WETLAND MITIGATION PLAN

For the Humboldt Bay Area Mitigation (HBAM) Project, Tuluwat Island

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In Humboldt County, California

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Chapter 1. Introduction

This final revised Wetland Mitigation Plan (WMP) substantially conforms to the plan dated July 16, 2019 to include the components required in Special Condition 5 of the Eureka-Arcata Corridor Project (Caltrans 2016b) Coastal Development Permit (CDP) 1-18-1078 application approved on August 7, 2019, as addended on August 6, 2019. In addition, this revised WMP provides a majority of the Site-Specific Plan Information detailed within the *Humboldt Bay Regional* Spartina *Eradication Plan* (H.T. Harvey & Associates 2013) for Tuluwat Island. Caltrans acknowledges that the mitigation being undertaken and calculation of mitigation credits pursuant to this final WMP, are in compliance with all assumptions, terms, and conditions of CDP 1-18-1078, Special Condition 5. In addition, Caltrans acknowledges that any proposed changes to this final plan will be reported to the Commission's Executive Director prior to implementation.

The California Department of Transportation (Caltrans) proposes to have a mitigation project implemented that would remove invasive Spartina on Tuluwat Island within Humboldt Bay (Appendix A), conduct follow up removal as needed, and fund indefinite long-term monitoring and removal of Spartina as offsite mitigation for impacts to 10.25 acres of coastal wetlands associated with the Eureka-Arcata Corridor Project (Caltrans 2016b), herein referred to as "Roadway Project.". The Eureka-Arcata Corridor Project includes safety improvements to U.S. Route 101 in Humboldt County, within the Safety Corridor, between the Cities of Eureka and Arcata from PM 79.9 to PM 86.3, consisting of several safety construction projects as follows: Tide Gate Replacement (01-0C930); Jacoby Creek Bridge Replacement (01-0E000); Extension of Acceleration/Deceleration Lanes and Lighting Improvements (01-0F220); Guardrail and Cable Rail Safety Barrier (01-0C970); and Indianola Interchange and Airport Road Improvements (01-36600).

Pending separate approvals or amendments by the California Coastal Commission (CCC), the planned Spartina removal mitigation would also provide mitigation for two regional trail projects; the County of Humboldt's Bay Trail South (HBTS) Project with 6.10 acres of impact to coastal wetlands and the City of Arcata Bay Trail North (ABTN) Project (CDP 1-16-0122) with 2.26 acres of impact to coastal wetlands (Table 1). As set forth the National Environmental Policy Act (NEPA) revalidations for the HBTS Project and ABTN Project Caltrans, as the NEPA Lead Agency for the projects, has committed to have a project implemented to mitigate the ABTN Project's impact to 2.26 acres of coastal wetlands and the HBTS Project's impact to 6.10 acres of coastal wetlands. It is noted that applications have, or

will be made, to the CCC to issue a material amendment to the ABTN Project's CDP #1-16-0122 and a new CDP for the HBTS Project. For the purposes of this WMP, all three of the above-named projects will be referred to as Projects.

As described in the Roadway Projects' CDP 1-18-1078, CCC staff determined that removal of invasive *Spartina densiflora*, (Spartina), a non-native cordgrass which threatens to dominate Humboldt Bay's remaining salt marsh, is considered substantial salt marsh restoration and functions as suitable mitigation to loss of wetlands as a result of the Project. According to the staff report for the Roadway Projects' CDP 1-18-1078, approximately 90% of the historic saltmarsh has been lost due to diking and conversion to agriculture and virtually all the remaining native saltmarsh in Humboldt Bay has been invaded by Spartina. Spartina profoundly alters estuarine habitats by replacing native plant species and Spartina removal has been demonstrated to enable saltmarshes to recover native species. Saltmarsh has high primary productivity which forms the base of estuarine food webs. Saltmarsh also provides nursery habitat for many invertebrates and fishes, is critical roosting and foraging habitat for many migrating and overwintering bird species and supports several species of rare plants in Humboldt Bay. Further, saltmarsh biogeochemical processes are important for maintaining water quality, nutrient cycles, and carbon storage. (H.T. Harvey & Associates 2013).

For this effort, Caltrans is working with local partners who are experts in the science of Spartina control as well as landowners who are currently working to remove Spartina on their lands, including but not limited to: Redwood Community Action Agency (RCAA), Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), City of Arcata, City of Eureka, and the Wiyot Tribe (the Tribe).

On April 4, 2019 Caltrans staff met with members of the Humboldt County Spartina Working Group which included staff from RCAA, USFWS, HBHRCD, the Tribe, and the California Coastal Conservancy. Sites around Humboldt Bay with Spartina were assessed to determine where the control effort should occur. Several factors were discussed such as: site access logistics, strategic locations based on seed dispersal, ecological continuity and containment, Spartina density, land ownership, and topography. Based on that discussion, Caltrans identified Tuluwat Island (Appendix A) to meet the Roadway Projects' mitigation requirement. On June 10th, 2019, Caltrans presented to the Wiyot Tribal Council to ask for their support and for access to the island in perpetuity, as required by CCC. The Tribal Council voted unanimously for the project and for allowing access on the island in perpetuity. The Chair signed a letter of

support that was then attached to the WMP on July 16, 2019. On October 21st, 2019, the City of Eureka officially signed the Deed, handing the rest of the island over to the Tribe. Although Caltrans has been working with the City of Eureka as well on this effort, now that the entire island is in ownership of the Tribe, Caltrans is now working directly with the Tribe to formalize an agreement for land access in perpetuity as required by Special Condition 5 of the CDP, the ABTN Project's NEPA revalidation, and HBTS Project's NEPA revalidation. On July 2 and July 3, 2019, the Tribe granted Caltrans and their consultants access their lands to conduct cultural resource surveys, and on October 3 and October 4, 2019 to conduct UAV (drone) and biological surveys to update the existing 2011 Spartina cover maps with the use of UAVs. Updated maps are shown in Appendix A and Aerial Survey Methods are attached in Appendix E. Preliminary site evaluations were done in October 2019 to measure and describe the size and density of Spartina infestation in the treatment areas chosen, and record vegetation composition, substrate characteristics, topography, tidal circulation and elevations, the presence of tidal channels on or adjacent to the site, site accessibility, the presence of sensitive resources, distances to the nearest aquaculture operation and residential areas, public access use in and around the area, and other factors relevant to the proposed treatment method (Appendix E). Letters of support are provided in Appendix B and the Land Access Agreement in Appendix C. The letters of support also express that the landowners do not wish to develop within Spartina mitigation lands in perpetuity, as described in the Corridor CDP Special Condition 5.B.4.

Caltrans intends to enter into a Cooperative Agreement with HBHRCD to have the HBHRCD implement the initial Spartina removal, monitoring and reporting the first two (2) years to meet removal success criteria and thereafter conduct maintenance, monitoring and reporting for the following five (5) years to reach success criteria described in Section 3.1 of this WMP and in the Roadway Project's CDP 1-18-1078. Caltrans has committed to assist with monitoring efforts and Caltrans efforts are described in Section 3.2.1 of this plan. Caltrans is also committed to providing an endowment to an appropriate entity to maintain native salt marsh in perpetuity by treating any new populations of Spartina as it invades from other areas of Humboldt Bay. An example Endowment Summary is provided in Appendix D that details anticipated long-term management activities and associated costs with a Spartina removal entity. This endowment summary may be amended to be reflective of actual efforts and costs of the long-term management following Year 1 of the maintenance and monitoring period (Year 3). On January 30, 2020 Caltrans staff again met with members of the Humboldt County Spartina Working Group to apprise them of the Tuluwat Island WMP.

1.1 Site Description and Conditions

The mitigation site on Tuluwat Island is approximately 280 acres of vegetated, vacant land bisected by Highway 255. The few private residential properties along the southeast shore of the island are not included in the mitigation area. The site is surrounded by the waters of Arcata Bay, and lies between Woodley Island and the City of Eureka to the south, and the community of Samoa on the Samoa Peninsula to the northwest. The Woodley Island Marina is located on the south coast of Woodley Island, with the majority of the island undeveloped and designated as a wildlife area. The Samoa Peninsula is sparsely developed with some industrial land uses directly across the Samoa Channel from the southern tip of Tuluwat Island. The mitigation site is relatively flat with an elevation range of sea level to approximately 6-8 feet above sea level (some areas of dredge spoil deposition are slightly higher). The majority of soils are characterized as very poorly drained tidal marsh supporting salt marsh vegetation, although there are also a few groves of trees, including a grove of mature cypress that serves as an important rookery for egrets and herons. Portions of the mitigation site are completely inundated at high tide, and an extensive network of small to large channels occur throughout the area.

The Tuluwat Village site at the northeast corner of the island has documented prior soil and groundwater contamination from historical uses of the area as a shipyard (ICF 2018) and has been the subject of U.S. Environmental Protection Agency brownfield cleanup and remediation activities (EPA 2018). This area of the Island will not be subject to any ground disturbing Spartina removal methods due to the presence of sacred cultural resources, and only the cover method of removal will be applied. In June 2018, a Phase I Environmental Site Assessment (ESA) was conducted on parcel APN 405-011-011 as part of the process of land transfer between the City of Eureka and the Tribe. The ESA did not identify any Recognized Environmental Concerns (RECs) or recommend the need for any future assessments based on records review, site reconnaissance, and interviews with persons knowledgeable of the present and past uses of the property (ICF 2018). Ground disturbing Spartina removal activities on the areas of the Island which have been selected (in consultation with the Tribe) for these treatments do not pose a risk of mobilizing contaminants to Humboldt Bay.

The entire island is designated a National Historic Landmark. It is also listed on the National Register of Historic Properties as well as listed in the California Register of Historical Resources. The island's significance is due to traditional, continuous use of the island by the Wiyot for well over a thousand years. Caltrans, in consultation with the Tribe, has developed a

detailed site-specific Cultural Resource Protection Plan for the project that addresses the unique sensitivity of the site.

1.2 Project Impacts and Mitigation Ratios

The purpose of this WMP is to describe Caltrans' mitigation approach for the 18.61 acres of impacts to wetlands protected by the California Coastal Act (CCA) associated with the Projects (Table 1). The CCC typically requires a 4:1 credit-to-impact mitigation ratio for impacts to coastal wetlands. Caltrans needs a minimum of 74.4 "acre-credits" for the Projects.

The mitigation "acre-credits" earned for Spartina treatment were calculated as follows: a 1.24:1 mitigation ratio for Spartina cover class of >60%, a 2.33:1 mitigation ratio for Spartina cover class of 26-60%, and 7.69:1 mitigation ratio for Spartina cover class of 1-25% cover (Corridor CDP Special Condition 5.A.1–3). This sliding scale mitigation was created by Coastal Commission ecologists to reflect the ecological benefit to Humboldt Bay. Using this scale, treating 178 acres of Spartina would produce approximately 81.8 "acre-credits" of mitigation credit which would ensure that the mitigation need of 74.4 acres at a 4:1 mitigation ratio for the Projects (Table 2) is met. Further, although in 2017 the Wiyot Tribe treated 18.6 acres of Spartina on the Tuluwat Island, east of the State Route 255,the CCC has advised that treating the entire island is the only feasible way to substantially restore native salt marsh due to the invasive nature of Spartina and the threat of Spartina seed dispersal throughout Humboldt Bay from the island. Therefore, the 18.6 acres of Tuluwat Island that was previously treated in 2017 will be retreated and thereafter maintained as part of the mitigation project.

Table 1. Updated estimated net impacts for all projects associated with the Eureka-Arcata Corridor Improvement Project's Humboldt Bay Area Mitigation Plan

Project Component	Wetland Type / Cowardin Code	CCA (1- or 2-parameter) wetlands (acres)[1]	Project Implementation schedule
Jacoby Creek Bridge Replacement (01-0C930)	Palustrine Emergent Persistent / PEM1	0.29	2019-2024
Jacoby Creek Bridge Replacement (01-0C930)	Estuarine Intertidal Emergent / E2EM	0.10	2019-2021
Guard Rails Median Barriers (01-0C970)	Palustrine Emergent Persistent / PEM1	1.60	2019-2021
Acceleration / Deceleration Lanes & Lighting (01-0F220)	Palustrine Emergent Persistent / PEM1	0.96	2019-2022
Interchange and Airport Road Improvements (01-36600)	Palustrine Emergent Persistent / PEM1	7.30	2021-2026
Eureka/Arcata Corridor Mitigation Subtotal		**10.25**	**2019-2026**
PROJECT 2: Humboldt Bay Trail North[2]			
Trail through estuarine habitats (0.48 at a 2:1 ratio)	Estuarine Intertidal Emergent / E2EM	0.96	2017
Trail through palustrine habitats (1.30 at a 1:1 ratio)	Palustrine Emergent Persistent / PEM1	1.30	2017
Humboldt Bay Trail North Mitigation Subtotal		**2.26**	**Complete**
PROJECT 3: Humboldt Bay Trail South[3]			
Trail through estuarine habitats	Estuarine Intertidal Emergent Ditch / E2EMd	2.67	2019
Trail through estuarine habitats	Estuarine Intertidal Emergent / E2EM	0.52	2019
Modification of estuarine shore and bottom	Estuarine Intertidal Rocky Shore and Unconsolidated Bottom / E2RS2 and E2US	0.01	2019
Trail through palustrine habitats	Palustrine Emergent Persistent Open Water Ditch / POWd	1.91	2019
Trail through palustrine habitats	Palustrine Emergent Persistent / PEM1	0.47	2019
Trail through palustrine habitats	Palustrine Scrub-Shrub / PSS	0.52	2019
Humboldt Bay Trail South Mitigation Subtotal		**6.10**	**Pending**
Total Permanent Impacts		**18.61**	

[1] California Coastal Act (CCA) wetland total reflects Clean Water Act (CWA) Section 404 wetland acreages plus additional 1- and 2-parameter CCA wetlands.
[2] The actual impact to these wetland types is 1.78 acres. The acres listed in the table include multiplication of this area by the listed ratios which are based on previous approvals between the City of Arcata and regulatory agencies. May require material amendment to CDP 1-16-0122.
[3] Includes proposed High-Tension Cable Barrier.

Table 2. Summary of Spartina Treatment and Mitigation Credit

Spartina Percent Cover Class on Tuluwat Island	Acres of Spartina proposed to be treated as shown in Appendix A-2	Mitigation Credit Ratio Proposed (acres of treatment-to-acres of mitigation credit)	"Acre-Credits" earned
1-25	81.06	7.69:1	10.54
26-60	17.62	2.33:1	7.56
>60	79.03	1.24:1	63.73
Total	**177.71**		**81.83**
Credit acres needed at a 4:1 mitigation ratio for all three projects in the Project			74.44

1.3 Agency Permits and Environmental Review

The following agency permits and environmental documentation will be used or are anticipated for the Spartina Removal project:

i) Existing Final Programmatic Environmental Impact Report (FPEIR) for Spartina Removal in the Humboldt Bay prepared by H.T. Harvey & Associates, Inc. and GHD, Inc. (2013).

ii) Existing Humboldt Bay Eelgrass Comprehensive Management Plan prepared by Merkel & Associates, Inc. (2017).

iii) Existing CCC Permit No. 1-14-0249 – Programmatic Coastal Development Permit for Spartina Removal in the Humboldt Bay (approved by the CCC on June 12, 2015 and Extended on December 5, 2019). The "FPEIR CDP."

iv) Existing CCC Permit No. 1-18-1078 (approved by the CCC on August 7, 2019, as Addended on August 6, 2019).

v) Existing Regional Water Board Resolution Waiving Waste Discharge Requirements R1-2017-0039, dated May 2, 2018. The "WDR R1-2017-0039."

1.4 Site-Specific Spartina Removal Plan Components

HBHRCD shall draft a Site-Specific Spartina Removal Plan and submit it to Caltrans at least two (2) weeks prior to commencement of primary treatment of Spartina. HBHRCD understands that Caltrans will thereafter submit it to the California Coastal Commission. The Site-Specific Spartina Removal Plan will address the proposed primary Spartina removal work to occur in the area shall be consistent with (1) all terms and conditions of Coastal

Development Permit 1-14-0249, and (2) the mitigation measures in the adopted Final Programmatic Environmental Impact Report (FPEIR) prepared for the project (dated March 21, 2013). The plan shall include, at a minimum, the following components:

(i) A description of the treatment area location, size, access routes, and proposed primary and anticipated secondary methods for Spartina removal;

(ii) A site evaluation that describes the size and density of the Spartina infestation in the treatment area, vegetation composition, substrate characteristics, topography, tidal circulation and elevations, the presence of tidal channels on or adjacent to the site, site accessibility, the presence of sensitive resources, distances to the nearest aquaculture operations and residential areas, public access use in and around the area, and other factors relevant to the proposed primary treatment method;

(iii) Analyses and, as applicable, survey results, completed by a qualified biologist using agency-approved protocols, for sensitive fish, birds, plants, and other sensitive species consistent with the relevant mitigation measures proposed in the FPEIR;

(iv) In cases where ground disturbance methods or imazapyr application are proposed, a preliminary assessment of sediment contamination in and around treatment areas and access routes consistent with the relevant mitigation measures proposed in the FPEIR;

(v) Any necessary approvals from the Regional Water Quality Control Board, the North Coast Unified Air Quality Management District, and other agencies as applicable for the proposed site-specific treatment activities;

(vi) Plans consistent with the mitigation measures in the FPEIR for all of the following, as applicable: (a) noise monitoring, (b) bird nesting habitat protection, (c) rare plant protection, (d) eelgrass avoidance, (e) erosion and sediment control, (f) hazardous materials spill prevention and containment, (g) worker health and safety, and (h) public access protection;

(vii) A protocol for the inadvertent discovery of artifacts or archaeological deposits developed consistent with the requirements of Special Condition 8;

(viii) A description of the specific mitigation measures proposed to avoid or minimize impacts to visual, biological, and cultural resources, water quality, surrounding mudflats, ESHA, and park and recreation areas, and public access from the proposed Spartina removal activities, including demonstrating consistency with all relevant mitigation measures from the FPEIR and the special conditions of this coastal development permit;

(ix) A site plan depicting the primary treatment area, designated ingress/egress routes, staging/stockpiling areas, buffer areas (from channels, nesting bird habitat, sensitive

plants, etc., as applicable), and locations of relevant mitigation measures (e.g., educational signage, locations to be staked for rare plant protection, locations for erosion and sediment control devices, etc.)

(x) A schedule for timing of work, including timing of mitigation measure implementation, and an analysis of how the proposed timing of work minimizes impacts on public access (e.g., avoiding peak use periods) and coastal resources;

(xi) Applicable acreage calculations demonstrating compliance with Special Condition 5;

(xii) A description of the specific implementation of performance standards that will assure achievement of the restoration goals and objectives set forth in the Humboldt Bay Regional Spartina Eradication Plan (H.T. Harvey & Assoc. 2012) including, but not limited to (a) the restoration of native tidal marsh plant species in the treatment area to a level of coverage and diversity similar to surrounding natural marshlands, and (b) achievement of fully restored (to "maintenance" stage) marsh habitats within the treatment area within five years of implementation of primary treatment;

(xiii) A monitoring plan that includes provisions for (a) monitoring the treatment area for a minimum of five years post implementation of primary treatment; (b) photo-documenting the restoration/recovery of the treatment area; and (c) performing quantitative sampling in the treatment area to track native plant recovery and Spartina presence/cover in the area throughout the monitoring period. The monitoring plan should include a schedule of proposed monitoring activities;

(xiv) A reporting plan that includes provisions for submittal to the Executive Director of (a) an "as built" report demonstrating that the initial restoration work has been completed in accordance with the approved site-specific Spartina removal plan within 30 days of completion of primary treatment; (b) annual reports of monitoring results by December 31st each year for the duration of the required monitoring period, beginning the first year after submittal of the "as-built" assessment. Each annual report shall include a "Performance Evaluation" section where information and results from the monitoring are used to evaluate the status of the restoration project and to recommend follow-up treatment methods as well as any necessary revegetation; and (c) a final monitoring report the end of the five-year reporting period. The final report must be prepared in conjunction with a qualified biologist. The report must evaluate whether the restoration site conforms to the goals, objectives, and performance standards set forth in the approved final site-specific Spartina removal plan.

Chapter 2. Implementation

2.1 Implementation Plan

As part of the Cooperative Agreement between Caltrans and HBHRCD, HBHRCD would perform the initial treatment work and the monitoring and maintenance for the first two (2) years using primarily mechanical methods (i.e. brush cutters, Marsh Master, etc.). In addition, HBHRCD would perform the five-year monitoring and maintenance of Spartina to achieve the success criteria outlined in Section 3.1. As outlined in Section 3.2, this work will be overseen by Caltrans mitigation specialists and biologists and would include an annual visit by Caltrans staff to the site to check on crews and coordinate with HBHRCD for any logistical issues that might come up. Caltrans staff may access the site to verify the results of the monitoring reports submitted by HBHRCD. If Spartina removal activities are not completed before the end of the authorization period for CDP 1-14-0249 (June 12, 2025), then Caltrans will seek an amendment to CDP 1-18-1078 to authorize any remaining Spartina removal activities.

A separate fund for a non-wasting endowment would be provided to an appropriate investment firm, with which the interest earned on the investment would be provided on an annual basis to an appropriate entity. The endowment would fund the long-term monitoring and removal of Spartina in perpetuity at the site after the success criteria has been met. The interest earned annually would provide funding for additional clearing necessary at the site to maintain a cover of Spartina of less than 5 percent in perpetuity.

The mitigation activities that will be taken on by HBHRCD include but are not limited to:

- Obtain any necessary approvals from the North Coast Regional Water Quality Control Board, the North Coast Unified Air Quality Management District, and other agencies as applicable for the proposed site-specific treatment areas for the purpose of treating Spartina.

- Follow the Cultural Resources Protection Plan prepared by Caltrans as part of the Cooperative Agreement with HBHRCD.

- Prior to starting the Spartina removal, conduct analyses and, as applicable, survey for sensitive cultural resources as well as biological resources such as fish, birds, plants, and other sensitive species consistent with the relevant mitigation measures agreed upon in the FPEIR CDP 1-14-0249 (Appendix F).

- Spartina removal on Tuluwat Island will be primarily conducted by HBHRCD by mechanically clearing and tilling of Spartina rhizomes using a Marsh Master or hand clearing around culturally sensitive areas under consultation with Wiyot and tribal historic officers (Appendix C). The Marsh Master can access much of the island directly from State Route 255 or, if necessary, owing to extensive dissecting tidal creeks, access from open waters may be necessary during high tide cycles to avoid eelgrass and at areas pre-identified as culturally insensitive sites. Handheld tools have been used extensively with successful results in the Humboldt Bay Management Area (H.T. Harvey & Associates 2013). Handheld tools are relatively easy to transport and can be highly selective, thereby minimizing non-target impacts. Field crews using handheld tools will also be valuable at all sites for follow-up treatment stages.

- Spartina removal would follow the FPEIR for all of the following, as it pertains to: (a) noise monitoring, (b) bird nesting habitat protection, (c) rare plant protection, (d) eelgrass avoidance, (e) erosion and sediment control, (f) hazardous materials spill prevention and containment, (g) worker health and safety, and (h) public access protection (Appendix F).

- Use mechanical treatment (i.e. Marsh Master, brush cutters etc.) to treat Spartina. No chemical control methods are allowed.

- Following Spartina removal and during the monitoring period, ground cover of Spartina and native vegetation will be estimated by HBHRCD using on-the-ground searching for new sprouts of Spartina, and ground truthing any surveys done by Caltrans using UAVs*.

*Since HBHRCD does not have the capacity to use UAVs, Caltrans has committed staff time to conduct UAV flight surveys and ground truthing efforts.

Table 3. Schedule of Proposed Spartina Removal and Monitoring at the Tuluwat Site

Restoration Task (HBHRCD)	Year								
	Pre-Treatment	1	2	3	4	5	6	7	9+
Initial Treatment		Aug / Sept 2021 (following completion of Site-Specific Spartina Removal Plan)	May (prior to seed set)						
Resprout Maintenance (as needed)				Sep.-Mar. (when natives are dormant)					
Seedling Maintenance (as needed)				Mar.-Aug. (when seedlings flush and grow)					
Seed Suppression				July-Aug. (in high threat stands if necessary)					
Revegetation (if needed)							Rainy season, if needed		
On-the-ground Monitoring, Documentation, and Reporting	Aug/Sep. 2021*		X*	X	X	X	X	X*	X**

* Initial and Final Removal Reports, as described in CDP 1-18-1078 Special Condition 5.B.12 and 5.B.13.

** Frequency of monitoring dependent on successful restoration of native salt marsh community, likely biennial.

Modified from Table 4-4 in the Humboldt Bay Regional *Spartina* Eradication Plan (H.T. Harvey & Associates 2013) to show two initial clearing years, five years of Monitoring and Maintenance, and site-specific schedule.

Chapter 3. Success Criteria, Monitoring and Reporting

3.1 Performance and Success Criteria

The Spartina removal activities will be evaluated annually using the performance and success criteria described below, as detailed in Special Condition 5 of the Corridor CDP. For this WMP, the category of "performance criterion" indicates whether the initial treatment was successful. The performance criterion will be used to guide site maintenance activities. The category of "success criteria" indicates whether the restoration goals have been achieved at the end of the monitoring period. For this WMP, the goal is to meet the success criteria by year 7 of the project, also known as year 5 of the monitoring and maintenance period that follows the 2-year initial treatment period.

Beyond year 7, further monitoring would be conducted by an implementing agency without Caltrans oversite to perform additional clearing and removal of Spartina as necessary to maintain a <5 percent or less cover of Spartina until regional eradication is achieved.

Performance Criterion for Initial Treatment (CDP 1-18-1078 Special Condition 5.9)

Year 1: No success criteria for Year 1 because initial treatment is expected to take 2 years.

Year 2: Demonstrate percent cover of Spartina decreased to <5 percent in all treatment areas after primary removal.

Success Criteria for the 5-year Maintenance and Monitoring Period

Years 3–6: Demonstrate Spartina cover remains <5 percent in all treatment areas.

Year 7: Demonstrate that the cover of Spartina is <5 percent in treatment areas, that the absolute percent cover of native salt marsh species is ≥80 percent, and that there are no unvegetated areas >2.5 square meters (26.9 square feet).

Beyond Year 7: Demonstrate percent cover of Spartina remains at <5 percent in treatment area and absolute percent cover of native salt marsh species remains ≥80 percent. See Section 3.4 for details on long-term monitoring and maintenance.

3.2 Monitoring Methods and Schedule

Monitoring will be conducted by HBHRCD and Caltrans to evaluate progress towards the project goal of restoring tidal marsh communities by eradicating Spartina and to document the natural recovery of native salt marsh species. Monitoring activities and timelines are set forth below.

3.2.1 Monitoring and Reporting Responsibilities of Caltrans

Monitoring methods (Pre-treatment): As part of the regional mapping effort, Spartina cover data were initially recorded or estimated from aerial photos in 2010 across Humboldt Bay (USFWS 2011), including on the proposed mitigation site of Tuluwat Island (Figure A-1 in Appendix A). To update this mapping, Spartina density was recorded in October of 2019 by Caltrans staff and consultants using high-resolution red-green-blue (RGB) and multi-spectral imagery acquired from the use of two separate unmanned aerial vehicle (UAV) flights (Figure A-2 in Appendix A). Initial review of the spectral imagery and resulting digital elevation surface model indicated Spartina was distinct among vegetation on the island, standing more erect, occurring in distinct bunched clusters, and generally standing taller than surrounding plants. The unique spectral signature, texture, and elevation profile of Spartina make it possible to distinguish dense patches as small as 0.5-square-meter from native vegetation (Figures 1 – 4 in Appendix E). It was determined that multispectral imagery and image classification tools could successfully be used to map the vegetation on Tuluwat. However, in areas where the Spartina was sparse, not bunched, and intermixed with other grasses, its spectral profile and elevational profile were less distinguishable. For this reason, detecting Spartina re-sprouts following initial treatment will likely require ground observations.

After the initial imagery review and mapping of the dense cover class (61 to 100 percent), a field sampling program was developed to collect on-the-ground data for ground truthing and calibration of the low and medium density cover classes during the image classification process. The field program consisted of an estimation of Spartina coverage within 1-square-meter quadrats within a series of transects. The transects, typically 100 to 300 feet long, were distributed across the island (Figure 5 in Appendix E). Transects were chosen to evaluate areas where Spartina was not distinctly identifiable, to verify and characterize the boundaries of dense Spartina populations, and to identify occurrences of the medium coverage class (26 to 60 percent). A total of 278 quadrats were sampled on November 6 and 8, 2019. In general, many of the medium density areas are made up of smaller clumps of dense Spartina that, in

aggregate, have a coverage that falls within the medium density category (Figure 7 in Appendix E).

ArcGIS Image Classification tools were used to conduct Spartina distribution mapping using the spectral reflectance values collected with the RedEdge-MX moultispectral camera. The process begins by developing a set of training polygons which are assigned to the various elements in the imagery. For the Tuluwat Island, training samples were developed for the known occurrences of Spartina, native vegetation, grasses, water bodies, and mud flats. The objective of the training was to categorize as much of the image into distinct mapping elements, or classes. The number and size of the training samples was adjusted until the most distinguishable spectral signature for Spartina was achieved. Several tools are available to review the quality and separability of the training samples, with the goal of developing a unique spectral signature. Using the training samples and their associated classes, the Maximum Likelihood Classification tool was used to provide the pixel-based mapping of the different elements. This is an iterative process, in which the results are reviewed, adjustments are made to the content and number of training polygons, and the analysis is re-run and reviewed again until an optimum balance between over mapping and under mapping Spartina is achieved.

It is important to note that the Spartina that is mapped through this process represents a collection of grouped pixels that can be assigned to Spartina, and therefore, by default, represents relatively dense clusters of Spartina. The classification process will not pick out diffuse individual plants as the spectral signature of these populations will be dominated by the mixture of other plant species present. In general, we found that the mapping was very good with positive identification of Spartina where it was suspected to be based on our qualitative review of the data and the field sampling that was conducted. In some areas we noted that Spartina was being under mapped based on variations in the imagery or the conditions on the ground (plants laid down) and in other cases there were vegetation types that were spectrally similar enough to Spartina to be erroneously mapped. The field sampling effort was important in identifying and accounting for these discrepancies.

Results of baseline UAV monitoring indicated that much of the original medium cover class density of 25-60% Spartina was now placed in the lower or higher classes (Appendix A, Appendix E). Regardless, total mitigation areas still exceed the 4:1 mitigation requirement for all three projects (Table 2).

During the field verification of the size and density of Spartina infestation in the treatment areas, field biologists also confirmed areas of native vegetation, unique topography, the location of tidal channels, site accessibility issues, the presence of sensitive cultural resource areas, distances to the nearest aquaculture operations and residential areas, public access use in and around the area, and other factors relevant to the proposed Project. These observations were largely confirmatory as most were evident in the high-resolution imagery (Appendix E).

Initial Treatment: The UAV flight will be conducted by Caltrans in a manner directly comparable to the 2019 flight paths and imagery analysis detailed in Appendix E by well-qualified persons with demonstrated experience and approval by the Executive Director [of the Coastal Commission] (Special Condition 5.B.6). Imagery analysis will demonstrate the effectiveness of the primary Spartina removal in the initial treatment phase, through mapping of restored areas with no Spartina cover, and mapping of areas with retained native vegetation.

In Year 3, transects will be walked throughout Tuluwat Island where Spartina removal occurred and both Spartina resprouts and native plant cover will be visually estimated by trained Caltrans biologists. These cover estimates are to be compared to any corresponding UAV flights and any discrepancies in imagery interpretation resolved.

If ground sampling is employed to assist with the training of any subsequent imagery analysis, then it must insure more-or-less uniform spatial coverage of the Spartina removal areas, randomized placement of the sampling units, and a demonstrated replication sufficient to provide an estimate of mean ground cover of native saltmarsh vegetation with a margin of error (confidence interval) of 10 percent absolute ground cover with a 90 percent confidence level (Special Condition 5.B.8). This will typically be undertaken using readily available online power analysis tools (https://statpages.info/#Power).

Monitoring During the 5-Year Maintenance Period: The third UAV flight in Year 7 will follow the same methods as stated above for the Initial Treatment. The project performance ground-truthing effort to assist the UAV flight will follow that as stated above for the Initial Treatment. Caltrans will implement the use of any UAV mapping and will confirm the findings documented in annual monitoring report through ground-truthing spot-check efforts. Photos taken at established photo points and aerial imagery will provide a consistent qualitative measure of restoration success.

Table 4. Schedule of Proposed Monitoring at the Tuluwat Site by Caltrans

Monitoring Task (Caltrans)	Year								
	Pre-Treatment	1	2	3	4	5	6	7	9+
UAV Spartina mapping 1 (pre-treatment)	Oct. 2019*								
UAV Spartina mapping 2 (post-treatment)				Oct. 2023 (following Initial Treatment)					
UAV Spartina mapping 3 (evaluate performance criteria)								Oct. 2028	

* Baseline mapping by Unmanned Aerial Vehicle (UAV) and ground-truthing for final Spartina WMP.

Annual Maintenance Reporting: Caltrans as described in the reporting requirements in 3.2.2 and Tables 5 & 6 below, will include the information in the draft monitoring reports submitted to Caltrans by HBHRCD. After approving the monitoring reports, Caltrans will submit final monitoring reports to Coastal Commission.

In Years 3 and 7, Caltrans will include the following information in the final monitoring reports:

- A summary of the monitoring methods including details associated with any interpretation of images obtained through the use of UAVs.
- A summary and analysis of the monitoring results of UAV surveys, including an evaluation of site conditions in the context of the performance standards and success criteria.
- A discussion of the field verification efforts conducted by Caltrans.
- A hard drive or CD of any aerial imagery obtained via the use of UAVs (provided by Caltrans).

3.2.2 Monitoring and Reporting Responsibilities of HBHRCD

Initial Treatment: As detailed in the *Humboldt Bay Regional* Spartina *Eradication Plan*, all sensitive resources present on the site should be noted, with information on sensitivity status (federal, state, or other listing) (H.T. Harvey & Associates 2013). Sensitive resources include rare species, special status wildlife species habitat, research plots or data gathering devices,

or cultural resources. If sensitive resources are present, measures needed to avoid, minimize, and/or mitigate impacts associated with the proposed treatment must be addressed and documented in concurrence with the *Bio-1 (Fish), Bio-3 (Harrier and Short-Eared Owl Nests), Bio-4 (Special Status Plants), Bio-5 (Eelgrass),* and *Bio-2 and Bio-6 (Noise)* Mitigation Measures detailed in the Final Programmatic Environmental Impact Report (FPEIR) for *Spartina* eradication in Humboldt Bay (H.T. Harvey & Associates and GHD 2013).

Humboldt Bay owl's clover (*Castilleja ambigua* ssp. *humboldtiensis*) and Point Reyes bird's beak (*Chloropyron maritimum* ssp. *palustre*) are related taxa that co-occur in similar habitats on some areas of Tuluwat island with low density Spartina. Both taxa are given a California Rare Plant Rank (CRPR) of 1B.2 by the CNPS, indicating they are "fairly endangered" in California and elsewhere (CNPS 2020). Neither species are protected by the State or Federal Endangered Species Acts. They occur in intertidal coastal and brackish marshes in the Humboldt Bay/Eel River region, specifically within high-elevation salt marshes and brackish marshes (Eicher 1987). Spartina treatment at the nearby Lanphere-Ma-le'l Marsh restoration site has had a positive effect on rare plant populations. Humboldt Bay owl's clover was censused and mapped at the site periodically since 1988. Pre-treatment population size fluctuated between 1,000-3,800 individuals, while post-treatment numbers reached 6,213 in the first year following restoration and then increased to 99,485 in 2011. A nearby control site peaked in 2008 but has declined every year since. Similarly, Point Reyes bird's beak was observed to have a similar post-treatment positive effect, although the population was not quantitatively monitored due to its more cryptic nature (Pickart 2012). Other plant species potentially present on Tuluwat Island include western sand spurrey (*Spergularia canadensis* var. *occidentalis*), a diminutive annual herb found in high elevation coastal salt marsh. It has a CRPR of 2B.1, which indicates it is seriously endangered in California, but more common elsewhere (CNPS 2020). In California, it is known only by its occurrences in/near Humboldt Bay, including a collection made from Tuluwat Island in 1980 (CNPS 2020). Little is known about western sand spurrey responses to Spartina removal. However, all three taxa mentioned above are expected to recover naturally from Spartina removal and, even if populations are impacted during the Project, to overwhelmingly benefit from the reduced competition (H.T. Harvey & Associates and GHD 2013). HBHRCD, as the implementing entity, will be responsible for assuring the recommendations within the FPEIR are followed.

Estimation of Spartina ground cover will include methods for intensively searching for Spartina cover within areas of infestation and the size of areas infested and documenting the search tracks with GPS. The entire treatment area must be visually examined along tracks

that are sufficiently narrow that small Spartina plants can be recognized. This task could be done in conjunction with the maintenance removal of Spartina (Special Condition 5.B.7). in accordance with the Corridor CDP. These field visits will determine the need for continued maintenance of Spartina and the effectiveness of the initial treatment (Table 3). Photos will be taken from permanent photo points (Special Condition 5.B.6).

Pre-treatment Reporting: Prior to Project implementation, HBHRCD will create a Site-Specific Spartina Removal Plan (see Section 1.4 for report details) and submit to Caltrans for review and submittal to CCC for approval (Table 5).

Initial Treatment Reporting: Within 30 days of completion of the initial treatment (estimated following year 2), HBHRCD will write the results from the monitoring efforts in an Initial Removal/As Built report documenting the success of the initial treatment, areas needing additional treatment, Spartina coverage, and areas lacking in native marsh vegetation (Table 5). In addition, the report should include locations of delineated polygons of known area, photos from the permanent photo points with a descriptive caption and a map showing the permanent photo points, and direction of photo and areas of concern or locations needing additional treatment.

Monitoring During the 5-Year Maintenance Period: During each year of the Monitoring and Maintenance period (Years 3-6), an accurate record will be maintained of annual field efforts and expenditures resulting from annual Spartina re-sprout survey and treatment efforts, in accordance with the Corridor CDP, Special Condition 5.B.10. Spartina re-sprouts and native plant cover will be visually estimated by trained biologists employed by HBHRCD. Spartina will then be treated after recording the cover. GPS tracks that are sufficiently narrow that small Spartina plants can be recognized are to be recorded and HBHRCD will submit annual reports to Caltrans and Caltrans will submit them to Coastal Commission (Special Condition 5.B.7). Photos will be taken from permanent photo points (Special Condition 5.B.6).

HBHRCD will conduct re-sprout searches, provide photos at established photo-points, and report to Caltrans a summary of work done that year and the monitoring methods and results.

If Caltrans' determines that the monitoring results indicate that the performance criteria are not being met in year 3, HBHRCD will work with Caltrans to develop adaptive management strategies that HBHRCD will thereafter implement.

Annual Maintenance Reporting: HBHRCD will prepare four (4) yearly monitoring reports (estimated years 3-6) (Table 5) which will include the results of the Spartina resprout survey, native salt marsh cover, maintenance conducted on the resprouts, a discussion on whether or not the success criteria are being met and potential remedial actions if success criteria are not being met, and photos from each permanent photo point with a caption describing the photo. Annual monitoring reports will also include a breakdown of the cost of monitoring and maintenance for the year. Annual monitoring reports will be submitted to Caltrans following the schedule in Table 6 who will conduct site visits covering approximately 20 percent of the treatment area to confirm the results within the annual report. The annual report and field verification results will be submitted to the CCC by Caltrans.

Final Monitoring Report: Following completion of the final year of monitoring (estimated year 7), a "Final Monitoring Report" will be written (Table 5). The Final Monitoring Report will evaluate whether the Spartina treatment areas have achieved the goals and the performance and success criteria set forth in Section 5.B.12 and 5.B.13 of the Corridor CDP. The final monitoring report shall include a summary of the monitoring results and a description of how the final monitoring results meet the success criteria. If success criteria have not been met, then remedial actions needed to meet the success criteria will be described and a description of what went wrong will be provided. The final monitoring report shall also contain the actual costs of monitoring and maintenance needed over the five years of monitoring to maintain Spartina at a $\leq$ 5% ground cover on the saltmarshes of Tuluwat Island. This information is central to Caltrans determination of the funding needed to establish a non-wasting endowment for Spartina treatment on Tuluwat Island.

Table 5: Yearly Monitoring and Reporting Schedule

Monitoring and Reporting Schedule (Year)						
1	2	3	4	5	6	7
Prior to Project implementation, Site-Specific Spartina Removal Plan(s)	Following Year 2, Initial Removal/ "As Built" Report and Performance Criteria Drone Assessment by Caltrans	1st Annual Monitoring Report	2nd Annual Monitoring Report	3rd Annual Monitoring Report	4th Annual Monitoring Report	Following Year 7, Final Monitoring Report and Success Criteria Drone Assessment by Caltrans

Table 6 below summarizes the estimated reporting tasks and submittal dates by HBHRCD.

Table 6. Estimated Monitoring Reporting Schedule

Report Task	Approximate Annual Date
HBHRCD submits preliminary survey results to CALTRANS	September 1st
CALTRANS and HBHRCD visit the island for verification of survey results	September 15th
Draft Monitoring report from HBHRCD to CALTRANS	October 1st
CALTRANS submits comments to HBHRCD	October 15th
HBHRCD address comments and resubmits to CALTRANS	October 31st
Final Draft Monitoring Report from HBHRCD to CALTRANS	November 15th
CALTRANS to add additional monitoring information and methods as applicable from section 3.2.1 (UAV surveys in Year 3 and 7)	December 1st
CALTRANS submits to Coastal Commission	December 31st

Each monitoring report from HBHRCD to Caltrans will include the following information:

- A summary of the project location and description of Spartina removal activities in each treatment area.
- Maps of the locations of and treatment areas, annotated to show treatment methods and timing.
- A list of the names, titles, and companies of the people who prepared the content of the annual report or conducted the monitoring activities that year.
- A reference to the resource agency permits and any subsequent letters of modification, as an appendix.
- A summary and analysis of the monitoring results, including an evaluation of site conditions in the context of the performance standards and success criteria.
- A discussion of the monitoring results, any modifications made to monitoring methods, and the cumulative maintenance efforts.
- Management recommendations, including discussion of any areas with inadequate performance and recommendations for remedial action.
- Maps showing locations of photograph points, and photographs taken from the established points, in an appendix.

3.3 Remedial Actions and Adaptive Management

If the monitoring results indicate that the performance criteria are not being met in year 3, the Caltrans Mitigation Specialist and Caltrans project Biologist will assess the potential reasons for the criteria not being met and will work with the HBHRCD to develop adaptive management strategies that HBHRCD will thereafter implement said strategies. If the success criteria are not met in year 7, the Caltrans Mitigation Specialist and Caltrans Project Biologist will assess the potential reasons for the criteria not being met and Caltrans will coordinate with CCC to ensure Special Condition 5.B.13 is met. If the final monitoring report indicates that the Spartina removal project has been unsuccessful, in part or in whole, based on the approved success criteria, Caltrans shall submit a revised or supplemental plan (e.g., Adaptive Management Plan) to compensate for those portions of the original plan that did not meet the approved performance standards. The revised plan shall be processed as an amendment to CDP #1-18-1078, unless the Executive Director of the Coastal Commission determines that no amendment is legally required.

3.3.1 Remedial and Adaptation Activities by HBHRCD

If the monitoring results indicate that the performance criteria are not being met in year 3, HBHRCD will work with CALTRANS to develop adaptive management strategies and thereafter implement said strategies.

3.4 Long Term Monitoring and Maintenance

Assuming performance criteria have been met for the 5-year monitoring and maintenance period (year 7), then ongoing, long-term Spartina monitoring and management will resume in year 9, This will allow for early detection and rapid response to re-infestation by Spartina. This will be conducted using visual searching for Spartina like that described to the search methods of the monitoring period. The frequency of monitoring will be dependent on the rate at which Spartina colonizes the site. This will likely be biennial and driven by data collected during the monitoring period and is subject to change.

Non-wasting endowment fund. A non-wasting endowment to fund the long-term monitoring and removal of Spartina in perpetuity. At the time of demonstrated success of the initial (primary) Spartina removal, Caltrans will establish a non-wasting endowment within two years that is reflective of the costs associated with maintenance in the 5-year monitoring period, to fund the long-term monitoring and removal of Spartina. Caltrans will submit evidence to the Executive Director of the Coastal Commission of the establishment of the

non-wasting endowment within two years of demonstrating success of initial treatment of Spartina. Such evidence may include such things as the identification of the entity that will hold the fund, a proposed contract with the investment firm that will hold the fund, an estimate of the annual cost of long-term monitoring and maintenance, an estimate of the necessary capitalization rate, and an initial estimate of the necessary size of the endowment necessary to fund long-term monitoring and maintenance. The non-wasting endowment shall be established and funded within two years following the demonstrated success of the primary Spartina removal, and shall include the following characteristics:

1. The non-wasting endowment fund shall be held, managed, invested, and disbursed solely for, and permanently restricted to, the long-term monitoring and removal of Spartina in perpetuity. The fund shall be operated and administered in accordance with the Uniform Prudent Management of Institutional Funds Act.

2. The non-wasting endowment fund shall be calculated to include a principal amount that, when managed and invested, generates interest reasonably anticipated to cover the annual costs of the long-term monitoring and removal of Spartina in perpetuity. The total annual expenses shall include investment and administration costs/fees. The non-wasting endowment shall be established in a manner that ensures that necessary disbursements are provided three years after the non-wasting endowment fund has been funded.

3. The entity holding the non-wasting endowment fund shall have the capacity to effectively manage the non-wasting endowment fund, including the capacity to achieve reasonable rates of return. The entity holding the non-wasting endowment shall submit an annual report to the Executive Director of the Coastal Commission at the end of every year detailing the compliance with Special Condition 5 of CDP 1-18-1078. The entity holding the non-wasting endowment also shall use generally accepted accounting practices and provide an annual fiscal report to the Executive Director of the Coastal Commission.

At the end of five years of annual monitoring and maintenance following successful primary removal, the endowment fund will be increased if the actual annual cost of monitoring and maintenance is larger than the initial estimate and the proceeds of the non-wasting endowment are insufficient to cover the higher cost. The calculations underlying such augmentation shall be provided to the Executive Director of the Coastal Commission for review and approval.

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Appendix A: Project Maps

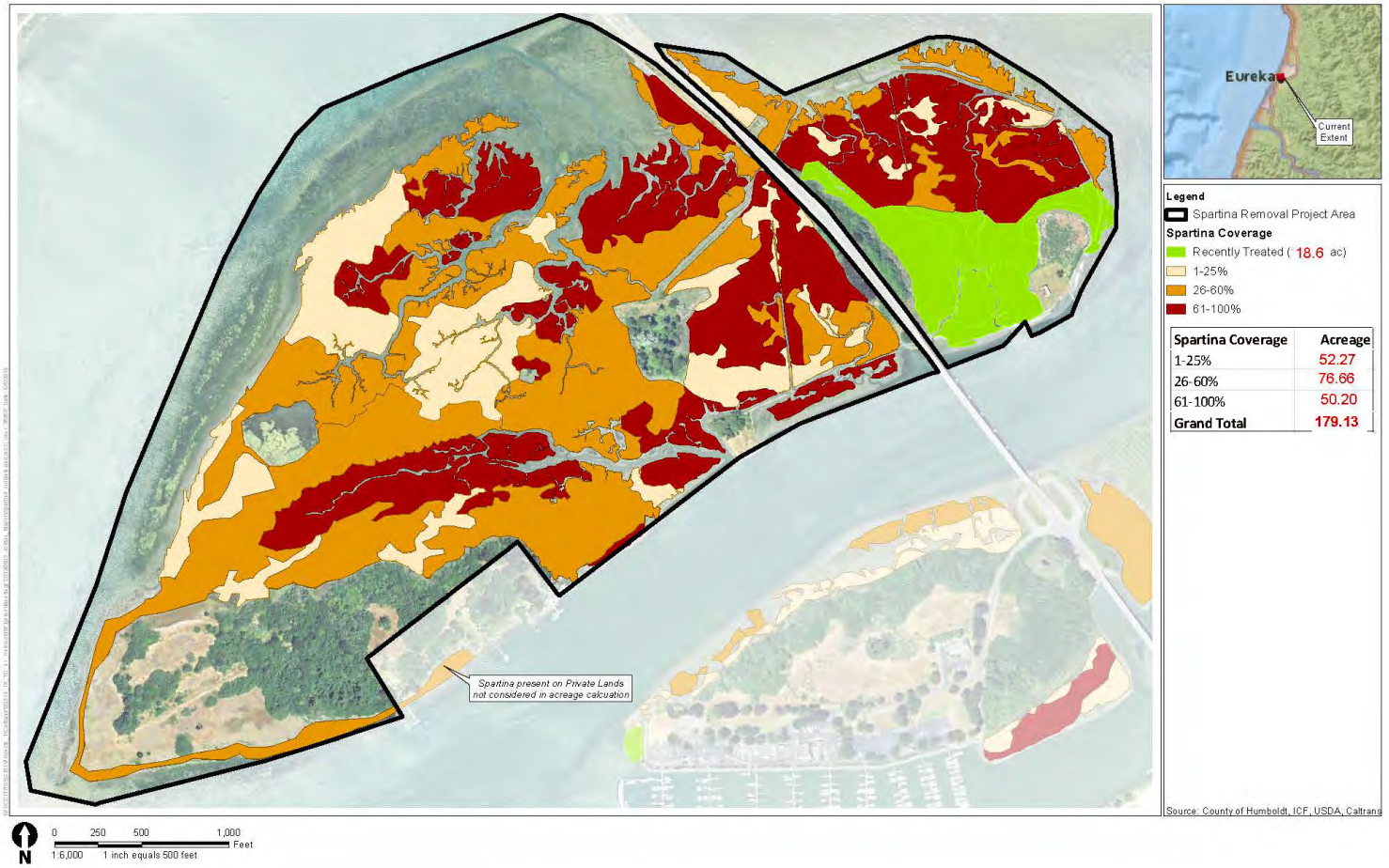

Figure A-1: Original map of Tuluwat Island showing Spartina coverage estimates from 2010, prior to aerial image analysis.

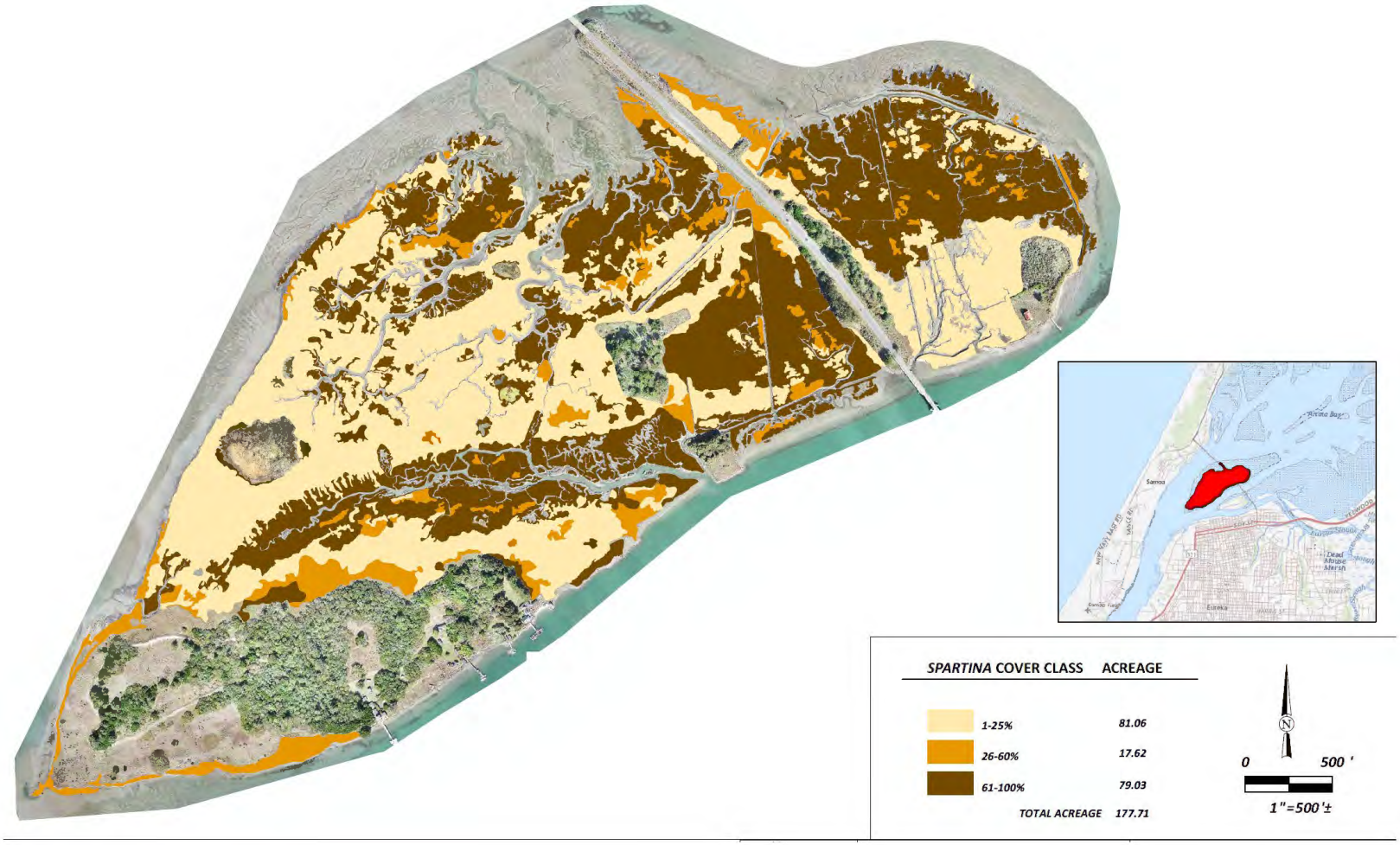

Figure A-2: Map of Tuluwat Island showing updated Spartina cover classes derived from unmanned aerial vehicle (UAV) image classification and analysis of multispectral imagery conducted in late fall of 2019 (Appendix E).

Appendix B: Letters of Support from Partner Agencies

California Department of Transportation
1656 Union Street
Eureka, CA 95501
Attn: Matt Brady, District 1 Director

June 11, 2019

Re: Spartina Mitigation Project - Wiyot Tribal landholdings on Indian Island

He'ba'lo' Mr. Brady,

For time immemorial the Wiyot Tribe (Tribe) has been stewards of its ancestral natural resources, including the waters and habitats of ***Wigi***, known today as Humboldt Bay. The Tribe's ongoing commitment to the protection and enhancement of the natural environment is evidenced by its current and past projects in and around Humboldt Bay, which include Brownfields remediation, invasive species control, water quality monitoring, and biological assessments. The Tribe also acknowledges the importance of collaboration and cooperation with other agencies to accomplish common restoration and protection goals. In the spirit of such collaboration, the Tribe is writing to verify our support of the project presented by the California Department of Transportation (Caltrans) to mitigate for impacts to coastal wetlands from the Eureka-Arcata Corridor safety improvement project. Treatment will entail the removal of the non-native, invasive *Spartina densiflora* (Spartina) on Indian Island, home to Wiyot village sites ***Tuluwat*** and ***Etpidohl***, the site of the Tribe's World Renewal Ceremony, and the Center of the Wiyot Universe.

One of the primary impacts on the land and trust resources on Indian Island's saltmarsh and mudflat habitats is the presence of invasive Spartina. Similar to most tidal marshes in Humboldt Bay, Spartina degrades estuarine habitat by excluding native salt marsh plants, altering the benthic macroinvertebrate community, reducing net primary productivity, and potentially transforming mudflats to salt marsh. Furthermore, the presence of invasive Spartina on Indian Island threatens both essential Tribal Trust resources such as medicinal and traditional plants, shellfish, and waterfowl as well as the cultural landscape of this vitally important spiritual center. This project aligns with Tribal objectives and goals set forth in Phase IV of the Indian Island Cultural and Environmental Restoration Project (IICERP) which includes the restoration of habitats surrounding the *Tuluwat* village site on Indian Island.

The Tribe fully supports the Caltrans mitigation project to remove Spartina on Tribally owned land on Indian Island. As such the Tribe agrees to allow access to personnel representing Caltrans and/or the implementing entity to perform initial treatment work, monitoring and maintenance in perpetuity, or until regional eradication is achieved. In addition to allowing access, the Tribe commits to restricting development within Spartina treatment areas, as defined in Section 30106 of the California Coastal Act, to removal or non-native vegetation and planting and maintenance of native vegetation to improve habitat value. In January 2019, the Eureka City Council voted unanimously to transfer approximately 200 acres of city owned land on Indian Island back to the Tribe. Though the Tribe does not have an official deed for these acres, Tribal Council has conditionally approved access while also restricting development in treated areas pending official transfer from the City of Eureka.

Čawokš,

Chairman Theodore Hernandez

April 5, 2019

California Department of Transportation
1665 Union Street
Eureka, CA 95501
Attention: Matt Brady, District 1 Director

He'bla lo (Greetings),

The Wiyot Tribe and Wiyot Natural Resources Department (WNRD) would like to express our enthusiastic interest in working with the California Department of Transportation (Caltrans) District 1 to help with their mitigation needs and to facilitate the eradication of invasive *Spartina densiflora* (*Spartina*) throughout Humboldt Bay (the *Wigi*) area saltmarshes, whose habitat has declined by 90% around the Bay. The WNRD has been part of a regional effort and broad partnership with various agencies and groups, including the CA State Coastal Conservancy (SCC) , the US Fish and Wildlife Service Humboldt Bay National Wildlife Refuge (HBNWR), the Redwood Coast Action Agency (RCAA), and Humboldt Bay Harbor Recreation and Conservation District (Harbor District), which has been developed to address *Spartina* eradication throughout Humboldt Bay, and has met with considerable success in developing protocols, methodology and in treating large portions of *Spartina*-infested areas. The Tribe has resolved to "protect and preserve traditionally important plant and animal species, and their communities, and to restore the ecological balance within its ancestral territory", which includes the entirety of Humboldt Bay, and a commitment to eradicate *Spartina* from its saltmarshes.

Tuluwat (Indian Island), an ancient Wiyot shell midden, which lies in the middle of Humboldt Bay, is the Tribe's center of the universe and is the site of the horrible Tuluwat massacre of 1860, where over 200 Wiyots were murdered in an act of genocide. Because of *Tuluwat's* central location within the Bay and its large saltmarshes, it has been identified as an important seed vector, contributing to *Spartina* dispersal throughout the Bay. The WNRD was successful in acquiring a portion of the necessary grant funding to eradicate Spartina on Tuluwat, through the Bureau of Indian Affairs (BIA) in 2014, however only 20 of 51 infested acres were able to be treated. Additional attempts to acquire funding have been unsuccessful in the recent political climate, and left *Tuluwat's Spartina* treatment incomplete. The Tribe is eagerly looking for assistance with its saltmarsh restoration needs and to maintain the initial investment of the partial *Spartina* treatment on *Tuluwat*, making this opportunity with Caltrans a great win-win for both entities.

Presently the Tribe is in the process of acquiring around ~160 additional acres of saltmarsh on the southern portion of Indian Island (*Etpidalh*) and it is estimated that at least 50-60 acres of this area has high density (>60%) cover of Spartina in need of eradication. This future acquisition furthers the Tribe's desires and need to restore its native saltmarshes and the ecological integrity of Humboldt Bay. The monumental task at hand could be greatly aided through the use of these invaded saltmarshes as Caltrans mitigation sites, and the selection of these areas for restoration would benefit and highlight the cultural significance and resource stewardship goals of the Wiyot Tribe. We endorse Caltrans'

willingness and desire to work the Tribe and other groups to benefit the saltmarshes of Humboldt Bay and the biodiversity they support. Please keep us informed regarding the development of the use of *Spartina* removal as an approved mitigation activity around Humboldt Bay, and know that the Tribe is interested and eager to be involved in the allocation our invaded marshes as mitigation sites for *Spartina* removal.

Rra'dutas (with kindness)

Adam N. Canter
Tribal Botanist, GIS, and Cultural Assistant
Table Bluff Reservation
1000 Wiyot Dr.
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707-733-5055 x 122

Humboldt Bay
Harbor, Recreation and Conservation District
(707) 443-0801
P.O. Box 1030
Eureka, California 95502-1030

April 5, 2019

To Whom it may Concern:

Humboldt Bay Harbor Recreation and Conservation District (HBHRCD) is interested in being the entity tasked with managing a contract and endowment funded by Caltrans to remove 155 acres of *Spartina densiflora* from Humboldt Bay.

HBHRDC will subcontract with Redwood Community Action Agency (RCAA) to create agreements with land owners of properties that have dense Spartina and conduct Spartina control using primarily mechanical methods with use of a marsh master and/or brush cutters. Some cases may require mechanical treatment.

RCAA would follow the requirements of the Final Programmatic Environmental Impact Report (FPEIR); follow all conditions of the CDP 1-14-0249; and follow provisions for obtaining any necessary approvals from agencies as applicable for the proposed site-specific treatment areas.

As part of the implementation of Spartina removal, RCAA would monitor and report treatment areas based on success criteria as described in the Draft Spartina Removal and Monitoring plan (SRMP) for the first five years of Spartina treatment. RCAA would also manage the Spartina removal, in perpetuity, or until Spartina in Humboldt Bay is eradicated, funded by the non-wasting endowment provided by Caltrans.

Sincerely,

Larry Oetker
Executive Director

EUREKA
COMMUNITY SERVICES

COMMUNITY SERVICES DEPARTMENT
1011 Waterfront Drive • Eureka, California 95501-1146 • (707) 441-4241

June 13, 2019

California Department of Transportation
1656 Union Street
Eureka, CA 95501
Attn: Matt Brady, District 1 Director

Dear Mr. Brady,
I am writing to allow Caltrans and their contractors and/or consultants to access City of Eureka owned lands, such as Elk River Slough, Palco Marsh and the salt marsh between the Samoa boat launch and the marsh lands behind Target. This is to allow Caltrans to access and treat areas that have the invasive cordgrass Spartina densiflora (Spartina) in salt marshes around Humboldt Bay. Caltrans is also allowed to conduct any necessary actions such as monitoring and maintenance of native salt marsh on these lands, in perpetuity, or until regional eradication of Spartina is achieved. The City of Eureka is willing to restrict any development within the proposed areas for Spartina treatment to removal of non-native vegetation, and planting and maintenance of native vegetation to improve habitat value, in perpetuity.

The City of Eureka is in the process of formally returning ownership of Tuluwat Island to the Wiyot Tribe. It is understood that Caltrans has presented to the Wiyot Tribal Council on June 10th, regarding the management of Spartina within Humboldt Bay on Tuluwat Island, as part of a mitigation package for various Caltrans projects. As a result, the Wiyot Council sent a letter in support of the project on June 11th, that grants access to Tuluwat Island for Spartina management activities in perpetuity. In addition, the Wiyot Tribe is willing to restrict any development within the proposed areas for Spartina treatment to removal of non-native vegetation, and planting and maintenance of native vegetation to improve habitat value, in perpetuity.

If the land transfer from the City has not taken place with the Wiyot Tribe, at the time Caltrans mitigation activities are required to occur, the City of Eureka would allow Caltrans and any of Caltrans' contractors to access the island to conduct management of Spartina during the transfer period.

Sincerely,

Miles Slattery
Community Services Director

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Humboldt Bay National Wildlife Refuge Complex
1020 Ranch Road
Loleta, California 95551

Matt Brady
District Director
Caltrans, District 1
1656 Union Street
Eureka, California 95501

Re: Support for Spartina Management as Mitigation in Humboldt Bay

Dear Mr. Brady:

I am writing to express our support for the management of *Spartina densiflora* (spartina) in Humboldt Bay as part of the mitigation package for various Caltrans projects. Spartina is a state-listed noxious weed with removal prioritized on a local, regional and west coast scale. Spartina infestation impacts a multitude of ecosystem services including Regulating (coastal resiliency from storms and floods), Provisioning (fisheries and aquaculture) and Supporting (nutrient cycling, food chain dynamics).

Humboldt Bay National Wildlife Refuge has been significantly involved in spartina eradication and salt marsh restoration and research in Humboldt Bay for some time. We helped develop the methodology currently used to treat spartina and have documented high success rate in restored salt marsh habitat with minimal retreatment.

Salt marsh is a rare and valuable habitat type and has suffered from severe degradation, including diking and filling resulting in the loss of approximately 90% of Humboldt Bay's historic salt marshes. Restoration of salt marshes through spartina removal is critical to maintaining the integrity of natural buffers for the surrounding cities and communities, sustaining plant and wildlife populations, increasing net productivity, blue carbon sequestration, and aiding in the recovery federally-listed species. We encourage and support pursuing spartina management as part of your mitigation approach.

Sincerely,

Kurt Roblek
Acting Refuge Manager

Coastal Conservancy

April 4, 2019

Matthew Brady, District 1 Director
California Department of Transportation, District 1
1656 Union Street
Eureka, CA 95501

Dear Mr. Brady,

I am writing you to express support for CalTrans District 1's efforts to provide invasive Spartina densiflora removal as mitigation for impacts from projects around Humboldt Bay. As you are aware, invasive Spartina has had significant impacts to the ecological resources of tidal marshes in Humboldt Bay, including the loss of native floral and faunal diversity as well reductions to marshes' primary productivity. In addition to these direct impacts, invasive Spartina's dominance in Humboldt Bay has also slowed efforts at marsh restoration because of fears that restored marshes would become dominated by this invasive species, compromising their habitat value. Spartina in Humboldt Bay and adjacent estuaries also threatens to colonize other West Coast estuaries via ocean dispersal of its seeds.

For over 13 years, the State Coastal Conservancy has worked with local partners and regional, statewide, and federal funders to tackle the issue of invasive Spartina. To-date, the Coastal Conservancy has funded over $760,000 on 140 acres of removal efforts throughout the Bay. In addition, SCC has worked with partners to help secure an additional $1.4 million for an additional 370 acres of Spartina removal. SCC has also served as the lead CEQA agency and provided assistance with programmatic permitting. However, to-date, need has far exceeded available public funds. Opportunities to strategically treat more extensive acreages and ensure management of treated sites into the long-term to prevent resprouts has long been a vision of the Coastal Conservancy.

While in and of itself, Spartina densiflora removal may seem a simple action within the Bay system, it provides extensive gains to the Bay's tidal marsh functioning and overall ecological health, both in the near term and under climate change. Our projects have witnessed high success rates when sites are monitored and diligently treated for Spartina resprouts. I enthusiastically support CalTrans's use of Spartina densiflora removal as mitigation for road corridor projects and the Coastal Commission's support of this new mitigation approach. The Coastal Conservancy looks forward to sustained engagement with this effort and ensuring public investment to-date on Spartina eradication in Humboldt Bay is successfully built upon with the removal efforts to come under the CalTrans mitigation efforts.

Sincerely,

Sam Schuchat
Executive Officer, California State Coastal Conservancy

1515 Clay Street, 10th Floor
Oakland, California 94612-1401
510·286·1015 Fax: 510·286·0470

Redwood Community Action Agency

Letter of Interest in Partnering with Caltrans for
TREATMENT OF SPARTINA IN HUMBOLDT BAY

Grant/Agreement Number:	To Be Determined
Cooperator Name:	**REDWOOD COMMUNITY ACTION AGENCY**
Performance Start Date:	To Be Determined
Performance End Date:	To Be Determined
Report Source:	N/A

To Whom it May Concern:

Redwood Community Action Agency (RCAA) is interested in being the entity tasked with managing the data collection, treatment, monitoring and overall management of Spartina removal activities funded by Caltrans. These services include:

- Initiate treatment of 155 acres of dense Spartina in Humboldt Bay using primarily mechanical methods with use of a marsh master and/or brush cutters. Some cases may require chemical treatment.
- Do the appropriate baseline data collection for each site; follow all requirements of the Final Programmatic Environmental Impact Report (FPEIR) prepared for the Humboldt Bay Regional Spartina Eradication Plan; follow all conditions of the CDP 1-14-0249; and follow provisions for obtaining any necessary approvals from agencies as applicable for the proposed site-specific treatment areas.
- Monitor and report on treatment success annually based on success criteria as described in the Draft Spartina Removal and Monitoring Plan (SRMP) for the first five years of Spartina treatment.
- Manage the maintenance removal, in perpetuity, or until Spartina in Humboldt Bay is eradicated, funded by the non-wasting endowment.

Redwood Community Action Agency (RCAA) has taken a leadership role in the planning and implementation of Spartina eradication activities in Humboldt County for over a decade. RCAA was involved in the preparation of the Spartina Regional Eradication Plan in 2008 and the Programmatic EIR in 2011. They have successfully managed multiple grants and coordinated with local agencies/landowners to treat Spartina in the region for over seven years. RCAA has a dedicated Restoration Field Crew, a specialized aquatic tractor used to efficiently treat Spartina called a Marsh Master, trucks, trailers, and tools. Moreover, RCAA has a business and contractor's license, fiscal staff, office manager, and other staff to maintain financial accounts, invoice, and other necessary accounting. The Project Manager at RCAA is also the chair of the Humboldt County Spartina Working Group and the Humboldt Weed Management Area.
While Caltrans is generally required to seek out multiple bids from the community for Spartina treatment, there are no other agencies or businesses in the area with an appropriate level of specialized experience eradicating Spartina from the salt marshes of Humboldt County to request bids from.

Authorized signature: _____ Date: 4/3/19
Val Martinez, Executive Director

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Arcata Field Office
1695 Heindon Road
Arcata, CA 95521
www.ca.blm.gov/arcata

May 14, 2019

In Reply Refer To:
1700 (CA330)P

Matt Brady, District Director
Caltrans, District 1
1656 Union Street
Eureka, California 95501

Subject: Support for Invasive Cordgrass Management as Removal and Monitoring in Humboldt Bay

Dear Mr. Brady:

The Bureau of Land Management (BLM) Arcata Field Office is the lead management agency for the Mike Thompson Wildlife Area, South Spit Humboldt Bay South Spit. The BLM supports Caltrans' proposal for off-site mitigation to offset impacts to coastal wetlands associated with the Eureka-Arcata Corridor project.

Invasive cordgrass (*Spartina densiflora*) has caused loss to approximately 90% of the saltwater marshes in Humboldt Bay that once provided sustainable net productivity to an abundance of native flora and fauna, as well as having supported a variety of ecological, recreational, and commercial services.

The Spartina Removal and Monitoring Project would include treatment of 51 patchy acres of variously dense infestations at South Humboldt Bay. The BLM would support the project by allowing Caltrans contractor/partner access for Spartina removal on the tidal marsh provided regulatory compliance has been completed.

Restoration of severely degraded saltwater marshes is necessary to promote recovery for native flora, fauna, and federally listed species, and to increase net productivity. The project provides an opportunity for BLM to further our goal of conserving and enhancing native plant and wildlife communities, and improving conditions for public use and enjoyment within our jurisdiction.

Sincerely,

Molly Brown
Arcata Field Manager

Appendix C: Tuluwat Island Land Access Agreement

RIGHT OF ENTRY AND ACCESS AGREEMENT BETWEEN THE STATE OF CALIFORNIA AND THE WIYOT TRIBE FOR HUMBOLDT BAY AREA MITIGATION AT TULUWAT ISLAND

THIS AGREEMENT, ENTERED INTO EFFECTIVE ON January 22, 2021, is between the STATE OF CALIFORNIA, acting by and through its Department of Transportation, referred to herein as "CALTRANS," and the Wiyot Tribe, referred to herein as "the TRIBE" (collectively the PARTIES).

RECITALS

WHEREAS, the TRIBE is the current landowner of Tuluwat Island and has jurisdiction over certain activities occurring on their lands (APN 405-011-010 and APN 405-011-011) (PROPERTY or RESTORATION SITE);

WHEREAS, CALTRANS intends to construct improvements to U.S. Route 101 in Humboldt County within the Safety Corridor between the cities of Eureka and Arcata from PM 79.9 to PM 86.3, consisting of several safety construction projects as follows: Tide Gate Replacement (01-0C930); Jacoby Creek Bridge Replacement (01-0E000); Extension of Acceleration/Deceleration Lanes and Lighting Improvements (01-0F220); Guardrail and Cable Rail Safety Barrier (01-0C970); and Indianola Interchange and Airport Road Improvements (01-36600). All the above-named projects are referred to herein as "PROJECT".

WHEREAS, the PROJECT will result in permanent impacts, referred to herein as "IMPACTS," to approximately 10.25 acres of coastal wetlands regulated by the California Coastal Act referred to herein as "CCA".

WHEREAS, CALTRANS, through the NEPA Document Revalidated in May, 2020 in which CALTRANS is the lead agency, will also undertake mitigation required for the City of Arcata's impact to 2.26 acres of coastal wetlands that resulted from their Arcata Bay Trail North Project; and CALTRANS, through the NEPA Document Revalidated in May, 2020 in which CALTRANS is the lead agency, will also undertake mitigation required for the County of Humboldt's impact to 6.10 acres of coastal wetlands that resulted from their Humboldt Bay Trail South Project; collectively referred to herein as the "TRAILS MITIGATION".

WHEREAS, the California Coastal Commission, pursuant to the CCA, issued a Coastal Development Permit (CDP #1-18-1078, dated September 13, 2019) for PROJECT, referred to herein as "CDP", attached herein as Exhibit A. CALTRANS is the permittee and responsible entity for providing compensatory mitigation for the PROJECT.

WHEREAS, the compensatory mitigation for the PROJECT and the TRAILS MITIGATION are detailed in the Wetland Mitigation Plan for the Humboldt Bay Area Mitigation (HBAM) Project, dated July 2019. The mitigation will occur on Tuluwat Island located just north of

the City of Eureka, in Humboldt Bay, California, that is currently owned by the TRIBE, referred to herein as the RESTORATION SITE.

WHEREAS, the Wetland Mitigation Plan dated July 2019 commits CALTRANS and its contractor and any sub-contractors to its contractor to implement the mechanical removal of the invasive plant *Spartina densiflora*, referred to herein as "Spartina" from saltmarshes in the Humboldt Bay area, and for continued mechanical, non-chemical treatment of Spartina in perpetuity.

WHEREAS, the RESTORATION SITE is zoned and planned "Natural Resource" according to City of Eureka's General Plan 2040 and Local Coastal Program. Conditional and/or permitted uses for the site include the proposed activities for the PROJECT, including the ongoing removal of Spartina and other non-native invasive species, maintenance of native vegetation, and habitat restoration.

WHEREAS, Public Resources Code, section 30513, requires that any zoning actions be reviewed and approved by the California Coastal Commission. The permanent protection of the RESTORATION SITE from future development (as defined in Public Resources Code, section 30106) is ensured pursuant to the CCA; and

WHEREAS, the TRIBE desires to restore their lands to their native state and supports the removal of Spartina from their land.

NOW THEREFORE, the TRIBE and CALTRANS do hereby agree to the following Rights of Entry and Access conditions and covenants:

IT IS MUTUALLY AGREED :

1. **Right of Entry**. The TRIBE grants CALTRANS and its contractors and any sub-contractors to the contractor a non-exclusive, non-possessory right to enter the RESTORATION SITE by vehicle or by foot on a sufficient regular basis, (1) to remove Spartina using a Marsh Master and hand tools, such as weed whackers, brush cutters, etc. (2) to monitor the success of Spartina removal with the use of boats, kayaks, unmanned aerial vehicles (UAVs) and other tools such as measuring tapes, flagging and quadrats, etc. and (3) further maintain native salt marsh by removing new occurrences of Spartina, using hand tools only as described above, as needed, in perpetuity. CALTRANS shall not use any chemical means of removal such as herbicides on the property. This Agreement gives CALTRANS an irrevocable perpetual license only and does not constitute a grant by the TRIBE of any ownership, leasehold, easement or other similar property interest or estate. CALTRANS agrees that neither it or its contractor or any sub-contractors to the contractor shall in any way interfere or permit any

interference with the use of the PROPERTY by the Tribe or its members. CALTRANS shall not use the PROPERTY for any purpose whatsoever except as specifically authorized in this Agreement. The TRIBE shall not bear any of the cost of Spartina removal that is part of the compensatory mitigation for the PROJECT and the TRAILS MITIGATION.

2. **Mitigation Site Protection**. The TRIBE agrees to protect in perpetuity the areas of Spartina removal from future development as defined by Section 30106 of the California Coastal Act, except for the ongoing removal of Spartina and other non-native invasive species, maintenance of native vegetation, and habitat restoration.

3. **Effective Date.** This Agreement shall be effective from the date of the last signature affixed below.

4. **Temporary Closure.** Nothing herein shall be construed as limiting or prohibiting the authority of the Wiyot Tribe to temporarily close the PROPERTY or RESTORATION SITE when necessary to protect the sanctity and privacy of traditional cultural or religious ceremonies on the PROPERTY. The TRIBE shall notify CALTRANS in writing fifteen (15) days before any closure will go into effect. The TRIBE and CALTRANS shall agree on a protocol for Caltrans to remove equipment, tools and debris on the PROPRERTY at least five (5) days before the Closure goes into effect.

5. **Dispute Resolution**. The PARTIES agree to seek in good faith informal resolution of any dispute arising under this Agreement. If the dispute cannot be resolved informally, either PARTY may seek to resolve the dispute and enforce this Agreement by legal action, consistent with the limited waiver of sovereign immunity set forth in section 5. In the event of litigation, to resolve any breach of, or dispute related to this Agreement, each party agrees to pay for their own attorneys' cost and expenses, without regard to who prevails.

6. **Limited Waiver of Sovereign Immunity**. In the event CALTRANS seeks enforce this Agreement through legal action, the TRIBE expressly consents to be sued therein and makes this limited waiver of sovereign immunity so that CALTRANS may exercise and enforce its rights under the terms of this Agreement to enter the RESTORATION SITE to perform the restoration work and monitoring activities. Any relief awarded by a court against the TRIBE under this limited waiver of sovereign immunity shall be limited to declaratory and injunctive relief, and damages shall not be awarded under any circumstances except as required to indemnify and hold Caltrans harmless under Paragraph 11 herein. This Agreement does not constitute, and shall not be construed as, a waiver of sovereign immunity by the TRIBE, except to permit judicial review and enforcement of rights under the terms of this Agreement.

   In the event of intervention by any third party into any such action without the consent of the TRIBE, the waiver of the TRIBE provided for herein may be revoked,

unless joinder is required to preserve the court's jurisdiction; provided that nothing herein shall be construed to constitute a waiver of the sovereign immunity of the TRIBE with respect to any such third party.

7. **Signatory**. The signatory for the TRIBE herein represents and warrants that the Wiyot Tribal Council has expressly authorized this limited waiver of sovereign immunity on behalf of the TRIBE.

8. **Laws and Regulations**. All work conducted at THE RESTORATION SITE shall be conducted in accordance with all Wiyot, local, state and federal laws and requirements. The Parties specifically acknowledge their obligation to comply with California laws governing the use and development of California coastal waters.

9. **Compliance**. To comply with all necessary permits and conditions where entry is granted to ensure the active long-term management and maintenance are necessary to meet the condition of long-term protection of native salt marsh, CALTRANS shall never use chemical treatment for the removal of Spartina.

10. **Notification.** CALTRANS and the contractor and any sub-contractors of CALTRANS agree to provide written notification to the TRIBE within five (5) days prior to entry. For the TRIBE, notice shall be provided to the Chairman. For CALTRANS, notice shall be provided to the Mitigation Specialist.

11. **Tribal Monitoring.** The TRIBE will select an appropriate Tribal Monitor to ensure protection and preservation of Tribal Cultural Resources (including both Traditional Cultural Properties and Historic Properties) from the proposed restoration activities and avoid potential impacts to culturally and biologically sensitive areas present at the RESTORATION SITE during all treatment and monitoring activities. The PARTIES shall agree on a protocol for carrying out tribal monitoring activities satisfactory to the TRIBE, including but not limited to, temporary cessation of some or all activities by CALTRANS if the Tribe concludes, after consultation with the Tribal Monitor and the TRIBE's Tribal Historic Preservation Officer, in its discretion that CALTRANS' activities under this Agreement threaten the integrity or sanctity of the TRIBE'S Cultural Resources.

12. **Hold Harmless and Indemnification**. Neither the TRIBE nor any officer, agent, or employee thereof can be held legally responsible for any injury, damage, or liability occurring by reason of anything done or omitted to be done by CALTRANS and/or its agents, contractors, subcontractors, consultants, or employees under or in connection with any work or authority, conferred upon CALTRANS under this agreement. It is understood and agreed that CALTRANS, to the extent permitted by law, will defend, indemnify, and save harmless the TRIBE and all of its officers, agents, and employees from all claims, suits, or actions of every name, kind, and description brought forth under, but not limited to, tortious, contractual, inverse condemnation, or other theories

or assertions of liability occurring by reason of anything done or omitted to be done by CALTRANS and/or its agents under this agreement.

Neither CALTRANS nor any officer or employee thereof can be held responsible for any injury, damage, or liability occurring by reason of anything done or omitted to be done by the TRIBE, its contractors, sub-contractors, and/or its agents under or in connection with any work, authority, or jurisdiction conferred upon the TRIBE under this agreement. It is understood and agreed that the TRIBE, to the extent permitted by law will defend, indemnify, and save harmless CALTRANS and all of its officers and employees from all claims, suits, or actions of every name, kind, and description brought forth under, but not limited to, tortious, contractual, inverse condemnation, or other theories or assertions of liability occurring by reason of anything done or omitted to be done by the TRIBE, its contractors, sub-contractors, and/or its agents under this agreement.

13. **No Continuing Waiver.** No waiver of any term, condition, or covenant contained in this Agreement or any breach of this Agreement shall be held to be a continuing waiver of that or any other term, condition, or covenant of this Agreement or of any other or subsequent breach of this Agreement.

14. **Execution.** This Agreement may be executed in several counterparts and all counterparts so executed shall constitute one agreement that shall be binding on all of the parties, notwithstanding that all of the parties are not a signatory to the original or the same counterpart. If any provision of this Agreement is held invalid, the other provisions shall not be affected thereby.

15. **Entire Agreement.** The Agreement contains the entire agreement between the TRIBE and CALTRANS. No alteration or variation of the terms of this Agreement shall be valid unless made by a formal amendment executed by the parties hereto and no oral understanding or agreement not incorporated herein shall be binding on any of the parties hereto.

16. **Termination.** If the Parties agree that Spartina has been completed and permanently eradicated on the PROPERTY after the removal success criteria of the Spartina Removal Plan have been met, and there is no longer any reason to maintain this Agreement, they may mutually terminate this Agreement, provided such termination does not violate any law or policy administered by the California Coastal Commission and the Commission agrees there is no reason to keep this Agreement in effect. The Parties agree to confer every five years to assess the status of Spartina on the Property. Upon termination, CALTRANS shall remove all of its equipment, tools, personal property, debris, and waste material. CALTRANS shall bear the cost of removal of such items. If CALTRANS fails to comply, the TRIBE may remove the materials and CALTRANS agrees to pay the TRIBE the full cost and expense of removal within one hundred and twenty (120) days of the submittal from the TRIBE to CALTRANS of an

invoice of the reasonable, actual expenses of removal of materials left by CALTRANS.

17. **Third Parties**. Nothing within the provisions of this Agreement is intended to create duties or obligations to or rights in third parties not party to this Agreement or to affect the legal liability of either party to the Agreement by imposing any standard of care different from the standard of care imposed by law.

18. **Condition of the Property.** Within a reasonable time after any activity by carried out by CALTRANS on the PROPERTY under this Agreement, CALTRANS agrees to remove all equipment, tools, and debris associated with those activities, and further, CALTRANS agrees to remove any hazardous materials deposited on the PROPERTY during its activities on the PROPERTY. If CALTRANS fails to comply with this provision, the TRIBE may remove the equipment, tools, debris and hazardous materials and CALTRANS agrees to pay the TRIBE the full cost and expense of such removal within one hundred and twenty (120) days of the submittal from the TRIBE to CALTRANS of an invoice of the reasonable, actual expenses of removal of materials left by CALTRANS.

IN WITNESS WHEREOF, CALTRANS and THE TRIBE do enter into this Agreement.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

By: _____
Matthew Brady, District 1 Director

Approved as to form:

By: _____
Cassandra Hoff, Deputy Attorney

THE WIYOT TRIBE

By: Theodore Hernandez
Theodore Hernandez, Tribal Chair

Approved as to form and procedure:

By: _____
Curtis G. Berkey, Attorney, Wiyot Tribe

Appendix D: Non-Wasting Endowment Summary

Non-Wasting Endowment Summary (Estimate)

Humboldt Bay Area Mitigation (HBAM) Spartina Removal Project

Mitigation Feature	Activity/Location	Responsible Party	Task/ Description	Frequency	Actions Required	Unit	# of Units	Cost/ Unit	Cost	Divide Years	Total Cost (annual set-aside)
Habitat Maintenance											
Project Manager/Ecologist	General Inspections of Mitigation Lands	TBD	180 acres	Every 2 years	Inspect mitigation parcel once every 2 years for identifying the need for Spartina treatment; Complete Inspection Form (10 hrs x 10 days).	Labor hours	100	$70	$7,000	2	$3,500
	Oversite of Field Crews maintaining Spartina	TBD	180 acres	Every 2 years	Oversee scheduling and communication with crews (4 hours x 10 days)	Labor hours	40	$70	$2,800	2	$1,400
Restoration Field Crew Supervisor	Lead Crew supervisor for Spartina removal	TBD	180 acres	Every 2 years	Lead Crew Supervisor (10 hours x 10 days)	Labor hours	100	$55	$5,500	2	$2,750
Restoration Field Crew Specialist (3)	Lead Spartina Crew	TBD	180 acres	Every 2 years	Spartina removal (10 hours x 10 days x 6 crew members)	Labor hours	300	$45	$13,500	2	$6,750
Restoration Field Crew Assistants (3)	Assistant Spartina Crew	TBD	180 acres	Every 2 years	Spartina removal (10 hours x 10 days x 6 crew members)	Labor hours	300	$40	$12,000	2	$6,000
										Sub-Total Habitat Maintenance Cost	**$20,400**
Field Equipment											
	Materials: (brushcutters, blades, tools, replacement parts, maintenance, marsh master maintenance, crew gear, etc)	TBD	Spartina removal maintenance	Replace annually as needed	New equipment every year as needed	Item	1	$3,650	$3,650	1	$3,650
	Passenger van	TBD	Replace van	Replace every 20 years	Replace van every twenty (20) years	Item	1	$30,000	$30,000	20	$1,500
	Mileage	TBD	Gasoline and maintenance of vehicles	Annual	Mileage cost for gas and maintenance of vehicles	Item	1	$500	$500	1	$500
	Trash Removal / Disposal	TBD	Trash disposal	Annual	Dump fee	1/2 ton	1	$30	$30	1	$30
										Sub-Total Field Equipment Cost	**$5,680**
Reporting											
Project Manager/Ecologist	General Inspection Report: Reporting to Caltrans and Resource Agency	TBD	General Inspection Report	Every 2 years	Report includes a reconciliation of endowment funds expended to date, record of observations, map of mitigation area, photo documentation, maintenance or management actions, and any recommendations for altered management practices. Prepare and submit report to the Coastal Commission. (160 hours per reporting year to monitor in the field and report)	Labor hours	160	$70	$11,200	2	$5,600
										Sub-Total Reporting Cost	**$5,600**

Non-Wasting Endowment Summary (Estimate)

Humboldt Bay Area Mitigation (HBAM) Spartina Removal Project

Mitigation Feature	Activity/Location	Responsible Party	Task/ Description	Frequency	Actions Required	Unit	# of Units	Cost/ Unit	Cost	Divide Years	Total Cost (annual set-aside)
Administration											
Administration	Project Coordination and Budget Management (Administrative Coordinator)	TBD	Supervise planning and management of mitigation land	Annual	Coordinate all aspects of mitigation project management, including reconciliation of budget, tracking monthly expenses, annual maintenance work, etc.; assume 40 hours/year	Labor hours	48	$55	$2,640	1	$2,640
	Liability Insurance	TBD	For ongoing treatment	Annual	Insurance	Item	1	$200	$200	1	$200
	Miscellaneous Office Supplies	TBD	Misc office expenses	Annual	Supplies such as paper, pens, staples, contribute to computer, printer, software purchases, etc.	Item	1	$200	$200	1	$200
	Legal Fund	TBD	Legal/Emergency Fund	Annual	Legal fund	Lump Sum	1	$50	$50	1	$50
										Sub-Total Administration Cost	**$3,090**
Financial Summary											
Financial Summary	Annual Costs	TBD		Annual	Sub-Total Habitat Maintenace Labor Cost + Sub-Total Field Equipment Cost + Sub-Total Reporting Cost + Sub-Total Administration Cost						$34,770
										Sub-Total Annual & Contingency Expense Costs	**$34,770**
	Administrative Costs	TBD	Ongoing Administrative Costs =15% of Sub-Total On-going Annual Costs.	Annual	Covers the off-site costs needed to manage the mitigation effort	Item	1	$5,216	$5,216	1	$5,216
										Sub-Total Adminstrative and Conservation Easement Oversight Costs	**$39,986**
	Funding Endowment	TBD	Establish endowment based on 4.0 % return and Total Annual Ongoing cost of $40,000 (rounded up)	Lump Sum	Receive endowment funds	Lump Sum Payment	$999,638				$999,638
										Endowment Needed to Provide Annual Income of $40,000	**$999,638**

Appendix E: Aerial Survey Methods

Phone: (707) 441-8855 Email: info@shn-engr.com Web: shn-engr.com
812 W. Wabash Avenue, Eureka, CA 95501-2138

Reference: 016043.300

February 26, 2020

Prepared for:
Jordan Mayor
ICF Jones & Stokes, Inc.
1437 3rd Street
Eureka, CA 95501

On behalf of:
Desiree Davenport
Caltrans North Region Environmental – Coastal Stewardship Branch
P.O. Box 3700
Eureka, CA 95502

Subject: UAV Mapping of *Spartina densiflora* on Tuluwat Island, Humboldt County, California; Methods and Results

Introduction

SHN was retained by ICF Jones & Stokes, Inc. to provide Caltrans with aerial services for mapping the density and distribution of the invasive plant known as dense-flowered cordgrass (*Spartina densiflora)* on Tuluwat Island in Humboldt Bay on the North Coast of California (Figure 1). A small unmanned aerial vehicle (UAV or drone) was used to collect imagery of the island in the fall of 2019. Our work was focused on the preparation of a distribution map to support mitigation planning associated with Caltrans improvements on the Highway 101 corridor. The final mapping is presented with three cover classes for *Spartina*; 1 to 25%, 26 to 60%, and 61 to 100%, consistent with previous mapping done by United States Fish and Wildlife Service in 2010.

The specific scope of work included the following tasks:

- Collect red/green/blue (RGB) and multispectral imagery of Tuluwat Island using a UAV.
- Establish and survey a network of ground control points (GCP) with a real time kinematic (RTK) global positioning system (GPS) for use in geo-rectification of imagery.
- Process raw photographs using photogrammetric software to develop geo-rectified orthophotos and reflectance maps.
- Develop a field sampling program to collect *Spartina* coverage data for use in training classification software.
- Perform analysis and image classification on RGB and multispectral imagery to identify and map the distribution of *Spartina*.
- Prepare a distribution map of *Spartina* with three cover classes; 1 to 25%, 26 to 60%, and 61 to 100%.

The purpose of this report is to provide details on the equipment and methods used to develop the final distribution mapping so that future monitoring can be completed in a comparable way.

Project Area

The focus of our work was Tuluwat Island, located within Humboldt Bay, just west of the City of Eureka. The island is accessed and transected by Highway 255. The island covers approximately 280 acres and is undeveloped other than a few private residential properties along the southeast shore and the Tuluwat Village site in the northeast corner of the island. Consistent with previous work, our mapping area excluded the private properties, the Highway 255 roadway and shoulders, Tuluwat Village, forested areas, and significant bodies of water (large ponds and major channels).

Equipment/Software

Unmanned Aerial Vehicle

Imagery was collected using a DJI Phantom 4 Pro piloted by Ramiro Massa and Harrison Hummel. The UAV mission planning was developed by Jason Buck with the MapPilot App by Maps Made Easy (version 4.0.8). All applications were run on an IPad connected to the controller. The Phantom 4 Pro is outfitted with a 1-inch, 20-megapixel camera that records standard RGB images. A MicaSense RedEdge-MX multispectral camera was externally mounted onto the airframe for the collection of multispectral imagery. The RedEdge-MX has five built-in 1.2-megapixel cameras that each record a discreet narrow spectral band; blue, green, red, red edge, and near-IR.

Survey Equipment

Surveying of GCPs was conducted using a Trimble R8 with integrated GNSS and Trimble TSC 3 Datalogger. Data collected in the field were post-processed using Trimble Business Center and OPUS (Online Positioning User Service). The datum used for this project was California State Plane Zone 1/NAVD 88.

Image Processing Software

Individual photographs were compiled into geo-rectified orthomosaics and reflectance maps using Pix4D Mapper Pro (Version 4.4.12) on a desktop computer (locally processed).

Orthomosaics and reflectance maps were loaded into ArcGIS (version 10.5) for quality review and analysis. The spatial analyst tools were used to conduct image classification. ArcGIS was also used to prepare the final map and calculate the acreages of each coverage class.

Methods

Field Methods

Scheduling and Field Preparation

In general, scheduling of the flights was primarily guided by the low tide window, nesting season of birds, and plant phenology. The tide cycles in the first week of October were chosen as they provided low tides during the middle part of the day when lighting is best. *Spartina densiflora* is a

perennial bunch grass that can grow to be over a meter tall and maintains a consistent form throughout the year. In contrast, native salt marsh vegetation becomes dormant in fall, making *Spartina* more apparent in aerial imagery during this time of year and throughout the winter months.

Survey of Ground Control Points

Twelve ground control targets were spatially distributed across the island (see below) and surveyed on September 25, 2019. Targets consisted of 12-inch square tiles (in vegetated areas) or painted crosses (on asphalt). The targets were surveyed with an RTK rover GPS with a base station set up at the NOAA station on Woodley Island. The GCPs were spatially distributed across the island.

Map showing distribution of Ground Control Points. Targets were surveyed with an RTK and coordinates used for geo-rectification of imagery.

Flight Planning

Prior to mobilization to the field, flight plans were developed using the MapPilot App on an iPad 4. Two individual automated missions were flown using the MapPilot App; one on the northeastern side of the freeway, and one on the southwest side of the freeway. Manually controlled flights were performed for survey transects directly adjacent to Highway 255. The flight plans consisted of a single set of back and forth flight lines generally oriented parallel to the highway as shown in the screenshot below.

Map showing flight path of drone (yellow lines) during pre-programmed missions developed in MapPilot App.

In general, the following parameters were used in the design of the flight plans:

Mapping Type:	3D Mapping (grid pattern)
Flight Altitude:	300 feet above ground
Front Overlap:	80%
Side Overlap:	75%
Camera Orientation:	Nadir (straight down)
Ground Sampling Distance:	2.5 centimeters per pixel (cm/px; RGB camera), 6 cm/px (multispectral camera)

UAV Flights and Image Acquisition

Aerial mapping was conducted on October 3 and 4, 2019. Weather conditions were good on both days, with sunny skies and light winds. Low tides during the day ensured that the subject areas were exposed and safely accessible. Multiple individual flights were required to cover the entire island to accommodate battery changes. On October 3, the flights were conducted between 10:00 a.m. and 12:40 p.m., and RGB imagery was collected. On October 4 the flights were conducted between 9:45 a.m. and 1:40 p.m. multispectral imagery was collected. Average flight time between battery changes was approximately 20 minutes with the entire island survey taking approximately 3 hours. A calibrated reflectance panel was used with the multispectral camera for later use in image processing. Although

the UAV was flown on a programmed flight path, manual control was maintained for the survey transects directly adjacent to Highway 255. An ICF wildlife biologist accompanied the two pilots on both days to observe any interactions the drone might have with residence birds on Tuluwat island.

Image Processing and Analysis

Preparation of Orthomosaics and Reflectance Maps

Pix4D Mapper Pro photogrammetric software was used to process the images into geo-rectified orthophotos (RGB imagery) and reflectance maps (multispectral imagery). GCPs and their surveyed coordinates were imported into the software to rectify the imagery and place it into the correct datum. Quality reports were reviewed to ensure the spatial accuracy was within an acceptable range (±10 cm).

The files prepared using Pix4D and their applications during the qualitative and quantitative analysis are discussed below.

RGB Imagery–Two RGB orthophotos were prepared, one each for October 3 and 4, 2019. Both orthophotos were observed to have similar image quality. The orthophotos provide a high-resolution data set (2.5 cm/px) for qualitative review of vegetation and features in the area of interest. The RGB imagery is not ideal for spectral analysis as there are only three bands (red, green, blue) and they are not narrow bands.

Reflectance Maps–A reflectance map was generated from each of the five individual cameras on the RedEdge-MX multispectral sensor (blue, green, red, red edge, and near infrared). The reflectance maps have a resolution of 6 cm/px and each pixel represents a quantitative measure of reflectance for each of the specific wavelengths. Within ArcGIS, individual reflectance maps are then combined into a single multiband raster file. The image classification tools available in ArcGIS were applied to the multiband raster to identify distinguishable populations of *Spartina*. A false color image with the near infrared, red, and green spectral bands displayed as an RGB composite (commonly used for vegetation analysis) is provided as Figure 2.

Digital Surface Model–A digital surface model (DSM) was developed from each of the RGB data sets. The DSM, when symbolized, can be useful in identifying variations in vegetation height, which proved to be very diagnostic for *Spartina* populations on many areas of the island. The DSM is provided as Figure 3.

Initial Data Review and Field Sampling

An initial qualitative review of the imagery was conducted to evaluate the ability to differentiate *Spartina*. *Spartina* is a perennial bunchgrass and is distinctly visible in many areas of the island as shown in Figure 4. In addition, *Spartina* is much more erect, with a distinct persistent bunching habit substantially taller (generally 0.5 to 3.0 feet higher) than the dominant surrounding native vegetation in the late fall. When it is clumped into dense clusters or populations, the DSM when used in combination with the digital surface model, proved to be very useful in the identification of populations of *Spartina* as small as 0.5 square meters (m^2). In general, where populations of *Spartina* are dense and mono-

dominant, there is a distinct character to its texture, elevation, and spectral reflectance that can be used for identification. In places where it is sparse or where it is intermixed with other grasses, it is less distinguishable.

After the initial review, a field sampling program was developed to collect on-the-ground data for ground truthing and calibration during the image classification process. The field program consisted of an estimation of *Spartina* coverage within 1m^2 quadrats within a series of transects. The transects, typically 100 to 300 feet long, were distributed across the island (Figure 5). Transects were chosen to evaluate areas where *Spartina* was not distinctly identifiable, to verify and characterize the boundaries of dense *Spartina* populations, and to identify occurrences of the medium coverage class (26 to 60%). A total of 278 quadrats were sampled on November 6 and 8, 2019. Figure 5 shows the locations of the quadrats, with locations color coded with the results of their representative percent *Spartina* coverage class (1 to 25%, 26 to 60%, and 61 to 100%).

Spectral Analysis and Image Classification

The ArcGIS Image Classification tools were used to conduct *Spartina* distribution mapping using the spectral reflectance values collected with the RedEdge-MX multispectral camera. The process begins by developing a set of training polygons which are assigned to the various elements in the imagery. For the Tuluwat Island, training samples were developed for the known occurrences of *Spartina*, native vegetation, grasses, water bodies, and mud flats. The objective of the training was to categorize as much of the image into distinct mapping elements, or classes. The number and size of the training samples is adjusted until the most distinguishable spectral signature for *Spartina* was achieved. Several tools are available to review the quality and separability of the training samples, with the goal of developing a unique spectral signature. Using the training samples and their associated classes, the Maximum Likelihood Classification tool was used to provide the pixel-based mapping of the different elements. The resulting raster file is a collection of pixels that have each been assigned to the class for which they have the *maximum likelihood* of belonging. This is an iterative process, in which the results are reviewed, adjustments are made to the content and number of training polygons, and the analysis is re-run and reviewed again until an optimum balance between over mapping and under mapping *Spartina* is achieved.

The final results showing the mapped *Spartina* through image classification are shown on Figure 6. It is important to note that the *Spartina* that is mapped through this process represents a collection of grouped pixels that can be assigned to *Spartina*, and therefore, by default, represents relatively dense clusters of *Spartina*. The classification process will not pick out diffuse individual plants as the spectral signature of these populations will be dominated by the mixture of other plant species present. In general, we found that the mapping was very good with positive identification of *Spartina* where it was suspected to be based on our qualitative review of the data and the field sampling that was conducted. In some areas we noted that *Spartina* was being under mapped based on variations in the imagery or the conditions on the ground (plants laid down) and in other cases there were vegetation types that were spectrally similar enough to *Spartina* to be erroneously mapped. The field sampling effort was important in identifying and accounting for these discrepancies.

Preparation of Coverage Class Map

The final step was to develop a map delineating the three cover classes for use in project planning. The resolution of the data sets used for the mapping is very high, with the ability to distinguish variations in vegetation at very fine scales (less than 1 m^2). Mapping all the features that are technically possible is not considered appropriate, so it was important to identify a resolution for the final mapping that meets the project needs for mitigation planning (reasonably accurate measurement of cover class areas), considers the scale the mapping will be viewed (1 inch = 500 feet), and optimizes the time required to prepare the map. A minimum mapping unit of 100 m^2 was chosen. We found that mapping at higher resolution than this did not significantly change the resulting coverage class acreages, and that the chosen resolution is sufficiently detailed for the viewed scale.

Fully automating the cover class mapping using the spectral analysis results and polygon editing tools in ArcGIS was explored, but ultimately found to not yield acceptable results. Heads up digitization (manual digitization through tracing features) informed by the review and analysis of all available data sets was found to be the most appropriate method.

The dense cover class (61 to 100%) was mapped largely based on the results of the spectral analysis where dense *Spartina* was identified through image classification. The medium cover class (26 to 60%) was identified through a combined review of the field sampling data, the spectral classification results, the elevation data in the DSM, and review of RGB and false color imagery. In general, many of the medium density areas are made up of smaller clumps of dense *Spartina* that, in aggregate, have a coverage that falls within the medium density category (Figure 7). Observations on the ground and the results of the field sampling program indicated that *Spartina* was present throughout most of the island, even if only present with coverage of 1 to 5%. Although there were some field sampling locations that had 0% *Spartina* present, areas with no *Spartina* that were large enough to meet our minimum mapping unit were not observed. The sparse coverage class (1 to 25%) was applied to all areas outside of the dense and moderate areas except for a large area in the southwest end of the island where vegetation is dominated by other grass species including *Deschampsia caespitosa*. The final results of the mapping are provided as Figure 8.

Conclusions

The high-resolution data collected from a UAV provides the opportunity to document vegetation distribution at a much finer scale than traditional satellite imagery without extensive effort involved with GPS mapping using large field crews. In addition, the flexibility of scheduling the data acquisition makes it easier to take advantage of optimum environmental conditions (such as, target plant phenology, tide stage, and lighting conditions). On Tuluwat Island, the unique spectral character, texture, and elevation profile of *Spartina* makes it possible to distinguish dense patches as small as 0.5 m^2 from native vegetation (Figure 4). Multispectral imagery and image classification tools can be used to map these dense patches with good results. Where the individual plants are widely dispersed or occur as diffuse shoots intermixed with other vegetation with similar characteristics, field observations are generally necessary to assist in establishing where it is present and the relative cover. For this reason, detecting Spartina resprouts following the initial removal treatments will likely require ground observations.

The cover class mapping prepared as part of this study and provided as Figure 8 represents a much more detailed view of the distribution of *Spartina* than previous mapping efforts by United States Fish and Wildlife Service. The total mapped area of *Spartina* remains similar; however, the mapped aerial extent of the intermediate cover class has been significantly reduced from approximately 77 acres down to 18 acres, with a corresponding increase in the sparse and dense cover classes of approximately 30 acres each.

Future surveys of *Spartina* distribution on Tuluwat Island that use UAV data collection techniques should consider the equipment, flight parameters, timing, and methods described in this report to maximize the comparability with the results of this study.

Sincerely,

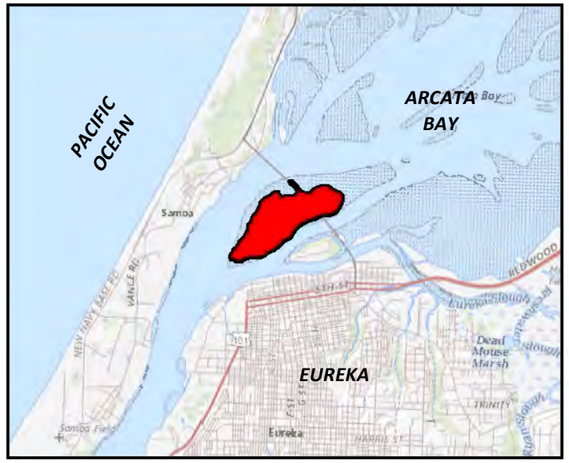
SHN

Jason Buck
UAV Program Manager

JPB:lam

Attachment 1: Figures

1 Figures



0 500 '

1"=500'±

AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 AND 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV).

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

Project Location Map
SHN 016043

February 2020 | MethodsReport_LocationMap_Figure1 | Figure 1

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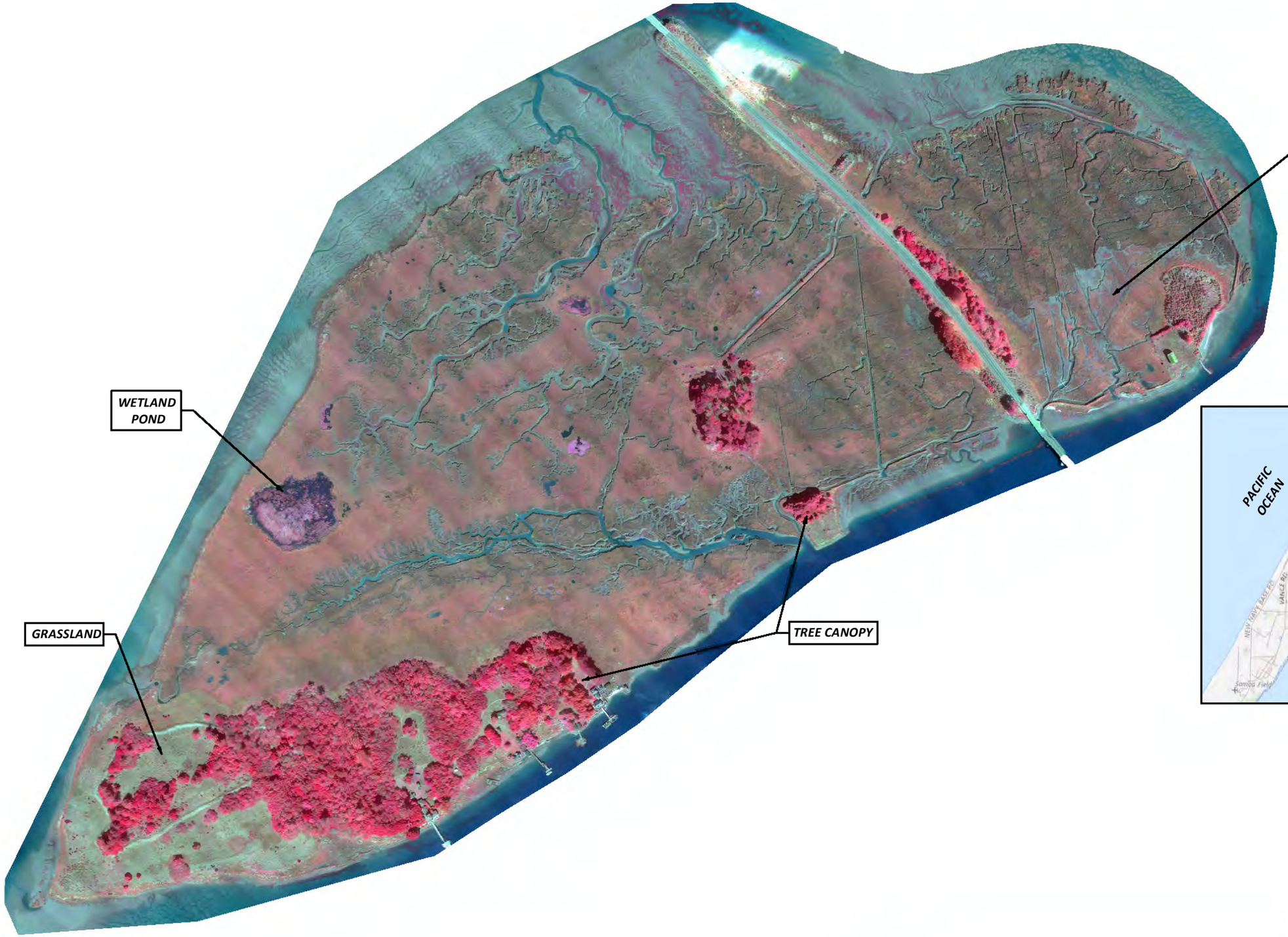

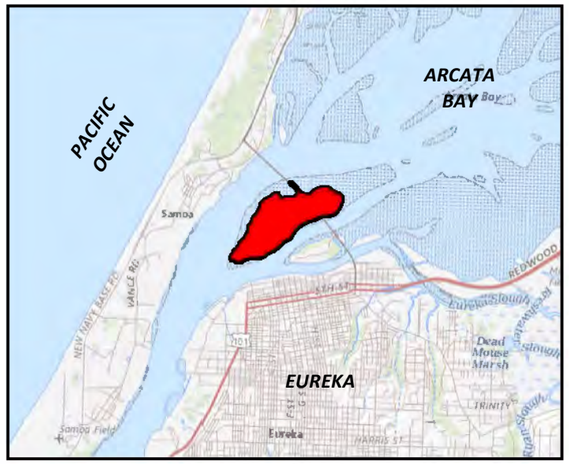

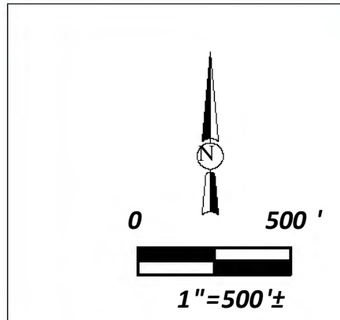

AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 AND 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV).
FALSE COLOR MAP SHOWING SPECTRAL BANDS NIR, RED AND GREEN DISPLAYED AS AN RGB COMPOSITE.

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

False Color Imagery
SHN 016043

February 2020 | MethodsReport_FalseColor_Figure2 | Figure 2

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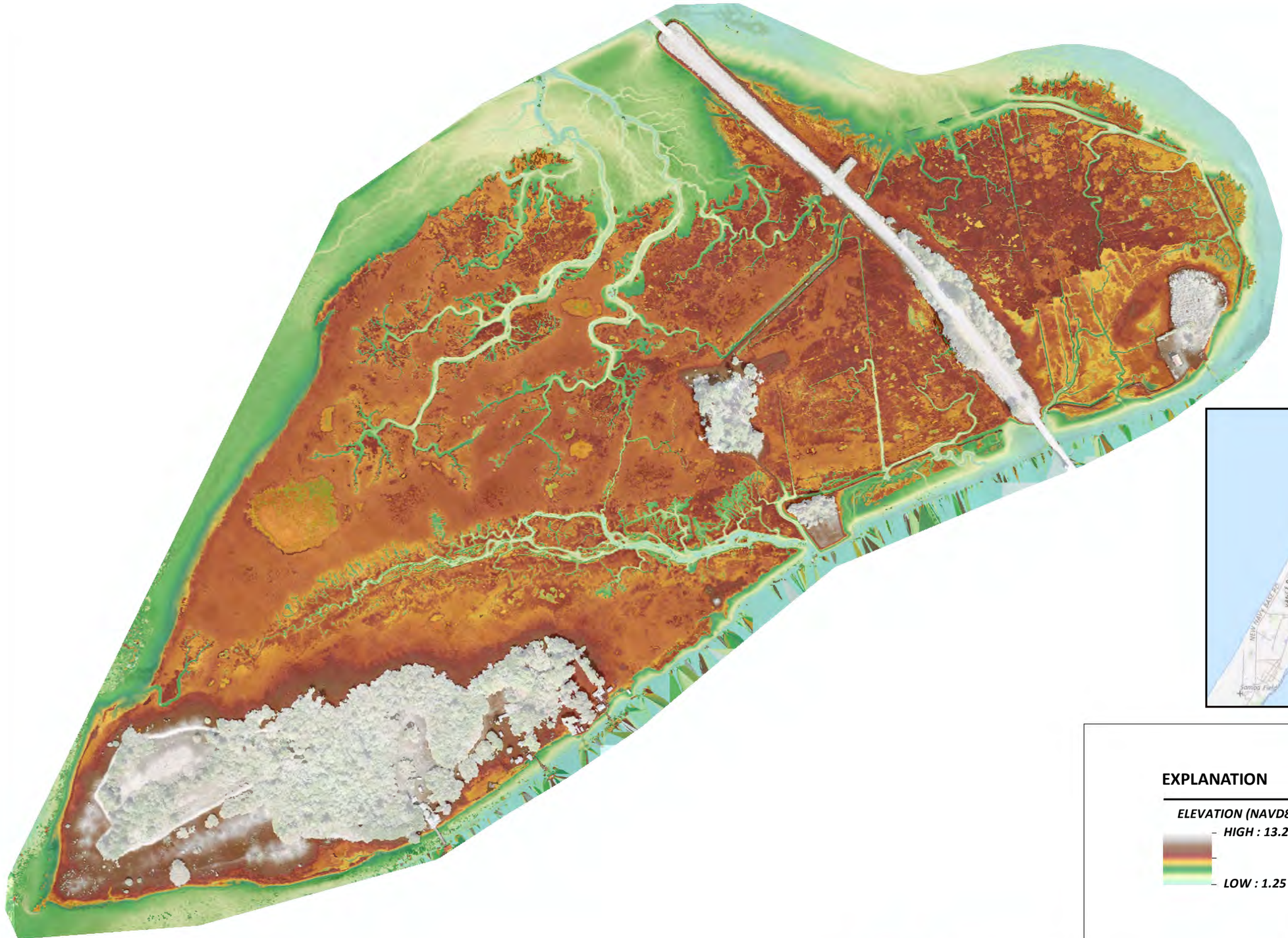

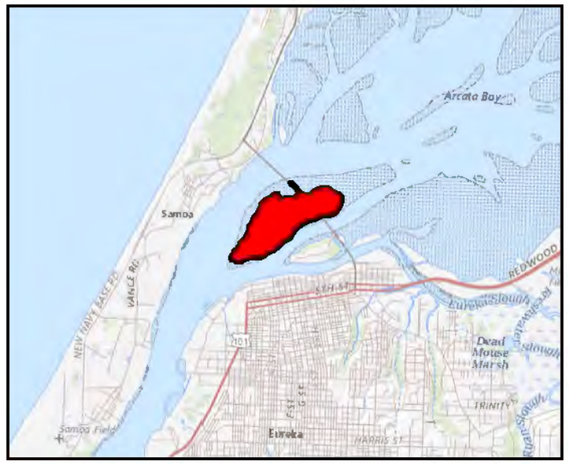

EXPLANATION

ELEVATION (NAVD88)

- ***HIGH : 13.25 FEET***
- ***LOW : 1.25 FEET***

0 500 '

1"=500'±

AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 AND 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV). DIGITAL SURFACE MODEL GENERATED WITH PHOTOGRAMMETRIC SOFTWARE.

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

Digital Surface Model
SHN 016043

February 2020 | MethodsReport_DigitalSurfaceModel_Figure3 | Figure 3

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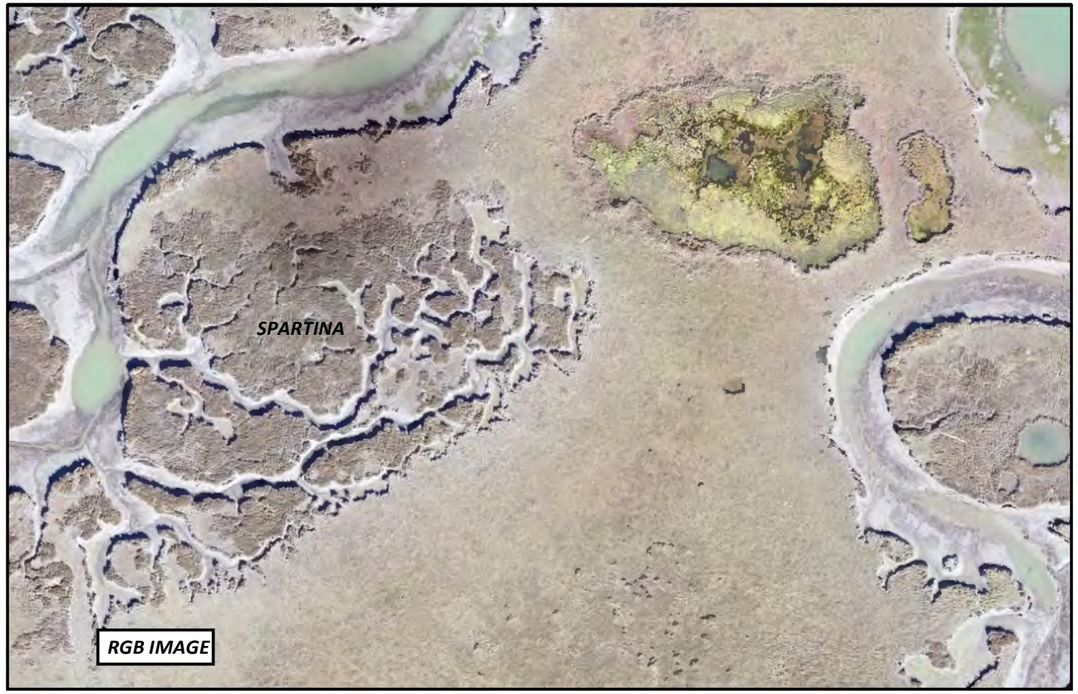

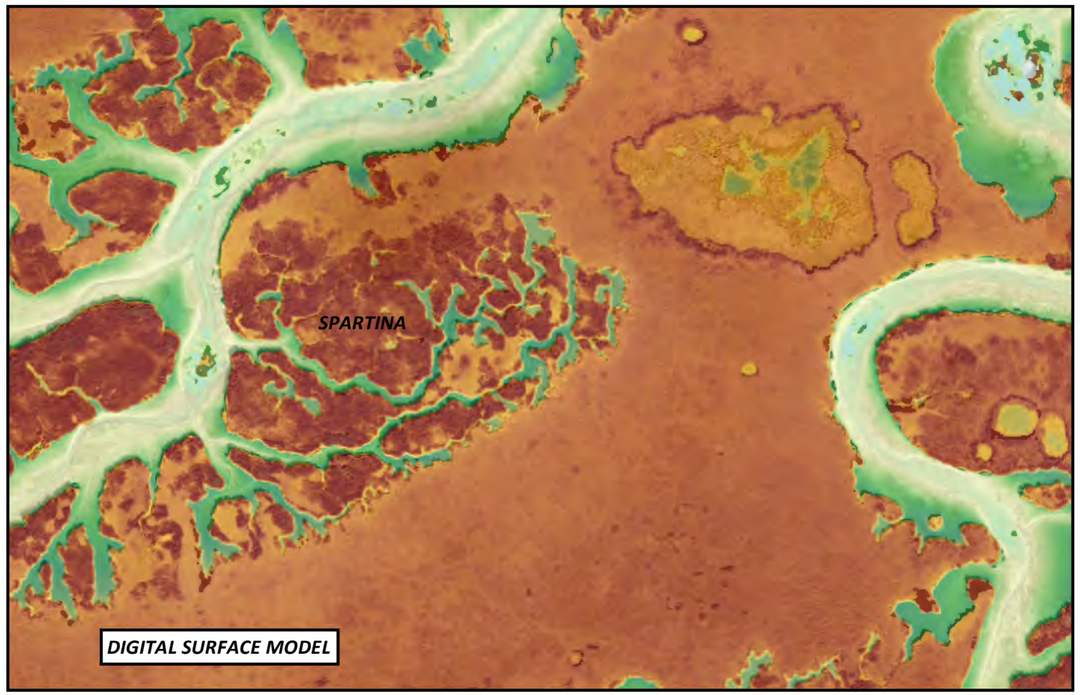

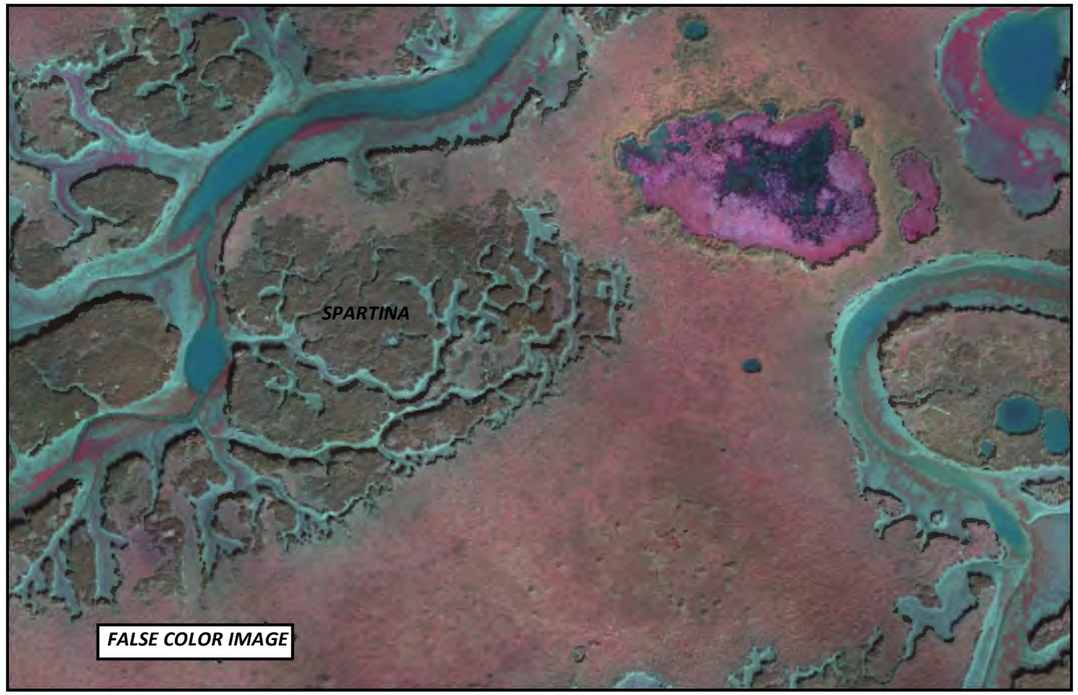

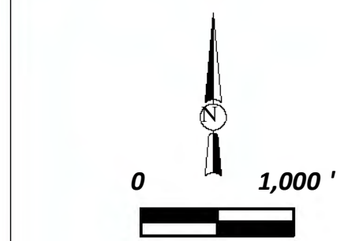

AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 AND 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV).

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

Spartina Identification
in Each Data Source
SHN 016043

February 2020 | MethodsReport_SpartinaOccurance_Figure4 | Figure 4

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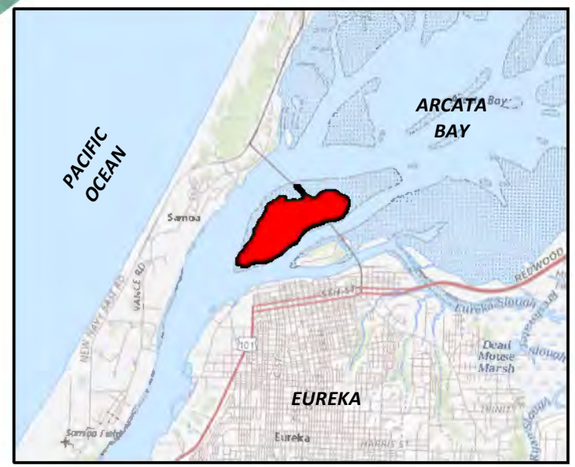

EXPLANATION

GROUND MAPPING RESULTS

PERCENT SPARTINA COVERAGE

- ***0%***
- ***1-25%***
- ***16-60%***
- ***61-100%***

N

0 ***500 '***

1"=500'±

AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 AND 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV).
FIELD SAMPLING PROGRAM CONDUCTED AS A COLLABORATIVE EFFORT WITH BOTANISTS FROM ICF, WIYOT TRIBE, CALTRANS AND SHN.

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

Field Program
Sample Locations
SHN 016043

February 2020 | MethodsReport_FieldProgram_Figure5 | Figure 5

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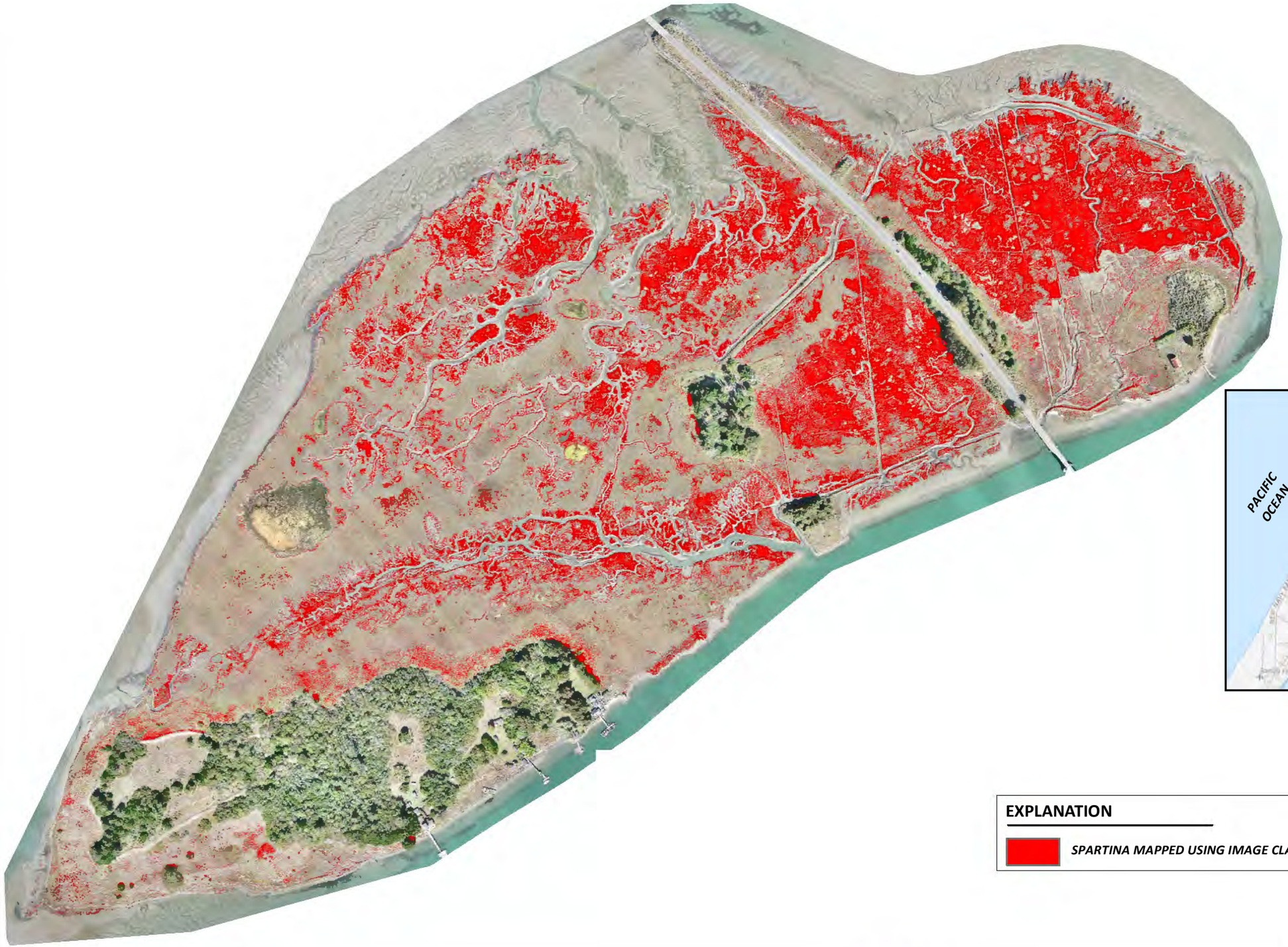

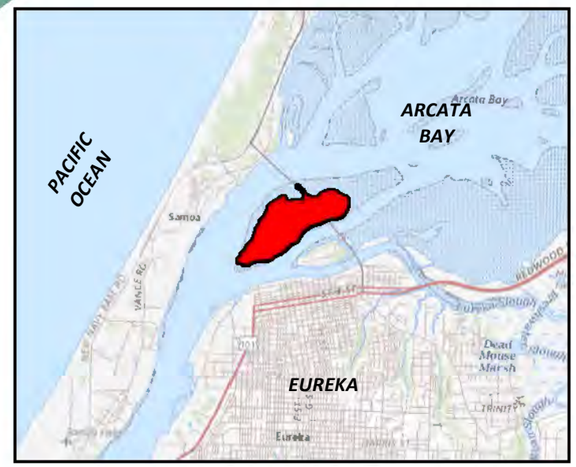

EXPLANATION

SPARTINA MAPPED USING IMAGE CLASSIFICATION

N

0 500 '

1"=500'±

AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 AND 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV). MAPPED SPARTINA DERIVED FROM ARCGIS IMAGE CLASSIFICATION PROCESSING ON MULTISPECTRAL IMAGERY.

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

Image Classification Results
Showing Mapped Spartina
SHN 016043

February 2020 | MethodsReport_SpectralAnalysisResults_Figure6 | Figure 6

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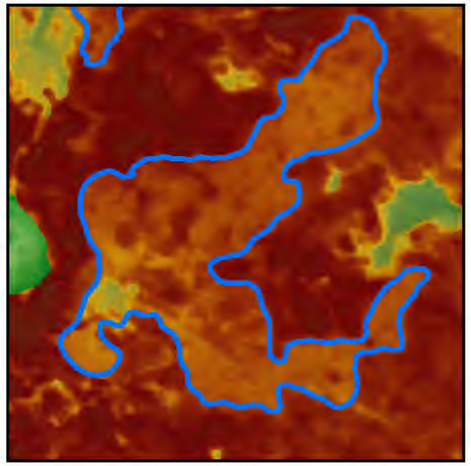
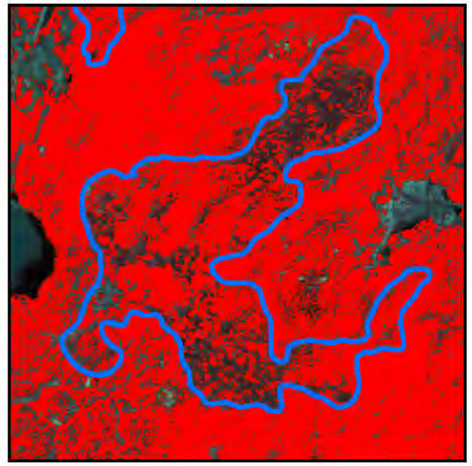
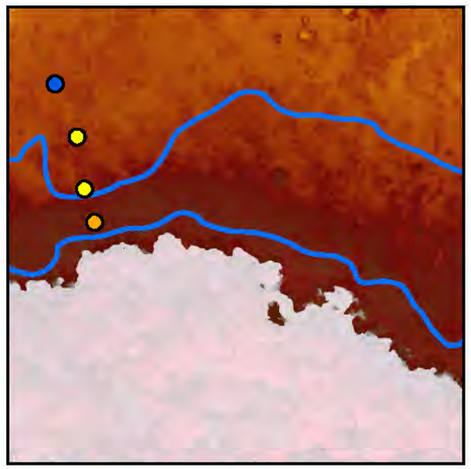
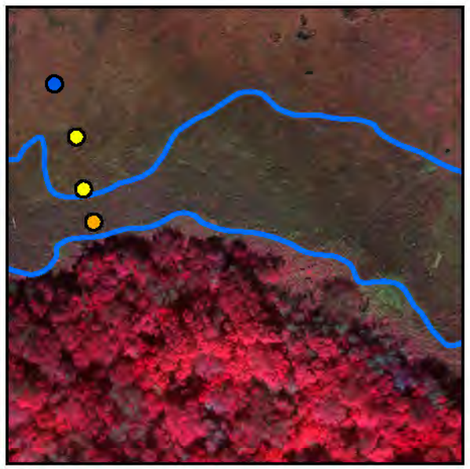
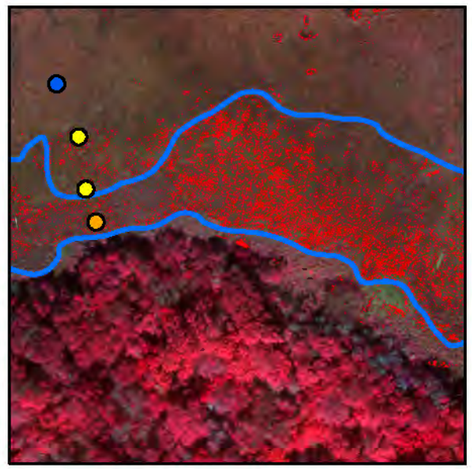
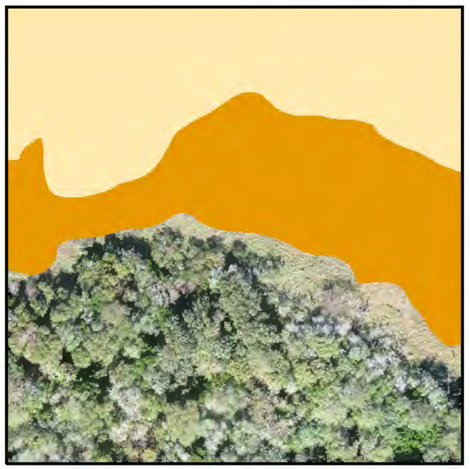
DIGITAL SURFACE MODEL | FALSE COLOR IMAGERY | IMAGE CLASSIFICATION RESULTS | FINAL COVERAGE CLASS MAPPING

EXAMPLE LOCATION 1






EXAMPLE LOCATION 2

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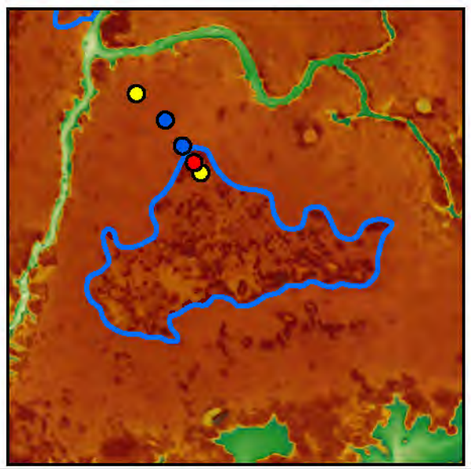

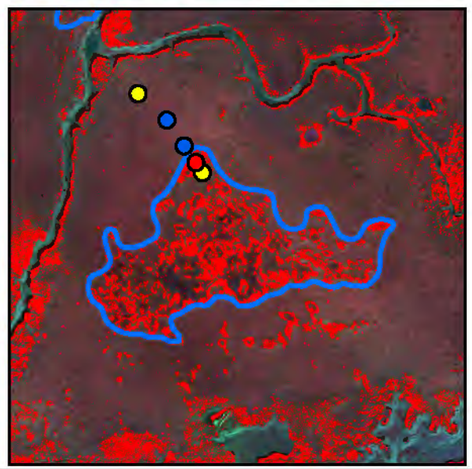


AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 and 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV).

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

Medium Density Mapping Examples
SHN 016043

February 2020 | MethodsReport_ModerateExamples_Figure7 | Figure 7

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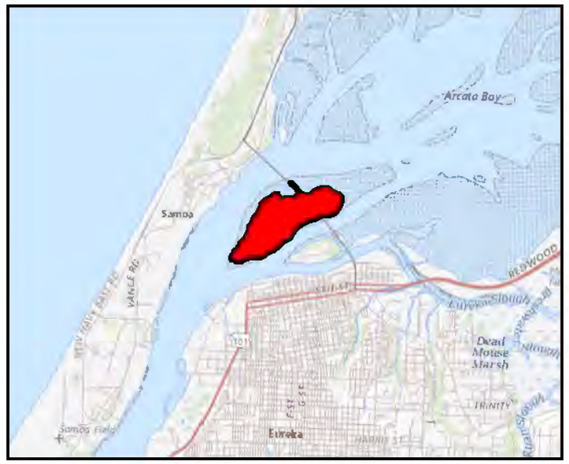

SPARTINA COVER CLASS	ACREAGE
1-25%	*81.06*
26-60%	*17.62*
61-100%	*79.03*
TOTAL ACREAGE	*177.71*

0 *500 '*

1"=500'±

MAP PREPARED AS A COLLABORATIVE EFFORT BETWEEN CALTRANS, WIYOT TRIBE, ICF AND SHN.
AERIAL IMAGERY COLLECTED BY SHN ON OCTOBER 3 AND 4, 2019 WITH AN UNMANNED AERIAL VEHICLE (UAV).
SPARTINA COVERAGE MAPPING DERIVED FROM CLASSIFICATION AND ANALYSIS OF MULTISPECTRAL IMAGERY.

Caltrans District 1
UAV Mapping of *Spartina densiflora*
Tuluwat Island, Humboldt Bay, California

Spartina Distribution Map
SHN 016043

February 2020 | MethodsReport_SpartinaCoverageMap_Figure8 | Figure 8

Path: E:\PROJECTS\2016\016043\GIS\PROJ_MXD\MethodsReport_SpartinaCoverageMap_Figure8.mxd User Name: Pix4D DATE: 2/25/20, 12:06PM

Appendix F. Mitigation Measures from FPEIR (CDP #1-14-0249)

APPENDIX B
Mitigation Measures in the Adopted Final Programmatic EIR Proposed Under CDP Application No. 1-14-0249

Aesthetic & Visual Resources	
AV-1	**Post Educational Signs**. Educational signs shall be posted in areas where public use is high. The signs will explain *Spartina*'s ecological impacts and describe the project. Increased public understanding of the project will improve the public's reaction to the temporary adverse change to the scenic marsh vista.
AV-2	**Limit covering**. In any given area that is visible from a public vantage point, including roads, highways and other areas of relatively high public use, covering shall be limited to 0.5 acres.
Air Quality	
AQ-1	**Dust Control**. Apply dust control measures where treatment methods may produce visible dust clouds and where sensitive receptors (i.e., houses, schools, hospitals) are located within 500 ft of the treatment site. The following dust control measures shall be included: • Suspend activities when winds are too great to prevent visible dust clouds from affecting sensitive receptors; and • Limit traffic speeds on any dirt access roads to 15 mi per hour.
AQ-2	**Smoke and Ash Emissions**. The Management Area is within NCUAQMD Smoke Management Zones 1 and 2. Therefore, for prescribed burns, notification of and coordination with NCUAQMD and a local fire agency shall happen well in advance, prior to initiating the burn. Depending upon the quantity of material to be burned, the District APCO may request that a burn authorization number be obtained prior to ignition. On a project specific basis, a burn permit may be required with NCUAQMD to address potential issues with smoke and as a component of a smoke management plan, if deemed necessary. Additional notification to the local fire agency and/or department may also be required as deemed appropriate by the APCO. The following shall be conducted as a part of this mitigation measure: • Initiate consultation with the District APCO by calling (707) 443-3093 (or the current phone number) to determine if the following would be required for the site specific project: • Burn authorization number, • Burn permit, and/or • Smoke management plan, as well as • Consultation with additional agencies such as the local fire agency and/or department. • If the treatment is occurring within the jurisdiction of a local fire agency and/or department, initiate consultation well in advance, prior to the initiating the burn.
Biological Resources	

BIO-1	**Minimize Effects of Mechanical *Spartina* Removal Methods to Special Status Fish Species**. On a project specific basis, a habitat analysis shall be done to determine if special status fish species have the potential to occur. If they could occur, then surveys may be done to establish that these species are absent, using protocols approved by USFWS or NMFS. If such surveys are not conducted, then the species will be assumed present. If special status fish species are present, then *Spartina* control methods will be selected that minimize potential impacts. To minimize erosion effects, control methods that are most likely to cause erosion (i.e., grinding, tilling, disking and digging/ excavating) will not occur within 15 ft of any aquatic habitat containing special status fish species, but this distance could be increased depending on site specific conditions, such as soil stability and bank slopes. Additionally, amphibious vehicles will not contact the channel substrate where special status fish species are present and the vehicles will be operated in such a manner that they avoid causing erosion into the channels. Furthermore, no flooding will be conducted in areas where special status fish species are present. Treatments that do not involve ground disturbance, such as top mowing, crushing, chemical treatment and covering will be the only methods used in close proximity (e.g., within 15 ft) to special status fish species. This mitigation measure is intended to avoid take as defined by the ESA and California ESA.
BIO-2	**Minimize Noise Effects**. Breeding special status birds could be present based on habitat and time of year. The breeding season is generally October through mid-August. On a project specific basis, a habitat analysis shall be done to determine if special status bird species have the potential to occur. If the habitat would support special status birds, and if eradication is planned to occur when these birds may be breeding, then surveys will be done to establish that these species are absent, using protocols approved by USFWS. If such surveys are not conducted, then the species will be assumed present. Response of birds to noise varies by species as well as site specific factors including ambient noise levels, topography and vegetation. A limit of 60 dB reaching breeding songbirds has recently been advocated for the by the California Department of Fish and Wildlife (see ICF Jones and Stokes 2009). For the purpose of this PEIR, if breeding birds are known or assumed present within close proximity to Spartina control activities than actions will be taken to ensure that ≤60 dB reaches the breeding area. Actions may include the use of sound measuring devices to determine the range of noise production and limit Spartina control methods accordingly (i.e., use quieter methods near breeding special-status birds).
BIO-3	**Avoid Northern Harrier and Short-Eared Owl Nests**. The breeding season is March-August for northern harriers (Loughman and McLandress 1994) and March-July for short-eared owls (Gill 1977). If *Spartina* control activities are planned to occur during these periods (i.e., between March-August) then a qualified biologist will assess whether there is potential nesting habitat for northern harrier or short-eared owls. If there is potential habitat, it will be avoided or a qualified biologist will survey the potential habitat immediately prior to *Spartina* control work and if nests are found then a minimum 300 ft buffer zone will be delineated. The buffer zone will be avoided by *Spartina* control workers and equipment.

BIO-4	**Minimize Impacts to Special Status Plant Species**. On a site specific basis, a habitat analysis shall be done to determine if special status plant species have the potential to occur. If they could occur, then surveys may be done to establish that these species are absent, using protocols approved by CDFW. If such surveys are not conducted, then the species will be assumed present. If special status plant species are present, then *Spartina* control methods will be selected that avoid or minimize potential impacts. Staked locations of special status plant populations or special status plant habitat shall be recorded, and field crews on foot or in vehicles shall be instructed to avoid and protect special status plant populations or plant habitat. Impact to the endangered dune plants beach layia and Humboldt Bay wallflower will be avoided by selecting access routes that do not contain these plants. For Humboldt Bay owl's clover and Point Reyes bird's beak, avoidance is determined not to be necessary because temporary effects during *Spartina* control are mitigated by the explosive increase in population that has been demonstrated after *Spartina* control (Pickart 2012). For other annual special status plants such as Western sand spurrey, avoidance shall occur by using only treatment methods that are highly selective; for example heavy equipment will not be operated where these plants or their habitat occur. For perennial plants such as Lyngbye's sedge, a qualified botanist shall stake out locations of special status plants and provide training to control crews to ensure that they minimize impacts to these plants. If special status plant populations or habitat occur near the high tide line, wrack and large deposits of mown *Spartina* shall be removed during the growing season. Special status plant populations shall be covered with fabric adjacent to areas sprayed with herbicide, or spray-drift barriers made of plastic or geo textile (aprons or tall silt fences) shall be installed. If accidental exposure to spray drift occurs, affected plants shall be thoroughly washed with silt-clay suspensions. To avoid trampling of special status plant species, in areas where frequent access will occur, paths shall be marked and used that avoid special status plant species to the maximum extent possible.
BIO-5	**Avoid Impacts to Eelgrass**. Workers removing *Spartina* in areas with the potential for eelgrass shall be trained to recognize eelgrass and the mudflats that are habitat for eelgrass. Training shall be conducted by a qualified biologist. Only methods that avoid physical disturbance to eelgrass plants shall be used in close proximity to eelgrass, such as top mowing and excavation. With this mitigation measure, there will be no impact to eelgrass.
BIO-6	**Reduce Noise near Marine Mammals**. If marine mammals are present within 200 ft of *Spartina* control operations, then methods which cause relatively high levels of noise (i.e., brushcutters, the Marsh Master and airboats) shall not be used. Other methods which do not generate a relatively high level of noise can be used.
Cultural Resources	
CR-1	**Worker Awareness**. Workers shall be made aware of the potential of uncovering artifacts or human remains, and instructed to cease work should any artifacts or human remains be found, and to contact the California Native American Heritage Commission (CNAHC), National Crime Information Center and/or County Coroner as appropriate. When treatment is allowed to begin again, areas identified as potentially having artifacts will be treated with methods that do not disturb the soil, such as top mowing, crushing and chemical treatment.
CR-2	**Site Specific Planning for Artifacts**. Site specific planning will include a consultation with the Wiyot Tribe to determine the likelihood that artifacts are present. If there are indications that artifacts are likely to be found, soil disturbing methods shall be avoided.

CR-3	**Site Specific Planning for Human Remains**. If, during site specific planning, indications are that human remains are likely to be found (e.g., based on literature or communications with representatives from a Tribe), soil disturbing methods shall not be used until the remains are located and properly removed. If the coroner determines that the remains may be Native American, the coroner will contact CNAHC. CNAHC staff will notify the most likely descendants of the deceased. The descendants may, with permission of the land owner or representative, "inspect the site of the discovery of the Native American remains and may recommend to the owner or the person responsible for the excavation work means for treating or disposing, with appropriate dignity, the human remains and any associated grave goods" (Public Resources Code Section 5097.98). The descendants must make their recommendations within 48 h of being contacted by CNAHC. The land owner will insure that the area within the immediate vicinity of the remains is not further disturbed or damaged until the land owner and the most likely descendants have "discussed and conferred" reasonable options.
Geology/Soils	
GS-1/ WQ-5	**Erosion Control**. *Spartina* control methods which directly impact the soil (i.e., grinding, tilling, disking, digging and excavation) shall not be conducted on salt marsh areas that are within 15 ft of a salt marsh edge that is directly exposed to wave action. Other control methods can be used in these areas. This mitigation measure only applies to salt marsh edges along Humboldt Bay proper where wave action is relatively high, not attached sloughs/channels nor the Eel River or Mad River estuaries. Future research may reveal that control methods that directly impact the soil do not result in a significant level of erosion and that this mitigation is not necessary.
Hazards/Hazardous Materials	
HHM-1	**Worker Injury from Accidents Associated with Manual and Mechanical Non-native *Spartina* Treatment**. A health and safety plan shall be developed to identify and educate workers engaged in *Spartina* removal activities. Appropriate safety procedures and equipment, including hearing, eye, hand and foot protection, and proper attire, shall be used by workers to minimize risks associated with manual and mechanical treatment methods. Workers shall receive safety training appropriate to their responsibilities prior to engaging in treatment activities.
HHM-2	**Accidents Associated with Release of Chemicals and Motor Fuel**. Contractors and equipment operators on site during treatment activities will be required to have emergency spill cleanup kits immediately accessible. If fuel storage containers are utilized exceeding a single tank capacity of 660 gallons or cumulative storage greater than 1,320 gallons, a Hazardous Materials Spill Prevention Control and Countermeasure Plan (HMSPCCP) would be required and approved by the NCRWQCD. The HMSPCCP regulations are not applicable for chemicals other than petroleum products; therefore, the contractor shall prepare a spill prevention and response plan for the specific chemicals utilized during treatment activities. This mitigation is intended to be carried-out in conjunction with Mitigation WQ-2.
HHM-3	**Worker Health Effects from Herbicide Application**. Appropriate health and safety procedures and equipment, as described on the herbicide or surfactant label, including PPE as required, shall be used by workers to minimize risks associated with chemical treatment methods. Mixing and applying herbicides shall be restricted to certified or licensed herbicide applicators.

HHM-4	**Avoid Health Effects to the Public and Environment from Herbicide Application**. For areas targeted for application of herbicides that are within 500 ft of human sensitive receptors (i.e., houses, schools, hospitals), prepare and implement an herbicide drift management plan to reduce the possibility of chemical drift into populated areas. The Plan shall include the elements listed below. To minimize risks to the public, mitigation measures for chemical treatment methods related to timing of herbicide use, area of treatment, and public notification, shall be implemented by entities engaging in treatment activities as identified below: • Coordinate herbicide applications with the County Agricultural Commissioner. Identify nearby sensitive areas (e.g., houses, schools, hospitals) and/or areas that have non-target vegetation that could be affected by the herbicide and provide advanced notification. • Establish buffer zones to avoid affecting sensitive receptors. • Identify the type of equipment and application techniques to be used in order to reduce the amount of small droplets that could drift into adjacent areas. Consult with herbicide manufacturer for proper application instructions and warnings. • Herbicide shall not be applied when winds are below 3 mile per hour or in excess of 10 mi per hour or when inversion conditions exist (consistent with Supplemental California Manufacturer Labeling), or when wind could carry spray drift into inhabited areas. This condition shall be strictly enforced by the implementing entity. Herbicide applications should not be conducted when surface-based inversions are present. Refer to Section 4.7, Air Quality, for discussion on inversions. The site-specific work plan should identify how meteorological conditions would be obtained. • Signs shall be posted at and/or near any public trails, boat launches, or other potential points of access to herbicide application sites a minimum of one week prior to treatment. • Application of herbicides shall be avoided near areas where the public is likely to contact water or vegetation. • At least one week prior to application, signs informing the public of impending herbicide treatment shall be posted at prominent locations within a conservative 500-foot radius of treatment sites where sensitive receptors could be affected. Schools and hospitals within 500 ft of any treatment site shall be separately noticed at least one week prior to the application. • No surfactants containing nonylphenol ethoxylate will be used.
HHM-5	**Health Effects to Workers, the Public and the Environment Due to Accidents Associated with Chemical Spartina Treatment**. Appropriate health and safety procedures and equipment shall be used to minimize risks associated with *Spartina* treatment methods, including exposure to or spills of fuels, petroleum products, and lubricants. These shall include the preparation of a health and safety plan, a spill contingency plan, and if threshold onsite storage values are exceeded, an HMSPCCP (see mitigation measure HHM-2 and the mitigation measures in Water Quality Section).
Hydrology/Water Quality	
WQ-1	**Managed Herbicide Control**. Herbicides shall be applied directly to plants and at low or receding tide to minimize the potential application of herbicide directly on the water surface, as well as to ensure proper dry times before tidal inundation. Herbicides shall be applied by a certified applicator and in accordance with application guidelines and the manufacturer label. The Control Program shall obtain coverage under the statewide General NPDES Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States (SWRCB 2004). The specific measures that will be required are not known at this time.

WQ-2	**Minimize Herbicide Spill Risks**. Herbicides shall be applied by or under the direct supervision of trained, certified or licensed applicators. Herbicide mixtures shall be prepared by, or under the direct supervision of trained, certified or licensed applicators. Storage of herbicides and surfactants on or near project sites shall be allowed only in accordance with a spill prevention and containment plan approved by the NCRWQCD; on-site mixing and filling operations shall be confined to areas appropriately bermed or otherwise protected to minimize spread or dispersion of spilled herbicide or surfactants into surface waters. This mitigation is intended to be carried out in conjunction with Mitigation HMM-2.
WQ-3	**Minimize Fuel and Petroleum Spill Risks**. Fueling operations or storage of petroleum products shall be maintained off-site, and a spill prevention and management plan shall be developed and implemented to contain and clean up spills. Transport vessels and vehicles, and other equipment (e.g., mowers) shall not be serviced or fueled in the field except under emergency conditions; hand-held gas-powered equipment shall be fueled in the field using precautions to minimize or avoid fuel spills within the marsh. For example, gas cans will be placed on an oil drip pan with a PIG® Oil-Only Mat Pad placed on top to prevent oil/gas contamination. Only vegetable oil-based hydraulic fluid will be used in heavy equipment and vehicles during Spartina control efforts. When feasible, biodiesel will be used instead of petroleum diesel in heavy equipment and vehicles during *Spartina* control efforts. Other, specific BMPs shall be specified as appropriate to comply with the Basin Plan and the other applicable Water Quality Certifications and/or NPDES requirements. This mitigation is intended to be carried out in conjunction with Mitigation HHM-2 in order to reduce potential impacts to less than significant level.
WQ-4/ HHM-6	**Assess Existing Contamination**. For projects where ground disturbance methods (such as digging or excavation) or imazapyr application are considered, a preliminary assessment shall be performed to determine the potential for contamination in sediments prior to initiating treatment. The preliminary assessment shall include (1) review of existing site data and (2) evaluation of historical site use and/or proximity to possible contaminant sources. If the preliminary assessment finds a potential for historic sediment contamination, an appropriate sediment sampling and analysis guide shall be followed and implemented, or soil contamination shall be assumed to be present. If contaminants with a known potential for synergistic effects with imazapyr are present or assumed to be present at levels higher than background levels, that would result in synergistic effects, an alternative treatment method (that shall not disturb sediment or apply imazapyr) will be implemented, such as repeated top-mowing, or the specific project shall apply to the Regional Water Board for site-specific WDR. If contaminants are present or assumed to be present at levels higher than background levels (but below levels that might trigger site cleanup), and these contaminants raise concerns for potential impacts from ground disturbance but not from synergistic effects due to imazapyr application, treatment methods that shall not disturb sediment (e.g., top mowing or imazapyr application) shall be used, or the specific project shall apply to the Regional Water Board for site-specific WDR. If significant contamination that warrants site cleanup is identified, sampling information shall be provided to the U.S. EPA or other appropriate authority.
WQ-5	**Erosion Control**. See GS-1 above
WQ-6	**Designate Ingress/Egress Routes**. Designated ingress/egress routes shall be established at control sites to minimize temporarily disturbed areas. Where areas adjacent to staging and stockpile areas are erosion prone, the extent of staging and stockpile areas shall be minimized by flagging their boundaries. An erosion/sediment control plan (ESCP) shall be developed for erosion prone areas outside the treatment area where greater than ¼ acre of ground disturbance may occur as a result of ingress/egress, access roads, staging and stockpile areas. The ESCP shall be developed by a qualified professional and identify BMPs for controlling soil erosion and discharge of treatment-related contaminants. The ESCP shall be prepared prior to any treatment activities, and implemented during construction.

WQ-7	**Removal of Wrack**. During site specific planning, tidal circulation will be visually assessed. In areas with relatively low tidal circulation, it will either be assumed that DO levels are depressed or monitoring will be conducted to determine if DO levels are depressed. In treatment areas located within or adjacent to waters known or expected to have depressed DO, if wrack is generated during the treatment process, the wrack shall be removed from the treatment area subject to tidal inundation or mulched finely and left in place.
WQ-8	NOT APPLICABLE since flooding is not one of the primary treatment methods authorized under this CDP application.
Land Use	
LU-1	**Use Certified Herbicide Applicators**. Herbicides will only be applied by certified applicators.
LU-2	**Compliance Monitors**. Applicators shall be assigned a compliance monitor who observes that spray does not reach agricultural fields.
LU-3	**Mechanical Methods near Agriculture**. If crops (including aquaculture crops such as oysters and clams) are growing in the vicinity of spraying, such that these crops would be more difficult to sell even if herbicides are undetectable, mechanical methods of treatment shall be selected.
LU-4	**Posting Notices and Limiting Access**. Public safety shall be ensured by posting notices and limiting access during treatment periods. Public notice shall be posted at the entrances of public lands, at trailheads, and on the websites of agencies responsible for the public lands, such as HBNWR. If members of the public access lands during treatment, the field supervisor shall have the authority to ask them to leave for their safety.
LU-5	**Do not treat *Spartina* during peak public use periods**. Although public use is minimal in the salt marshes where *Spartina* primarily occurs, there is some use, particularly by waterfowl hunters. *Spartina* treatment will not occur in waterfowl hunting areas during periods of time when hunters are active. If other peak periods of public use are identified in *Spartina* infested areas then control efforts will also avoid these time periods.
Noise	
N-1	**Use Relatively Quiet Brushcutters**. All brushcutters shall be new and quieter models, with noise not exceeding 90 dB.
N-2	**Selective Use of the Marsh Master**. Avoid treatment that uses the Marsh Master, if residential receptors are within 800 ft.
N-3	**Limit Hours of Operation**. Within 3,200 ft of homes, hours of operation shall be within times that residents would be the least disturbed, as in during work and school hours, and avoiding early morning or early evening.