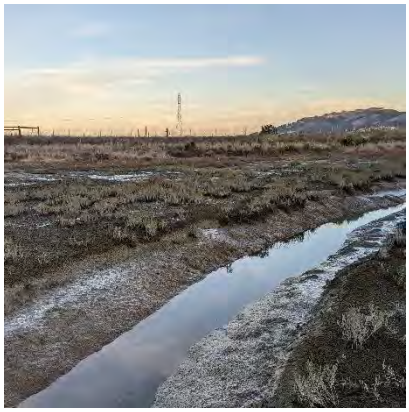
Corte Madera Four-Acre Tidal Marsh Restoration Project

Year 3 (2023) Annual Monitoring Report

Corte Madera, Marin County, California



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List of Acronyms

BCDC	Bay Conservation and Development Commission
Cal-IPC	California Invasive Plan Council
Corps	U.S. Army Corps of Engineers
District	Golden Gate Bridge, Highway & Transportation District
HMMP	Habitat Mitigation and Monitoring Plan
MHHW	Mean Higher High Water
NAVD88	North American Vertical Datum of 1988
RWQCB	Regional Water Quality Control Board
UAV	Unmanned Aerial Vehicle

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1.0 INTRODUCTION

This report presents the results from the third year of the 5-year annual monitoring period for the Golden Gate Bridge, Highway & Transportation District (District) Corte Madera Four-Acre Tidal Marsh Restoration Project (Project) located in Corte Madera, Marin County, California (Appendix A, Figure 1). Annual monitoring of the Project Area is specified for 5 years in the U.S. Army Corps of Engineers (Corps) Section 404 permit (File Number 1999-24251N), Regional Water Quality Control Board (RWQCB) Water Quality Certification (WDID# 2 CW429899), and Bay Conservation and Development Commission (BCDC) permit (M2019.011.00). Monitoring is conducted to assess whether the Project is meeting performance criteria. Monitoring criteria and performance goals for the restoration area are detailed in the Habitat Mitigation and Monitoring Plan (HMMP) written for the project and approved by the permitting agencies. A copy of the HMMP is included as Appendix B. This monitoring report presents the results of the third year (2023) of monitoring and the progress toward meeting performance goals.

1.1 Background

The Project meets the needs of the District's outstanding environmental restoration obligations. The District's 1988 Corps permit authorized the dredging and disposal of 90,000 cubic yards of dredge sediment associated with maintenance of the Larkspur Ferry Terminal (#17486N). As a condition of the Corps permit covering these activities, the District was required to create a maximum of 2.0 acres of tidal marsh and habitat suitable for California Ridgway's rail (*Rallus longirostris obsoletus*, formerly California clapper rail). In 1996, ferry operation was modified to include the acquisition of a high-speed ferryboat for the Larkspur Ferry Terminal operations. Consequently, the District consulted with local environmental groups and permit agencies regarding mitigation of anticipated environmental impacts and agreed to create an additional 2.0 acres of tidal marsh habitat, resulting in a commitment to restore a total of 4.0 acres of tidal marsh. The Project fulfills this commitment by restoring approximately 4.3 acres of tidal marsh habitat. The restoration efforts temporarily impacted existing 0.18 acre of tidal marsh and relocated 0.28 acre of seasonal wetlands within the Project Area.

1.2 Restoration Goal

The goals of the Project are to restore approximately 4.3 acres of tidal salt marsh and create habitat for Ridgway's rail. This includes restoring native plant species within the tidal marsh area and transition zone and reducing the presence of invasive plant species throughout the Project Area. In addition, the Project will be monitored to ensure that there is no adverse erosion or sedimentation within the restored tidal marsh or adjacent Northern Drainage Channel. The total restored acreages of jurisdictional wetlands are summarized in Table 1. The restored marsh is tidally connected to the Northern Drainage Channel, which is connected to the San Francisco Bay. See Appendix A, Figure 1.

Summary of restoration goals:

- restore tidal wetlands in a diked marshland that was historically tidal wetlands;
- provide habitat for Ridgway's rail;
- create seasonal wetland habitat to mitigate for the Project's impacts to existing seasonal wetlands;

- restore native plant vegetation within the tidal marsh area, the transition zone; and upland refugia areas of the Project;
- reduce cover and control the spread of invasive plant species within the tidal marsh and transition zone in the Project Area; and
- minimize adverse sedimentation and channel erosion in the tidal channels of the new marsh and the adjacent Northern Drainage Channel.

Table 1: Proposed and Completed Habitat Restoration

WETLAND TYPE	RESTORED AREA (ACRES)
Seasonal Wetlands	0.28
Tidal Habitats (Total)	4.30
Tidal Marsh – Channel	*0.30*
Tidal Marsh – Low Marsh	*0.23*
Tidal Marsh – High Marsh	*3.77*

1.3 Earthwork

1.3.1 Earthwork for the Creation of the Tidal Marsh

The restored tidal marsh was created by excavating historic Bay sediments from the diked former baylands and lowering the existing grades to create a tidal marsh plain to appropriate elevations for low marsh (3.75-4.75 feet relative to the North American Vertical Datum of 1988 (NAVD88)) and high marsh (4.75-6.5 feet NAVD88) tidal zones. In addition, a system of tidal channels was excavated (2.0-3.75 feet NAVD88) and connected to the adjacent Northern Drainage Channel (a tidal channel) in order to provide full tidal hydrology to the site. A portion of an existing earthen berm and trail was excavated to provide access to the tidal waters of the Northern Drainage Channel. The excavated material was reused on-site and configured to create a replacement perimeter berm and a low mound to the south and east of the restored tidal marsh area supporting a public trail. In all, approximately 28,000 cubic yards of material was excavated to create the new tidal marsh and deposited on-site to re-create a berm and low mound adjacent to the restored area.

The internal tidal channels have been sized to provide full tidal hydrology for the new tidal marsh. In addition, the channels have been designed to convey water at velocities within a range that is not expected to cause scouring and should preclude the channels from accumulating sediment. The size and configuration of the tidal channels is expected to develop and mature over time into a state of equilibrium.

1.3.2 Earthwork for the Creation of the Seasonal Wetland

Creation of new seasonal wetland habitat necessitated the excavation of approximately 600 cubic yards of soils. This involved creating a shallow depression with a maximum depth of 4 to 6 inches over a 0.28-acre area. The material removed to create the seasonal wetland was reused on-site to create the low mound supporting the public trail discussed in the previous section. The restored seasonal wetland is located approximately 175 yards south of the restored marsh perimeter.

1.4 Revegetation Plan

Revegetation within the tidal marsh plain consisted of plantings sourced from local nurseries. Tidal marsh plain planting was restricted to the highest elevations of the marsh surface because of the risk that stronger and more frequent tidal action at lower elevations could wash away the plantings. Natural colonization of native tidal marsh species is being relied upon for vegetation in the lower elevations of restored tidal areas, as seeds and vegetative propagules capable of rooting in mudflats are carried on-site via tidal flows. Project design is intended to promote rapid colonization by creating suitable substrates and elevation profiles for the establishment of salt marsh vegetation. To provide a seed source within the restored tidal area, approximately 10 percent of the high marsh was planted with pickleweed and other high marsh plant species. Seed production from this small area of planting is expected to augment natural seed input via tidal flows from adjacent tidal marshes. The low marsh was not actively planted based on recommendations from the San Francisco Estuary Institute Invasive Spartina Project (ISP). Due to the presence of invasive non-native *Spartina alterniflora* in the vicinity, there is a potential for it to hybridize with the native cordgrass, *Spartina foliosa,* which would typically be planted at the low marsh elevations.

To support a functioning marsh ecosystem, including habitat for Ridgway's rail, planting was completed in the marsh transition zone. A well-vegetated transition zone increases cover for Ridgway's rail and other species to hide from predators within during high tides. Prior to planting, a temporary spray irrigation system was installed within the transition zone planting area to provide supplemental water during the first 2 to 3 years of monitoring. Irrigation will be applied during the dry season (summer) and during dry winters to supplement any deficiency in rainfall that may occur to ensure successful establishment of the plants. The transition zone was revegetated with a combination of native grass and shrub species in order to provide vegetative cover for Ridgway's rail, which is likely to use these areas for refugia during extreme high tide events. In addition, the transition zone and upland disturbed areas throughout the Project footprint were hydroseeded with a seed mix at densities indicated in Table 2, in conjunction with an erosion control seed mix void of invasive plant species. The planting palette was chosen based on previous restoration experience in the Bay and the current vegetation inhabiting functioning marshes in the immediate vicinity of the site.

Planting and seeding occurred following the final site grading and during the rainy season. Table 2 summarizes the revegetation plan for the Project based on the project as-built report (WRA 2021).

Table 2. Planting Palette & Seeding Rates by Biological Community

	BOTANICAL NAME	COMMON NAME	SIZE	ON-CENTER SPACING (FEET)	QUANTITY TOTAL
High Marsh Zone	*Distichlis spicata*	salt grass	TB5	1.0	2,651
	Jaumea carnosa	marsh jaumea	TB5	1.0	1,642
	Frankenia salina	alkali heath	TB5	1.0	541
	Limonium californicum	California sea lavender	TB5	1.0	821

	BOTANICAL NAME	COMMON NAME	SIZE	ON-CENTER SPACING (FEET)	QUANTITY TOTAL
	Salicornia pacifica	pickleweed	TB5	1.0	11,090
				TOTAL	**16,745**
Transition Zone	*Baccharis glutinosa*	salt marsh baccharis	D16	3.0	189
	Grindelia stricta	coastal gumweed	D16	3.0	189
	Baccharis pilularis	coyote brush	D16	6.0	108
		TOTAL			**486**
Seasonal Wetland Seed Mix	*Carex praegracilis*	field sedge	2.00	0.56	
	Eleocharis macrostachya	creeping spike rush	1.00	0.28	
	Elymus triticoides	creeping wild rye	4.00	1.12	
	Hordeum brachyantherum	meadow barley	6.00	1.68	
	Juncus bufonius	toad rush	1.00	0.28	
	Juncus phaeocephalus	brownhead rush	1.00	0.28	
	Oenothera elata	evening primrose	2.00	0.56	
	TOTAL	**17.00**	**4.76**		
Upland/ Transition Hydroseed Mix	*Baccharis pilularis*	coyote brush	0.15	1.50	
	Bromus carinatus	California brome	3.00	30.00	
	Danthonia californica	California oatgrass	3.00	30.00	
	Elymus glaucus	blue wild rye	6.00	60.00	
	Eschscholzia californica	California poppy	4.00	40.00	
	Festuca microstachys	three weeks fescue	6.00	60.00	
	Hordeum brachyantherum	meadow barley	8.00	80.00	
	Sisyrinchium bellum	blue-eyed grass	3.00	30.00	
	Stipa pulchra	purple needlegrass	4.00	40.00	
	TOTAL		**37.15**	**371.50**	

1.4.1 Coordination with the San Francisco Estuary Invasive Spartina Project

The Project consulted with the ISP regarding the planting of *Spartina foliosa* and received a response letter dated November 22, 2019, with the following recommendations:

- There are known occurrences of invasive *Spartina* in the vicinity of the project site;

- The ISP strongly recommends that the project not actively plant *Spartina foliosa* because of the risk of infestation and hybridization of invasive *Spartina*; and
- The ISP expects passive recruitment of native *Spartina foliosa* at this site because there are existing populations of native *Spartina* within adjacent tidal marsh areas.

As a result, the Project did not plant *Spartina foliosa*. No alternatives for planting in the low marsh are available since the native cordgrass *Spartina foliosa* is the only native species that grows at low marsh elevations. The Project will rely on natural recruitment for establishing vegetation in the low marsh. As requested, the ISP will be notified if monitoring detects *Spartina* colonization within the restoration area to allow them to incorporate the site into their monitoring and treatment plans.

1.5 Access Control and Species Protection Fencing

An access control fence was installed on either side of the perimeter berm and informal trail that is located south and east of the restored tidal area to minimize anthropogenic disturbance to the restored tidal marsh, transition zone, and upland/upslope refugia areas. The fence isolates an upland refugia area adjacent to the restored marsh that varies in width from 50 to 135 feet and also restricts recreational access to the southern portion of the Project Area as well as areas adjacent to the south and east of the Project Area. The fence consists of galvanized wire mesh mounted on wooden or metal posts.

1.6 As-Built Conditions

Construction, inclusive of planting, was completed in January 2021. As-built conditions were documented following completion of restoration efforts, including a bathymetry and LiDAR survey of the Project Area and the Northern Drainage Channel. A brief letter report outlining the as-built conditions of the restoration area was submitted to the regulatory agencies following the completion of all restoration activities, inclusive of planting (WRA 2021).

2.0 PERFORMANCE AND MAINTENANCE MONITORING

2.1 Success Criteria

Monitoring is performed to demonstrate that the Project accomplishes all the restoration goals and to help identify the need for maintenance activities. Monitoring covers the following factors:

- Tidal hydrology;
- Erosion and siltation within tidal channels;
- Seasonal wetland hydrology;
- Revegetation of the tidal marsh area, transition zone, and upland refugia areas; and
- Revegetation of the seasonal wetland.

Monitoring that would trigger maintenance activities focuses on the following:

- Identify areas of excess erosion or siltation within tidal channels;
- Identify the need to implement invasive weed control;
- Identify the need to repair or replace the access control fence; and
- Identify the need to replace plantings in the transition zone or high marsh

The monitoring program will last 5 years or until success criteria are achieved. Quantitative monitoring is performed to evaluate performance as specified in tables 3 and 4. The final report will include a topographic survey of the Project Area and an updated jurisdictional wetland delineation.

Success of the proposed restoration activities will require the successful establishment of wetland vegetation, demonstration of channel stability (i.e., lack of significant erosion and sedimentation indicators), and control of invasive weed species that may invade the newly constructed tidal marsh and seasonal wetland. Success criteria, as outlined in the HMMP, will be used to evaluate the development of the restored wetland habitats. The success criteria include:

- 50 percent total cover of native high marsh vegetation by Year 5;
- 80 percent survival of native shrub plantings within the transition zone;
- Control of invasive species;
- Absence of significant erosion affecting upper tidal range or cover over the area within the restored marsh where soil containing elevated levels of nickel was removed and replaced with clean soils;
- Presence of a functioning, self-sustaining wetland system;
- The restored seasonal wetland shall perform similarly to reference wetland conditions within the parcel by Year 5; and
- Permanent photo-documentation points will be established at several locations to visually track the progress of the restoration site toward meeting final success criteria described below.

Tables 3 and 4 summarize success criteria for completing annual monitoring in years 1, 2, 3, and 5 for the restored tidal marsh, transition zone, upland refugia, and seasonal wetland habitats. The Regional Water Quality Control Board permit requires that monitoring be completed each year during the 5-year monitoring period. However, no criteria were included for Year 4 in the approved HMMP (Appendix B). Year 4 monitoring will occur in compliance with the permit, with results compared to the Year 5 monitoring criteria to assess any final actions required to achieve the criteria during Year 5.

Table 3. Success Criteria for Restored Tidal Habitats

HABITAT ZONE	CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 5
Tidal Marsh, Transition Zone, and Upland Refugia	**Erosion and/or Sedimentation**	Document baseline topography using low altitude, high resolution imagery Qualitative monitoring to observe signs of sedimentation/erosion	Compare digital topographic data with hydrology monitoring data to identify sedimentation/erosion reducing the extent of marsh ponded at Mean Higher High Water (MHHW) or cover over area with elevated nickel	Compare digital topographic data with hydrology monitoring data to identify sedimentation/erosion reducing the extent of marsh ponded at MHHW or cover over area with elevated nickel	Compare digital topographic data with hydrology monitoring data to identify sedimentation/erosion reducing the extent of marsh ponded at MHHW or cover over area with elevated nickel. Sedimentation does not contribute to reduction in MHHW by more than 0.3 ft depth Depth of cover over area where elevated nickel was removed is at least 0.5 ft
	Hydrology	Install water-depth data loggers in main tidal channel, secondary tidal channel, and two within the marsh plain	Compare hydrographs; calculate and compare the tidal datum	Compare hydrographs; calculate and compare the tidal datum	MHHW within the tidal marsh is within 0.3 ft of MHHW within the Northern Drainage Channel.

Table 3. Success Criteria for Restored Tidal Habitats

HABITAT ZONE	CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 5
	Vegetation	N/A No active planting of low marsh will be conducted.	Following native cordgrass establishment, low marsh cover will increase 5 percent annually.	Following native cordgrass establishment, low marsh cover will increase 5 percent annually.	Following native cordgrass establishment, low marsh cover will increase 5 percent annually.
		N/A The high marsh will be planted with native species in Year 1.	Native plant cover within the restored high marsh will be ≥ 15 percent.	Native plant cover within the restored high marsh will be ≥ 22.5 percent.	Native plant cover within the restored high marsh will be ≥ 50 percent.
		N/A The transition zone will be planted with native shrubs in Year 1.	Native shrub survival within the transition zone will be 90 percent.	Native shrub survival within the transition zone will be 80 percent.	Native shrub survival within the transition zone will be 80 percent.
		Invasive plants ranked by the California Invasive Plant Council as "High" will not exceed 5 percent absolute cover within the tidal marsh, transition zone, and upland refugia, exclusive of annual grasses.			
		Report presence of *Spartina* sp. to facilitate on-site genetic testing and control of invasive and hybrid *Spartina*, if present, by the Invasive Spartina Project.			No invasive or hybrid *Spartina* within the tidal restoration area.

Table 3. Success Criteria for Restored Tidal Habitats

HABITAT ZONE	CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 5
	Wetland Delineation		N/A		A protocol-level wetland delineation will be completed to verify boundaries of wetlands and non-wetland waters.

Table 4. Success Criteria for Restored Seasonal Wetland Habitat

HABITAT ZONE	CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 5
Seasonal Wetland	**Hydrology**	Soils in the restored seasonal wetland will be inundated or saturated within 12 inches of the soil surface for at least 14 consecutive days.			
	Vegetation*	Absolute native plant cover in the restored seasonal wetland will be ≥ 40 percent of absolute native plant cover in the reference seasonal wetland.	Absolute native plant cover in the restored seasonal wetland will be ≥ 50 percent of absolute native plant cover in the reference seasonal wetland.	Absolute native plant cover in the restored seasonal wetland will be ≥ 60 percent of absolute native plant cover in the reference seasonal wetland.	Absolute native plant cover in the restored seasonal wetland will be ≥ 100 percent of absolute native plant cover in the reference seasonal wetland.
		Invasive plants ranked by the California Invasive Plant Council as "High" will not exceed 5 percent absolute cover within the seasonal wetland.			
	Wetland Verification	N/A			A protocol-level wetland delineation will be completed to verify boundaries of wetlands and non-wetland waters.

*the success criterion language for native plant cover was changed from the original to allow the metrics to be mathematically possible given the definitions of "relative" and "absolute" cover in the scientific literature, and consistent with the intent of this metric.

2.2 Monitoring Methods

The following section outlines the monitoring methods that will be used to measure the success criteria for the Project, including an as-built topography survey of the Project. Vegetation monitoring efforts will be conducted in spring during the appropriate plant growth season to assess vegetation across the restored wetlands.

2.2.1 Photographic Documentation

Ten permanent monitoring locations were established where photographs will be taken to document the development of restored habitats and to illustrate that normal sediment transport processes are occurring within the Project Area over time. Photographs will be taken with a handheld camera from ground level or from a camera mounted on an unmanned aerial vehicle (UAV). These photographs will capture the development (revegetation success) and status of the following:

- Tidal marsh area, including potential signs of erosion and/or sedimentation within tidal channels;
- Transition zone;
- Upland refugia;
- Seasonal wetland; and
- Access control fence.

Photographic documentation for the third year of monitoring was recorded on July 12 and 14, 2023.

2.2.2 Erosion and Sedimentation

The potential adverse effects of erosion and sedimentation are monitored using digital topographic data developed from aerial photographs. Following construction and in years 2, 3, and 5, low altitude, high-resolution, color imagery will be acquired using a UAV for use in assessing both erosion and vegetative cover. Imagery will be acquired at low tide to expose the entire restoration area. Photogrammetry software will be used to generate high-resolution topography (digital terrain model) from the color imagery. However, the UAV is unable to penetrate vegetation to reach the surface, so as vegetation fills in, it can distort the topographic data. To account for this potential distortion, topography is verified using on-the-ground cross-section surveys. Topographic data will be compared to post-construction baseline data to determine changes in marsh surface and tidal channel geometry and evaluate performance criteria. Should any significant adverse erosion or sedimentation be observed, the District will notify the regulatory permitting agencies to determine appropriate corrective actions. Baseline as-built topography was recorded via UAV photography in February 2021. Current topography was documented using UAV photography of the site on August 18, 2023.

2.2.3 Tidal Hydrology

Tidal hydrology will be considered successful by demonstrating that the new tidal marsh area is exposed to full tidal hydrology. Tidal hydrology is verified through use of pressure/water-level data loggers to measure and confirm full tidal inundation as well as biannual photographic evidence that the site is fully inundated at high tide events. Pressure transducers equipped with data loggers are installed each year in the Northern Drainage Channel and the restored tidal marsh within slotted PVC housings. Elevations of the housings were surveyed relative to the NAVD88; coordinates were surveyed using the California State Plane. On August 16, 2023, four pressure transducers

equipped with data loggers were installed. Three were installed within the restored marsh: one in the lower tidal channel at the northern boundary of the restoration area, adjacent to the Northern Drainage Channel (1.80 feet NAVD88); one in an upper channel in the southern portion of the marsh (3.45 feet NAVD88); and one in high marsh near the southwestern edge of the marsh, outside of a channel (6.67 feet NAVD88). Earlier, in 2021, a data logger was installed at the pump station at the western edge of the Northern Drainage Channel to provide reference data. However, the data logger was stolen. In 2022, the fourth location was moved away from the pump station to the interior of the channel (1.70 feet NAVD88), a location that is less accessible to humans and therefore less likely to be interfered with; this location was used again in Year 3. The gauges were comprised of data loggers, a slotted PVC pipe, and T-posts. The locations were topographically surveyed using a Trimble RTK device and were tied in with an existing control point, which is located near the pump station at the western end of the Northern Drainage Channel at an elevation of 11.43 feet NAVD88. The loggers were left to collect data from August 16 to October 27, 2023, to capture a large range of tidal conditions. Tidal hydrology monitoring locations are depicted in Appendix A, Figure 2.

Photographs of the site fully inundated at high tide were taken on November 23, 2022, and January 3, 2023, and are included in Appendix C.

2.2.4 Vegetation Coverage in the Tidal Marsh

The development of vegetation coverage within the tidal marsh is monitored to demonstrate that the rate of revegetation is on-track based on the success requirements for the Project. This will include the low marsh and high marsh areas of the Project Area. The absolute cover of vegetation within the tidal marsh was measured with the remote-sensing analysis software called "eCognition". This software allows users to classify different signature outputs of satellite images and aerial photographs. Using a high-resolution aerial image collected during low tide, the software can determine the aerial cover of vegetation.

Using aerial imagery, vegetation signature recognition software interprets signatures of the vegetation, and the software can automatically define the boundaries of every color signature on the color aerial photograph, a process also known as a multi-resolution segmentation analysis. This analysis generates polygons that require classification in the aerial imagery by a trained geospatial analyst familiar with the software and tidal ecology. On August 18, 2023, WRA flew a UAV to capture aerial imagery of the site and subsequently used that imagery and the eCognition software to measure vegetation cover. On November 1, 2023, WRA completed a site visit using a georeferenced map of the aerial imagery analysis results to confirm that the classification analysis accurately captured the vegetation composition and aerial cover observed. During this site visit, WRA also quantified any observed invasive species within the tidal marsh.

2.2.5 Vegetation Coverage in the Transition Zone

The development of the vegetation coverage within the transition zone will be measured to demonstrate that this area has sufficient shrub coverage to support Ridgway's rail refugia. The monitoring will measure absolute coverage of shrubs in the transition zone. Absolute coverage of shrubs will be used in later years when the size of the shrubs starts to become substantial. The coverage of shrubs will be measured using one of the following methods:

- Vegetation count of live shrubs species within the transition zone; and/or
- Acquire high-resolution aerial imagery collected with a UAV, estimate percent coverage manually or using aerial imagery analysis software, and verify desktop analysis on-the-ground.

Vegetation Counts

Utilizing the planting palette developed for the transition zone, qualified biologists will walk the transition zone and monitor all live shrub species within this zone to determine the planting success.

Aerial Imagery Analysis

A similar aerial imagery analysis will be completed as that described above for the tidal marsh.

On July 14, 2023, shrub survival was determined by walking the transition zone and counting all live plantings. Natural recruitment of native shrub species was included in the totals.

2.2.6 Seasonal Wetland Hydrology

The hydrology of the seasonal wetland will be measured by collecting data that demonstrates that the soils within the seasonal wetland are saturated or inundated for the required minimum duration of 14 consecutive days during the rainy season. Data will be collected using one of the following or an equivalent method:

- Installation and data collection from a shallow groundwater well;
- Installation and inspection of a staff gauge; or
- Field verification of inundation.

In Year 3, inundation and saturation were observed on the ground on January 3, February 1, March 23, and May 5, 2023. Images of inundation and saturation during Year 3 are included in Appendix C.

2.2.7 Vegetation Coverage in the Seasonal Wetlands

The development of vegetation coverage within the restored seasonal wetland and a reference seasonal wetland is monitored to demonstrate that the rate of revegetation is on-track based on the performance requirements for the Project as outlined in Table 5. The established reference wetland is a local depressional wetland within an undisturbed area of the property of similar size to the restored seasonal wetland (Appendix A, Figure 2). The absolute cover of vegetation within the restored seasonal wetland and reference seasonal wetland will be measured using the transect-quadrat method or an equivalent method:

Transect-Quadrat Vegetation Monitoring

Seasonal wetland vegetation is monitored using transect-quadrat methods for both the restored seasonal wetland and reference seasonal wetland habitats (Appendix A, Figure 2). Transects are located in the restored and reference seasonal wetlands that are spaced 50 feet apart across the longest portion of the wetland, and one transect extends perpendicular through the narrowest portion of the wetland. Given the relatively smaller size of the seasonal wetlands, the perpendicular transect has been included to ensure that transects adequately capture the variation of depth within each depressional feature. The application of quadrats will follow the same random number assignment and spacing as described above. Species composition and percent cover will be collected through this methodology. In Year 3, vegetation monitoring occurred on July 12, 2023.

2.2.8 Access Control Fence

The access control fence will be inspected during annual monitoring site visits to confirm that it remains in working condition. The fence will be repaired or replaced as needed. The tidal marsh areas, transition zone, and upland refugia area will be inspected for evidence of significant anthropogenic disturbances.

2.3 Remedial Actions

If annual or final success criteria are not met, the District will prepare an analysis of the potential cause(s) of failure and, if determined necessary by the permitting agencies, propose remedial action for approval. Subsequent annual and final monitoring reports may be required to confirm that remedial actions were successful. The District will be responsible for reasonably funding the remedial actions necessary for successful completion of the mitigation efforts. Remedial actions may include additional planting of native wetland species, invasive species abatement activities, or modification of Project features to ensure proper hydrological functioning.

2.4 Reporting

Annual monitoring reports will cover the monitoring year beginning at the start of the rainy season (approximately October 1st) and will cover 12 calendar months forward from that point, with submittal occurring by January 31 of the following year.

3.0 PAMPAS GRASS TREATMENT

A large, established population of pampas grass (*Cortadera selloana*), totaling approximately 9 acres in size, is present adjacent to but outside of the Project Area. Pampas grass has a Cal-IPC High rating and is an aggressive invader. While it currently is nearly absent from the Project Area (See Section 4.2.2), this species is beginning to encroach into the restored seasonal wetland area, and its wind-dispersed seeds could easily spread into the tidal marsh restoration area. Not only does the pampas grass pose a direct threat to the biodiversity and structural function of restoration efforts on the Project Area, but it has the potential to expand into neighboring Baylands and surrounding open spaces.

A multi-phased approach to treating the pampas grass population was developed. Each plant will first be trimmed with a power hedge trimmer and then uprooted and turned over with the use of a rubber tracked, mid-sized excavator fitted with bucket and thumb, which will allow the root system to dry out and eliminate the need for disposal of the vegetation. Follow-up treatments will occur the following year, and resprouts will be removed manually, or by use of mechanical hedge trimmers.

The first phase of pampas grass treatment occurred in an approximately 3-acre portion of the population that is closest to the tidal marsh restoration area and is located immediately east and southeast of the restored marsh footprint. The pampas grass located outside of this 3-acre area was trimmed to reduce seed production and limit the photosynthetic capability of the plants. Work first occurred in September, with follow-up trimming occurring in November 2023. No herbicide was used.

4.0 MONITORING RESULTS

This section presents the results of Year 3 monitoring activities. The locations of vegetation monitoring transects and photo-monitoring locations are depicted in Appendix A, Figure 2. Photo-monitoring and high tide photographs are included in Appendix C. Tidal hydrology monitoring data collected is presented in Appendix D. Vegetation monitoring data is included in Appendix E. Table 5 below summarizes the Year 3 progress toward meeting each success criterion. A narrative summary of the progress toward meeting each success criterion is provided in the following sections.

Table 5. Summary of Success Criteria and Year 2 Monitoring Results

PERFORMANCE STANDARD	YEAR 3 SUCCESS CRITERION	YEAR 3 RESULT	SUCCESS CRITERION MET?
Tidal Marsh, Transition Zone, and Upland Refugia			
Erosion and/or Sedimentation	Compare digital topographic data with hydrology monitoring data to identify sedimentation/erosion reducing the extent of marsh ponded at Mean Higher High Water (MHHW) or cover over area with elevated nickel	Year 3 topography compared with baseline topography. No evidence of detrimental erosion or sedimentation	Yes
Hydrology	Compare hydrographs; calculate and compare the tidal datum	Hydrographs and tidal datums were compared	Yes
Vegetation	Following native cordgrass establishment, low marsh cover will increase 5 percent annually	Cordgrass established in the low marsh for the first time in Year 3	N/A
	Native plant cover within the restored high marsh will be ≥ 22.5 percent.	Native plant cover was 38 percent	Yes
	Native shrub survival within the transition zone will be 80 percent	Native shrub survival was 113 percent	Yes
	California Invasive Plant Council (Cal-IPC) High plants will not exceed 5 percent	Cal-IPC High plants were less than 5 percent	Yes
	Report presence of *Spartina* sp. to ISP	*Spartina* sp. reported to ISP	Yes
Seasonal Wetland			
Hydrology	Soils in restored wetland inundated or saturated ≥ 14 days	Soils inundated and/or saturated for > 14 days	Yes
Vegetation	Absolute native plant cover in the restored seasonal wetland will be ≥ 60 percent of absolute native plant cover in the reference seasonal wetland	Absolute native cover in restored wetland is 2.5 percent of the absolute native cover in the reference wetland	No
	Cal-IPC High plants will not exceed 5 percent	Cal-IPC High plants were less than 5 percent	Yes

4.1 Tidal Marsh, Transition Zone, and Upland Refugia

4.1.1 Photographic Monitoring

Photographic monitoring recorded on July 12 and July 14, 2023, is provided in Appendix C.

4.1.2 Erosion and/or Sedimentation

Baseline topography was documented using UAV imagery of the site taken on December 15, 2020. Current topography was documented using UAV imagery of the site taken on August 18, 2023, and verified with on-the-ground cross-section surveys conducted on August 16, 2023. Cross-section comparisons were made between the topographic data collected in Year 3 and the baseline topography. The cross-section locations are depicted in Appendix A, Figure 3. The cross-section comparisons are depicted in Appendix A, Figure 4. UAV data showed several irregular increases in elevation on all cross-sections, some greater than 1-foot. However, these irregular, sometimes large increases in elevation are due to the fact that the drone-based topographic data collection system cannot penetrate vegetation which has established in the marsh. In areas where vegetation has not yet established, the increase in elevation between Year 3 and Year 2 is much more subtle, and in some parts of the low marsh, the elevation actually decreased slightly. At Cross-section 1 (XS-1) and Cross-section 2 (XS-2), the elevation in the low marsh was still greater than the as-built elevation, despite the decrease in elevation compared to Year 2. Cross-section 3, located within the area of elevated nickel, showed a very slight decrease in elevation between Year 2 and Year 3. There was a slightly greater decrease in elevation in the low marsh, and in some parts of the low marsh, the elevation has decreased to slightly below the as-built elevations. However, the lowest elevation, at the lowest point of the low marsh, is equivalent to the as-built elevation.

Tidal marshes are dynamic systems, and slight variations in elevation from year to year are normal, particularly in years with high rainfall, such as Year 3, when there is an increased volume of water in the system. In general, the high marsh appears to be relatively stable, as indicated by the steady increase in vegetation and the presence of algae on the surface in unvegetated areas. The low marsh morphology is still stabilizing, but this is to be expected since the low marsh experiences more frequent tidal action and more concentrated flows compared to the high marsh.

Additionally, the vegetation has been slow to colonize the low marsh, but as vegetation establishes, it will further stabilize the low marsh. Although the elevation of the low marsh at Cross-section 3 decreased slightly, it is still equivalent at its lowest point to the as-built elevation. As such, no signs of detrimental erosion or sedimentation occurred within the area of elevated nickel. As confirmed by visual observations of the high tide line, the extent of marsh has not been reduced since February 2021. In fact, the marsh is actually slightly larger than the as-built boundary in many areas (see Appendix A, Figure 5). As such, no detrimental erosion or sedimentation occurred in Year 3. In addition, no signs of detrimental erosion or sedimentation were qualitatively observed elsewhere in the marsh during maintenance and monitoring visits completed during the year. Therefore, the Year 3 success criterion was met.

4.1.3 Hydrology

Tidal hydrology monitoring locations are depicted in Appendix A, Figure 2. The data collected in Year 3 is presented in Appendix D. As in Year 1 and Year 2, the greatest tidal fluctuation was recorded in the lower channel at the northern edge of the restored tidal area, which is closest to

the San Francisco Bay and has the lowest base elevation (1.8 feet NAVD88). Also as in Year 1 and Year 2, the least tidal fluctuation was recorded in the high marsh close to the southwest edge of the restored tidal area, which is located farthest from the San Francisco Bay and has the highest base elevation. This gauge, located at 6.67 feet NAVD88 in elevation, was only inundated at the highest tides.

The highest tides in the Northern Drainage Channel (reference location), the lower channel, and the upper channel are approximately the same. The timing of tidal inundation at the high marsh monitoring location, which is only inundated during the highest tides, coincides with some of the highest inundation levels at the other monitoring locations. The fact that tidal peaks are similar at the monitoring locations indicates that tidal inundation is continuing to function as designed within the restoration area.

The as-built elevation for full tidal inundation of the restored tidal area is 6.5 feet NAVD88. Photographs were taken on November 23, 2022, and January 3, 2023 (Appendix C), that depict the restored tidal area fully inundated at high tide. The predicted highest tides on those dates (NOAA 2021, 2022) were 6.8 feet NAVD88 and 6.5 feet NAVD88, respectively, which corroborates the photographs. The photographs and corroborating tide predictions demonstrate that the restored tidal area is hydrologically functioning as designed for the second consecutive year since it was constructed. Because tidal hydrographs and tidal datums were compared, the Year 3 success criterion was met.

4.1.4 Vegetation

Marsh Vegetation Cover

Vegetation in the high marsh continues to expand. Planted individuals have expanded, and natural recruits have also established beyond planted areas. Pickleweed (*Salicornia pacifica*) recruits were the most abundant, but other species were observed, including alkali heath (*Frankenia salina*), marsh jaumea (*Jaumea carnosa*), and salt grass (*Distichlis spicata*). Photographs showing tidal marsh species recruitment are provided in Appendix C, and the vegetated areas are depicted in Appendix A, Figure 5. No non-native species were observed in high marsh. A total of 1.43 acres of the 3.80 acres of high marsh (38 percent) were vegetated by native plant species. Therefore, absolute native plant cover within the high marsh was greater than 22.5 percent, and the Year 3 high marsh success criterion was met.

The Year 3 low marsh cover success criterion ("Following native cordgrass establishment, low marsh cover will increase 5 percent annually") is not yet applicable because Year 3 is the first year that cordgrass established in low marsh elevations within the restoration area. A single, small clump was observed approximately 100 feet south of the boundary between the restoration area and the Northern Drainage Channel, on the east side of the main low marsh channel. The native cordgrass present at the mouth of the restoration area was there prior to restoration.

Scattered pickleweed is present in the higher elevations of low marsh habitat, but the total cover is negligible. At present, absolute native plant cover in planned low marsh elevations is less than 1 percent. The lack of low marsh vegetation establishment is not a result of annual management actions. Suitable habitat and conditions for native cordgrass are present, but it simply did not begin to colonize until Year 3. Further, because the ISP recommends *not* planting cordgrass because of the risk of infestation and hybridization by the invasive cordgrass, there are no management

actions that can be taken to increase cordgrass cover. While low marsh colonization is happening more slowly than anticipated, it is expected to increase in the coming years.

Transition Zone Planting

Table 6 below summarizes the survival of transition zone plantings.

Table 6. Summary of Transition Zone Survival

SPECIES	COMMON NAME	NUMBER PLANTED	NUMBER OBSERVED	SURVIVAL
Baccharis glutinosa	salt marsh baccharis	189	183	97%
Baccharis pilularis	coyote brush	108	77	71%
Grindelia stricta	coastal gumweed	189	287	152%
	TOTAL	**486**	**547**	**113%**

Overall, native shrub survival was 113 percent. Although the site is meeting the Year 3 success criterion, it is performing even better than the numerical data would suggest. While some mortality did occur, living plants were generally robust. Surviving plants include 13 coyote brush and 5 coastal gumweed (*Grindelia stricta*) replacement plants that were installed based on recommendations from the Year 1 monitoring report following the loss of plants during the very dry summer of 2021. Additionally, similar to Year 2, the coastal gumweed count in Year 3 was much higher than the number planted because of abundant seedling recruits. Given the density of the seedings in some areas, it is likely that many of them will not survive because of competition with other nearby plants, but the fact that the gumweed continues to produce viable seed is a good indication that it will continue to expand.

Additionally, the natural colonization by salt grass, a native species that was not planted in the transition zone, continued in Year 3. Salt grass is expected to continue to expand throughout the 5-year monitoring period, which is a positive development for the site because it will increase native vegetation cover and help reduce the spread of invasive species.

Invasive Species Cover

Following recommendations made in the Year 2 Annual Monitoring Report (WRA 2023), on March 3 and 27, 2023, patches of Harding grass were treated in parts of the upland refugia area on the west, south, and east sides of the restored marsh using the solarization method. In the treatment areas, the Harding grass was first cut to the ground, then 6-millimeter-thick black plastic sheeting was placed on the ground surface and affixed using 18-inch metal pins. Sand bags and jute netting were also placed to weigh the sheeting down and help keep it in place against wind, rain, and disturbance by wildlife. The sheeting was left in place until mid-November 2023, and the Harding grass had been successfully suppressed.

Following removal of the sheeting, plugs of native species including creeping wildrye (*Elymus triticoides*) and narrowleaf milkweed (*Asclepias fascicularis*) were planted in the solarization areas. These plantings will provide native habitat cover and will reduce the likelihood of recolonization by non-native species. Harding grass is an aggressive invader that is established adjacent to the upland area of the restored marsh. The solarization effort and native species plantings will help to reduce future management needs for Harding grass and allow the native plantings and native recruits in the adjacent restoration area to thrive. Other invasive and non-native plant species,

such as fennel (*Foeniculum vulgare*), French broom (*Genista monspessulana*), wild radish (*Raphanus sativus*), and birdsfoot trefoil (*Lotus corniculatus*) were also controlled throughout the year, using a combination of hand-pulling and weed-whipping. As a result of this management effort, the presence of Cal-IPC High species was less than 1 percent within the restoration area. Therefore, the Year 3 success criterion was met.

Cordgrass (*Spartina*)

A few small colonies of cordgrass are located at the boundary between the restoration area and the Northern Drainage Channel. All were present prior to restoration activities (the two small clusters in the excavated restoration channel are resprouts from plants that were there prior to construction). As stated above, in Year 3, cordgrass established in the interior of the restoration for the first time. ISP surveyed the restoration area on June 7 and September 4, 2023, and determined that all plants are the native cordgrass *Spartina foliosa*. ISP was notified of the presence of these plants on September 6, 2023. Therefore, the Year 3 success criterion was met. The notification and the response from ISP are included as Appendix F.

4.2 Seasonal Wetland

4.2.1 Hydrology

The restored seasonal wetland was directly observed on the ground on January 3, February 1, March 23, and May 5, 2023. On all dates, the restored seasonal wetland was fully inundated and/or saturated. The observations demonstrate that the wetland was inundated and/or saturated for more than 14 days during the Year 3 monitoring period. Therefore, the Year 3 success criterion was met.

4.2.2 Vegetation

Relative Native Plant Cover

Both the reference wetland and the restored wetland were dominated by non-native species and had a low presence of native species. The reference wetland had slightly lower species richness in Year 3 (eight species present) than in Year 2 (nine species present) and was dominated by brass buttons (*Cotula coronopifolia*) and Italian rye grass (*Festuca perennis*). Two native species were present, totaling 4 percent absolute cover: cocklebur (*Xanthium strumarium*) and western sea-purslane (*Sesuvium verrucosum*). Absolute cover of all plant species was 34.9 percent, a slight decrease from 43 percent in Year 2.

The restored wetland had higher diversity Year 3 (21 species present) than in Year 2 (16 species present) and was dominated by Italian rye grass and Pacific bentgrass (*Agrostis avenacea*).

Absolute native plant cover in the restored wetland was 0.1 percent, a decrease of 0.9 percent from Year 2, though the native species richness increased from four in Year 2 to six in Year 3. Native species present were tall flatsedge (*Cyperus eragrostis*), creeping wildrye, coastal gumweed, meadow barley (*Hordeum brachyantherum*), toad rush (*Juncus bufonius*), and western sea-purslane. Absolute cover of all plant species was 65.4 percent, a slight increase from 61 percent in Year 2. Bare ground comprised only 1 percent, a decrease of 23 percent from Year 2, but this decrease was primarily the result of an increase in plant litter and biotic crust (34.5 percent total). The cover of unvegetated areas in Year 3 is naturally occurring as result of prolonged inundation and high salinity soils and is therefore not problematic.

The absolute cover of native species in the restored wetland (0.1 percent) is 2.5 percent of the absolute cover of native species in the reference wetland (4 percent). The Year 3 success criterion of greater than 60 percent of the absolute native plant cover in the reference wetland was therefore not met. However, the fact that the success criterion was not met should not be interpreted as a deficiency in site management. In Year 1 and Year 2, the absolute cover of native plant species in the reference wetland was 0.1 percent, and native cover was higher in the restored wetland than in the reference wetland. The increase in native cover in Year 3 is almost entirely the result of natural colonization of the reference wetland by cocklebur (*Xanthium strumarium*), a native species. Cocklebur was present in the reference wetland in Year 1 and Year 2, but its presence was negligible, such that it was not captured by the transect sampling. In Year 3, perhaps because of the above normal rainfall, the cocklebur population increased substantially. Cocklebur is a ruderal native species that can behave like a non-native weed, in the sense that it is adapted to disturbed habitat, regularly occurs in such conditions, and can respond readily to sudden changes in conditions. The landscape surrounding the reference and restored wetlands has not changed, the topography of the two wetlands has not changed, and the land use has not changed. The only difference in Year 3 is that stochastic climatic events were favorable to a ruderal native species.

Invasive Species Cover

A single invasive species, pampas grass (*Cortaderia selloana*) was present in the restored seasonal wetland in Year 3. Only two plants were present, and their cover was negligible. Because the cover of Cal-IPC High plants was less than 5 percent, the Year 3 success criterion was met.

5.0 CONCLUSIONS AND MAINTENANCE RECOMMENDATIONS

The tidal marsh, transition zone, upland refugia, and seasonal wetland are performing well, and are meeting all applicable Year 3 success criteria. Cordgrass has established at low marsh elevations for the first time in Year 3, so the low marsh vegetation criterion is not yet applicable. Low marsh vegetation cannot be planted because of ISP recommendations, so the vegetation will have to develop naturally, and no management actions can be taken to improve colonization.

The success of the site was achieved as a result of regular management and maintenance activities that occurred throughout Year 3. Irrigation for all shrub plantings occurred in January, February, March, April, June, July, and August. Per the HMMP, Year 3 is the final year that the plantings can be irrigated. As such, no irrigation will occur in Year 4 and Year 5. The plantings appear to be established and generally robust, and it is anticipated that they will survive for the remainder of the monitoring period without supplemental irrigation.

In addition to the Harding grass solarization treatment in the tidal marsh restoration area and the pampas grass treatment adjacent to the Project Area, weed management activities such as hand removal and mowing occurred in the Project Area as needed throughout the year. Invasive species were kept under control, and this is likely a key factor in the robust growth of shrub plantings and the natural colonization by native species observed during monitoring visits. Weed management activities reduce competition of non-native weeds with native plantings, allowing native plants to colonize and flourish. Given the success of the site in Year 3, it is recommended that regular site management activities continue to help ensure that restoration goals continue to be met.

Additionally, a patch of approximately 50 blackwood acacia (*Acacia melanoxylon*) trees is developing in the open area between the public trail and the restored seasonal wetland. They are likely sprouts from the roots of a tree or trees that was or were present in that location prior to

restoration activities. Although these trees do not pose a threat to the short-term goals of meeting the 5-year performance criteria, control of these trees will create greater long-term resiliency for the site. While blackwood acacia is not tolerant of wetland conditions, established trees can overhang and shade out wetland species.

The restored seasonal wetland is not meeting the Year 3 vegetation success criterion that absolute native plant cover will be greater than or equal to 60 percent of absolute native plant cover in the reference seasonal wetland. This is the result of a stochastic event where a ruderal native species, cocklebur, expanded in the reference seasonal wetland, and not the result of a change in land management or wetland topography or site mismanagement. As such, no action needs to be taken.

Overall, the site is performing very well and is anticipated to meet Year 5 monitoring criteria without substantial challenges.

6.0 REFERENCES

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WRA 2023 WRA, Inc. 2023. Corte Madera Four-Acre Tidal Marsh Restoration Project Year 2 (2022) Annual Monitoring Report. January.

APPENDIX A. FIGURES

Path: L:\Acad 2000 Files\23000\23294\GIS\ArcMap\2018\Redesign\HMMP\Figure 1 Location.mxd

Sources: National Geographic, WRA | Prepared By: njander, 1/20/2022

Figure 1. Vicinity Map - Project Area Location

Corte Madera Four-Acre
Tidal Marsh Restoration Project
Town of Corte Madera, Marin County, California

0 0.5 1 Miles

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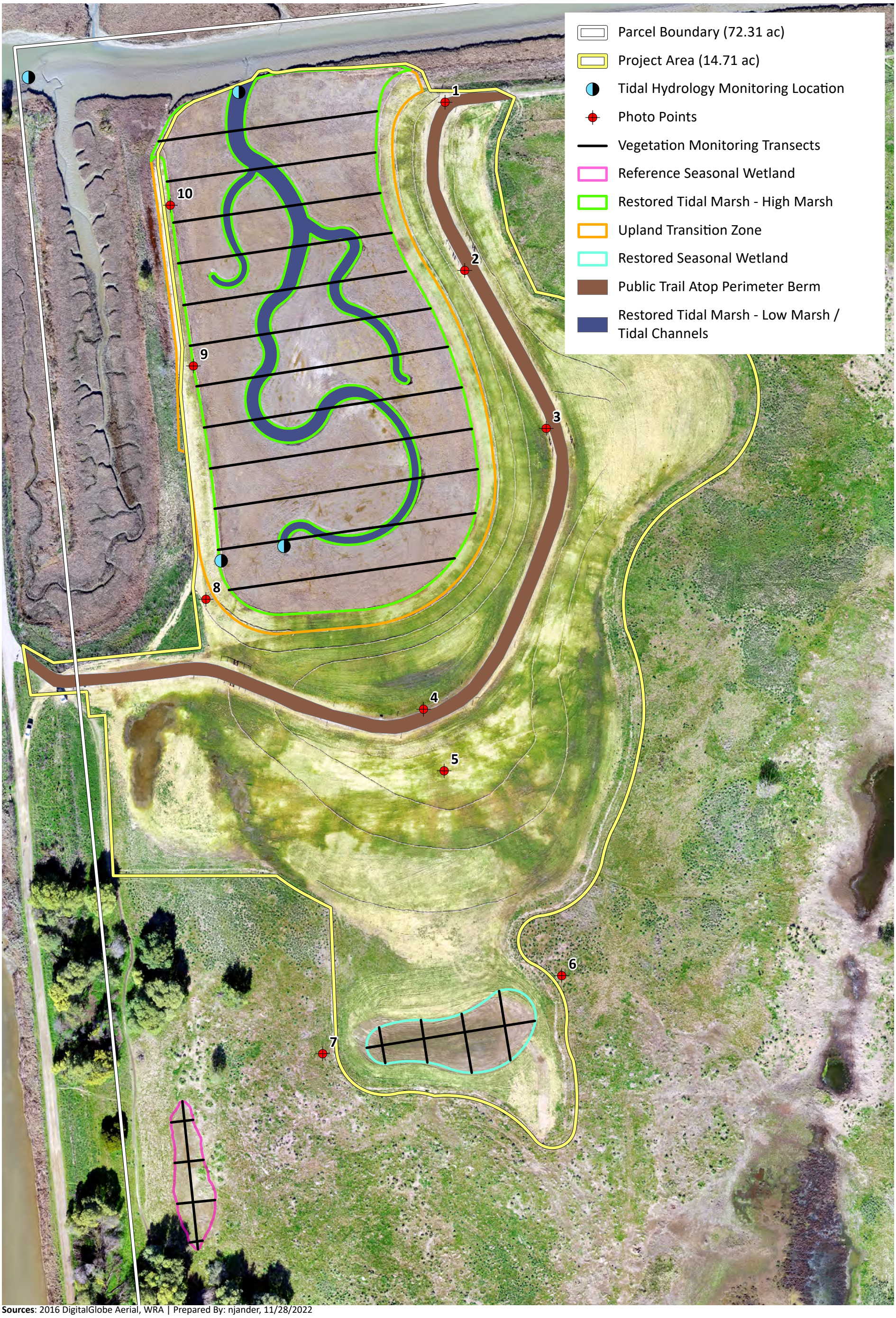
wra
ENVIRONMENTAL CONSULTANTS



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Sources: 2016 DigitalGlobe Aerial, WRA | Prepared By: njander, 11/28/2022

Figure 2. Monitoring Locations

Corte Madera Four-Acre Tidal Marsh Restoration Project
Corte Madera, Marin County, California

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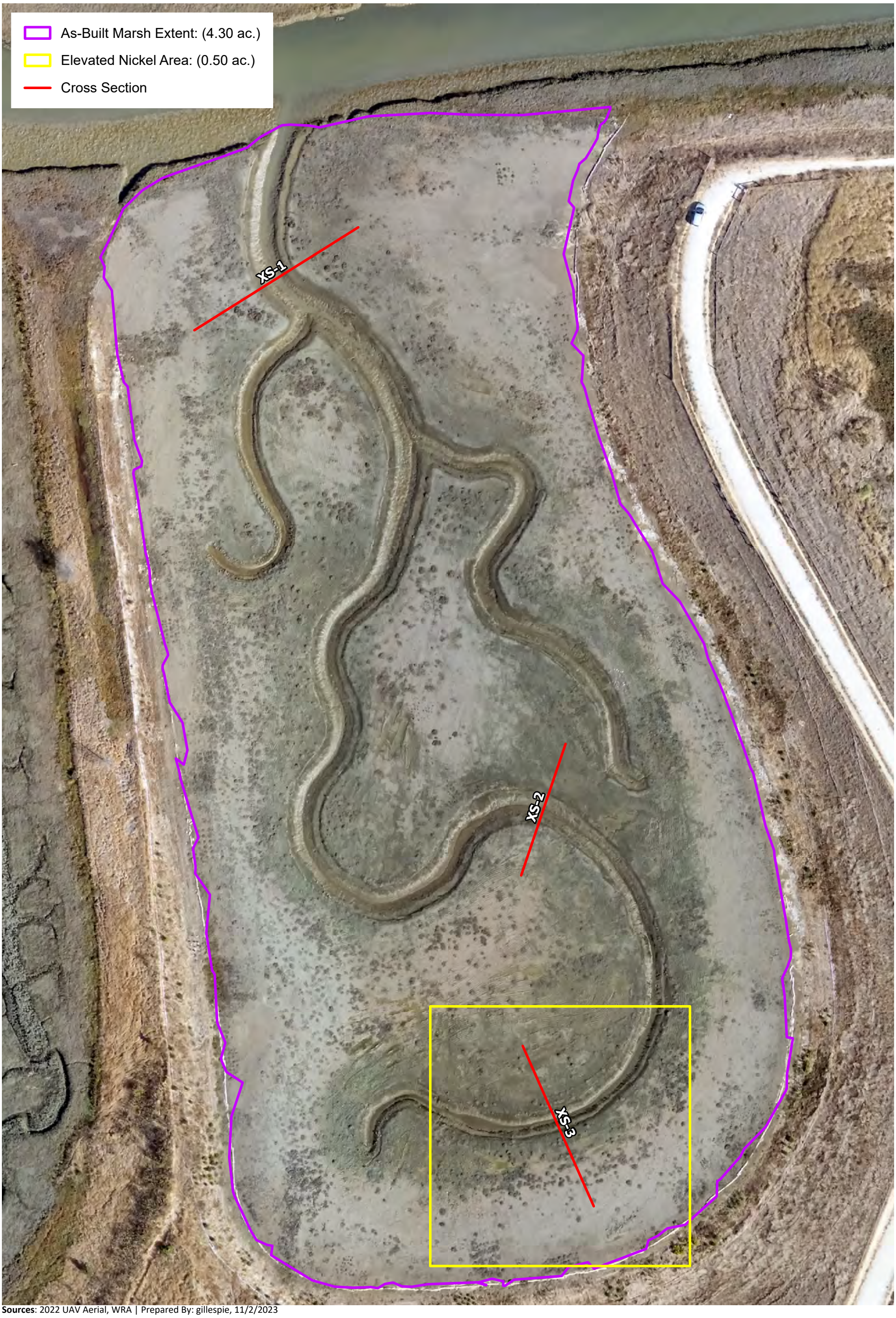

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Sources: 2022 UAV Aerial, WRA | Prepared By: gillespie, 11/2/2023

Figure 3. Cross Section Overview

Corte Madera Four-Acre Tidal Marsh Restoration Project
Corte Madera, Marin County, California

0 25 50 Feet

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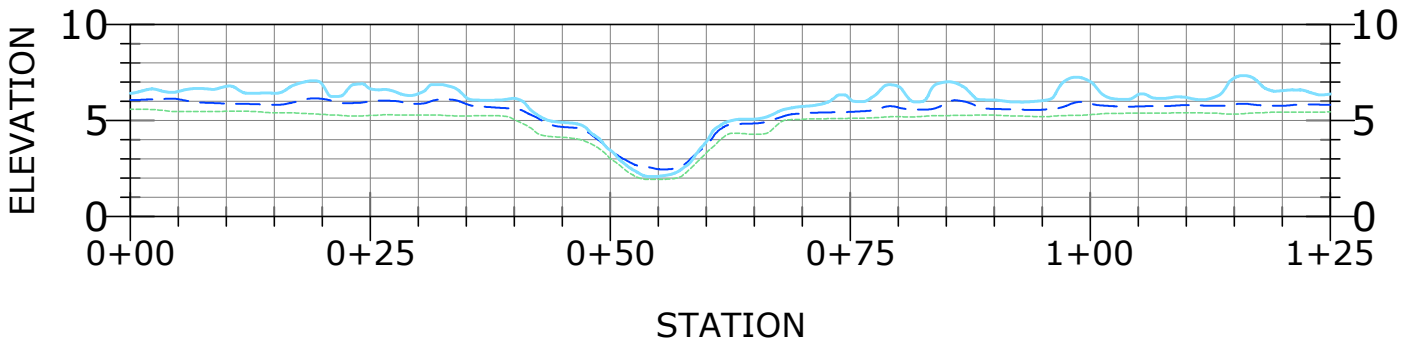
FIGURE 4.
CHANNEL CROSS-SECTIONS

CORTE MADERA 4-ACRE TIDAL MARSH
RESTORATION PROJECT MARIN
COUNTY, CALIFORNIA



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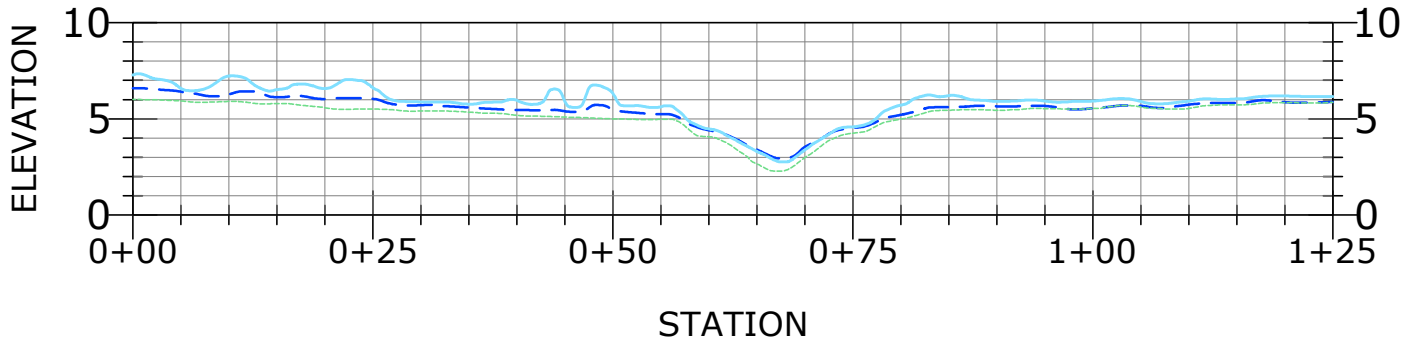

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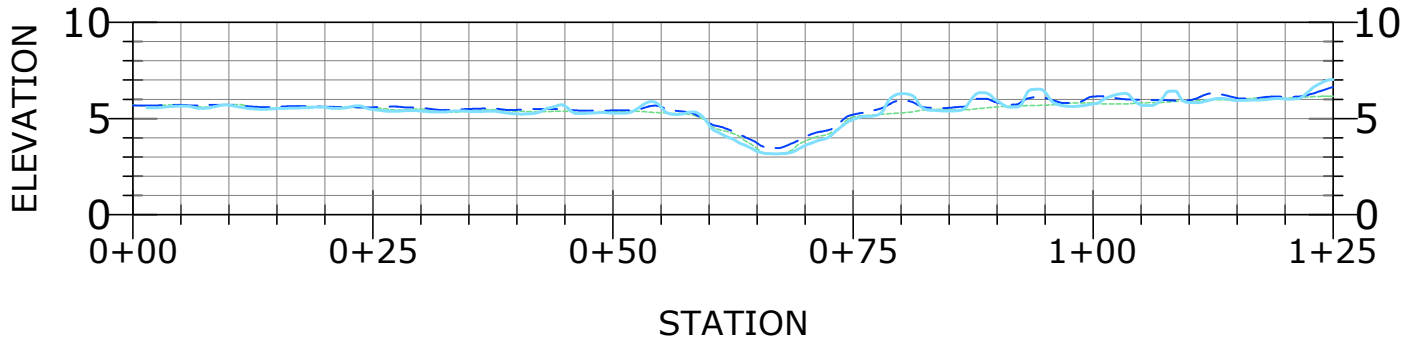

3 CROSS SECTION 3
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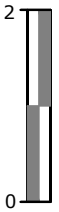
LEGEND

AS-BUILT DRONE SURVEY (WRA, 2021)

YEAR 2 DRONE SURVEY (WRA, 2022)

YEAR 3 DRONE SURVEY (WRA, 2023)



VERTICAL SCALE: 1 " = 2 '

HORIZONTAL SCALE: 1 " = 20 '

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APPENDIX B. HABITAT MITIGATION AND MONITORING PLAN

Habitat Mitigation and Monitoring Plan - Revised

CORTE MADERA FOUR-ACRE TIDAL MARSH RESTORATION PROJECT
CORTE MADERA, MARIN COUNTY, CALIFORNIA

Prepared For:
Golden Gate Bridge Highway & Transportation District
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WRA Contact:
Phil Greer
Greer@wra-ca.com

Date:
September 12, 2019
Revised June 25, 2020

WRA Project #:
23294

GOLDEN GATE BRIDGE HIGHWAY & TRANSPORTATION DISTRICT

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1.0 INTRODUCTION

The purpose of this Habitat Mitigation and Monitoring Plan (HMMP) is to describe the goals and components of the restoration plan as well as the criteria and methods to monitor performance during the five years following completion of the Golden Gate Bridge, Highway & Transportation District Corte Madera 4-acre Tidal Marsh Restoration Project ("Project"; RWQCB Place ID 857558, BCDC Permit No. M2019.011.00, and US Army Corps of Engineers [USACE] File Number 1999-24251N).

The Golden Gate Bridge Highway & Transportation District (District, Applicant) is proposing to restore approximately 4.3 acres of tidal marsh habitat on its 72-acre property located in the Town of Corte Madera, Marin County, California (see Figure 1, attached). The Project Area includes a 14.7-acre portion of the property in which ground disturbance will occur (see Figure 1).

The proposed Project meets the needs of the District's outstanding restoration obligations to restore 4 acres of tidal marsh habitat suitable for California Ridgway's rail (*Rallus longirostris obsoletus*, Federal Endangered). The proposed Project will fulfill this commitment by restoring approximately 4.3 acres of tidal marsh habitat. The proposed restoration efforts will temporarily impact an existing 0.18 acre of tidal marsh and 0.28 acre of seasonal wetlands. The Project will relocate 0.28 acre of seasonal wetlands within the Project Area. The Project will result in restored tidal connectivity to the Project Area and provide tidal marsh habitat in support of Federal-listed species such as the California Ridgway's rail and salt marsh harvest mouse (*Reithrodontomys raviventris*, Federal Endangered).

2.0 EXISTING CONDITIONS

The proposed Project is located within the limits of the Town of Corte Madera, approximately 0.25 mile east of Highway 101 and 0.6 mile south of Sir Francis Drake Boulevard (see Figure 1). The Project Area is approximately 14.7 acres located in the northwestern portion of a 72-acre parcel owned by the GGBHTD (see Figure 2). The subject parcel is bordered on three sides by tidal salt marsh of the California Department of Fish and Wildlife (CDFW) Corte Madera Marsh Ecological Reserve (CMER): to the north by Heerdt Marsh; to the east by North Muzzi Marsh; and to the south by Muzzi Marsh. Shorebird Marsh is located just west of the northern extent of the Project Area and collects treated stormwater from the Town. In the greater vicinity of the Project Area to the west, land uses include the Redwood Highway and commercial development.

The Project Area occurs on diked former baylands along the margins of San Francisco Bay. Based on a review of historic aerial photographs, it was determined that the tidal salt marsh adjacent to and including the Project Area was diked and reconfigured starting in the 1950s, with man-made berms disrupting tidal influence to the baylands. In the 1970s, an inner set of berms was constructed on and around the perimeter of the subject parcel and tidal activity was returned north, east, and south of the perimeter berm.

The lands outboard of the perimeter berm and the surrounding CMER marshes currently support healthy stands of native tidal salt marsh vegetation. However, the subject parcel remains

disconnected from tidal activity by the perimeter berm. Over time, elevations within this diked portion of the subject parcel have subsided, resulting in the mix of seasonal wetlands and ruderal uplands that exists today. These lands contain a mix of highly disturbed habitat. Most of the plant communities on the Project Area, including seasonal wetland plant communities, are dominated by non-native, invasive plant species and are of relatively low quality for wildlife.

The Project Area contains 0.28 acre of seasonal wetlands and 0.18 acre of tidal marsh (high marsh pickleweed bench) subject to jurisdiction of the USACE as "Waters of the U.S." and to RWQCB as "Waters of the State" (Figure 2). The proposed Project will include impacting the existing seasonal wetlands by excavation of fill previously deposited in the Project Area, grading to the appropriate elevations to establish tidal marsh, and excavating new tidal channels to connect to an existing tidal channel (the northern drainage channel) by breaching the existing northern berm. Temporary impacts of the Project are summarized in Table 1. The Project has been designed to maximize the amount of wetland habitat restoration and enhancement, while minimizing impacts to existing wetland features. Existing tidal marsh impacted by the opening of the new tidal channel are mitigated for by the project design. Seasonal wetlands impacted by the creation of the new tidal channel will be mitigated by creating new seasonal wetlands at an area south of the new tidal marsh (Figure 2).

Table 1. Temporary Projects Impacts to Section 401/401 Wetlands and Non-Wetland Waters

JURISDICTIONAL FEATURES	TEMPORARY IMPACTS (ACRES)
Seasonal Wetlands	0.28
Pickleweed Bench	0.18
TOTAL	0.46

3.0 RESTORATION PLAN

3.1 Restoration Goals

The goals of the Project are to restore approximately 4.3 acres of tidal salt marsh and create habitat for Ridgway's rail. This includes restoring native plant species within the tidal marsh area and transition zone and reducing the presence of invasive plant species throughout the Project Area. In addition, the Project will be monitored to ensure success and that there is no adverse erosion or sedimentation within the restored tidal marsh or adjacent northern drainage channel. The total restored acreages of jurisdictional wetlands are summarized in Table 2.

Summary of restoration goals:

- restore tidal wetlands in an area that was historically tidal wetlands;
- provide habitat for Ridgway's rail;
- create seasonal wetland habitat to mitigate for the project's impacts to existing seasonal wetlands;
- restore native plant vegetation within the tidal marsh area, the transition zone; and upland refugia areas of the Project;
- reduce cover and control the spread of invasive plant species within the tidal marsh and transition zone in the Project Area; and

- minimize adverse sedimentation and channel erosion in the tidal channels of the new marsh and the adjacent northern drainage channel.

Table 2. Proposed Section 404/401 Habitat Restoration

JURISDICTIONAL FEATURES	RESTORED AREA (ACRES)
Seasonal Wetlands	0.28
Tidal Habitats (Total)	4.30
Tidal Marsh – Channel	*0.30*
Tidal Marsh – Low Marsh	*0.23*
Tidal Marsh – High Marsh	*3.77*

3.2 Earthwork

3.2.1 Earthwork for the Creation of the Tidal Marsh

The restored tidal marsh will be created by excavating historic Bay sediments and lowering the existing grades to create a tidal marsh plain to appropriate elevations for low marsh (3.75-4.75 feet NAVD88) and high marsh (4.75-6.5 feet NAVD88) tidal zones. In addition, a system of tidal channels will be excavated (2.0-3.75 feet NAVD88) and connected to the northern drainage channel in order to provide full tidal hydrology to the site. The excavated material will be reused on-site and configured to create a perimeter berm and a low mound to the south and east of the restored tidal marsh area. There will be a 10:1 slope from the tidal marsh area to the surrounding upland areas. In all, approximately 28,000 cubic yards of material would be excavated to create the new tidal marsh and deposited on-site to re-create a berm and low mound adjacent to the restored area.

The internal tidal channels have been sized to provide full tidal hydrology for the new tidal marsh. In addition, the channels have been designed to convey water at velocities within a range that will not cause scouring and preclude the channels from accumulating sediment. The size and configuration of the tidal channels is expected to develop and mature over time into a state of equilibrium.

3.2.2 Earthwork for the Creation of the Seasonal Wetland

Creation of new seasonal wetland habitat would necessitate the excavation of approximately 600 cubic yards of soils. This will involve creating a shallow depression with a maximum depth of 4 to 6 inches. The material removed to create the seasonal wetland will be reused on-site to create the low mound discussed in the previous section.

3.3 Revegetation Plan

Revegetation within the tidal marsh plain will consist of plugs or plantings sourced from local nurseries. In addition, as part of the restoration design, native tidal marsh species are expected to naturally colonize in the restored tidal areas, as seeds and vegetative propagules capable of

rooting in mudflats are carried on-site via tidal flows. Project design is intended to promote rapid colonization by creating suitable substrates and elevation profiles for the establishment of salt marsh vegetation.

Revegetation of the site will focus on establishing native plant species throughout the tidal marsh and transition zone. The Project will rely on a combination of active planting and natural recruitment to establish tidal marsh vegetation. The low marsh will not be actively planted based on recommendations from the Invasive Spartina Project (ISP). Due to the presence of invasive non-native *Spartina alterniflora* in the vicinity, there is a potential for it to hybridize with the native cordgrass, *Spartina foliosa*. To provide a seed source within the restored tidal area, 10% of the high marsh will be planted with pickleweed and other high marsh plant species. Seed production from this small area of planting is expected to augment seed input from adjacent tidal marsh.

Prior to planting, a temporary spray irrigation system will be installed within the transition zone planting area to provide supplemental water during the first two to three years following implementation. Irrigation will be applied during the dry season (summer) and during dry winters to supplement any deficiency in rainfall that may occur to ensure successful establishment of the plants. The transition zone will be revegetated with a combination of native grass and shrub species in order to provide vegetative cover for Ridgway's rail, which are likely to use these areas for refugia during extreme high tide events. In addition, the transition zone and upland disturbed areas throughout the Project footprint will be hydroseeded with a seed mix at appropriate densities as indicated in Table 3 in conjunction with erosion control seed mix void of invasive plant species. The planting palette was chosen based on previous restoration experience in the Bay and the current vegetation inhabiting the adjacent, functioning marsh.

Planting and seeding will occur following the final site grading and during the rainy season. Table 3 summarizes the revegetation plan for the Project.

Table 3. Planting Palette and Seeding Rates by Biological Community

	BOTANICAL NAME	COMMON NAME	SIZE	SPACING (O.C.# FEET)	% COVER	QUANTITY TOTAL
High Marsh Zone	*Distichlis spicata*	salt grass	4" or equivalent	1.0	1.5%	2,462
	Jaumea carnosa	marsh jaumea	4" or equivalent	1.0	1.5%	2,462
	Limonium californicum	western marsh rosemary	4" or equivalent	1.0	0.5%	821
	Salicornia pacifica	California pickleweed	TB2° or equivalent	1.0	6.5%	10,668
				TOTAL	**10%**	**16,413**
Transition Zone	*Baccharis glutinosa*	salt marsh baccharis	D16† or equivalent	3.0	6.66%	189
	Grindelia stricta	coastal gumweed	D16† or equivalent	3.0	6.66%	189
	Baccharis pilularis	coyote brush	D16† or equivalent	6.0	6.66%	108
				TOTAL	**20%**	**486**

° Treeband 2 (TB2) pots are 2.38 in. square by 5 in. deep for a total volume of 24 in^3

† Deepot 16 (D16) pots are 2 in. in diameter by 7 in. deep for a total volume of 16 in^3

On-center spacing (O.C.)

Table 3. Planting Palette and Seeding Rates by Biological Community (continued)

	BOTANICAL NAME	COMMON NAME	PURE LIVE SEED (LBS./ACRE)	PURE LIVE SEED (TOTAL LBS.)
Seasonal Wetland Seed Mix	*Carex praegracilis*	field sedge	2.00	0.56
	Eleocharis macrostachya	creeping spike rush	1.00	0.28
	Elymus triticoides	creeping wild rye	4.00	1.12
	Hordeum brachyantherum	meadow barley	6.00	1.68
	Juncus bufonius	toad rush	1.00	0.28
	Juncus phaeocephalus	brownhead rush	1.00	0.28
	Oenothera elata	evening primrose	2.00	0.56
		TOTAL	**17.00**	**4.76**
Upland/ Transition Seed Mix	*Baccharis pilularis*	coyote brush	3.00	30.00
	Bromus carinatus	California brome	3.00	30.00
	Castilleja exserta	Purple owl's clover	3.00	30.00
	Danthonia californica	California oatgrass	3.00	30.00
	Elymus glaucus	blue wild rye	6.00	60.00
	Eschscholzia californica	California poppy	4.00	40.00
	Festuca microstachys	three weeks fescue	6.00	60.00
	Hordeum brachyantherum	meadow barley	8.00	80.00
	Sisyrinchium bellum	blue-eyed grass	3.00	30.00
	Stipa pulchra	purple needlegrass	4.00	40.00
		TOTAL	**43.00**	**430.00**

3.3.1 Coordination with the San Francisco Estuary Invasive Spartina Project

The Project Applicant consulted with the San Francisco Estuary Invasive Spartina Project (ISP) regarding the planting of *Spartina foliosa* and received a letter with the following recommendations:

- There are known occurrences of invasive *Spartina* in the vicinity of the project site;
- The ISP strongly recommends that the project not actively plant *Spartina foliosa* because of the risk of infestation and hybridization of invasive *Spartina*; and
- The ISP expects passive recruitment of native *Spartina foliosa* at this site because there are existing populations of native *Spartina* within adjacent tidal marsh areas.

As a result, the Project will not plant *Spartina foliosa*, and the construction documents have been modified to remove *Spartina foliosa* from the planting palette. No alternatives for planting in the

low marsh are available since the native cordgrass *Spartina foliosa* is the only native species that grows at low marsh elevations. The Project will rely on natural recruitment for establishing vegetation in the low marsh. As requested, the ISP will be notified if monitoring detects *Spartina* colonization within the restoration area to allow them to incorporate the site into their monitoring plans.

3.4 Resilience to Sea Level Rise

The Project design was evaluated for resilience to rising sea levels. Sea level rise projections for this Project were selected from the Ocean Protection Council's State of California Sea Level Rise 2018 Guidance report. The report acknowledges an increase in uncertainty of sea level rise projections after the year 2100 due to a lack of available climate model experiments that extend beyond this date. Therefore, sea level rise estimates were selected from the earliest available years, 2030 to 2100. Specifically, the estimates selected are based on the San Francisco tide gauge for the years 2030, 2060, 2080, and 2100 in order to assess the impact of sea level rise in the Project Area over time. An average of the high and low projection values was used for these selected years. The report provides low, medium-high, and extreme risk aversion scenarios.

Sea level rise predictions were used for the low risk aversion scenario because this scenario is appropriate for the projects with "minimal consequences, flexibility to adapt, or low economic burden as a result of sea-level rise". Using these predictions, the restored tidal marsh plain will remain as pickleweed through 2030, and by 2060, it will mostly convert to low marsh habitat comprised of cordgrass. By 2080, tidal areas adjacent to the tidal channel within the Project Area will begin shifting to mudflat, as will adjacent marshes to the north of the Project Area. By 2100, only the edge of the proposed tidal marsh plain will remain as low marsh habitat, and the remainder of the tidal marsh plain will be mudflat. While the projection shows an eventual conversion of tidal marsh to mudflat, the Project's proposed elevations are appropriate because they correspond with the elevation of the existing tidal marsh in the adjacent CMER. Therefore, conversion of habitat in the Project Area will align with changes in the surrounding marsh.

3.5 Access Control and Species Protection Fencing

A permanent access control fence is proposed to be installed on either side of the berm and informal trail located south and east of the restored area to minimize anthropogenic disturbance to the created tidal marsh, transition zone, and upland refugia areas. The fence will isolate an upland refugia area adjacent to the created marsh that will vary in width from 50 to 135 feet and will also restrict recreational access to the center portions of the parcel, which is currently prohibited per posted no-trespassing signs. The fence will consist of galvanized wire mesh mounted on wooden or metal posts. The maximum height of the fence will be approximately 50 inches. The woven wire mesh will be mounted 8 inches above the ground to allow wildlife to move underneath the fence. Fence posts will be installed at eight foot intervals.

During construction, the Project will use temporary exclusionary fencing to keep small mammals, including the salt marsh harvest mouse, from entering the active construction site. Prior to installing the fence, the vegetation inside the work area will be removed, per details developed, reviewed, and approved by the US Fish and Wildlife Service (USFWS) through the consultation process under Section 7 of the Endangered Species Act.

3.6 Construction Schedule

To minimize disturbance to wildlife in adjacent tidal marshes, all construction activities including planting will be scheduled to avoid the California Ridgway's rail breeding season, which spans February through August. Construction will take approximately five months in total, and is anticipated to occur between September 1, 2020, and January 31, 2021. Construction mobilization and earthwork is expected to comprise the first three months of this period, with marsh planting to follow during the rainy season. Construction will occur during daytime hours, 7:00 AM to 5:00 PM on Monday through Friday, and between 10:00 AM and 5:00 PM on Saturdays and Sundays (if needed), in accordance with the Town's Noise Ordinance.

3.7 As-Built Conditions

As-built conditions will be documented following completion of restoration efforts, including a bathymetry and LiDAR survey of the Project Area and the northern drainage channel. A brief letter report outlining the as-built conditions of the restoration area will be prepared and submitted to the regulatory agencies within three months of the completion of all restoration activities, inclusive of planting.

4.0 PERFORMANCE AND MAINTENANCE MONITORING

4.1 Success Criteria

Monitoring will be performed to demonstrate that the Project accomplishes all of the restoration goals listed in Section 3.1, and will identify the need for maintenance activities. Monitoring will demonstrate performance of the following:

- Tidal hydrology;
- Erosion and siltation within tidal channels;
- Seasonal wetland hydrology;
- Revegetation of the tidal marsh area, transition zone, and upland refugia areas; and
- Revegetation of the seasonal wetland.

Monitoring that would trigger maintenance activities will focus on the following:

- Identify areas of excess erosion or siltation within tidal channels;
- Identify the need to implement invasive weed control; and
- Identify the need to repair or replace the access control fence.

The monitoring program will span for five years, or until success criteria are achieved. Quantitative monitoring will be performed to evaluate performance in years specified in Tables 4 and 5. The final report will include an as-built topo survey of the Project Area and an updated wetland delineation determination.

Table 4. Success Criteria for Restored Tidal Habitats

HABITAT ZONE	CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 5
Tidal Marsh, Transition Zone, and Upland Refugia	Erosion and/or Sedimentation	Document baseline topography using low altitude, high resolution imagery Qualitative monitoring to observe signs of erosion/ sedimentation	Compare digital topographic data with hydrology monitoring data to identify sedimentation/ erosion reducing MHHW or cover over area with elevated nickel	Compare digital topographic data with hydrology monitoring data to identify sedimentation/ erosion reducing MHHW or cover over area with elevated nickel	Compare digital topographic data with hydrology monitoring data to identify sedimentation/ erosion reducing MHHW or cover over area with elevated nickel Sedimentation does not contribute to reduction in MHHW by more than 0.3 ft Depth of cover over area with elevated nickel is at least 0.5 ft
	Hydrology	Install water-depth data loggers in main tidal channel, secondary tidal channel, and two within the marsh plain	Compare hydrographs; calculate and compare the tidal datum	Compare hydrographs; calculate and compare the tidal datum	MHHW within the tidal marsh is within 0.3 ft of MHHW within the Northern Drainage Channel.
	Vegetation	N/A No active planting of low marsh will be conducted.	Following native cordgrass establishment, low marsh cover will increase 5 percent annually.	Following native cordgrass establishment, low marsh cover will increase 5 percent annually.	Following native cordgrass establishment, low marsh cover will increase 5 percent annually.

Table 4. Success Criteria for Restored Tidal Habitats (continued)

HABITAT ZONE	CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 5
		N/A The high marsh will be planted with native species in year 1.	Native plant cover within the restored high marsh will be ≥ 15 percent.	Native plant cover within the restored high marsh will be ≥ 22.5 percent.	Native plant cover within the restored high marsh will be ≥ 50 percent.
		N/A The transition zone will be planted with native shrubs in year 1.	Native shrub survival within the transition zone will be 90%.	Native shrub survival within the transition zone will be 80%.	Native shrub survival within the transition zone will be 80%.
		Invasive plants ranked by the California Invasive Plant Council (CaI-IPC) as "High" will not exceed 5 percent absolute cover within the tidal marsh, transition zone, and upland refugia, exclusive of annual grasses.			
		Report presence of *Spartina* sp. to facilitate on-site genetic testing and control of invasive and hybrid *Spartina* by the Invasive Spartina Project (ISP).			No invasive or hybrid *Spartina* within the tidal restoration area.
	Wetland Delineation	N/A			A protocol-level wetland delineation will be completed to verify boundaries of wetlands and non-wetland waters.

Table 5. Success Criteria for Restored Seasonal Wetland Habitat

HABITAT ZONE	CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 5
Seasonal Wetland	Hydrology	Soils in the restored seasonal wetland will be inundated or saturated within 12 inches of the soil surface for at least 14 consecutive days.			
	Vegetation	Relative native plant cover within the restored seasonal wetland will be ≥ 40 percent relative cover of total plant cover in the reference seasonal wetland.	Relative native plant cover within the restored seasonal wetland will be ≥ 50 percent of total plant cover in the reference seasonal wetland.	Relative native plant cover within the restored seasonal wetland will be ≥ 60 percent of total plant cover in the reference seasonal wetland.	Relative native plant cover within the restored seasonal wetland will include 100 percent of total plant cover in the reference seasonal wetland.
		Invasive plants ranked by the Cal-IPC as “High” will not exceed 5 percent absolute cover within the seasonal wetland.			
	Wetland Verification	N/A			A protocol-level wetland delineation will be completed to verify boundaries of wetlands and non-wetland waters.

Success of the proposed restoration activities will require the successful establishment of wetland vegetation, demonstration of channel stability (i.e. lack of significant erosion and sedimentation indicators), and control of noxious weed species that may invade the newly constructed jurisdictional features. Success criteria will be used to evaluate the development of the restored wetland habitats. The success criteria include:

- 50 percent total cover of native high marsh vegetation by Year 5;
- Control of invasive species;
- Absence of significant erosion affecting upper tidal range or cover over area of elevated nickel;
- Presence of a functioning, self-sustainable wetland system;
- The restored seasonal wetland shall perform similarly to reference wetland conditions within the parcel by Year 5; and
- Permanent photo-documentation points will be established at several locations in order to visually track the progress of the restoration site toward meeting final success criteria described below.

Tables 4 and 5 summarize success criteria for completing annual monitoring in Years 1, 2, 3, and 5 for the restored tidal marsh, transition zone, upland refugia, and seasonal wetland habitats.

4.2 Monitoring Methods

The following section outlines the monitoring methods that will be used to measure the success criteria for the Project including an as-built topography survey of the Project (Section 3.7). Vegetation monitoring efforts will be conducted in the spring during appropriate plant growth season to assess vegetation across the restored wetlands

4.2.1 Photographic Documentation

A minimum of ten permanent monitoring locations will be established where photographs will be taken to document the development of restored habitats and to illustrate that normal sediment transport processes are occurring within the Project Area over time. Photographs will be taken with a hand held camera from ground level or from a camera mounted on an unmanned aerial vehicle (UAV).

These photographs will capture the development (revegetation success) and status of the following:

- Tidal marsh area, including potential signs of erosion and/or sedimentation within tidal channels;
- Transition zone;
- Upland refugia;
- Seasonal wetland; and
- Access control fence.

4.2.2 Erosion and Sedimentation

The potential adverse effects of erosion and sedimentation will be monitored over a period of 5

years using digital topographic data developed from aerial photographs. Following construction and in years 2, 3, and 5 low altitude, high-resolution color imagery will be acquired using an unmanned autonomous vehicle (UAV) for use in assessing both erosion and vegetative cover. Imagery will be acquired at low tide in order to expose the entire restoration area. Photogrammetry software will be used generate a high-resolution topography (digital terrain model) from the color imagery. Topographic data will be compared to post-construction baseline data to determine changes in marsh surface and tidal channel geometry and evaluate performance criteria. Should any significant adverse erosion or sedimentation be observed, the District will notify the regulatory permitting agencies to determine appropriate corrective actions.

4.2.3 Tidal Hydrology

Tidal hydrology will be considered successful by demonstrating that the new tidal marsh area is exposed to full tidal hydrology. Tidal hydrology will be verified through use of pressure / water-level data loggers to measure and confirm full tidal inundation as well as biannual photographic evidence that the site is inundated fully at high tide events. Pressure transducers equipped with data loggers will be installed in the northern drainage channel and in the new tidal marsh channel network, within a slotted PVC housing. Elevations of the housings will be surveyed relative to the North American Vertical Datum of 1988; coordinates will be surveyed using the California State Plane. Data from the devices will be collected and included in the annual monitoring report.

4.2.4 Vegetation Coverage in the Tidal Marsh

The development of vegetation coverage within the tidal marsh will be monitored to demonstrate that the rate of revegetation is on-track based on the success requirements for the Project. This will include the low marsh and high marsh areas of the Project Area. The absolute cover of vegetation within the tidal marsh will be measured through using one of the following or an equivalent method:

- Manual monitoring of vegetated areas using the transect-quadrat method; or
- Acquire high-resolution aerial imagery collected with a UAV, estimate percent coverage manually or using eCognition software, and verify desktop analysis on-the-ground.

<u>Transect-Quadrat Vegetation Monitoring</u>

To evaluate vegetation performance standards, wetland types are monitored using transects, including the tidal marsh. Each transect serves as the sample unit and the quadrats are averaged to obtain transect cover. Twelve transects will be spaced approximately every 50 feet) to capture the restored 4.3-acre tidal marsh and are laid out perpendicular to and across the primary channel to capture the full extent of the tidal marsh zones (see Figure 2, attached). At each transect, a random number will be chosen from 0 through 9 using a random number generator to select the first sampling location in meters. At each sampling location, an approximately 3 foot by-3 foot (1-m by 1m) quadrat will be used to assess plant cover and species richness. Subsequent quadrats will then be placed approximately every 15 feet (5 m) so that one quadrat is sampled approximately every 30 feet (10 m) of transect length. Quadrat locations along each transect will be noted on field data forms. Approximately 6–foot- (2-m)-wide belt transects will be used along the north side of each transect to record species richness by capturing additional species not detected in the quadrats.

Vegetation data will be stratified based on low- and high-marsh zones and will be used to quantify the average percent cover within both tidal marsh zones, as well as capturing percent invasion by plants ranked by Cal-IPC as "High."

The San Francisco Bay Invasive Spartina Project will be consulted to verify that cordgrass growing within the Project site is native Pacific cordgrass (*Spartina foliosa*) and not one of the four invasive *Spartina* species or hybrids found in San Francisco Bay. Their biologist will be given permission to access the site and verify that the Project site has only the native species.

Aerial Imagery with eCognition

An alternative method to analyzing vegetation performance can be achieved with the remote-sensing analysis called "eCognition" of high-resolution aerial imagery collected for the Project Area via UAV. The eCognition software is a remote-sensing software package that allows users to classify different signature outputs of satellite images and aerial photographs. Using a high-resolution aerial image, aggregate area data can be utilized to determine the percent cover of vegetative cover.

Using aerial imagery, eCognition software can interpret signatures of the vegetation and the software can automatically define the boundaries of every color signature on the color aerial photograph, which is also known as a multi-resolution segmentation analysis. This generates polygons that require classification in the aerial imagery by a trained geospatial analyst familiar with the software and tidal ecology. A biologist would complete a site visit using a georeferenced map of the eCognition analysis results to confirm that the classification analyses accurately captures the vegetation composition and aerial cover observed. During this site visit, the biologist will also quantify any observed invasive species within the tidal marsh and complete monitoring for other required success criteria.

4.2.5 Vegetation Coverage in the Transition Zone

The development of the vegetation coverage within the transition zone will be measured to demonstrate that this area has sufficient shrub coverage to support Ridgway's rail refugia vegetation coverage. The monitoring will measure absolute coverage of shrubs in the transition zone or the density of shrubs in the transition zone. Density of shrubs will be used to measure success in the early years when individual shrubs are still small. Absolute coverage of shrubs will be used in later years when the size of the shrubs start to become substantial. The vegetation coverage of shrubs will be measured using one of the following methods:

- Vegetation count of live shrubs species within the transition zone; and/or
- Acquire high-resolution aerial imagery collected with a UAV, estimate percent coverage manually or using eCognition software, and verify desktop analysis on-the-ground.

Vegetation Counts

Utilizing the planting palette developed for the transition zone, qualified biologists will walk the transition zone and monitor all live shrub species within this zone to determine the planting success.

Aerial Imagery with eCognition

Similar analyses will be completed as that described above for the tidal marsh.

4.2.6 Seasonal Wetland Hydrology

The hydrology of the seasonal wetland will be measured by collecting data that demonstrates that the soils within the seasonal wetland are saturated or inundated for the required minimum duration of 14 consecutive days. Data will be collected using one of the following or an equivalent method:

- Installation and data collection from a shallow groundwater well;
- Installation and inspection of a staff gauge; or
- Field verification of inundation.

4.2.7 Vegetation Coverage in the Seasonal Wetlands

The development of vegetation coverage within the created seasonal wetland and a reference seasonal wetland identified within the parcel will be monitored to demonstrate that the rate of revegetation is on-track based on the performance requirements for the Project as outlined in Table 5. The established reference wetland will be a local depressional wetland within undisturbed areas of the property of similar size to the restored seasonal wetland. The absolute cover of vegetation within the restored seasonal wetland and reference seasonal wetland will be measured through using the following or an equivalent method:

- Manual monitoring of vegetated areas using the transect-quadrat method

Transect-Quadrat Vegetation Monitoring

Similar transect-quadrat methods as discussed above will be utilized for monitoring both the restored seasonal wetland and reference seasonal wetland habitat (see Figure 2, attached). The restored and reference seasonal wetland will have transects established; spaced 50 feet apart across the longest portion of the wetland and one transect extending perpendicular through the narrowest portion of the wetland. Given the relatively smaller size of the seasonal wetlands, the perpendicular transect has been included to ensure that transects adequately capture the variation of depth within each depressional feature. The application of quadrats will follow the same random number assignment and spacing as described above. Species composition and percent cover will be collected through this methodology.

4.2.8 Access Control Fence

The access control fence will be inspected during annual monitoring site visits to confirm it remains in working condition. The fence will be repaired or replaced as-needed. The tidal marsh areas, transition zone, and upland refugia area will be inspected for evidence of significant anthropogenic disturbances.

4.3 Remedial Actions

If annual or final success criteria are not met, the District will prepare an analysis of the potential cause(s) of failure and, if determined necessary by the permitting agencies, propose remedial action for approval. Subsequent annual and final monitoring reports may be required to confirm that remedial actions were successful. The District will be responsible for reasonably funding the remedial actions necessary for successful completion of the mitigation efforts. Remedial actions may include additional planting of native wetland species, noxious weed abatement activities, or modification of Project features to ensure proper hydrological functioning.

4.4 Reporting

The first year's Annual Report will be submitted by January 31 after the first full growing season and associated performance monitoring activities have been completed. Subsequent Annual Reports will cover the monitoring year beginning at the start of the rainy season (approximately October 1st), and will cover 12 calendar months forward from that point, with submittal occurring by January 31 of the following year. Reports will summarize the monitoring results and make recommendations for maintenance or management, if determined necessary. The condition of seeded wetland areas shall be described, as well as any observed threats to these restored areas. New colonization of invasive species and plans for their removal or control shall be detailed, as necessary. The Final (Year 5) Annual Report will also include a formal delineation of jurisdictional wetlands and present an evaluation of whether the restoration area has become sufficiently self-sustaining or whether additional invasive species control work or other monitoring should be performed.

5.0 COMPLETION OF MITIGATION

5.1 Notification of Completion

Upon completion of the monitoring period, final reports will be sent to the permitting agencies detailing the results of the final year of monitoring. In addition, a Notice of Completion will be prepared, signed by the District, and submitted to the permitting agencies to confirm successful completion of the restoration effort.

6.0 REFERENCES

California Invasive Plant Council (Cal-IPC). 2006. California Invasive Plant Inventory. California Invasive Plant Council, Berkeley, CA. Available online: https://www.cal-ipc.org/plants/inventory/.

San Francisco Bay Conservation and Development Commission. 1968. San Francisco Bay Plan. Reprinted March 2012.

WRA. 2015. Jurisdictional Delineation Report. Wetland Restoration Design and Permitting Support Services at Corte Madera Ecological Reserve. Prepared for Golden Gate Bridge Highway and Transportation District.

FIGURES

Figure 1. Vicinity Map - Project Area Location

Path: L:\Acad 2000 Files\23000\23294\GIS\ArcMap\2018\Redesign\HMMP\Figure 1 Location.mxd

Sources: National Geographic, WRA | Prepared By: mweidenbach, 7/24/2019

Figure 1. Vicinity Map - Project Area Location

Corte Madera Four-Acre
Tidal Marsh Restoration Project
Town of Corte Madera, Marin County, California

0 0.5 1 Miles

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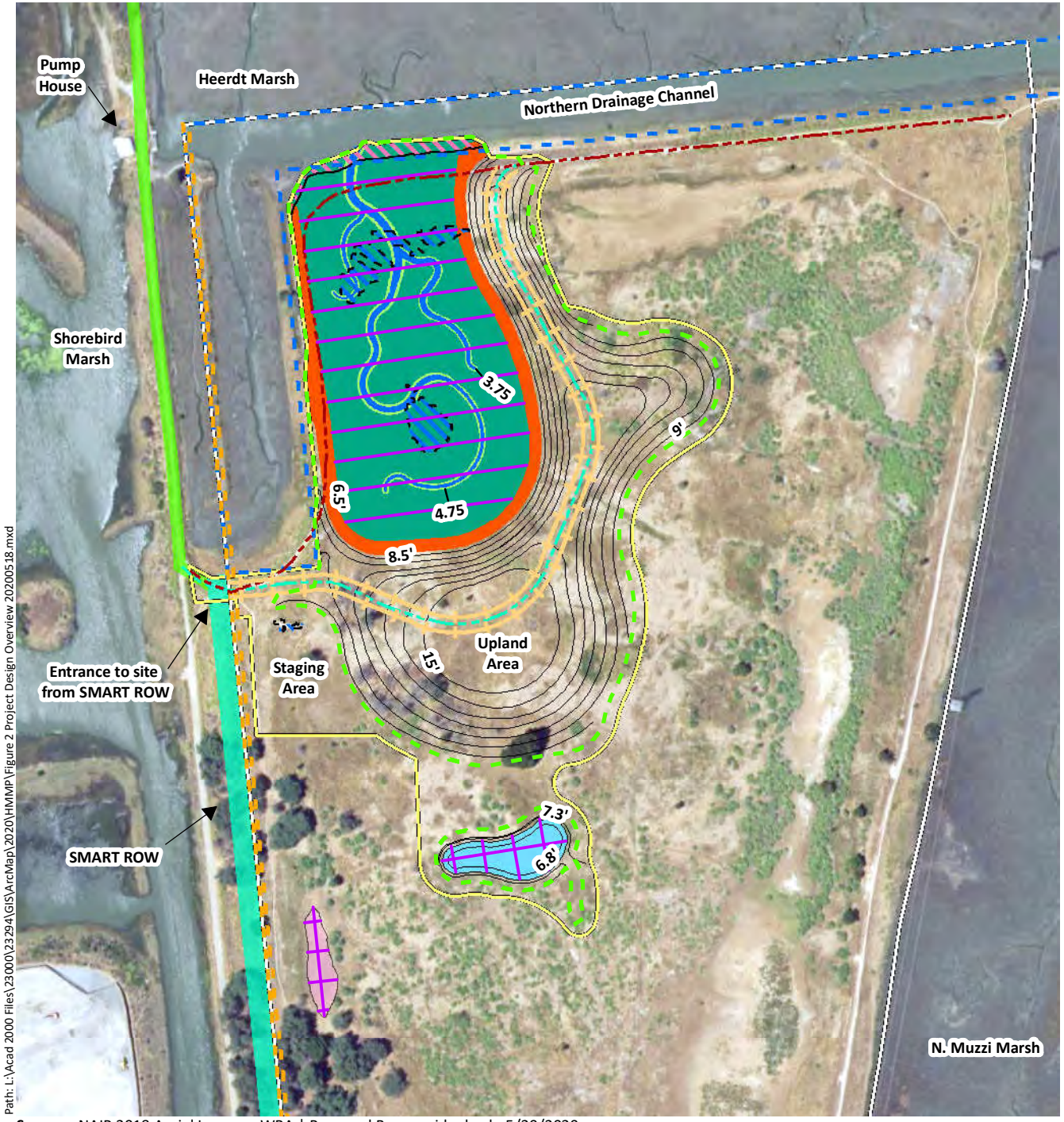
Figure 2. Project Design Overview

Figure 2.
Project Design Overview

Corte Madera Four-Acre
Tidal Marsh Restoration Project
Town of Corte Madera,
Marin County, California



Path: L:\Acad 2000 Files\23000\23294\GIS\ArcMap\2020\HMMP\Figure 2 Project Design Overview 20200518.mxd

Sources: NAIP 2018 Aerial Imagery, WRA | Prepared By: mweidenbach, 5/20/2020

- Parcel Boundary (72.31 ac)
- Project Area (14.71 ac)
- Monitoring Transects
- Reference Wetland
- Existing Unsanctioned Trail
- Proposed Informal Trail
- Pedestrian/Animal Exclusion Fence
- Limit of Grading (12.16 ac)
- Grading Contours

Existing Seasonal Wetlands

- Permanent Impact (0.28 ac)

Existing Tidal Marsh

- Temporary Impact (0.18 ac)*

Existing Easements (surveyed)

- Town of Corte Madera Drainage Easement
- AT&T Easement

District Access Easements (mapped from legal descriptions)

- 20' Public Access Easement within SMART ROW
- 35' Public Access Easement within SMART ROW

Proposed Habitat Restoration

- Tidal Marsh - Channel (0.30 ac)
- Tidal Marsh - Low Marsh (0.23 ac)
- Tidal Marsh - High Marsh (3.77 ac)
- Upland Transition Zone (0.75 ac)
- Seasonal Wetlands (0.28 ac.)

*This impact will result in the conversion of 0.01 ac. of High Marsh to Tidal Channel

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0 200 400

Feet

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ENVIRONMENTAL CONSULTANTS

APPENDIX C. SITE PHOTOGRAPHS

Photograph 1. Photo-monitoring Location 1. View of transition zone and tidal marsh, facing west. Photo taken July 12, 2023.

Photograph 2. Photo-monitoring Location 2. View of tidal marsh (background), transition zone (a narrow band adjacent to the tidal marsh), and uplands (foreground), facing northwest. Photo taken July 14, 2023.

Photograph 3. Photo-monitoring Location 3. View of trail and exclusion fence, facing southeast. Photo taken July 14, 2023.

Photograph 4. Photo-monitoring Location 4. View of trail and exclusion fence, facing east. Photo taken July 14, 2023.

Photograph 5. Photo-monitoring Location 5. View of upland disposal area with seasonal wetland in background, facing south. Photo taken July 12, 2023.

Photograph 6. Photo-monitoring Location 6. View of restored seasonal wetland, facing west. Photo taken July 12, 2023.

Photograph 7. Photo-monitoring Location 7. View of restored seasonal wetland, facing east. Photo taken July 12, 2023.

Photograph 8. Photo-monitoring Location 8. View of transition zone and tidal marsh, facing northeast. The tidal marsh vegetation in view is pickleweed (*Salicornia pacifica*). Photo taken July 14, 2023.

Photograph 9. Photo-monitoring Location 9. View of tidal marsh, facing east. Tidal marsh vegetation in view is dominated by pickleweed. Photo taken July 14, 2023.

Photograph 10. Photo-monitoring Location 10. View of restored tidal marsh and adjacent previously existing marsh, facing north. Tidal marsh vegetation in view on the right is dominated by pickleweed. Vegetation in view on the left is dominated by Italian rye grass (*Festuca perennis*). Photo taken July 14, 2023.

Photograph 11. View north of the restored tidal area fully inundated at high tide. The predicted high tide elevation was 6.5 feet mean lower low water. Photo taken November 23, 2022.

Photograph 12. View north of the restored tidal area fully inundated at high tide. The predicted high tide elevation was 6.2 feet mean lower low water. Photo taken January 3, 2023.

Photograph 13. View southeast of the restored tidal area (upper center and upper right), Northern Drainage Channel, and adjacent tidal marsh fully inundated at high tide. The predicted high tide elevation was 6.5 feet mean lower low water. Photo taken from the public path at the pump station. Photo taken November 23, 2022.

Photograph 14. View west of the restored tidal area fully inundated at high tide near the boundary with the Northern Drainage Channel. The predicted high tide elevation was 6.2 feet mean lower low water. Photo taken January 3, 2023.

Photograph 15. View of the high marsh in the restored tidal marsh. Image shows expanding native plantings, primarily pickleweed, as well as natural native species recruits. Photo taken July 14, 2023.

Photograph 16. View of the low marsh (channel) and high marsh in the restored tidal marsh, looking north toward the mouth of the marsh. Image shows expanding native plantings as well as natural native species recruits, primarily pickleweed. Photo taken November 1, 2023.

Photograph 17. View of the restored seasonal wetland, facing west. Image shows the wetland fully inundated. Photo taken February 1, 2023.

Photograph 18. View of the restored seasonal wetland, facing west. Image shows the wetland fully inundated. Photo taken March 23, 2023.

Photograph 19. View of the restored seasonal wetland, facing east. Image shows the wetland fully inundated. Photo taken February 1, 2023.

Photograph 20. View of the restored seasonal wetland, facing east. Image shows the wetland fully inundated. Photo taken March 23, 2023.

Photograph 21. Harding grass (*Phalaris aquatica*) plastic solarization sheeting at the southwest end of the tidal marsh restoration area. Jute netting and sandbags were placed on top of the plastic sheeting to help hold it in place and reduce damage from wind and coyotes (*Canis latrans*). View facing north. Photo taken April 4, 2023.

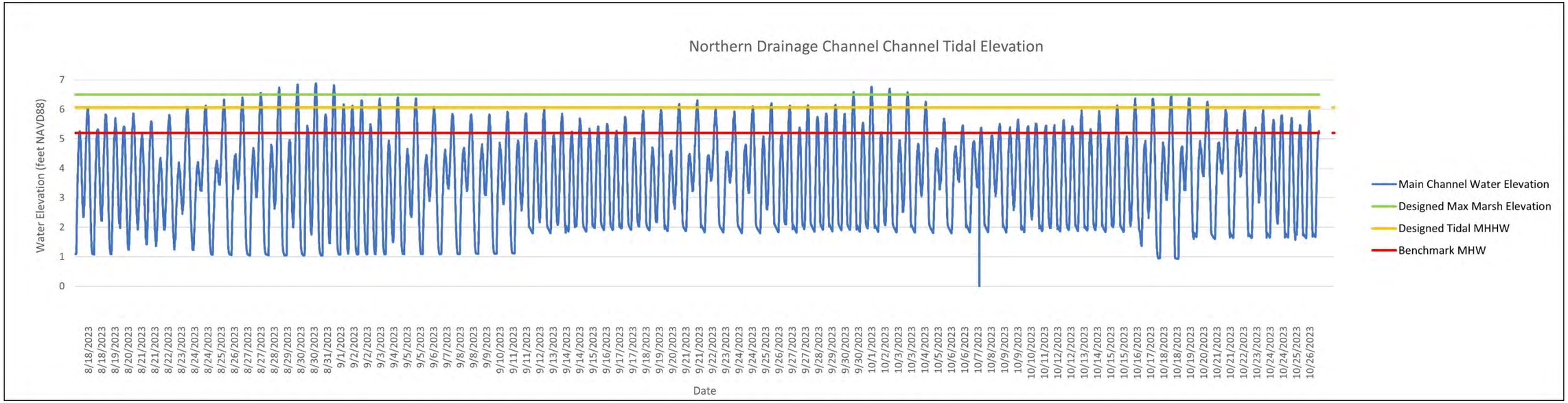
Photograph 22. Harding grass plastic solarization sheeting at the northeast end of the tidal marsh restoration area. Jute netting and sandbags were placed on top of the plastic sheeting to help hold it in place and reduce damage from wind and coyotes. View facing northwest. Photo taken April 4, 2023.

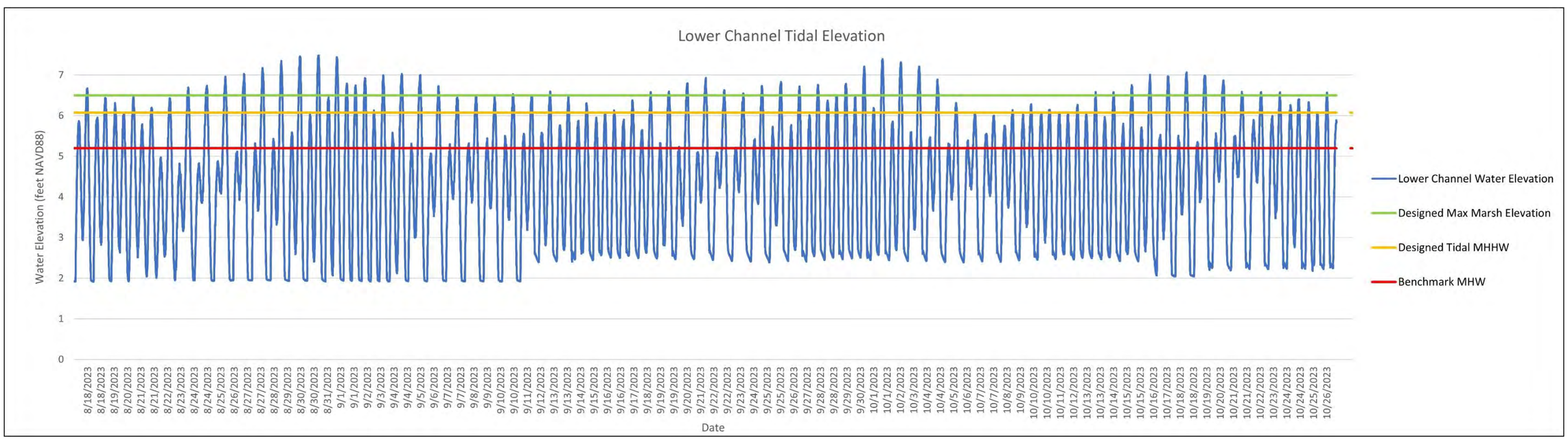
Photograph 23. Excavator digging up pampas grass *(Cortaderia selloana*) east and outside of the tidal restoration area as part of the first phase of the project to eradicate pampas grass adjacent to the restoration areas. One of the goals is to prevent pampas grass from invading the restoration area. Photo taken September 21, 2023.

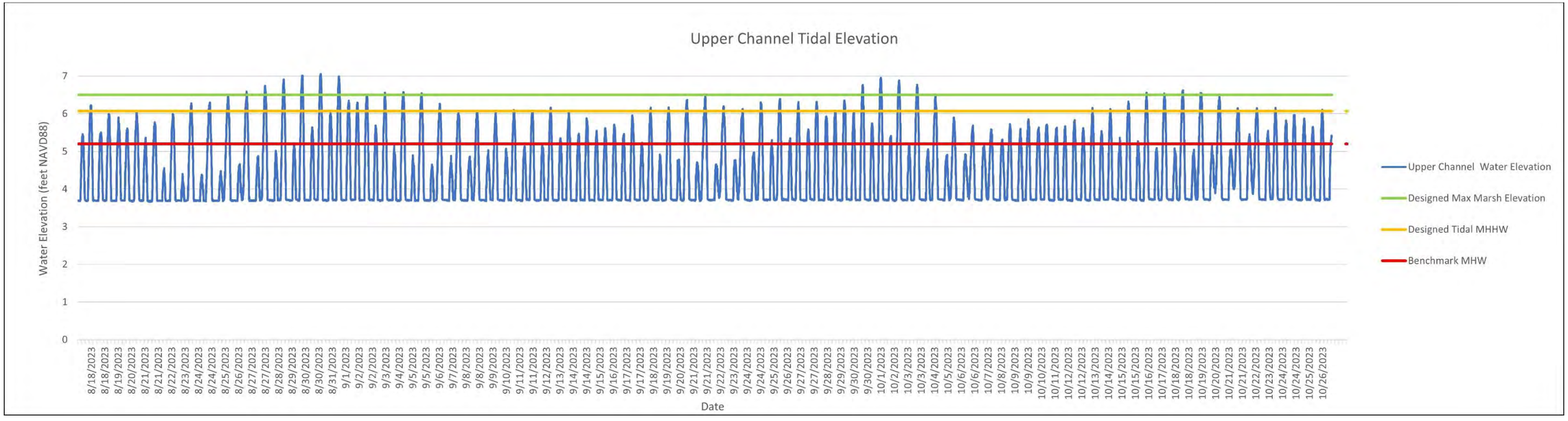
Photograph 24. Trimming leaves from pampas grass to prep it for excavation, east and outside of the tidal restoration area. Part of the first phase of the project to eradicate pampas grass adjacent to the restoration areas. One of the goals is to prevent pampas grass from invading the restoration area. Photo taken September 21, 2023.

APPENDIX D. TIDAL ELEVATION MONITORING DATA

Appendix D. Tidal Elevation Monitoring Data






Upper Channel Tidal Elevation
Water Elevation (feet NAVD88)
0
1
2
3
4
5
6
7
8/18/2023
8/18/2023
8/19/2023
8/20/2023
8/21/2023
8/21/2023
8/22/2023
8/23/2023
8/24/2023
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10/21/2023
10/22/2023
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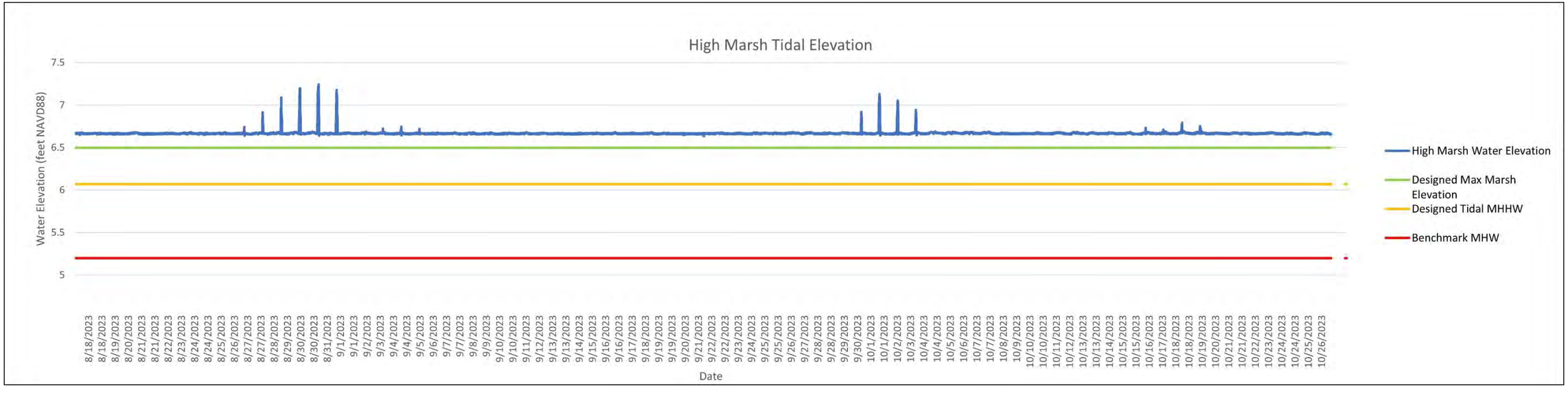
10/24/2023
10/25/2023
10/26/2023
Date
Upper Channel Water Elevation
Designed Max Marsh Elevation
Designed Tidal MHHW
Benchmark MHW


High Marsh Tidal Elevation
Water Elevation (feet NAVD88)
5
5.5
6
6.5
7
7.5
8/18/2023
8/18/2023
8/19/2023
8/20/2023
8/21/2023
8/21/2023
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10/22/2023
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10/24/2023
10/25/2023
10/26/2023
Date
High Marsh Water Elevation
Designed Max Marsh Elevation
Designed Tidal MHHW
Benchmark MHW

APPENDIX E. VEGETATION MONITORING DATA

Appendix E. Vegetation Monitoring Data

Year 3 Monitoring	Observers: Scott Batiuk, Katie Tyree		Date: 7/12/2023	Average for Restored Seasonal Wetland	Restored Seasonal Wetland																									
Species	Common name	Origin	CAL-IPC Status	Absolute Percent Cover (%)	Present?	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26
						Absolute Percent Cover (%)																									
Agrostis avenacea	Pacific bentgrass	Exotic	Cal-IPC Limited	28.6	X	50	90	50	0	0	0	0	0	0	0	0	0	2	95	80	75	97	90	0	0	35	75	0	0	5	0
Atriplex prostrata	Fat-hen	Exotic	Exotic	0.0	X	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0.01	1	0	0
Cortaderia selloana	pampas grass	Exotic	Cal-IPC High	-	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cotula coronopifolia	brassbuttons	Exotic	Cal-IPC Limited	1.9	X	0	0.01	3	0.01	0	0.01	0	12	0.01	0	0	12	1	0.01	1	0.01	0.01	0	1	0.01	0	0	0	0	20	0
Crypsis schoenoides	swamp pricklegrass	Exotic	Exotic	0.0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0
Cyperus eragrostis	tall flatsedge	Native	Native	-	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dittrichia graveolens	stinkwort	Exotic	Cal-IPC Moderate	0.0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0.01	0	0	0	0	0	0
Elymus triticoides	creeping wild rye	Native	Native	0.0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0
Festuca perennis	Italian rye grass	Exotic	Cal-IPC Moderate	29.2	X	1	0.01	10	29	39	57	75	58	75	70	75	72	13	0.01	0.01	0	0	0.01	10	35	0.01	0	75	30	1	35
Grindelia stricta	coastal gumweed	Natie	Native	-	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hordeum brachyantherum	meadow barley	Native	Native	0.0	X	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
Hordeum marinum	Mediterranean barley	Exotic	Cal-IPC Moderate	-	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juncus bufonius	toad rush	Native	Native	0.0	X	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	1
Lotus corniculatus	birdsfoot trefoil	Exotic	Exotic	0.4	X	0	0	0	0.01	0	0	0	0	0	0	0	0	0.01	10	0	0	0.01	0	0	0	0.01	1	0	0	0	0.01
Phalaris aquatica	Harding grass	Exotic	Cal-IPC Moderate	0.4	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0.01	0	6	0	0
Polygonum aviculare	prostrate knotweed	Exotic	Exotic	3.7	X	3	0.01	1	1	0	3	0	0	0.01	0	0	1	14	0.01	0.01	0	0.01	0	4	5	15	0	0	1	5	44
Polypogon monspeliensis	rabbitsfoot grass	Exotic	Cal-IPC Limited	0.4	X	0	1	0.01	0	0	0	0	0	0	0	0	0	0	0.01	7	3	0.01	0	0	0.01	0	0	0	0	0	0
Pseudognaphalium luteoalbum	Jersey cudweed	Exotic	Exotic	0.0	X	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rumex crispus	curly dock	Exotic	Cal-IPC Limited	0.5	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	1	0
Sesuvium verrucosum	western sea-purslane	Native	Native	0.0	X	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0.01	0
Spergularia rubra	red sand-spurrey	Exotic	Exotic	-	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Litter/Thatch	20.8	-	0	0	0	65	45	30	20	30	25	30	25	15	10	0	0	0	0	7	50	60	0	25	25	50	10	20
Bare Ground	1.0	-	0	1	0	0	0	10	5	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Biotic Crust	13.7	-	45	8	36	5	15	0	0	0	0	0	0	0	55	0	20	25	3	0	35	0	50	0	0	0	58	0
Average Plant Cover	65.4	-	55	91	64	30	39	60	75	70	75	70	75	85	30	105	88	78	97	95	15	40	50	76	75	50	32	80
Average Number Native Plant Species	0.4	-	1	1	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	1	1	0	0	0	0	0	2	1
Average Native Cover	0.1	-	1.01	0.01	0	0	0	0	0	0	0	0	0	0	0.02	0	0.01	0	0	0.01	0	0	0	0	0	0	0.02	1
Relative Native Cover	0.1	-	2	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Average Number Invasive (Cal-IPC High) Plant Species	0.0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average Invasive (Cal-IPC High) Cover	0.0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Year 3 Monitoring	Observers: Scott Batiuk, Katie Tyree		Date: 7/12/2023	Average for Reference Seasonal Wetland	Reference Seasonal Wetland														
Species	Common name	Origin	CAL-IPC Status	Absolute Percent Cover (%)	Present?	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
						Absolute Percent Cover (%)														
Agrostis avenacea	pacific bentgrass	Exotic	Cal-IPC Limited	2.0	X	0	0	0	0	0	0	0	0.01	0	30	0	0	0	0.01	0
Atriplex prostrata	fat-hen	Exotic	Exotic	0.9	X	0	13	0.01	0	0	0	0	0	0	0.01	0.01	0.01	0	0	0
Cotula coronopifolia	brassbuttons	Exotic	Cal-IPC Limited	21.7	X	25	16	26	35	25	25	1	25	35	35	0	20	28	30	0
Festuca perennis	Italian rye grass	Exotic	Cal-IPC Moderate	5.9	X	10	1	2	1	0.01	0.01	0	0	0	0.01	32	20	2	0	20
Polygonum aviculare	Prostrate knotweed	Exotic	Exotic	0.3	X	0.01	0	0	0	0	0	0	0	0	0	5	0	0	0	0
Sesuvium verrucosum	western sea-purslane	Native	Native	0.3	X	0	0	0	0	0	0	5	0	0	0.01	0	0.01	0	0	0
Spergularia rubra	red sand-spurrey	Exotic	Exotic	0.1	X	0	0.01	0	0	0	0	0	0	0	1	0	0	0	0	0
Xanthium strumarium	cocklebur	Native	Native	3.7	X	0	0.01	12	5	25	10	2	0.01	0	0.01	1	0	0	0	0
Litter/Thatch				20.5	-	33	0	0	19	25	15	0	25	10	0	65	20	10	5	80
Bare Ground				18.0	-	0	0	0	0	0	0	0	50	55	40	0	0	60	65	0
Biotic Crust				20.5	-	32	60	60	40	25	50	0	0	0	0	0	40	0	0	0
Average Plant Cover				34.9	-	35	30	40	41	50	35	8	25	35	66	38	40	30	30	20
Average Number Native Plant Species				0.9	-	0	1	1	1	1	1	2	1	1	2	1	1	0	0	0
Average Native Cover				4.0	-	0	0.01	12	5	25	10	7	0.01	0	0.02	1	0.01	0	0	0
Relative Native Cover				14.1	-	0	0.03	30	12.2	50	28.6	87.5	0.04	0	0.03	2.63	0.02	0	0	0
Average Number Invasive (Cal-IPC High) Plant Species				0.0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average Invasive (Cal-IPC High) Cover				0.0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX F. NOTIFICATION TO THE INVASIVE SPARTINA PROJECT

wra

Scott Batiuk <batiuk@wra-ca.com>

RE: Spartina at the Corte Madera Marsh restoration site (2023)

1 message

Tobias Rohmer <toby@olofsonenvironmental.com> Wed, Sep 6, 2023 at 5:15 PM
To: Scott Batiuk <batiuk@wra-ca.com>, "Marilyn@SCC" <Marilyn.Latta@scc.ca.gov>, Peggy Olofson <peggy@olofsonenvironmental.com>, Info <info@olofsonenvironmental.com>

Hi Scott, and thanks for the notification.

We did a through inventory within the restoration tract on June 7th, and then a limited inventory of the adjacent Corte Madera Ecological Reserve and Muzzi Marsh just Monday of this week (September 4th). The nearest invasive *Spartina* of any species we have detected is >400m from the restoration tract.

Thanks again for the regular checkins. We really appreciate it.

Cheers

-Tobias

From: Scott Batiuk <batiuk@wra-ca.com>
Sent: Wednesday, September 6, 2023 8:57 AM
To: Marilyn@SCC <Marilyn.Latta@scc.ca.gov>; Tobias Rohmer <toby@olofsonenvironmental.com>; Peggy Olofson <peggy@olofsonenvironmental.com>; Info <info@olofsonenvironmental.com>
Subject: Spartina at the Corte Madera Marsh restoration site (2023)

Hi,

This is my annual notification to ISP regarding the presence of a species of *Spartina* at the Corte Madera 4-Acre Tidal Marsh restoration site in Corte Madera, Marin County, approximately 0.5 mile south of the Larkspur Ferry Terminal. One of the monitoring requirements for the site is to report to ISP if any spartina is found within the restoration area. Similar to last year, Spartina was observed at the far northern edge of the restoration area, at the interface between the restoration area and the east-west oriented tidal channel adjacent to the restoration area. This patch has basically stayed the same size for the past 3 years. However, *Spartina* has finally started to colonize the interior of the restoration

marsh, though just barely. One small clump was observed about 100 feet up the main low marsh channel. See the attached KMZ for the approximate location of the spartina. See also the attached PDF that shows the spartina locations.

In 2022, it was determined by ISP that the spartina was *Spartina foliosa*. It seems likely that the new spartina location in the interior of the marsh is foliosa considering foliosa is at the mouth of the channel, but I can't confirm that. Has ISP been out there yet in 2023?

Scott Batiuk, CCB
Plant Biologist

batiuk@wra-ca.com
Direct 415.524.7211 | Cell 206.419.3616

CLEAN WATER ACT SECTION 401 WATER QUALITY CERTIFICATION AND ORDER for:

Corte Madera 4-Acre Tidal Marsh Restoration Project, Marin County

Sent via electronic mail: No hard copy to follow

Effective Date: **June 30, 2020**

Place ID 857558
WDID# 2 CW429899

Applicant: Golden Gate Bridge, Hwy & Transportation District
Attn: Lynford Edwards
P.O. Box 9000, Presidio Station
San Francisco, CA 94129
Phone: (415) 923-2349
Email: ledwards@goldengate.org

Applicant's Agent: Phil Greer
2169-G East Francisco Blvd
San Rafael, CA 94901
Phone: (415) 524-7294
Email: greer@wra-ca.com

Water Board Staff: Nicole Fairley
1515 Clay Street, Suite 1400
Oakland, CA 94612
Phone: (510) 622-2424
Email: nicole.fairley@waterboards.ca.gov

Table of Contents

Order

This Clean Water Act (CWA) section 401 Water Quality Certification and Order (Order) is issued at the request of Golden Gate Bridge, Hwy & Transportation District (Permittee) for the Corte Madera 4-Acre Tidal Marsh Restoration (Project). We received the application for certification (Application) on April 8, 2019. On May 3, 2019, we issued a notice of incomplete application and requested additional information including, a planting plan, a monitoring plan, and the correct application fee. We received supplemental information needed to complete the application on June 26, 2020.

The Permittee has also applied to the U.S. Army Corps of Engineers (Corps), Regulatory Branch for coverage under Nationwide Permit 27 (Aquatic Habitat Restoration, Establishment, and Enhancement Activities), pursuant to CWA Section 404 (33 USC 1344).

I. Project

The Project purpose is to restore approximately 4.3 acres of tidal salt marsh and create habitat for Ridgway's Rail to satisfy Larkspur Ferry Terminal's mitigation requirements. The Project will restore tidal marsh habitat near the California Department of Fish and Wildlife Corte Madera Marsh Ecological Reserve in Corte Madera (37.935405, 122.510868). The Project will satisfy the Permittee's mitigation requirements to establish 2 acres of tidal marsh habitat suitable for Ridgway's Rail in accordance with a 1988 Corps Project (#17486N) tied to dredging the Larkspur Ferry Terminal and an additional 2 acres of tidal marsh habitat associated with a 1996 environmental settlement for introducing high-speed ferries at the Larkspur Ferry Terminal. The Project site is currently diked former baylands that is disconnected from tidal influence and has subsided over time, resulting in the mix of seasonal wetlands and ruderal uplands that exist today.

The Project involves grading upland areas and approximately 0.28 acres of existing seasonal wetlands in historically diked baylands to create low, middle, and high marsh ecotones with a connection to an existing tidal channel adjacent to the site. A system of tidal channels will be excavated and connected to the northern drainage channel in order to provide full tidal hydrology to the site. These channels have been designed to allow daily tidal flushing, prevent ponding, and are expected to develop and mature over time into a state of equilibrium. Excavated materials will be placed adjacent to the tidal wetland to provide upland transition habitat. Native tidal marsh and transition zone plantings will be installed and invasive plant species will be removed and managed.

To the south of the tidal marsh restoration area, a 0.28-acre seasonal wetland will be constructed through grading a seasonal wetland depression and vegetating the area with native seasonal wetland species. The Project will reuse all excavated sediments on site, and soils within the proposed tidal marsh surface that have been identified as having unsuitable composition for wetland restoration, but is suitable for recreational use, will be excavated, backfilled, and then capped with a minimum of 3 feet of clean soil in the adjacent upland re-use area. To minimize disturbance to wildlife in adjacent tidal marshes, all construction activities, including plantings, will be conducted between September 1 and January 31. Construction mobilization and earthwork is expected to comprise the first three months of this period, with the marsh planting to follow during the rainy season.

II. Impacts to Waters of the State

If effective best management practices (BMPs) are not implemented during construction, waters of the state may be impacted by increased erosion and sedimentation, and/or discharging debris and other waste materials. The Project will temporarily impact 0.28 acres of existing seasonal wetlands and 0.18 acres of existing tidal marsh habitat. The seasonal wetland area will be transitioned into tidal marsh habitat and the temporarily impacted tidal marsh area will be graded to construct the tidal channel connection and then restored to tidal marsh.

III. Mitigation

During construction, the Permittee will avoid and minimize impacts to waters of the State by implementing appropriate and effectives BMPs as described in the Application. These include, but are not limited to, installing temporary and permanent exclusionary fencing, excavating and capping soils not suitable for wetland habitat, and breaching the perimeter levee last to prevent inundation prior to site stabilization.

To compensate for temporary impacts to seasonal wetlands on site, the Project will construct 0.28 acres of seasonal wetlands and vegetate with appropriate native species. The Project will provide a net increase in tidal marsh habitat of approximately 4 acres, restoring the area to its natural habitat type.

IV. California EcoAtlas

Regional, state, and national studies have determined that tracking of mitigation and restoration projects must be improved to better assess the performance of these projects, following monitoring periods that last several years. To effectively carry out the State's Wetlands Conservation Policy of no net loss to wetlands, the State needs to closely track both losses and successes of mitigation and restoration projects affecting wetlands and other waters of the State. The Water Board must also track project performance in Bay Area creeks subject to routine repair and maintenance activities, such as recurring instabilities. Therefore, we adopted the digital interactive mapping tool called *EcoAtlas*.[1] *EcoAtlas* is a web-based tool that integrates maps, project plans, site conditions, restoration efforts, and other elements on a project-by-project basis based on data inputs. Accordingly, we require the Permittee to upload their Project information to *EcoAtlas* with the *Project Tracker* tool at https://ptrack.ecoatlas.org. The California Wetlands Monitoring Workgroup developed *EcoAtlas* and maintains detailed instructions for *Project Tracker* on its website at https://ptrack.ecoatlas.org/instructions.

V. California Environmental Quality Act (CEQA)

On April 30, 2019, the Permittee, as lead agency, adopted a Mitigated Negative Declaration (State Clearinghouse (SCH) No. 2019049151) for the Project and filed a Notice of Determination (NOD) at the SCH on July 26, 2020. The Water Board, as a Responsible Agency under CEQA, has reviewed the project CEQA documents and finds that the

[1] Source: California Wetlands Monitoring Workgroup (CWMW), 2019. *EcoAtlas*. Accessed May 14, 2019. https://www.ecoatlas.org. The California Wetland Monitoring Workgroup (CWMW) provides technical oversight on the development of content and functionality of EcoAtlas. As a member of CWMW, San Francisco Estuary Institute provides day-to-day support and management of EcoAtlas, and can be contacted by email at ptrackadmin@sfei.org.

Project's significant environmental effects that are within the Water Board's purview and jurisdiction have been identified and will be mitigated to less-than-significant levels. Specifically, significant impacts pertaining to wetland and aquatic habitat and water quality will be mitigated to less-than-significant levels through implementation of mitigation measures identified in the CEQA documents and the mitigation identified above, all of which are required to be implemented and reported on by this Certification.

VI. Conditions

The Water Board independently reviewed the Project record to analyze impacts to water quality and the environment and designated beneficial uses within the Project's watershed. In accordance with this Order, the Permittee may proceed with the Project under the following terms and conditions:

General Conditions

1. The Project shall be constructed in conformance with the Project description provided in the Application. The Permittee shall fully comply with engineering plans, specifications, and technical reports submitted in the Application or required as part of this Order. Any changes to information provided in the Application must be submitted to the Water Board and receive Executive Officer approval before the changes are implemented.

2. Disturbance or removal of vegetation shall be minimized. The site shall be stabilized through incorporation of appropriate BMPs, including the successful reestablishment of native vegetation to enhance wildlife habitat values, and to prevent and control erosion.

3. No equipment shall be operated in stream channels or other waters where there is flowing or standing water. Fueling, cleaning, or maintenance of vehicles or equipment during construction shall not take place within any areas where an accidental discharge to waters of the State may occur.

4. No unauthorized construction related materials or wastes shall be allowed to enter into or be placed where they may be washed by rainfall or runoff into waters of the State. When construction is completed, any excess material shall be removed from the work area and any areas adjacent to the work area where such material may be discharged to waters of the State.

Mitigation

5. To mitigate for 0.28 acres of temporary impacts to seasonal wetlands and 0.18 acres of temporary impacts to tidal marsh habitat, the Permittee shall restore all areas of temporary impacts to waters of the State and all upland areas temporarily impacted that could result in a discharge to waters of the State in accordance with the *Habitat Mitigation and Monitoring Plan* (HMMP), as revised on June 25, 2020, and incorporated herein by reference.

6. If restoration of temporary impacts to waters of the State is not completed within one year of the impacts, additional compensatory mitigation shall be required to offset temporal loss of waters of the State.

Monitoring and Reporting

7. The Permittee shall input Project information to *EcoAtlas* within 14 days from the date of this Order, consistent with Finding **IV**. The Project information shall be added to

the *Project Tracker* tool in *EcoAtlas* online at https://ptrack.ecoatlas.org. Instructions for adding information to *EcoAtlas* are available at https://ptrack.ecoatlas.org/instructions, or by contacting the San Francisco Estuary Institute by email at ptrackadmin@sfei.org, or the Water Board case manager listed on the cover page of this Order. The Executive Officer may grant an extension to the 14-day deadline if the Permittee submits a request in writing to the Water Board case manager listed on the cover page of this Order. The extension request may be submitted via electronic mail.

8. The Permittee shall submit an Annual Project Status Report each year by January 31 commencing the calendar year after issuance of this Certification. The Report shall reference CIWQS Place ID 857558 and state whether Project construction activities have been initiated or delayed. Annual reporting shall continue until a Notice of Project Construction Completion is received (see Condition 9 below).

9. No later than 30 days after completing Project construction activities, the Permittee shall submit, acceptable to the Executive Officer, a Notice of Project Construction Completion. The Notice shall include the date Project construction activities (defined as construction of both the Project and any compensatory mitigation) were completed and reference CIWQS Place ID 857558. The Notice shall be sent via email to RB2-401Reports@waterboards.ca.gov, or by mail to the attention of 401 Certifications Reports (see address on the letterhead).

10. To verify Project success, monitoring shall be conducted in accordance with the HMMP as revised on June 25, 2020. This includes monitoring restored tidal/seasonal wetland hydrology, geomorphology, and revegetation for a minimum of 5 years and progress towards meeting performance criteria shall be reported in year 2, 3, and 5.

    Hydrology

    Tidal Marsh: Water-depth data loggers shall be installed in the main northern tidal channel, the secondary tidal channel, and two within the tidal marsh plain to monitor hydrology throughout the restored tidal marsh area. Each year, the hydrographs and tidal datums shall be compared between the data logger locations and the performance criterion shall be mean higher high water (MHHW) recorded in the tidal marsh is within 0.3 feet of MHHW within the main northern tidal channel.

    Seasonal Wetland: Soils in the restored seasonal wetland shall be inundated or saturated within 12-inches of the soil surface for at least 14 consecutive days each year.

    Geomorphology

    Tidal Marsh: Following Project completion, as-built conditions shall be documented with a bathymetry and LiDAR survey of the Project area and northern drainage channel. Each monitoring year, baseline topography shall be documented using low altitude, high resolution imagery to be compared to as-built conditions and previous years. Visual inspections shall also be conducted to photograph and identify any signs of erosion/sedimentation. The performance criteria shall be no significant erosion or sedimentation that is impacting habitat quality and no erosion that is threatening to expose buried soils that are unsuitable for wetland surfaces.

Vegetation

Tidal Marsh: One year following planting, vegetation data collection shall begin and shall consist of percent cover and percent survival of plantings, native species recruitment, invasive species ranked "High" by the California Invasive Plant Council (Cal-IPC), and invasive/hybrid *Spartina*. Performance criteria for low marsh, high marsh, and transition zone plantings are as follows:

Year 2: Low marsh shall have 10 percent native cover or greater; High marsh shall have 15 percent native cover or greater; Native shrub survival within the transition zone shall be 90 percent or more;

Year 3: Low marsh shall have 15 percent native cover or greater; High marsh shall have 23 percent native cover or greater; Native shrub survival within the transition zone shall be 80 percent or more;

Year 5: Low marsh shall have 25 percent native cover or greater; High marsh shall have 50 percent native cover or greater; Native shrub survival within the transition zone shall be 80 percent or more;

All Years: No more than 5 percent cover of invasive plants ranked "High" by Cal-IPC;

Seasonal Wetland: Seasonal wetlands existing on site that will not be disturbed by the Project will be used as a reference site to compare wetland vegetation success. Performance criteria are as follows:

Year 1: Relative native plant cover within the restored seasonal wetland shall be 40 percent or greater than total plant cover in the reference seasonal wetland;

Year 2: Relative native plant cover within the restored seasonal wetland shall be 50 percent or greater than total plant cover in the reference seasonal wetland;

Year 3: Relative native plant cover within the restored seasonal wetland shall be 60 percent or greater than total plant cover in the reference seasonal wetland;

Year 5: Relative native plant cover within the restored seasonal wetland shall be 100 percent or greater than total plant cover in the reference seasonal wetland;

All Years: No more than 5 percent cover of invasive plants ranked "High" by Cal-IPC;

Wetland Verification: In year 5, both the restored tidal marsh and the seasonal wetland shall have a protocol level wetland delineation completed to verify the boundaries of wetlands and non-wetland waters. The performance criteria shall be, at the minimum, four acres of tidal marsh have been successfully established and 0.28 acres of seasonal wetland have been successfully established.

11. The Permittee shall submit annual monitoring reports, acceptable to the Executive Officer, by January 31 following each monitoring year with the first monitoring year commencing the calendar year after completing the Project. Each annual report shall summarize each year's monitoring results, including the need for, and implementation of, any remedial actions to help

meet the performance criteria. The annual reports shall compare data to previous monitoring years and describe progress towards meeting final performance criteria.

12. The final monitoring report shall document if the site meets the final performance criteria. If the final criteria are not met, the Permittee shall, in consultation with the appropriate agencies, identify remedial measures to be undertaken, including extension of the monitoring and reporting period until the criteria are met. The Permittee shall implement all remedial measures identified upon receiving written acceptance by the Executive Officer. Success of the mitigation program shall be determined by, and acceptable to, the Water Board Executive Officer.

13. Annual monitoring reports shall reference CIWQS Place ID 857558 and shall be submitted via email to RB2-401Reports@waterboards.ca.gov, or by mail to the attention of 401 Certifications Reports (see the address on the letterhead).

14. Within 30 days of successfully establishing the Project's compensatory mitigation, the Permittee shall submit, acceptable to the Executive Officer, a Notice of Mitigation Monitoring Completion notifying the Water Board that mitigation has been completed. The Notice shall be submitted via email to RB2-401Reports@waterboards.ca.gov, or by mail to the attention of 401 Certifications Reports. This notification shall include the date compensatory mitigation was completed, the Project Name, and CIWQS Place ID 857558.

Administrative

15. The Permittee shall grant Water Board staff or an authorized representative, upon presentation of credentials and other documents as may be required by law, permission to: (1) enter upon the Project site or compensatory mitigation site(s) where a regulated facility or activity is located or conducted, or where records are kept; (2) have access to and copy any records that are kept and are relevant to the Project or the requirements of this Order; (3) inspect any facilities, equipment, practices, or operations regulated or required under this Order; and (4) sample or monitor for the purposes of assuring Order compliance.

16. A copy of this Order shall be provided to any consultants, contractors, and subcontractors working on the Project. Copies of this Order shall remain at the Project site for the duration of this Order. The Permittee shall be responsible for work conducted by its consultants, contractors, and any subcontractors.

17. The Permittee shall provide a signed and dated notification to the Water Board of any change in ownership or interest in ownership of the Project area at least 10 days prior to the transfer of ownership. The purchaser shall also submit a written request to the Water Board to be named as the permittee in an amended order. Until such time as this Order has been modified to name the purchaser as the permittee, the Permittee shall continue to be responsible for all requirements set forth in this Order.

General Compliance

18. The Permittee shall notify the Water Board of any event causing a violation of compliance with water quality standards as soon as practicable (ideally within 24 hours). Notification may be via telephone, email, delivered written notice, or other verifiable means.

19. Failure to implement the Project as proposed is a violation of this Order. Violation of this Order is a violation of state law and is subject to administrative civil liability pursuant to California

Water Code (CWC section 13350. Failure to meet any condition of this Order shall constitute a violation of the Porter-Cologne Water Quality Control Act and the Clean Water Act and may subject you to civil liability imposed by the Water Board to a maximum of $5,000 per day of violation or $10 for each gallon of waste discharged in violation of this Order.

20. In response to a suspected violation of any condition of this Order, the Water Board may require the Permittee to furnish, under penalty of perjury, any technical or monitoring reports the Water Board deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports.

21. Should new information come to our attention that indicates a water quality problem with this Project, the Water Board may issue Waste Discharge Requirements pursuant to California Code of Regulation title 23 (23 CCR) section 3857.

22. This Order shall continue to have full force and effect regardless of the expiration or revocation of any federal license or permit issued for the Project.

Standard Conditions

23. This Order is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to CWC section 13330 and 23 CCR 3867.

24. This Order is not intended and shall not be construed to apply to any activity involving a hydroelectric facility and requiring a FERC license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to 23 CCR Subsection 3855(b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

Fees

25. In accordance with 23 CCR section 2200, the Permittee shall pay an annual fee to the Water Board each fiscal year (July 1 – June 30) until Project construction activities are completed and an acceptable Notice of Project Construction Completion is received by the Water Board. If monitoring is required, the Permittee shall pay an annual fee to the Water Board until monitoring activities are completed and an acceptable Notice of Mitigation Monitoring Completion is received by the Water Board.

26. This Order is conditioned upon total payment of the full fees, including annual fees, required in State regulations (23 CCR sections 2200(a)(3) and 3833(b)(3)) and owed by the Permittee. The Application fee for this Project, $6.665, was paid in full on June 5, 2019, and was calculated as Category A – Fill & Excavation Discharges with the dredge and fill fee calculator.

I, Michael Montgomery, Executive Officer, do hereby issue this Order certifying that any discharge from the proposed Project will comply with the applicable provisions of sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Clean Water Act, and with other applicable requirements of State law. This discharge is also regulated under State Water Resources Control Board Order No. 2003-0017-

DWQ, “General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification,” which requires compliance with all conditions of this Order.

If you have any questions concerning this Order, please contact Nicole Fairley of my staff at (510) 622-2424 or nicole.fairley@waterboards.ca.gov.

for Michael Montgomery
Executive Officer

Cc: SWRCB, DWQ, Stateboard401@waterboards.ca.gov
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