LIVE OAK POINT LIVING SHORELINES

2023 (Fall) Project and Reference Site Monitoring Report

USACE Permit No.:	SAJ-2011-00287
FDEP Permit No.:	0387876-001-EI-66
Permittee:	Northwest Florida Water Management District 81 Water Management Drive Havana, FL 32333-4712 POC: Robert Lide (robertlide@nwfwater.com)
Entity Conducting Monitoring: (Vegetation Only)	Choctawhatchee Basin Alliance of Northwest Florida State College 109 South Greenway Trail Santa Rosa Beach, FL 32459-5415 POC: Rachel Gwin (gwinr@nwfsc.edu)
Project Location:	Live Oak Point Salt Marsh 30.43° North, -86.25° West (Project Site) 30.42° North, -86.27° West (Reference Site) Approximately 2 ½ Miles NW of Santa Rosa Beach Walton County, Florida

Contents

Synopsis

Live Oak Point contains the largest salt marsh system (approximately 1,000 acres) in Choctawhatchee Bay. However, its ecological integrity and long-term survival is threatened by ongoing erosion and shoreline retreat. Analysis of historic aerials indicates that, since 1941, the salt marsh has retreated up to 300 FT along the northern edge. In situ measurements and analysis of recent digital orthophoto quads (DOQs) show that, prior to construction of breakwaters in 2021 – 2022, shoreline retreat averaged >4 FT per year.

The objectives of the Live Oak Point Living Shorelines project are 1) halting loss of salt marsh habitat at Live Oak Point, 2) restoring salt marsh habitat in a strip parallel to the current shoreline protected by limerock breakwaters, and 3) enhancing existing salt marsh habitat via improved buffers. To achieve these objectives, a living shoreline is being implemented along the northern edge of the Live Oak Point salt marsh.[1] Initial observations strongly suggest that, where breakwaters have been constructed, trajectories have been established that will result in all objectives being achieved.

New construction of approximately 3,440 FT of limerock breakwaters has been implemented at the project site (completed Fall 2022). Plantings of salt marsh vegetation (*Spartina patens, Juncus roemarianus, Spartina alterniflora*) have been implemented along approximately 1,000 FT of shoreline, with additional plantings scheduled for Spring 2024. Barring unforeseen events (e.g., major storms; lack of available plants), full completion of this project is anticipated in 2024.

The Live Oak Point Living Shorelines project is a component of the Northwest Florida Water Management District (NWFWMD) In-Lieu Fee (ILF) mitigation program (USACE Permit SAJ-2011-00287) and will generate, upon full completion, 2.61 estuarine mitigation credits for use by the Florida Department of Transportation (FDOT).

This 2023 (Fall) Project and Reference Site Monitoring Report has been developed to comply with federal and state monitoring requirements. It is the fifth monitoring report for the reference site, the other four monitoring events having been conducted in Fall 2021, Spring 2022, Fall 2022, and Spring 2023. It is the first monitoring report for the project area (monitoring of the project area, as planned, commenced after breakwater construction was completed and substantial planting of salt marsh vegetation had occurred). Parameters for the Fall 2023 project and reference site monitoring are vegetation cover, sediment accretion, panoramic and general photo documentation. The reference site has similar geomorphology, tidal range, elevations, and vegetation community structure when compared with the project site (the reference site is located approximately 3,000 FT southwest of the project site).

[1] The NWFWMD has contracted with the Choctawhatchee Basin Alliance of Northwest Florida State College (CBA) to implement the Live Oak Point Living Shorelines project. Breakwaters were constructed 2021 – 2022. Planting of marsh species is anticipated to be completed in 2024.

Results of the Fall 2023 vegetation monitoring indicate strong similarity between the project site and the reference site (at both sites, the low marsh is dominated by *Spartina alterniflora*, the mid marsh is dominated by *Spartina patens*, and the high marsh is dominated by *Juncus roemerianus*). At the project site, sediment is generally accumulating behind the newly constructed breakwaters, with *Spartina alterniflora* expanding in places. Oyster colonies are rapidly becoming established on the breakwaters and submerged aquatic vegetation (SAV), primarily *Halodule* spp., has moved in behind breakwaters. Planted vegetation has generally done well where protected by breakwaters, though some planted vegetation has washed out where breakwaters were not constructed due to SAV-avoidance concerns (corrective measures are being investigated such as coir logs, coconut matting, or construction of additional breakwater with measures taken to avoid SAV impacts).

All monitoring reports for the Live Oak Point Living Shorelines project site and reference site are posted at https://www.nwfwater.com/Water-Resources/Regional-Wetland-Mitigation-Program/Regional-Mitigation-Plan/NWFWMD-Mitigation-Sites/Choctawhatchee-Watershed-Mitigation-Sites/Live-Oak-Peninsula-ILF/Living-Shorelines or any successor website.

Figure 1. Fall 2023 Monitoring Overview

Figure 2. Fall 2023 Project Site Monitoring

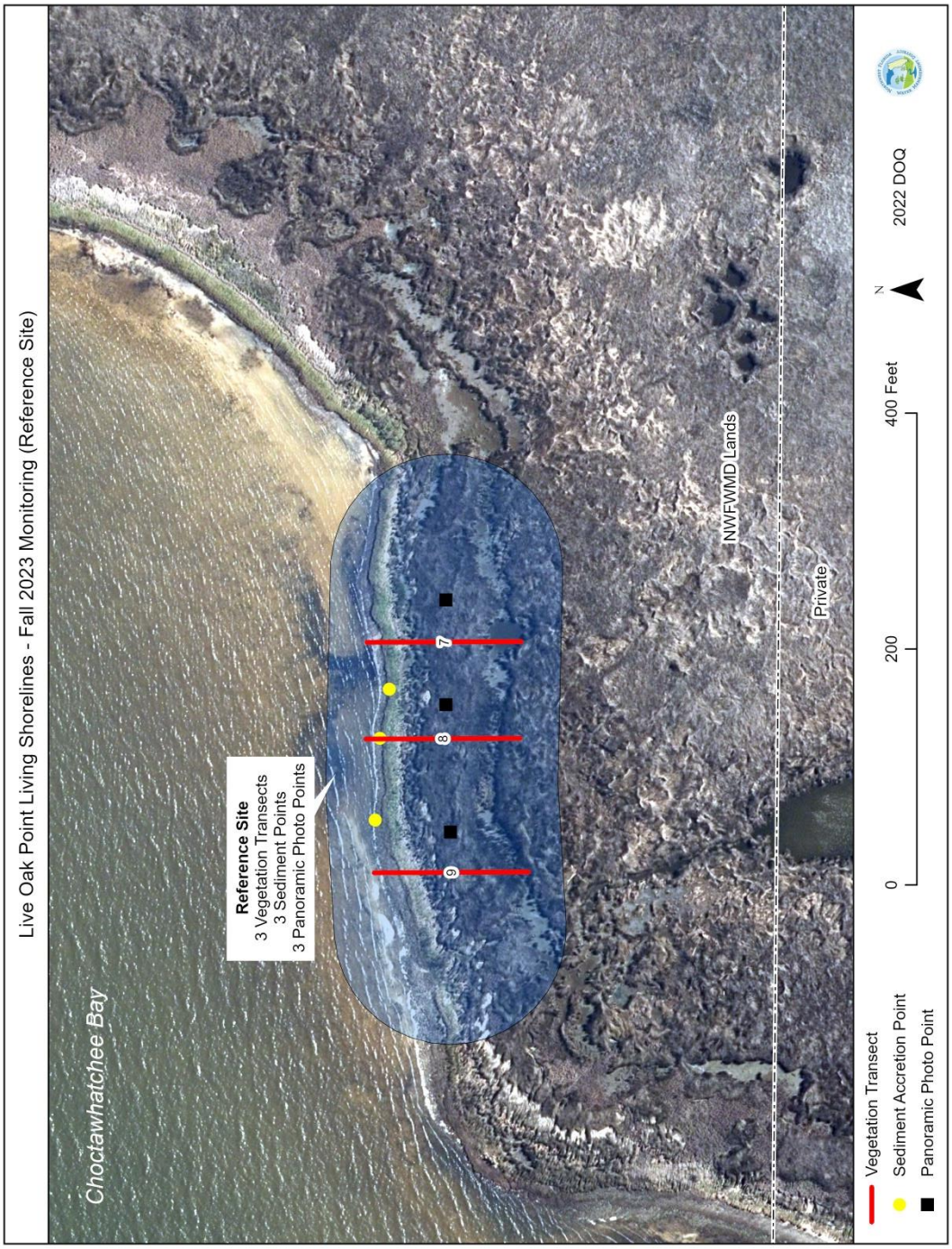

Figure 3. Fall 2023 Reference Site Monitoring

Vegetation Monitoring

Vegetation cover at the project site and reference site was quantitatively measured on 10/30/2023 using a modified Daubenmire method.[2] Three (3) transects of variable length were established in the reference area and six (6) transects of variable length were established in the project area. Each transect began in the low marsh and extended into the high marsh. Twelve (12) 0.5-meter square ($0.25m^2$) quadrats were sampled along each transect. Four (4) quadrats were located in the low marsh, four (4) in the mid marsh, and four (4) in the high marsh. All plant species were identified in each quadrat. Percent cover of vegetation by species and bare ground was visually estimated.

No exotic or invasive plants were present in any transect. Data collected on 10/30/2023 indicate that, at both the project site and reference site, the low marsh is dominated by *Spartina alterniflora*, the mid marsh by *Spartina patens*, and the high marsh by *Juncus roemerianus*.

Average percent cover of live vegetation (derived from vegetation transects) for the low marsh was 53% at the project site compared with 54% for the reference site; for the mid marsh was 70% at the project site compared with 83% for the reference site; and for the high marsh was 64% at the project site compared with 86% for the reference site.

Table 1. Percent Cover of Vegetation (Fall 2023; Project Site versus Reference Site)

		Project Site	**Reference Site**
Low Marsh	Live Vegetation	53%	54%
	Bare Ground / Duff / Dead Vegetation	47%	46%
Mid Marsh	Live Vegetation	70%	83%
	Bare Ground / Duff / Dead Vegetation	30%	17%
High Marsh	Live Vegetation	64%	86%
	Bare Ground / Duff / Dead Vegetation	36%	14%

[2] Daubenmire, Rexford. 1959. A Canopy-coverage method of vegetational analysis. Northwest Science 33:43-64.

Simpson's Diversity Index ($D = 1 - \sum (P)^2$; where P = percent cover for a given species)[3] was 0.71 for the project site and 0.72 for the reference site, indicating strong similarity between the sites.[4]

Table 2. Simpson's Diversity Index

Species	**Project Site**		**Reference Site**	
	Percent Cover (P)	**P^2**	**Percent Cover (P)**	**P^2**
Juncus roemerianus (Needle Rush)	0.3760	0.1414	0.3180	0.1011
Spartina alterniflora (Smooth Cordgrass)	0.2906	0.0844	0.3009	0.0905
Spartina patens (Saltmeadow Cordgrass)	0.2437	0.0594	0.2640	0.0697
Distichlis spicata (Saltbush)	0.0897	0.0080	0.1171	0.0137
Total	1.0000	0.2932	1.0000	0.2750
Simpson's Diversity Index $(D) = 1 - \sum (P)^2$	0.71		0.72	

[3] Simpson, E.H. 1949. Measurement of Diversity. Nature, 163:688.

[4] Percent cover of bare ground, duff, and dead vegetation excluded from Simpson's Diversity Index calculations.

Sorensen's Similarity Index (SI = 2C / A + B; where A = the number of species at the project site, B = the number of species at the reference site, and C = the number of species common to both sites)[5] was 1.0.

Table 3. Sorensen's Similarity Index (Fall 2023; Project Site and Reference Site)

A = Number of Species at Project Site	4
B = Number of Species at Reference Site	4
C = Number of Species in Common Between Project Site and Reference Site	4
Sorensen's Similarity Index (SI) = 2C / (A + B) = 2(4) / (4 + 4) = 8 / 8 = 1.0	

[5] Sorensen, T. 1948. A method of establishing groups of equal amplitude in plant sociology based on similarity of species and its application to analyses of the vegetation on Danish commons. Kongelige Danske Videnskabernes Selskab. 5 (4): 1–34.

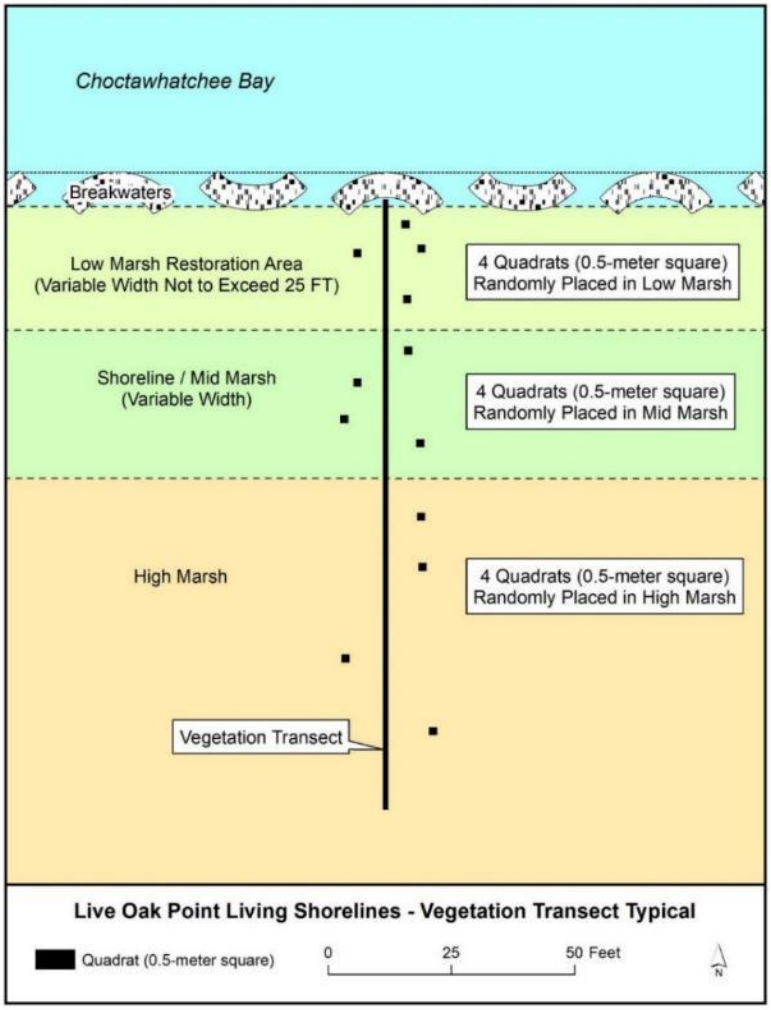

Figure 4. Vegetation Transect Sampling Design (Breakwaters Not Present at Reference Site)

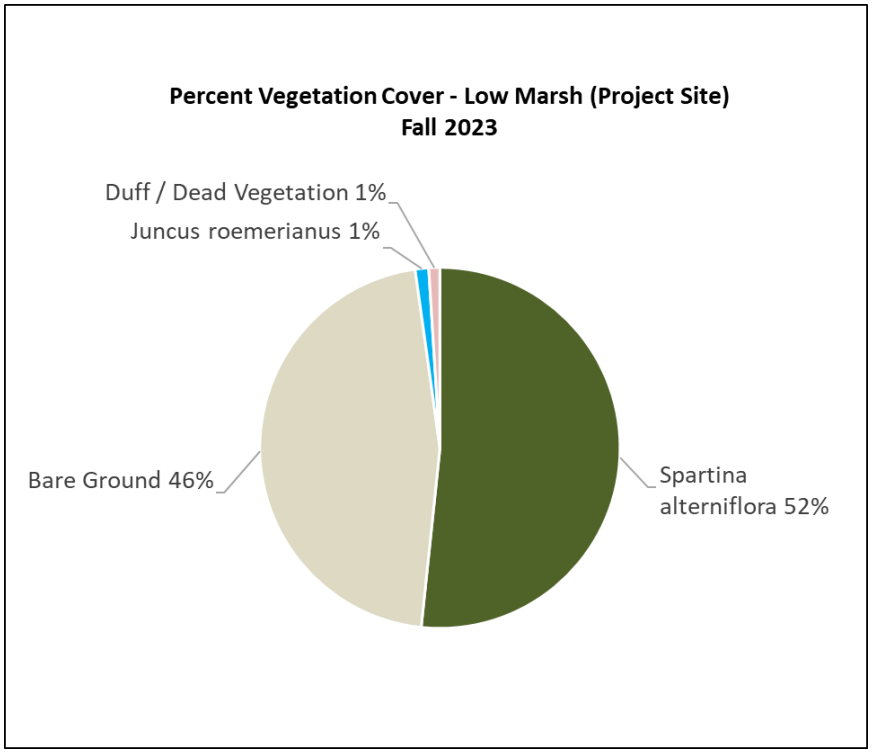

Figure 5. Project Site Low Marsh Vegetation (Average of Transects T1 - T6)

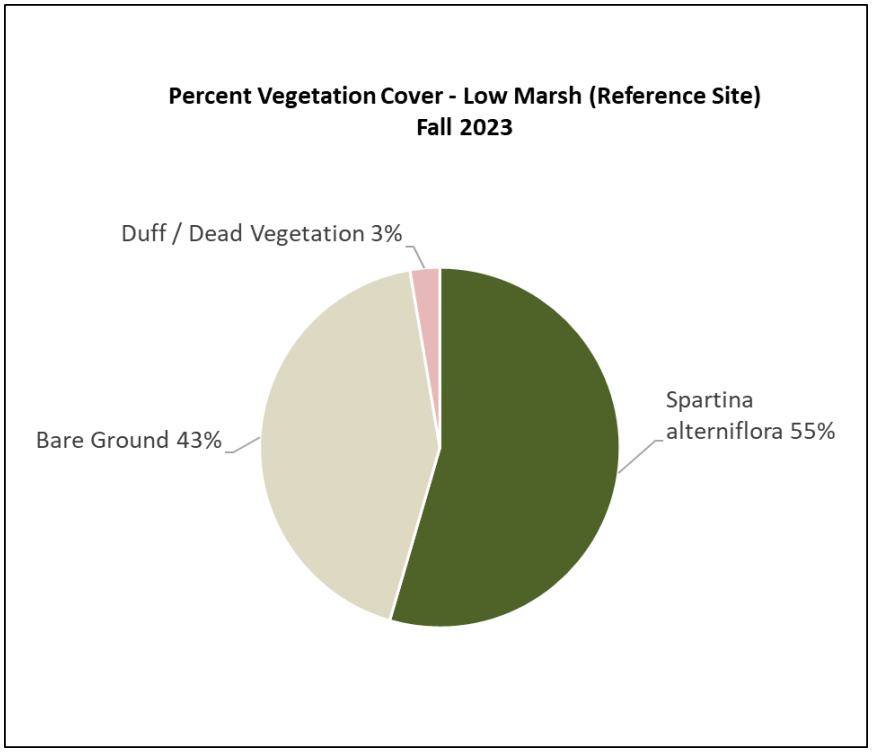

Figure 6. Reference Site Low Marsh Vegetation (Average of Transects T7 - T9)

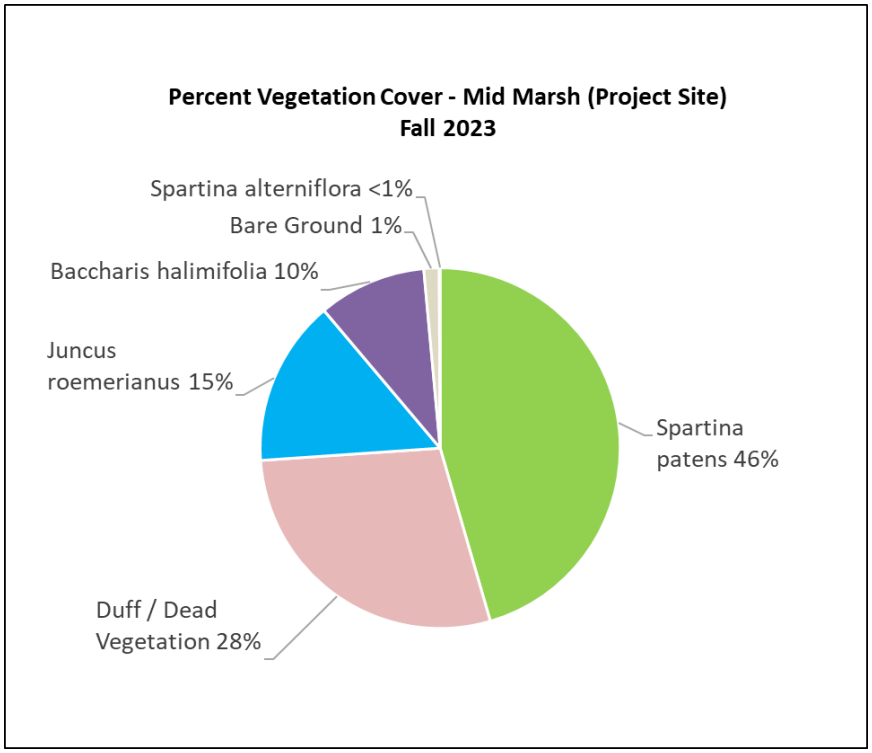

Figure 7. Project Site Mid Marsh Vegetation (Average of Transects T1 - T6)

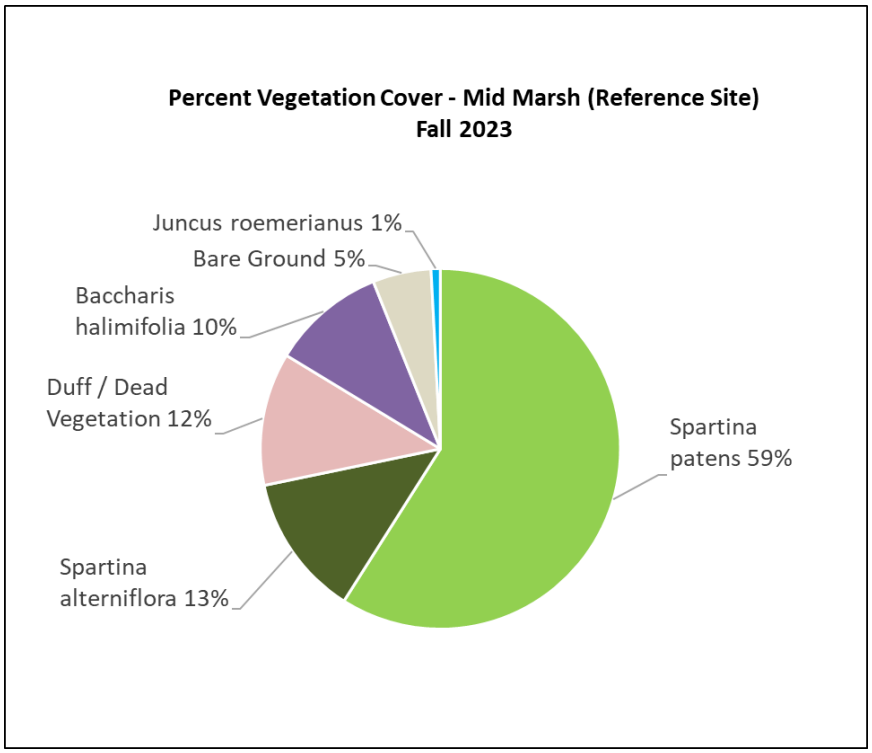

Figure 8. Reference Site Mid Marsh Vegetation (Average of Transects T7 - T9)

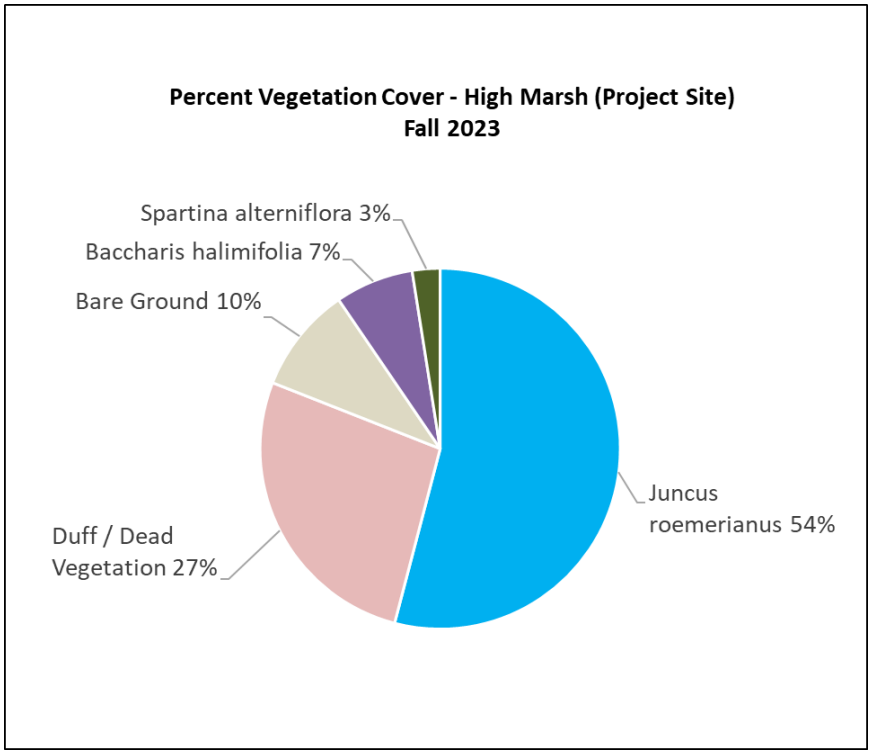

Figure 9. Project Site High Marsh Vegetation (Average of Transects T1 - T6)

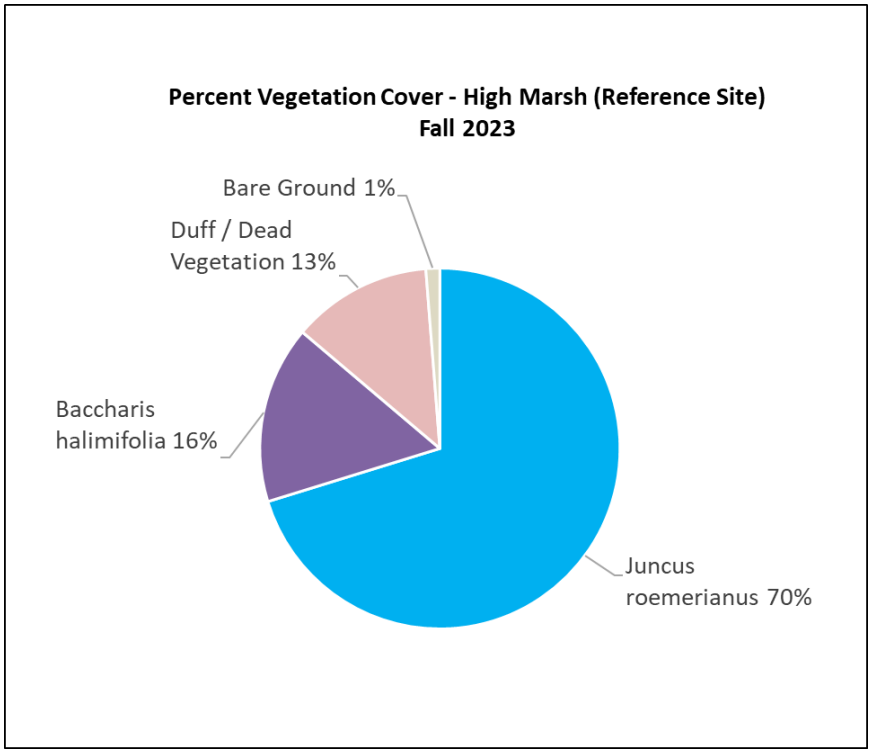

Figure 10. Reference Site High Marsh Vegetation (Average of Transects T7 - T9)

Table 4. Reference Site and Project Site Vegetation (Fall 2023) by Marsh Zone*

Species	Project Site			Reference Site		
	Low Marsh	**Mid Marsh**	**High Marsh**	**Low Marsh**	**Mid Marsh**	**High Marsh**
Baccharis halimifolia (Saltbush)	0%	10%	7%	0%	10%	16%
Bare Ground	46%	1%	10%	43%	5%	1%
Duff / Dead Vegetation	1%	28%	27%	3%	12%	13%
Juncus roemerianus (Needle Rush)	1%	15%	54%	0%	1%	70%
Spartina alterniflora (Smooth Cordgrass)	52%	<1%	3%	55%	13%	0%
Spartina patens (Saltmeadow Cordgrass)	0%	46%	0%	0%	59%	0%

*Due to rounding, percentages may not sum to precisely 100%.

Sediment Accretion Monitoring

To roughly estimate vertical sediment accretion or decrease in the reference area and project area, fifteen sediment accretion monitoring points have been established with systematic data collection beginning May 2023.[6] Each point, assigned a unique ID of SB1 through SB15, consists of a 4" x 7" concrete paving stone placed, plus or minus, approximately 20 cm below the vegetated ground surface. Measurements are made by inserting a thin metal rod into the ground until it makes contact with the buried paving stone, retracting the rod, and then measuring the rod against a meter stick. Although data collected to date, at face value, indicate a slight decline in ground surface level at both the reference site and project site (~10 mm per year on average at the reference site; ~12 mm per year on average at the project site), visual observations suggest that vertical erosion is not occurring and that in all probability some slight settling of soil (post-burial of the paving stone) is instead occurring. Trends are expected to become apparent over time and with additional measurements. Sea level rise for the Panama City area has been estimated by National Oceanic and Atmospheric Administration area at 2.91 mm per year.[7] Data collected at SB1 through SB15 will be used to establish sediment accretion trends for comparison with estimated sea level rise.

[6] Earlier attempts at measuring sediment accretion either washed out or were vandalized.
[7] Station 8729108 Panama City, Florida; Relative Sea Level Trend; ±0.58 mm per year; 1973 to 2021.

Table 5. Vertical Sediment Accretion Monitoring

		Average Depth Below Ground Surface (cm)					
Site	**Point**	**4 MAY 2023** (Julian Date) 2460068	**18 MAY 2023** (Julian Date) 2460082	**21 JLY 2023** (Julian Date) 2460146	**18 OCT 2023** (Julian Date) 2460235	**Change in Ground Surface Elevation (cm)**	**Annualized Rate of Change (mm/yr)**
Reference Site	SB-1	17.1	15.8	16.6	17.4	0.3	6.56
	SB-2B	-	19.0	18.0	18.1	-0.9	-18.94
	SB-3B	-	18.1	17.2	17.3	-0.8	-18.21
					Reference Site Average:	-0.5	-10.20
Project Site	SB-4	21.2	-	21.4	21.1	-0.1	-3.28
	SB-5*	20.7	-	19.4	17.6	-3.1	-68.12
	SB-6	17.3	-	16.9	16.8	-0.5	-11.29
	SB-7	19.9	-	19.2	19.8	-0.1	-2.19
	SB-8	24.5	-	24.1	23.8	-0.7	-14.21
	SB-9*	11.6	-	6.9	2.8	-8.7	-190.51
	SB-10	27.0	-	27.2	25.7	-1.4	-29.51
	SB-11	17.7	-	17.4	16.3	-1.4	-30.96
	SB-12	8.3	-	10.0	8.5	0.2	4.01
	SB-13*	12.7	-	12.7	11.0	-1.8	-38.61
	SB-14	15.0	-	14.9	14.5	-0.5	-9.84
	SB-15	11.2	-	10.9	10.8	-0.4	-8.01
					Project Site Average:	-1.5	-33.54
					Project Site Average (Excluding SB-5, SB-9, and SB-13):	-0.5	-11.70

*Located at marsh/water interface and strongly affected by wave action.

Panoramic Photo Monitoring

Project Site Photo Photos

Figure 11. Project Site Photo Point T1 Looking East – 10/18/2023

Figure 12. Project Site Photo Point T1 Looking West – 10/18/2023

Figure 13. Project Site Photo Point T2 Looking East – 10/18/2023

Figure 14. Project Site Photo Point T2 Looking West – 10/18/2023

Figure 15. Project Site Photo Point T3 Looking East – 10/18/2023

Figure 16. Project Site Photo Point T3 Looking West – 10/18/2023

Figure 17. Project Site Photo Point T4 Looking East – 10/18/2023

Figure 18. Project Site Photo Point T4 Looking West – 10/18/2023

Figure 19. Project Site Photo Point T5 Looking East – 10/18/2023

Figure 20. Project Site Photo Point T5 Looking West – 10/18/2023

Figure 21. Project Site Photo Point T6 Looking East – 10/20/203

Figure 22. Project Site Photo Point T6 Looking West – 10/18/2023

Reference Site Photos

Figure 23. Reference Site Photo Point T7 Looking East – 10/18/2023

Figure 24. Reference Site Photo Point T7 Looking West – 10/18/2023

Figure 25. Reference Site Photo Point T8 Looking East – 10/18/2023

Figure 26. Reference Site Photo Point T8 Looking West – 10/18/2023

Figure 27. Reference Site Photo Point T9 Looking East – 10/18/2023

Figure 28. Reference Site Photo Point T9 Looking West – 10/18/2023

Other Photo Documentation

Figure 29. Installation of Sediment Accretion Monitoring Point

Figure 30. Example of Sediment Accretion Monitoring Point Location

Figure 31. Oyster Colonization on Breakwater

Figure 32. Sediment Accumulation and SAV Behind Constructed Breakwaters

Figure 33. Expansion of *Spartina alterniflora*

Figure 34. Expansion of *Spartina alterniflora*

Figure 35. Planting of Marsh Vegetation

Figure 36. Established Marsh Plantings