field	2 years with no invasive Spartina (2021-2022)							
		24c	Petaluma Marsh	8/31	Yes		X		X		
25	Outer Coast	25a	Tom's Point (Tomales Bay)	3/8/23 (COI)	Yes						X
		25b	Limantour Estero	11 years with no invasive Spartina (2012-2022)							
		25c	Drakes Estero	10 years with no invasive Spartina (2013-2022)							
		25d	Bolinas Lagoon north	4 years with no invasive Spartina (2019-2022)							
		25e	Bolinas Lagoon south	10 years with no invasive Spartina (2013-2022)							
26	North San Pablo Bay	26a	White Slough / Napa River	12 years with no invasive Spartina (2011-2022)							
		26b	San Pablo Bay NWR & Mare Island	10/6	Yes		X				X
		26c	Sonoma Creek	7/19	Yes		X				
		26d	Sonoma Baylands	12 years with no invasive Spartina (2011-2022)							
27	Suisun Bay	27a	Point Buckler	6/8	Yes		X				
		27b	MOTCO Islands	6/7-6/8	Yes		X				
		27c	Honker Bay	6/8; 6/20	Yes		X				
		27d	MOTCO mainland	6/7; 6/20; 7/6	Yes		X				

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