APPENDIX D-3
ENVIRONMENTAL SURVEY REPORTS

MT. SINAI MEDICAL CENTER, CONTINUTING AUTHORITIES PROGRAM (CAP) SECTION 14, PROJECT

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

September 2016

US Army Corps of Engineers
Jacksonville District

Mount Sinai CAP 14 Project
Seagrass, Coral, and Upland Tree Surveys

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INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Jacksonville District, is proposing to replace a 3,500-foot long bulkhead along the westward shoreline of Biscayne Bay. The bulkhead protects the shoreline of Mt. Sinai Medical Center located at 4300 Alton Road, Miami, Florida. Damage and wear to the bulkhead have rendered the structure unfit to protect the shoreline in the event of a severe weather event. Coastal Eco Group, Inc. (CEG) was contracted by GRB Environmental Services, Inc. (GRB) to collect, analyze, and report field data necessary to assess impacts to hardbottom and seagrass resources associated with the proposed bulkhead replacement. The three survey tasks in the scope of work were: 1) Encrusting Organism/Scleractinian Coral Survey; 2) Seagrass Survey; and 3) Upland Tree Survey.

METHODS

The CEG field team consisted of certified scientific SCUBA divers/marine scientists with extensive experience in coral identification, hardbottom characterization, and seagrass monitoring and mapping. The encrusting organism survey of the bulkhead was conducted on May 2, 2016, and the seagrass survey was conducted on 8 days between May 2 and June 2, 2016 due to several inclement weather days. Seventy transects were established in 50-ft. increments along the 3,500-ft (1,067 m) length of the bulkhead. The transects were created in ArcGIS 10.2 and located in the field using a handheld Trimble XH Differential GPS (DGPS) with decimeter accuracy. Transects were set from north (Transect 1) to south (Transect 70) (**Figure 1**). Each transect was marked with a wooden survey stake at the top of the bulkhead; the transect number was written on the stake for reference. Because the original coordinates for each transect were created in ArcGIS using aerial imagery, transect locations were adjusted in the field to correspond with the edge of the bulkhead. DGPS coordinates were collected in the field during installation of the transect stakes. The survey area is shown on the NOAA bathymetry map in **Figure 2**.

The encrusting organism transects were located vertically along the bulkhead from the stake to the bay bottom. At each stake, the seagrass transects began at the base of the bulkhead and extended waterward of the bulkhead for a maximum distance of 400 ft.

A survey of upland trees located immediately adjacent to the bulkhead was conducted by GRB staff on May 2 and 3, 2016.

Encrusting Organism/Scleractinian Coral Survey

The purpose of the survey was to determine the number of corals ≥ 10 cm that will potentially be relocated to an alternative location and to determine the number of corals < 10 cm that would be impacted by bulkhead replacement.

The total scleractinian coral transect survey area was 70 sq. m (70 transects, each 1 m in width) (**Figure 3**). At each transect, a survey tape was extended from the wooden stake down the length of the bulkhead and weighted on the seafloor. Scientists carried a meter stick to reference the 0.5-m transect width. Transect lengths varied based on exposure of the bulkhead.

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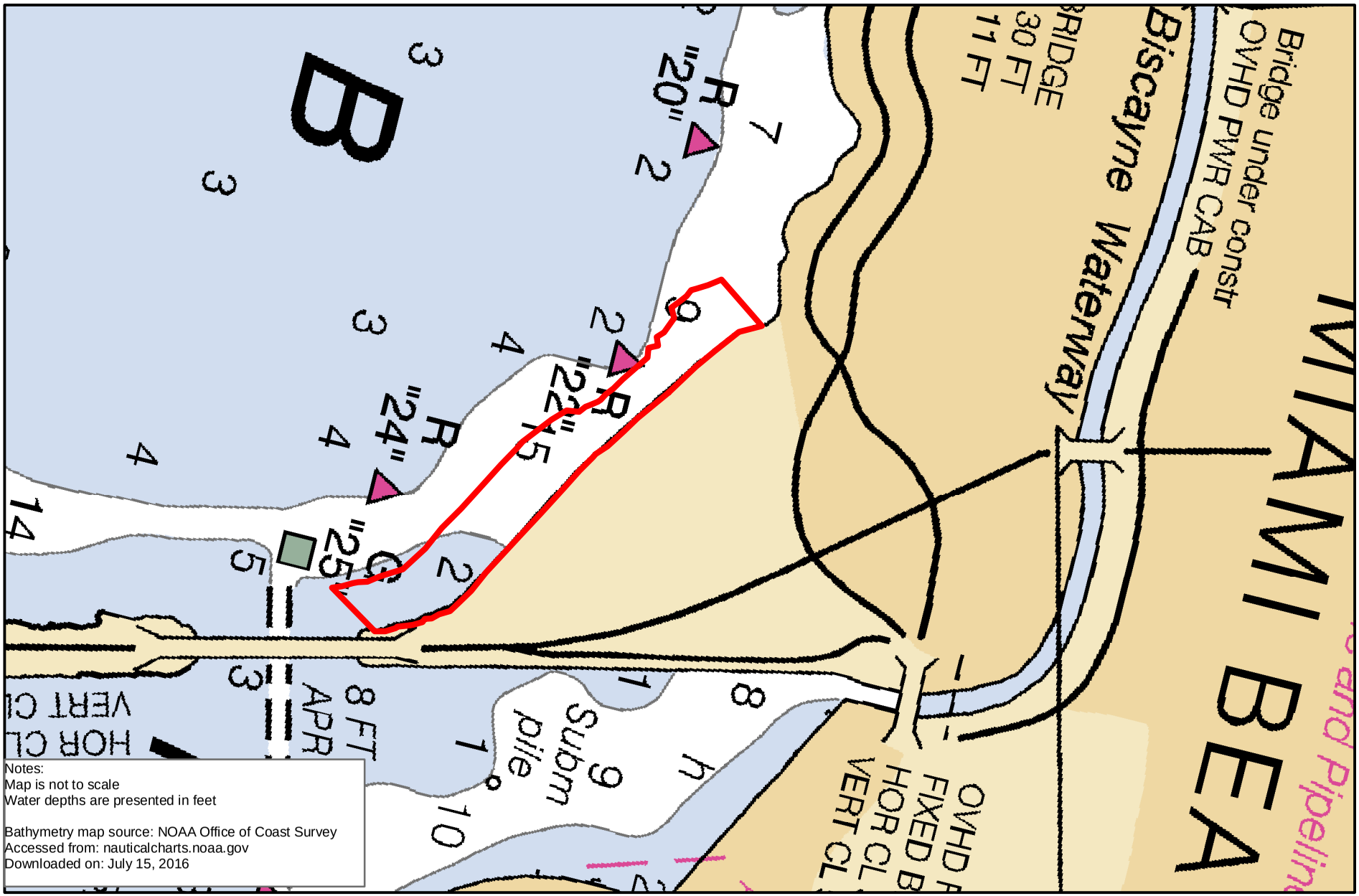
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transect Location Map
Figure 1

Coastal Eco-Group Inc.



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Mt. Sinai Bulkhead Replacement
NOAA Bathymetry Map of Study Area Showing Approximate Seagrass Survey Area Boundary
Figure 2

Coastal Eco-Group Inc.

Seawall Transects with Stony Coral	Stony Coral Species	> 10 cm
T19	*Oculina diffusa*	Yes
T28	*Siderastrea siderea*	No
T29	*Siderastrea siderea*	Yes
T30	*Oculina diffusa*	Yes
T32	*Siderastrea siderea*	No
T33	*Oculina robusta* (A); *Siderastrea* c.f. *siderea* (B)	(A) Yes; (B) No
T34	*Siderastrea siderea*	Yes
T36	*Oculina diffusa*	Yes
T38	*Siderastrea* c.f. *siderea*	No
T39	*Siderastrea siderea*	No

Mt Sinai Hospital Bulkhead Replacement
Vertical Stony Coral Transects
Survey completed on May 2, 2015
Figure 3

Coastal Eco-Group Inc.

Due to shallow water depths at the time of the survey, the coral survey was conducted by snorkeling or wading along the bulkhead. Several of the transects, particularly those along the southern end of the survey area, were located along portions of the bulkhead that are buried by wrack and debris.

The following data were collected for all scleractinian coral colonies ≥ 1 cm in diameter within 0.5 m on either side of the transect line (1-m wide belt):

- Species (to the lowest taxonomic rank possible) including a note if the species is listed as threatened under the Endangered Species Act.
- Colony size, including length (longest axis), width (perpendicular to the longest axis), and height (in the direction of growth)
- Colony orientation (x,y,z)
- Overall health (i.e., presence of disease or bleaching)
- Percent live and dead tissue; and
- General description of the original colony location (i.e., eastern Colonized Habitat-shallow or segments) and depth.

All scleractinian coral colonies were documented with still digital photography (**Appendix A**). A PVC pole with 10-cm increments and slate with a unique identification number were included in each photograph to accurately identify each coral colony. A representative landscape photograph of the encrusting organisms was also collected at each transect (**Appendix B**).

A quantitative encrusting organism survey was conducted at 10 of the 70 transects. The ten transects were located along the bulkhead from Transect 7 to 55 (**Figure 4**). The transects were spaced approximately 350 ft apart from Transect 7 to Transect 49; Transects 49 through 55 were spaced approximately 150 ft intervals due to burial of the bulkhead along the southern extent of the survey area.

Flora and sessile fauna within 0.5 m on either side of the survey tape (1-m wide transect) were characterized by functional group, identified to the lowest possible taxon, and assigned percent cover at each transect. Percent cover was calculated based on a visual assessment of the entire transect defined as 1 m in width by the length of the bulkhead, which ranged from 4.27 ft to 7.51 ft (1.30 m to 2.29 m). Due to the short transect lengths, scientists were able to assess the entire transect area for percent cover. Four of the ten transects (25, 31, 37, and 43) were assessed by dividing the transects into two sections by exposure, either emergent at the time of the survey or submerged, assessing percent cover of functional groups within each section, and then averaging percent cover over the two segments. Functional groups present at the transects were empty space, turf algae, macroalgae, sponge, hydroid, scleractinian coral, tunicate, anemone, fanworm, barnacle, bivalve and limpet.

Seagrass Survey

Seagrass surveys were conducted along the 70 transects to document seagrass presence/absence, species composition, and distribution. The data will be used to determine areas of potential impacts to seagrasses adjacent to the bulkhead. Highly-used navigable waters are located within the boundaries of the survey areas between Transects 10 and 35 (**Figure 1**). Due to safety concerns with diving in and adjacent to these waters, CEG coordinated with GRB and the USACE Project Manager after the first two survey days to discuss shortening transect lengths in this area where the channel markers are closest to the bulkhead. Several of the original 400-ft length transects extended waterward of the channel red day marker. The USACE Project Manager approved shortening these transects by as much as 150 ft to provide a larger buffer from vessel activity. Transect lengths and survey dates are provided in **Tables 1a** through **1c**.

A survey vessel equipped with a Trimble STS461 DGPS and HYPACK navigational software or a Trimble XH DGPS was used to locate each transect in the water. Weighted buoys were used to mark the location of transect reference points. Due to persistently strong currents within the survey area, survey tapes were only used at Transects 1 through 15 to reference distance. At these transects, the dive team weighted the survey tape at the bulkhead and swam the transect using an underwater compass to follow a directional heading of 315° toward the weighted buoy at the end of the transect. At the remaining 55 transects, surface buoys were placed at 50 ft increments along the length of the transect to replace the survey tape.

Marine scientists swam along the transects, noting seagrass cover and species composition; macroalgae cover and composition; and substrate type within a 2-meter wide area centered along the transect. A 2-m PVC pipe was used as a reference for transect width. At Transects 1 to 15, the dive team used the survey tape laid on bottom to record changes in seagrass cover/species along the transect. Survey tapes were replaced with surface buoys at 50-ft intervals for Transects 16 to 70 as described above. Scientists swam each 50 ft segment and recorded habitat type within the segment.

Seagrass occurrence and substrate type along each transect were characterized using a line-intercept assessment. Although the RFQ included point quadrat sampling for seagrass cover, this method was not required pursuant to the USACE responses to questions to the RFQ.

Field data sheets on waterproof paper were attached to clipboards and used to record data at each transect. Percent cover was assessed using the Braun Blanquet (BB) classification system to provide more detailed information on percent cover in comparison to the general classifications in the line-intercept protocol (**Table 2**). A total BB score was determined for all seagrass and macroalgae species present; individual BB scores were then assigned to each seagrass species. The BB scores were used to calculate the more general description of linear extent of bottom type described in the RFQ: seagrass cover < 25%; 25-50%; 50-75%; and > 75%. Percent cover of vegetated and unvegetated bottom type along the transects were calculated by summing the linear extent of each category and dividing by the total length of transect line. Due to the distribution of seagrass abundance throughout the survey area with the greatest

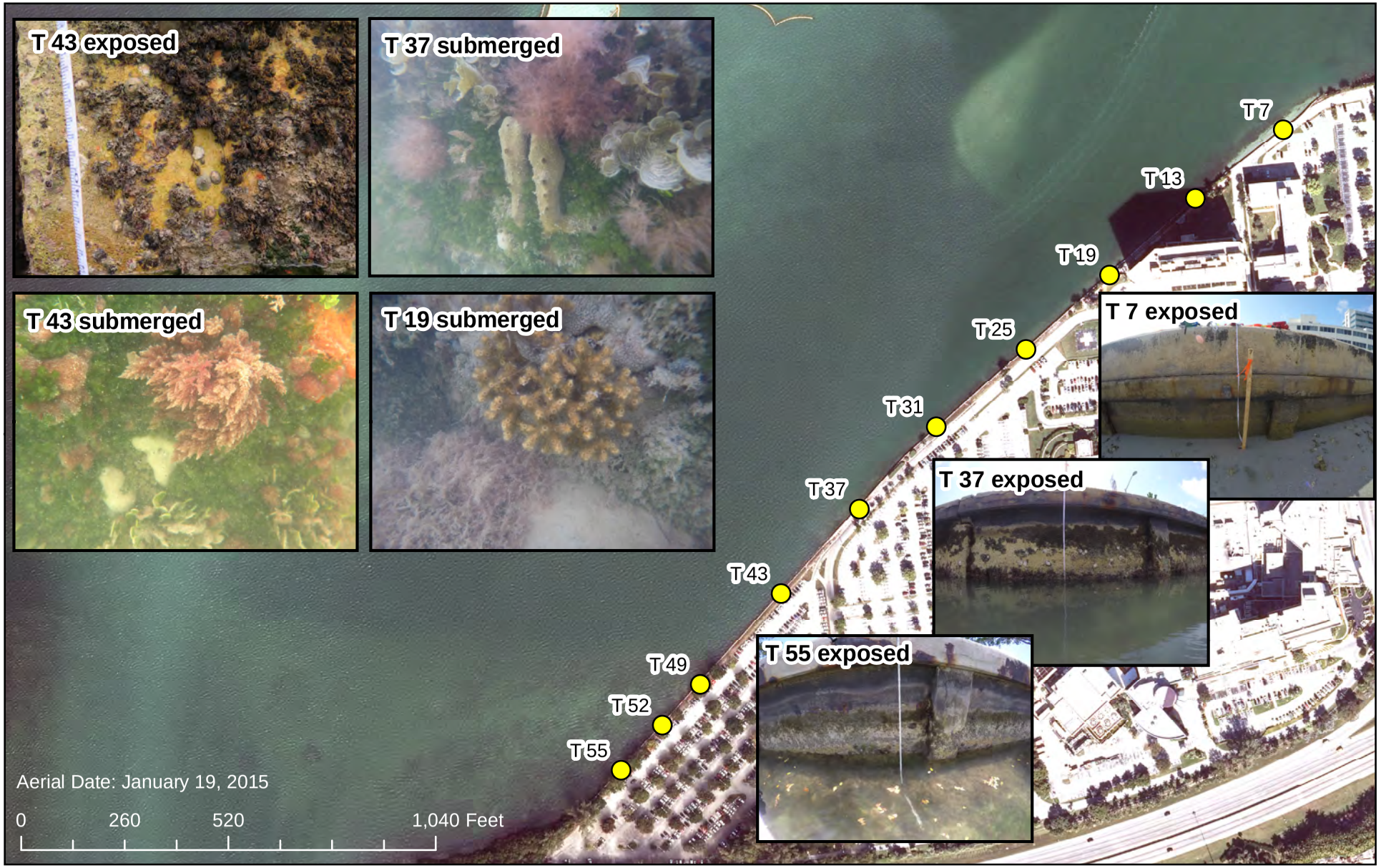
transitions observed within the first 100 ft of the transects, overall mean percent cover of seagrass at each transect is not displayed in this report. Seagrass abundance data are displayed as linear extent and percent cover.

Substrate was characterized as muck, sand, rubble, shell, or any combination thereof. Transects were documented with digital videography using a GoPro HERO 4 HD video camera. Representative photographs throughout the survey area were extracted from the video data and are presented in **Appendix C**. The complete video transect and still photograph library have been provided to the Corps on a portable hard drive.

The seagrass bed edge at each transect was marked with a weighted buoy; coordinates of the landward edge were recorded at all transects. The landward bed edge along the bulkhead was mapped in the field on June 2, 2016; scientists snorkeled along the bed edge and recorded the edge position using a handheld Trimble XH DGPS.

Tree Survey

GRB conducted a survey of a subset of upland trees located behind the bulkhead. The tree survey concentrated on the northern and southern sections of the property behind and adjacent to the bulkhead. The location of each surveyed tree was recorded with a handheld Trimble XH DGPS with decimeter accuracy. Representative photographs were taken for each tree using a Ricoh GPS camera with 1-m accuracy (**Appendix D**); GPS locations of a few trees were determined from photographs taken with the Ricoh camera. Diameter at breast height (DBH) and health of the tree, noting any deflects or disease, were recorded for each tree. Species identifications were verified from the digital still photographs.



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Mt. Sinai Hospital Bulkhead Replacement
Encrusting Organism Vertical Transects Survey
Completed on May 2, 2016
Figure 4

Coastal Eco-Group Inc.

Table 1a. Length of each seagrass transect, coral/encrusting organism transect, and data collected at each transect type

Transect	SAV			CORAL/ENCRUSTING ORGANISMS		
	Seagrass Transect Length (ft)	Survey Date	Data Collected	Coral Transect Length (ft)	Coral/General Encrusting Data Collected	Quantitative Encrusting Data Collected
1	400	5/2/2016	Line Intercept Data for Seagrass Density and Substrate/ Video	4.59	Species, size, location, and overall health of each stony coral colony/ Landscape photos of the encrusting community/ Representative photos of the encrusting community	Percent cover of functional groups, with identification to lowest possible taxon where appropriate
2	400	5/2/2016		4.27		
3	400	5/3/2016		3.94		
4	400	5/3/2016		3.28		
5	400	5/3/2016		6.56		
6	400	5/3/2016		5.25		
7	400	5/3/2016		4.27		
8	400	5/3/2016		3.61		
9	400	5/3/2016		3.61		
10	330	5/5/2016		4.27		
11	313	5/5/2016		3.61		
12	303	5/5/2016		4.92		
13	313	5/5/2016		5.41		
14	257	5/5/2016		5.91		
15	290	5/5/2016		6.23		
16	250	5/20/2016		6.56		
17	250	5/20/2016		6.00		
18	250	5/20/2016		5.91		
19	250	5/20/2016		6.23		
20	250	5/20/2016		6.23		
21	250	5/24/2016		5.58		
22	250	5/24/2016		6.82		
23	250	5/24/2016		6.40		
24	250	5/24/2016		6.69		

Notes: Coral data were collected at all 70 transects; quantitative encrusting data were only collected at the 10 transects highlighted in yellow. Coral and encrusting organism surveys were conducted on May 2, 2016.

Table 1b. Length of each seagrass transect, coral/encrusting organism transect, and data collected at each transect type

Transect	SAV			CORAL/ENCRUSTING ORGANISMS		
	Seagrass Transect Length (ft)	Survey Date	Data Collected	Coral Transect Length (ft)	Coral/General Encrusting Data Collected	Quantitative Encrusting Data Collected
25	250	5/31/2016	Line Intercept Data for Seagrass Density and Substrate/ Video	6.56	Species, size, location, and overall health of each stony coral colony/ Landscape photos of the encrusting community/ Representative photos of the encrusting community	Percent cover of functional groups, with identification to lowest possible taxon where appropriate
26	260	5/24/2016		6.89		
27	280	5/24/2016		6.23		
28	280	5/24/2016		6.56		
29	345	5/24/2016		6.23		
30	300	6/2/2016		5.91		
31	365	5/31/2016		5.91		
32	325	6/2/2016		5.91		
33	350	5/31/2016		5.91		
34	350	6/2/2016		6.23		
35	350	5/31/2016		6.00		
36	400	6/2/2016		5.91		
37	400	5/31/2016		5.58		
38	400	6/2/2016		5.09		
39	400	5/31/2016		5.51		
40	400	6/2/2016		5.28		
41	400	5/31/2016		7.22		
42	400	6/2/2016		7.87		
43	400	6/2/2016		7.51		
44	400	6/2/2016		7.87		
45	400	6/2/2016		7.41		
46	400	6/2/2016		6.89		
47	400	6/2/2016		6.89		

Notes: Coral data were collected at all 70 transects; quantitative encrusting data were only collected at the 10 transects highlighted in yellow. Coral and encrusting organism surveys were conducted on May 2, 2016.

Table 1c. Length of each seagrass transect, coral/encrusting organism transect, and data collected at each transect type

Transect	SAV			CORAL/ENCRUSTING ORGANISMS		
	Seagrass Transect Length (ft)	Survey Date	Data Collected	Coral Transect Length (ft)	Coral/General Encrusting Data Collected	Quantitative Encrusting Data Collected
48	400	6/2/2016	Line Intercept Data for Seagrass Density and Substrate/ Video	6.23	Species, size, location, and overall health of each stony coral colony/ Landscape photos of the encrusting community/ Representative photos of the encrusting community	Percent cover of functional groups, with identification to lowest possible taxon where appropriate
49	400	6/2/2016		5.25		
50	400	6/2/2016		4.92		
51	400	6/2/2016		5.12		
52	400	6/2/2016		4.92		
53	400	6/2/2016		4.76		
54	400	6/2/2016		5.25		
55	400	5/20/2016		5.09		
56	400	5/20/2016		5.25		
57	400	5/16/2016		4.92		
58	400	5/20/2016		4.10		
59	400	5/16/2016		3.12		
60	400	5/16/2016		0.00		
61	400	5/16/2016		0.00		
62	400	5/16/2016		0.00		
63	400	5/16/2016		0.00		
64	400	5/16/2016		0.00		
65	400	5/16/2016		0.00		
66	400	5/16/2016		0.00		
67	400	5/16/2016		0.00		
68	400	5/16/2016		0.00		
69	400	5/20/2016		0.00		
70	400	5/20/2016		4.40		

Notes: Coral data were collected at all 70 transects; quantitative encrusting data were only collected at the 10 transects highlighted in yellow. Coral and encrusting organism surveys were conducted on May 2, 2016.

Table 2. Braun-Blanquet (BB) and line-intercept cover scale for seagrass abundance

Line Intercept Score	Percent Abundance	BB Score	Percent Abundance
0	Seagrass absent	0	Species absent
1	< 25%	0.1	Species represented by a solitary short shoot
2	25-50%	0.5	Species represented by a few short shoots
		1	< 5% cover
3	50-75%	2	5-25% cover
		3	25-50% cover
4	>75%	4	50-75% cover
		5	75-100% cover

GIS Desktop Analysis

Prior to the field survey, a desktop GIS analysis was conducted in ArcGIS 10.2 to create a shapefile of the study area and transect locations along the bulkhead. Seventy 400-ft transects were created at a perpendicular angle along the entire 3,500-ft bulkhead. Nine points were generated along each transect: one at each endpoints and at 50-ft intervals along the transects. These points were used to deploy buoys in the field for distance and location references while scientists collected line intercept data.

Twenty-six transects (26) were shortened to less than 400 ft in length. The navigation channel marker (Red 22) was located approximately 330 ft from the bulkhead around the end of Transects 18 and 19. Transects 10 through 35 were shortened in order to provide a safety buffer from the highly-used navigable channel through the study area.

Transect field data were entered into an Excel spreadsheet, and the lengths from the line intercept survey were used to split each transect line into segments. Once transects were split, seagrass and substrate data for each line segment were imported into the shapefile attribute table. Line intercept attribute data were displayed in a map by symbolizing the cover values with different colors.

To create the seagrass habitat polygon shapefile, a polygon was first delineated around all transects to create the study area. Next, the study area polygon was split into multiple polygons based on habitat type. Habitat types were delineated by interpolating between transect line segments of similar seagrass composition. Each polygon delineated within the project area was then displayed with different colors based on species composition.

RESULTS AND DISCUSSION

Encrusting Organism/Scleractinian Coral Survey

Scleractinian corals were recorded at only 10 of the 70 belt transects on the bulkhead. Nine of the ten transects had only one scleractinian coral colony, and one transect (Transect 33) had two colonies for a total of 11 colonies. The 10 transects with scleractinian corals were generally located at the center of the project area (**Figure 3**). Only four species from two genera were identified. All colonies identified were located within the first 40 cm of the transects from the base of the bulkhead. Six of the 11 colonies were located within the first 15 cm of the transects. **Table 3** provides the location, species, and size data for each scleractinian coral.

Five of the 11 scleractinian coral colonies were < 10 cm in diameter; three were identified as *Siderastrea siderea* and two were identified as *S.* cf. *siderea* (meaning that they were too small to confirm in the field, but are likely *S. siderea*). The six remaining colonies were ≥ 10 cm in diameter and were identified as *Oculina diffusa*, *O. robusta*, or *S. siderea*. None of the 11 colonies displayed signs of bleaching or disease, and all had 100% live tissue.

Table 3. Location, species, and size data for each scleractinian coral identified along the 70 vertical seawall transects.

Transect	Transect Length (m)	Water Depth (m)	Scleractinian Coral Species	Coral ID	Length (cm)	Width (cm)	Height (cm)	> 10 cm	% Live	Location on transect (cm)	Orientation (R/L)	Distance from transect line (cm)
T19	1.90	0.85	*Oculina diffusa*	A	15	13	7	Yes	100	20	West	16
T28	2.00	0.94	*Siderastrea siderea*	A	2	2	0.5	No	100	0.05	East	12
T29	1.90	0.90	*Siderastrea siderea*	A	11	8	1	Yes	100	15	East	25
T30	1.80	0.80	*Oculina diffusa*	A	16	10	16	Yes	100	30	East	32
T32	1.80	0.75	*Siderastrea siderea*	A	7	6	1	No	100	4	West	25
T33	1.80	0.80	*Oculina robusta*	A	17	14	9	Yes	100	20	West	5
T33	1.80	0.80	*Siderastrea* cf. *siderea*	B	6	5	0.5	No	100	25	East	30
T34	1.90	0.85	*Siderastrea siderea*	A	12	7	1	Yes	100	14	West	4
T36	1.80	0.75	*Oculina diffusa*	A	24	16	11	Yes	100	36	West	50
T38	1.55	0.50	*Siderastrea* cf. *siderea*	A	3	3	0.5	No	100	12	West	50
T39	1.68	0.72	*Siderastrea siderea*	A	4	3	0.5	No	100	0.5	East	18

Four functional groups dominated the percent cover across the 10 encrusting organism transects (**Table 4**). Macroalgae, empty space, turf algae, and sponge cover, when combined, comprised 80% to 100% of the total cover. Empty space was defined as areas along the transect that did not contain any live encrusting flora or fauna. Empty space was highest at Transects 7, 52 and 55. These three transects also had the shortest total lengths from the base to the top of the bulkhead. Macroalgae contributed to more than 50% of the total cover at 7 of the 10 transects and more than 20% at all transects. The highest macroalgae cover was at Transects 31 and 37. Sponge cover was highest at Transects 25 and 43, which had the longest total transect lengths. Other functional groups identified during the encrusting surveys were hydroid, scleractinian coral, tunicate, anemone, fanworm, barnacle, bivalve and limpets.

Table 4. Percent cover of each functional group identified along the ten vertical encrusting transects within the project area.

Encrusting Organism Survey Transects	Transect Length (ft)	Functional Groups												
		Empty Space	Turf Algae	Macroalgae	Sponge	Hydroid	Scler. Coral	Tunicate	Anenome	Fanworm	Barnacle	Bivalve	Limpets	Cyano bacteria
T 7	4.27	60	20	20	0	0	0	0	0	0	0	0	0	0
T 13	5.41	35	5	55	1	0	0	0	0	0	1	0	3	0
T 19	6.23	20	15	49	10	0	1	1	0	0	2	1	1	0
*T 25	6.56	30 ± 30	3 ± 2	51 ± 16	13 ± 12	0 ± 0	0	1 ± 0	0	0	0.5 ± 0.5	0.5 ± 0.5	1 ± 0	0
*T 31	5.91	15 ± 15	3.5 ± 3.5	78.5 ± 18.5	0.5 ± 0.5	0 ± 0	0	0.5 ± 0.5	0	0.5 ± 0.5	1 ± 1	0 ± 0	0.5 ± 0.5	0
*T 37	5.58	25 ± 25	5 ± 5	67 ± 30	1.5 ± 1.5	0 ± 0	0	0 ± 0	0	0	0.5 ± 0.5	0.5 ± 0.5	0.5 ± 0.5	0
*T 43	7.51	7 ± 7	15 ± 5	51.5 ± 6.5	10.5 ± 9.5	3 ± 2	0	3 ± 2	0	0	5.5 ± 4.5	1.5 ± 0.5	3 ± 3	1
T 49	5.25	35	8	53	0	0	0	1	1	0	0	0	2	0
T 52	4.92	59	2	35	1	0	0	1	0	0	0	1	1	0
T 55	5.09	50	2	44	1	0	0	1	0	0	1	0	1	0

Notes: (*) Identifies transects that were split between the area that was exposed along the transect and the submerged portion. Percent cover values for the split transects were averaged between the exposed and submerged areas (average ± SE).

Seagrass Survey

Figures 5 through **15** display the distribution of seagrasses and substrate types throughout the survey area. A total of 17.04 acres of seagrass habitat and 9.11 acres of unvegetated bottom were mapped within the survey area. The seagrass bed is dominated by *Halophila decipiens*, *Halodule wrightii*, and *Syringodium filiforme*; *Thalassia testudinum* occurs in sporadic, dense patches, primarily in the northern and southern extents of the bed (**Figure 5**). A mixed species seagrass bed dominates the nearshore and increases in extent at the south end of the survey area; this mixed species bed accounts for 10.16 acres of seagrass habitat in the study area. The mixed species bed transitions to 6.75 acres of *H. decipiens* in the offshore portion of the study area. Monospecific *H. wrightii* and *T. testudium* patches accounted for 0.10 and 0.03 acres of the total seagrass habitat, respectively. Two occurrences of *Halophila engelmannii* were noted along Transect 12. *Halophila johnsoniii* was not observed during the survey.

Based on distribution of species abundances throughout the survey area, the seagrass bed has been divided into three segments for presentation of the results: north, central and south. The north segment consists of Transects 1 through 9 (**Table 5**). The seagrass bed is consistent throughout the north segment and characterized by moderate to high density seagrass dominated by *H. decipiens*. There is a distinct transition from a mixed species bed of *H. wrightii, H. decipiens, S. filiforme,* and *T. testudinum* from the bulkhead to a monospecific bed of *H. decipiens* around 100 ft offshore of the bulkhead. *Halodule wrightii* and *H. decipens* were recorded at every transect in the north segment. Although *H. wrightii* is generally distributed throughout the first 100 ft of each transect, occurrences were noted to 220 ft at Transect 1. *Syringodium filiforme* and *T. testudinum* occur in low density throughout the north segment. An occurrence of *S. filiforme* was noted to 220 ft; however, this species was generally confined to the first 50 ft and was observed at seven of the nine transects. *Thalassia testudinum* was recorded at six transects and was consistently recorded with < 5% cover. The greatest extent of *T. testudinum* was 263 ft at Transect 1, but it mostly occurred within the first 100 ft.

The seagrass bed edge ranged from 322 ft to 410 ft from the bulkhead; Transect 5 extended 410 ft from the bulkhead (**Table 6**). The nearshore bed edge ranged from 0 ft to 26 ft waterward of the bulkhead (**Tables 7**and **8**). The area between the bulkhead and the seagrass bed edge was dominated by rubble; sand was the dominant substrate at the bed edge. Transect 9 had the greatest linear extent of unvegetated bottom (101 ft, 25%) and the smallest linear extent in the north segment (322 ft). The unvegetated portion of Transect 9 from 322 ft to 400 ft was sand and low cover of macroalgae. Transect 5 had the lowest percent cover of unvegetated bottom (10 ft, 2%); *H. decipiens* extended to 410 ft.

Substrate in the north segment was dominated by sand (**Table 9**). Rubble was common at the start of the transects. Muck was recorded at Transects 1, 2, and 5, generally between 50 ft and 200 ft. Muck was noted at Transect 5 from about 40 ft to 100 ft followed by a sand/muck matrix from 100 ft to the end of the transect; seagrass density was high at this transect despite the presence of muck and comprised *H. wrightii*, *H. decipiens*, and *T. testudinum*. *Halophila decipiens* was the only species noted waterward of 100 ft.

The central segment consists of Transects 10 through 35. These transects were shortened due to safety concerns and ranged between 250 ft and 365 ft in length. **Table 10** provides the total length of each central segment transect and linear extent of seagrass abundance. Similar to the north segment, the seagrass bed is characterized a dense, mixed species bed in the nearshore transitioning to *H. decipiens* in the offshore where the bottom type transitions into a muck-dominated substrate and water depth is deeper. Bed widths varied throughout the central segment (**Table 11**). The offshore bed edge at Transects 10 through 21 ranged from 210 ft to 313 ft; the nearshore edge extended between 0 ft and 15 ft from the bulkhead (**Tables 12** and **13**). The bed narrowed to the south, extending only 50 ft to 100 ft seaward of the bulkhead at Transects 22 through 35.

All four species of seagrass observed in the north segment were present throughout the entire length of the central segment. Two occurrences of *H. engelmannii* were observed along

Transect 12. *Halophila decipiens* and *Halodule wrightii* were observed at every transect. *Syringodium filiforme* and *T. testudinum* were recorded at 18 and 14 of the 26 transects, respectively. The dense, mixed bed had the greatest extent from Transects 10 to 14; *H. decipiens, H. wrightii* and *T. testudium* were observed to 100 ft at most of the transects in this area. Throughout the central segment, *S. filiforme* was only recorded within the mixed bed to 30 ft, but occurred in high density. Beginning at Transect 15 and continuing south to Transect 35, the extent of the dense, mixed bed ranged from 15 ft to 50 ft. With the exception of Transect 12, *H. decipiens* was the only species present beyond 100 ft from the bulkhead. *Halodule wrightii* was observed to 121 ft, and the two occurrences of *H. engelmannii* were observed between 210 ft and 240 ft.

Muck was the dominant substrate throughout the central segment of the survey area (**Table 14**). The presence of muck had a negative relationship with seagrass presence. Transects in the northern extent of the central segment were characterized by sand and exhibited greater seagrass cover than transects characterized by muck. Furthermore, line intercept data revealed a general transition from muck to sand along the offshore seagrass bed edge.

Transects 36 through 70 are in the south segment of the study area. Seagrass cover and diversity increased throughout this segment to the south, and the greatest extent of the mixed species bed was noted in the south segment (**Table 15**). *Halophila decipiens, H. wrightii,* and *S. filiforme* were observed at every transect in the south segment; and *T. testudinum* was recorded at 21 of the 35 transects. Bed extent of the mixed species bed ranged from 20 ft to 80 ft from Transects 36 to 48 and increased to between 100 ft and 300 ft at Transects 49 through 54. All four species were observed to some extent to 400 ft from Transects 55 through 64, then decreased slightly to between 300 ft and 350 ft throughout the remaining transects. At several transects, the bed transitioned from a combination of *H. decipiens, H. wrightii, S. filiforme,* and *T. testudinum* into a mixed *H. decipiens/H. wrightii* bed before transitioning into the monospecific *H. decipiens* at the end of the transects. The nearshore bed edge in the south segment ranged from 1 ft to 28 ft from the bulkhead (**Tables 16, 17,** and **18**).

The bed edge at Transects 43 through 48, excluding Transect 47, represents the easternmost occurrence of seagrass along these transects and not the actual offshore edge of the seagrass bed (**Table 16**). There were no occurrences of *H. decipiens* at Transect 47 west of the continuous bed; however, at Transects 43 to 48 occurrences of seagrass were noted waterward of the consistent seagrass bed edge. The edge of consistent seagrass at Transects 43 through 48 ranged from 50 ft to 100 ft; the remainder of the transect is characterized as a zone of seagrass occurrence due to the very sparse cover. Muck was the dominant substrate from Transects 36 to 50; sand or a sand/shell mix dominated the remaining transects (**Table 19**). Although there are occurrences of *H. decipiens*, it is unlikely, due to the presence, that seagrass will persistently establish within this portion of the study area. Additionally, several of the plants were uprooted, likely due to the strong currents in this area.

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Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Seagrass Habitat Map of the Study Area
Figure 5

Coastal Eco-Group Inc.

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Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept Species Richness
Figure 6

Coastal Eco-Group Inc.

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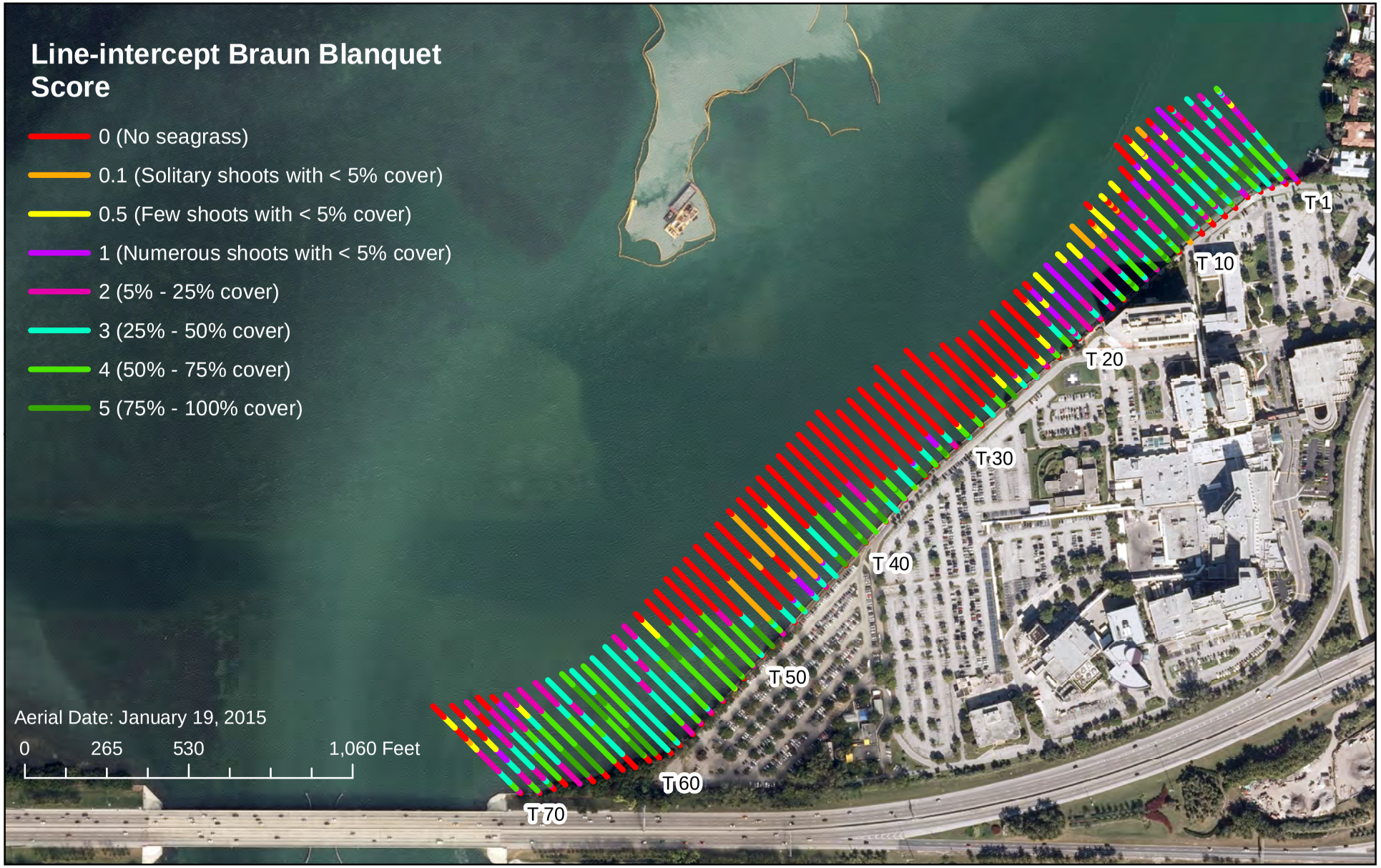
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept Species Composition
Figure 7

Coastal Eco-Group Inc.



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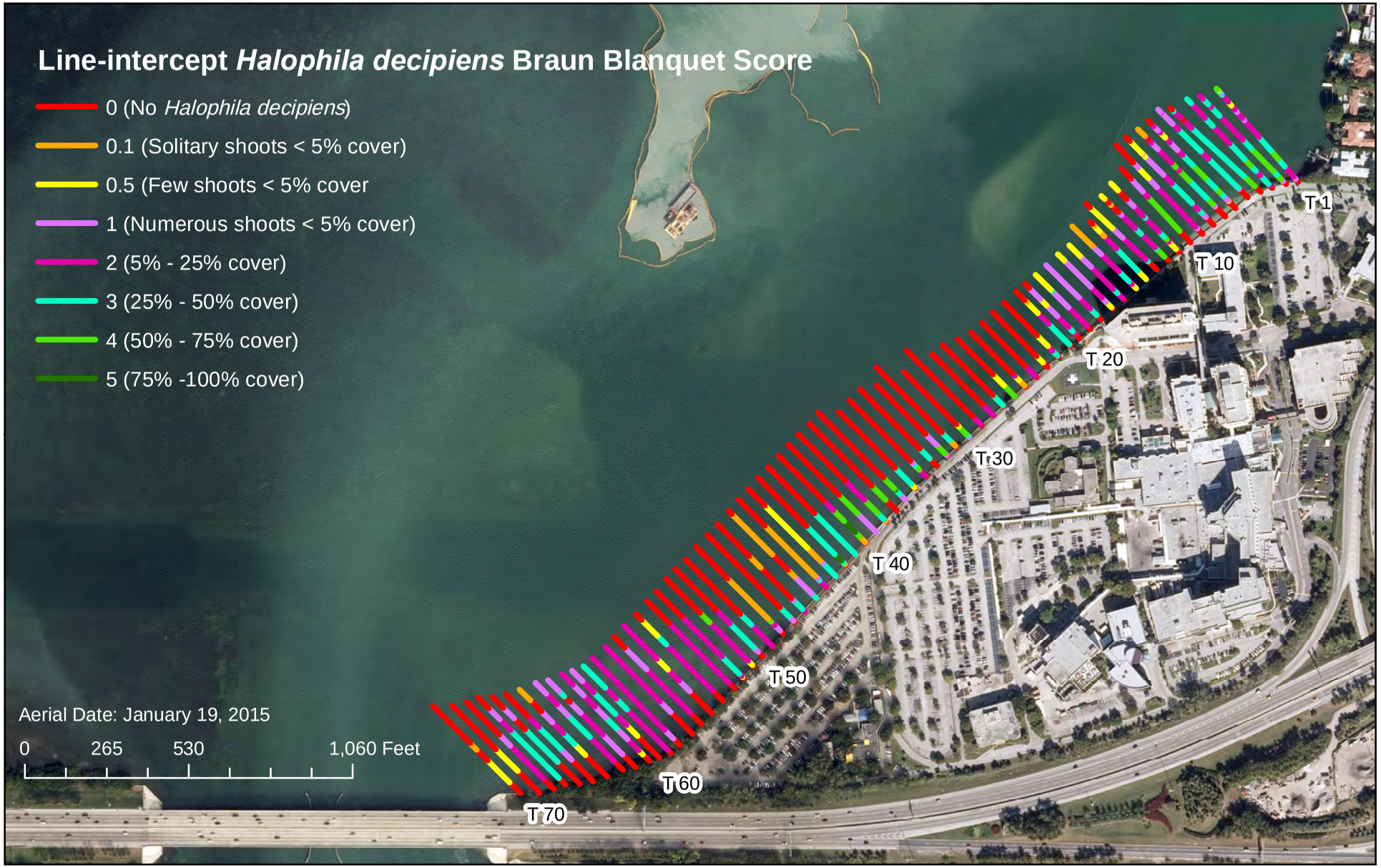
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept Braun-Blanquet Score
Figure 8

Coastal Eco-Group Inc.



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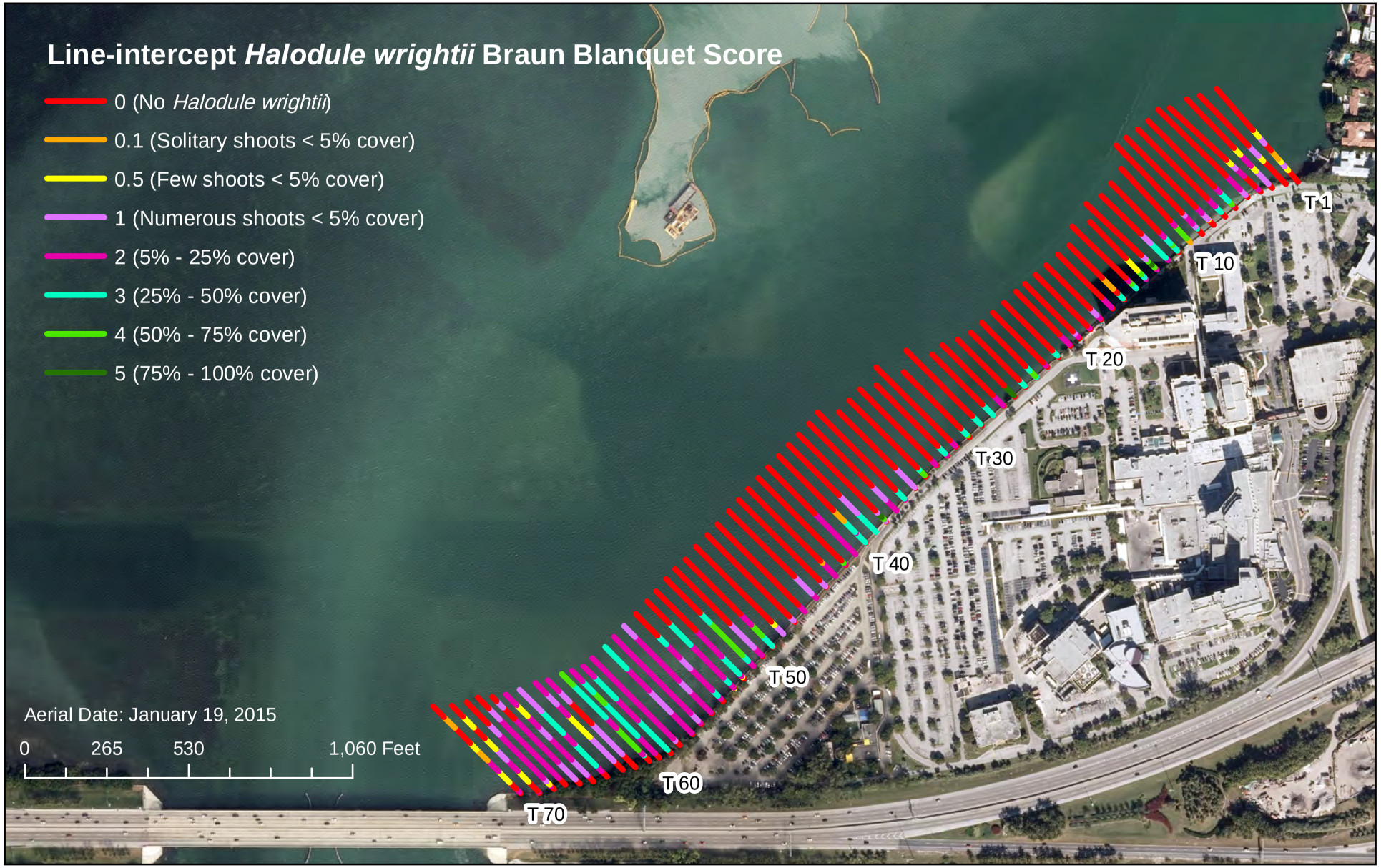
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept *Halophila decipiens* Braun-Blanquet Score
Figure 9

Coastal Eco-Group Inc.



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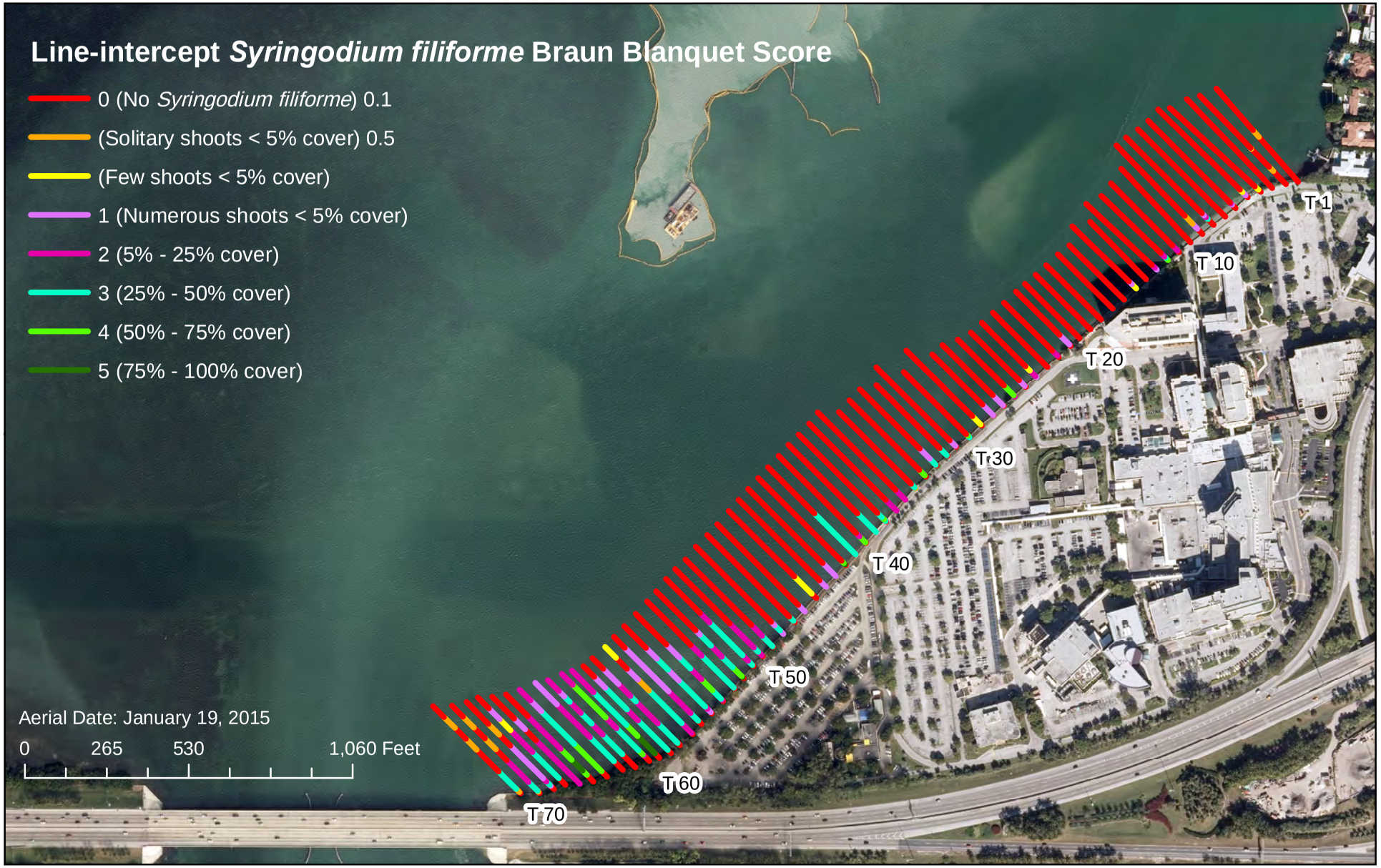
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept *Halodule wrightii* Braun-Blanquet Score
Figure 10

Coastal Eco-Group Inc.



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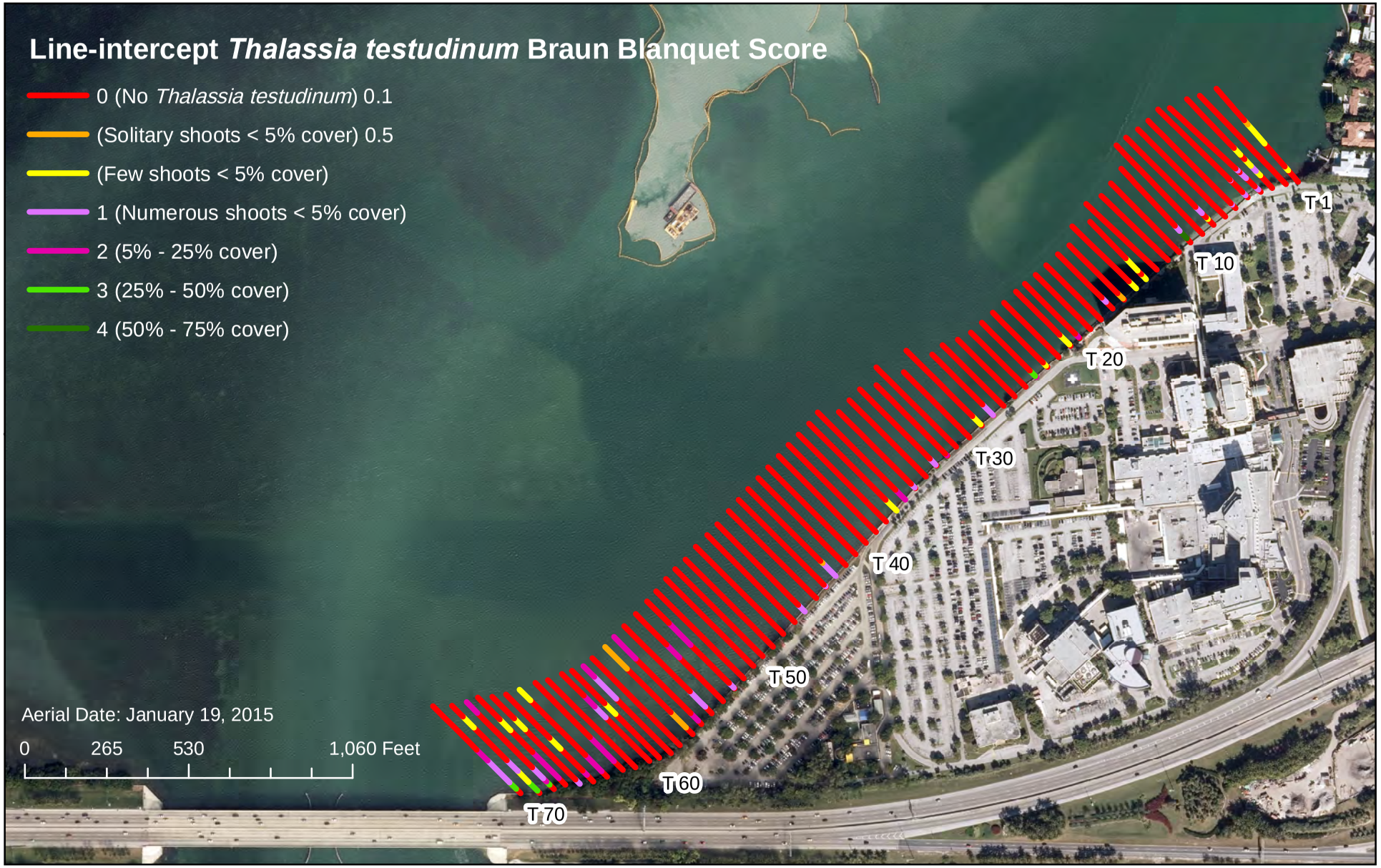
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept *Syringodium filiforme* Braun-Blanquet Score
Figure 11

Coastal Eco-Group Inc.



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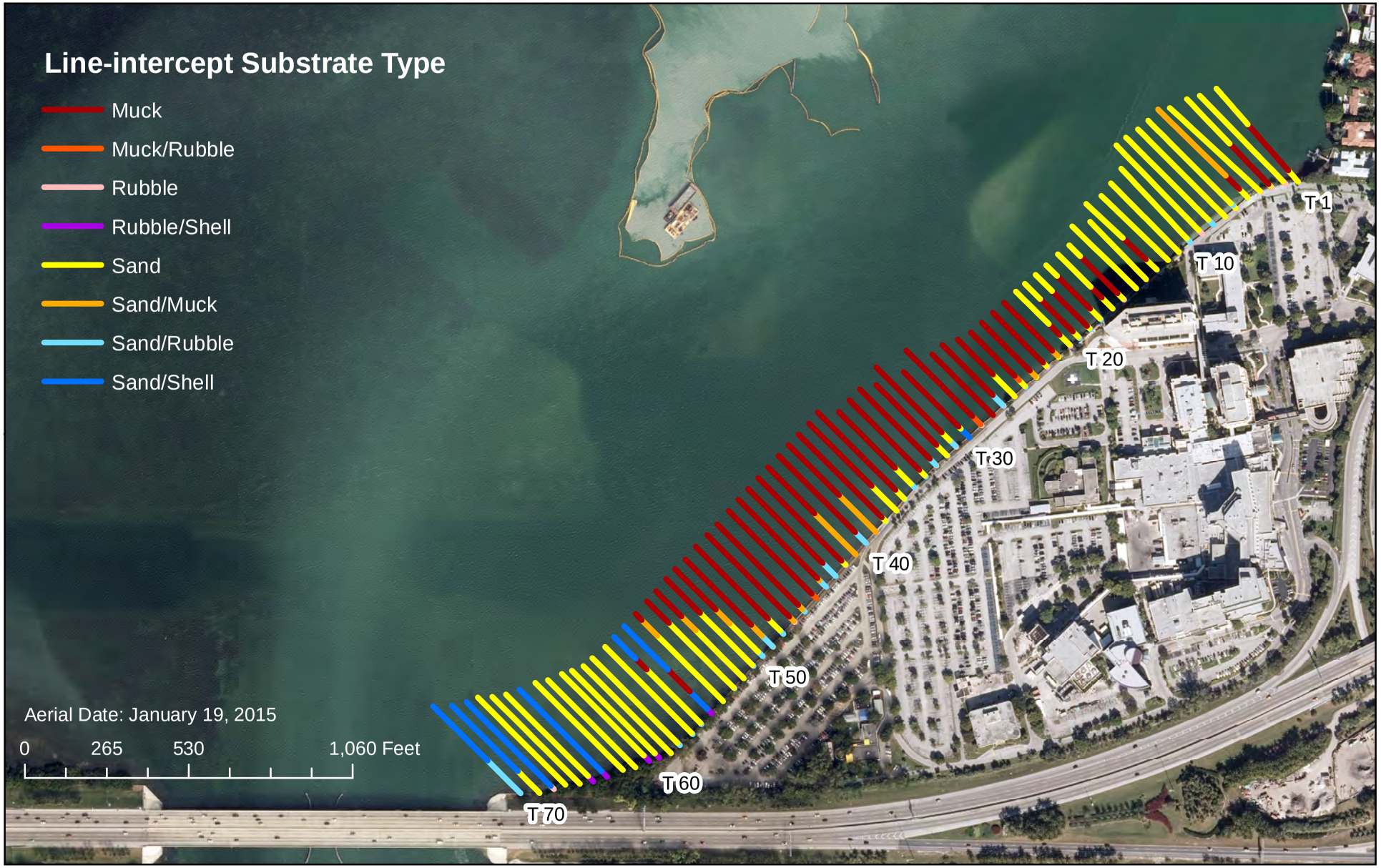
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept *Thalassia testudinum* Braun-Blanquet Score
Figure 12

Coastal Eco-Group Inc.



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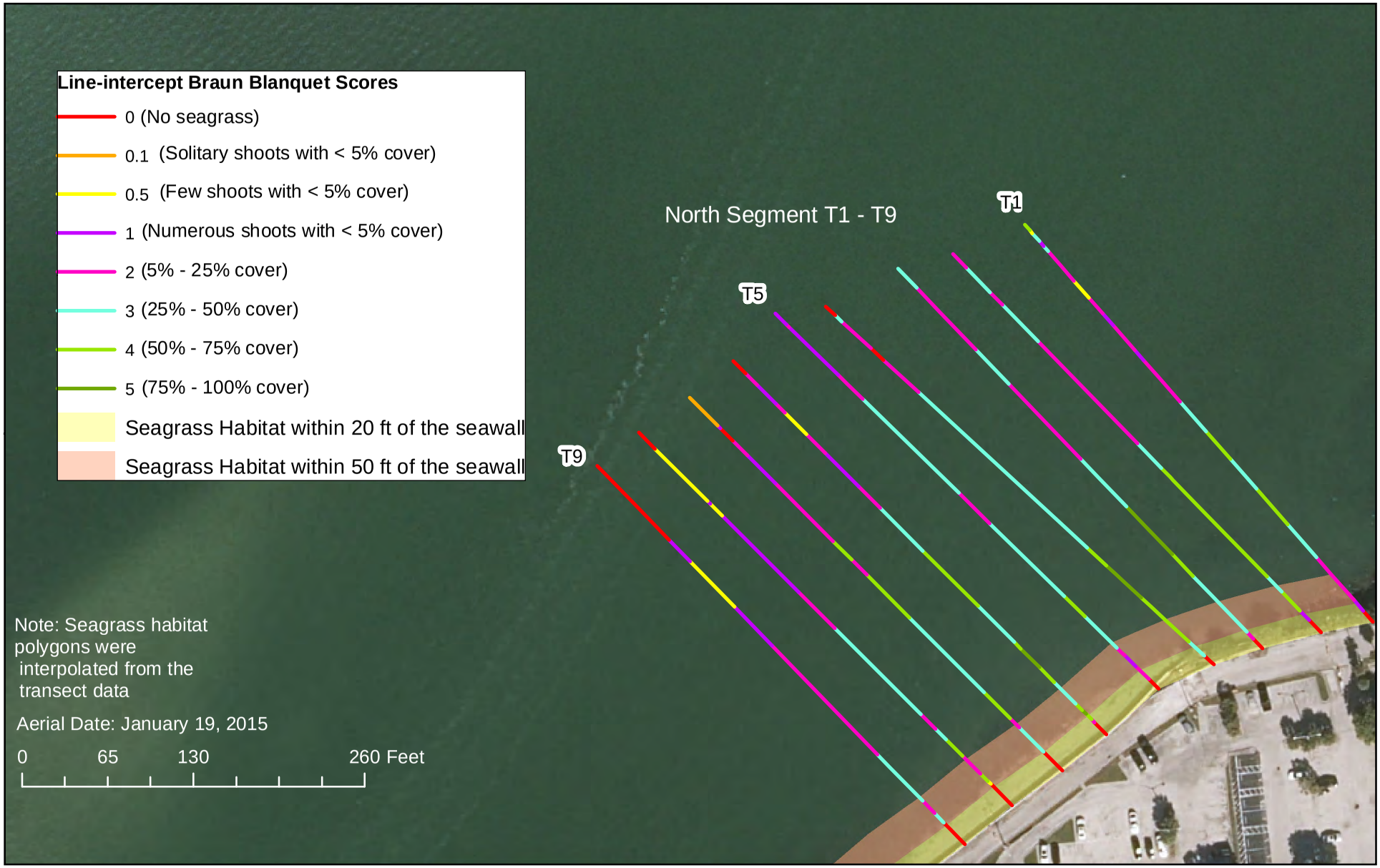
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey Transects
Line-intercept Substrate
Figure 13

Coastal Eco-Group Inc.



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Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey
Line Intercept Braun-Blanquet Scores along the North Segment Transects and Seagrass Habitat within 20 ft and 50 ft from the Seawall
Figure 14a

Coastal Eco-Group Inc.

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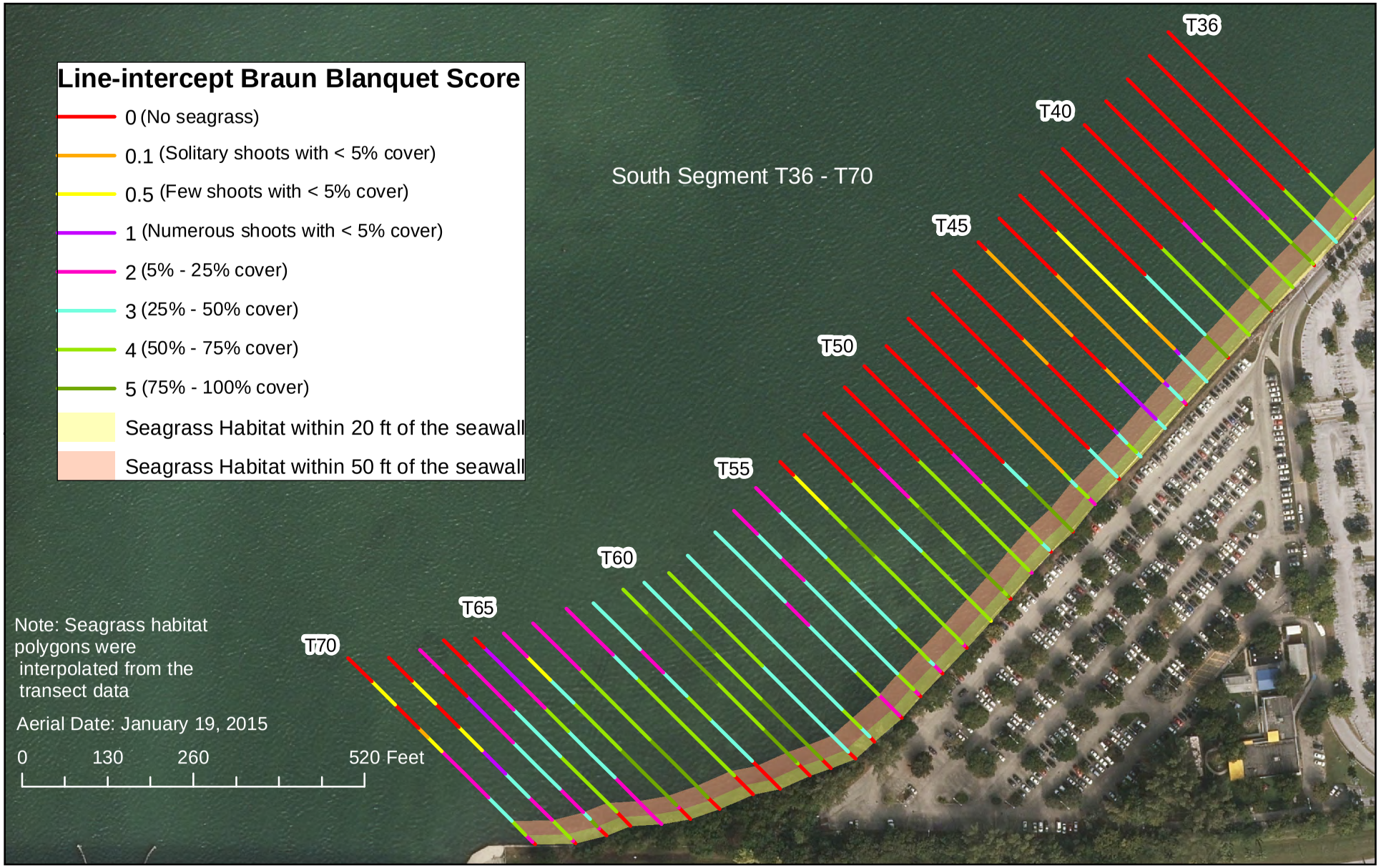
Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey
Line Intercept Braun-Blanquet Scores along the Central Segment Transects and Seagrass Habitat within 20 ft and 50 ft from the Seawall
Figure 14b

Coastal Eco-Group Inc.



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Mt. Sinai Hospital Bulkhead Replacement
Seagrass Survey
Line Intercept Braun-Blanquet Scores along the South Segment Transects and Seagrass Habitat within 20 ft and 50 ft from the Seawall
Figure 14c

Coastal Eco-Group Inc.

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Mt. Sinai Hospital Bulkhead Replacement Seagrass Survey

Seagrass Habitats within 50 ft of the Seawall- North Segment

Figure 15a

Coastal Eco-Group Inc.

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Mt. Sinai Hospital Bulkhead Replacement Seagrass Survey

Seagrass Habitats within 50 ft of the Seawall- Central Segment

Figure 15b

Coastal Eco-Group Inc.

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Mt. Sinai Hospital Bulkhead Replacement Seagrass Survey

Seagrass Habitats within 50 ft of the Seawall- South Segment

Figure 15c

Coastal Eco-Group Inc.

Table 5. Linear extent (ft) of seagrass abundance classifications along transects in the north segment of the survey area, Transects 1-9

	Transect	Line Intercept (ft)					Line Intercept (ft)							
		Percent Cover					Braun-Blanquet Scale							
		0%	<25%	25-50%	50-75%	> 75%	0	0.1	0.5	1	2	3	4	5
North Segment	1	11	217	105	67	0	11	0	20	40	157	105	67	0
	2	13	144	108	135	0	13	0	0	10	134	108	135	0
	3	10	150	167	23	50	10	0	0	0	150	167	23	50
	4	33	66	196	68	37	33	0	0	0	66	196	68	37
	5	10	162	216	22	0	10	0	0	78	84	216	22	0
	6	26	147	109	94	24	26	0	22	56	69	109	94	24
	7	33	167	106	94	0	33	29	0	34	104	106	94	0
	8	39	231	103	27	0	39	0	72	85	74	103	27	0
	9	101	240	59	0	0	101	0	48	64	128	59	0	0

Note: Transect 5 was 410 ft in length, all other transects were 400 ft. total length. Line intercept category <25% only reflects area where seagrass was present (1-25%).

Table 6. Location of the seagrass bed edges, linear extent (ft) of vegetated bottom, and percent cover of unvegetated bottom along the entire transect and within the first 20 ft and 50 ft of each transect in the north segment, Transects 1-9

	Transect	Nearshore Bed Edge (ft)	Offshore Bed Edge (ft)	Total Linear ft Vegetated Bottom	Total % Unvegetated Bottom	0-20 ft		0-50 ft	
						Linear ft Vegetated Bottom	% Unvegetated Bottom	Linear ft Vegetated Bottom	% Unvegetated Bottom
North Segment	1	0	400	389	3%	9	55%	39	22%
	2	3	400	387	3%	7	65%	37	26%
	3	2	400	390	3%	10	50%	40	20%
	4	5	390	367	8%	10	50%	40	20%
	5	9	410	390	2%	10	50%	40	20%
	6	21	387	374	7%	7	65%	37	26%
	7	18	400	367	8%	0	100%	30	40%
	8	26	384	361	10%	0	100%	27	46%
	9	21	322	299	25%	0	100%	27	46%

Table 7. Distance of the nearshore bed edge to the bulkhead, seagrass abundance, species composition, and substrate type at the nearshore bed edge at transects in the north segment, Transects 1-9

	Transect	Distance of Nearshore Bed Edge to Bulkhead (ft)	BB Score	LI Score	Species Present	Substrate
North Segment	1	0	1	1	Hd	Sand
	2	3	1	1	Hd	Sand
	3	2	2	1	Hd	Sand
	4	5	3	2	Hw, Sf, Tt	Sand
	5	9	2	1	Hw, Sf, Tt	Sand
	6	21	2	1	Hw	Sand/Rubble
	7	18	3	2	Hw	Sand
	8	26	0.5	1	Hw	Sand
	9	21	3	2	Hd, Hw, Sf	Sand

Table 8. Approximate distance of the nearshore bed edge to the bulkhead at approximately 25 ft intervals between Transects 1-9 in the north segment

	Transect	Distance of Nearshore Bed Edge to Bulkhead (ft)
North Segment	1.5	0
	2.5	2
	3.5	1
	4.5	6
	5.5	15
	6.5	13
	7.5	18
	8.5	19
	9.5	17

Note: Distances were estimated in ArcGIS 10.2.

Table 9. Average (±SE) macroalgal cover, linear extent, and percent cover of the dominant substrate at transects in the north segment, Transects 1-9

	Transect	Avg (±SE) Macroalgae BB	Dominant Substrate		
			Type	LI (ft)	% Cover
North Segment	1	1.1 (±0.1)	Sand	204	51%
	2	1.7 (±0.2)	Sand	387	97%
	3	2.0 (±0.3)	Sand	209	52%
	4	2.4 (±0.2)	Sand	397	99%
	5	1.7 (±0.2)	Sand/Muck	309	75%
	6	1.9 (±0.2)	Sand	391	98%
	7	1.0 (±0.1)	Sand	400	100%
	8	1.4 (±0.2)	Sand	377	94%
	9	1.0 (±0.1)	Sand	383	96%

Note: Transect 5 was 410 ft in length, all other transects were 400 ft. total length.

Table 10. Linear extent (ft) of seagrass abundance along transects in the central segment of the survey area, Transects 10-35

	Transect	Transect Length (ft)	Line Intercept (ft) Percent Cover					Line Intercept (ft) Braun-Blanquet Scale							
			0%	<25%	25-50%	50-75%	> 75%	0	0.1	0.5	1	2	3	4	5
Central Segment	10	330	48	98	0	128	56	48	18	0	57	23	0	128	56
	11	313	46	172	40	42	13	46	0	34	33	105	40	42	13
	12	303	42	113	89	32	27	42	20	18	13	62	89	32	27
	13	313	17	237	20	10	29	17	0	99	46	92	20	10	29
	14	257	8	118	59	72	0	8	32	23	0	63	59	72	0
	15	290	0	211	30	36	13	0	93	0	40	78	30	36	13
	16	250	5	200	20	25	0	5	0	50	50	100	20	25	0
	17	250	5	225	20	0	0	5	0	30	120	75	20	0	0
	18	250	5	215	30	0	0	5	0	0	150	65	30	0	0
	19	250	4	241	5	0	0	4	0	70	75	96	5	0	0
	20	250	25	190	35	0	0	25	0	30	100	60	35	0	0
	21	250	46	110	50	44	0	46	10	50	0	50	50	44	0
	22	250	156	70	0	24	0	156	0	50	0	20	0	24	0
	23	250	206	44	0	0	0	206	0	30	0	14	0	0	0
	24	250	200	0	25	25	0	200	0	0	0	0	25	25	0
	25	250	193	31	26	0	0	193	0	20	0	11	26	0	0
	26	260	160	50	0	0	50	160	0	50	0	0	0	0	50
	27	280	233	0	0	47	0	233	0	0	0	0	0	47	0
	28	280	231	0	49	0	0	231	0	0	0	0	49	0	0
	29	345	307	0	0	38	0	307	0	0	0	0	0	38	0
	30	300	239	11	8	35	7	239	0	11	0	0	8	35	7
	31	365	303	26	36	0	0	303	0	0	0	26	36	0	0
	32	325	228	50	0	22	25	228	0	0	50	0	0	22	25
	33	350	277	0	46	27	0	277	0	0	0	0	46	27	0
	34	350	284	11	10	10	35	284	0	0	11	0	10	10	35
	35	350	257	3	73	17	0	257	3	0	0	0	73	17	0

Table 11. Location of the seagrass bed edges, linear extent (ft) of vegetated bottom, and percent cover of unvegetated bottom along the entire transect and within the first 20 ft and 50 ft of each transect in the central segment, Transects 10-35

	Transect	Nearshore Bed Edge (ft)	Offshore Bed Edge (ft)	Total Linear ft Vegetated Bottom	Total % Unvegetated Bottom	0-20 ft		0-50 ft	
						Linear ft Vegetated Bottom	% Unvegetated Bottom	Linear ft Vegetated Bottom	% Unvegetated Bottom
Central Segment	10	15	282	282	15%	20	0%	50	0%
	11	5	313	267	15%	13	35%	43	14%
	12	1	285	261	14%	20	0%	50	0%
	13	4	296	296	5%	20	0%	50	0%
	14	3	249	249	3%	20	0%	50	0%
	15	5	290	290	0%	20	0%	50	0%
	16	3	250	245	2%	15	25%	45	10%
	17	2	250	245	2%	15	25%	45	10%
	18	10	250	245	2%	15	25%	45	10%
	19	5	250	246	2%	16	20%	46	8%
	20	3	230	225	10%	15	25%	45	10%
	21	10	210	204	18%	14	30%	44	12%
	22	4	100	94	62%	14	30%	44	12%
	23	8	50	44	82%	14	30%	44	12%
	24	7	50	50	80%	20	0%	50	0%
	25	4	61	57	77%	16	20%	46	8%
	26	3	100	100	62%	20	0%	50	0%
	27	3	50	47	83%	17	15%	47	6%
	28	6	50	49	83%	19	5%	49	2%
	29	4	43	38	89%	15	25%	38	24%
	30	5	61	61	80%	20	0%	50	0%
	31	0	66	62	83%	16	20%	46	8%
	32	4	100	97	70%	17	15%	47	6%
	33	1	76	73	79%	17	15%	47	6%
	34	7	71	66	81%	15	25%	45	10%
	35	3	93	93	73%	20	0%	50	0%

Note: See Table 9 for transect lengths

Table 12. Distance of the nearshore bed edge to the bulkhead, seagrass abundance, species composition, and substrate type at the nearshore bed edge at transects in the central segment, Transects 10-35

	Transect	Distance of Nearshore Bed Edge to Bulkhead (ft)	BB Score	LI Score	Species Present	Substrate
Central Segment	10	15	5	4	Hw, Tt	Sand
	11	5	4	3	Hw, Sf	Sand
	12	1	5	4	Hw, Sf	Sand
	13	4	2	1	Hw, Sf	Sand
	14	3	2	1	Hd, Hw, Tt	Sand
	15	5	4	3	Hd, Hw, Sf, Tt	Sand
	16	3	4	3	Hd, Hw, Tt	Sand
	17	2	2	1	Hd, Hw	Sand
	18	10	2	1	Hw	Sand
	19	5	2	1	Hw	Sand
	20	3	3	2	Hw, Tt	Sand
	21	10	4	3	Hd, Hw, Sf, Tt	Sand
	22	4	4	3	Hd, Hw, Sf	Sand
	23	8	2	1	Hw, Tt	Sand
	24	7	3	2	Hw, Sf, Tt	Sand
	25	4	3	2	Hd, Hw, Sf	Sand
	26	3	5	4	Hd, Sf	Sand
	27	3	4	3	Hd, Hw, Sf	Sand/Rubble
	28	6	3	2	Hd, Hw, Sf, Tt	Muck
	29	4	4	3	Hd, Hw, Sf, Tt	Muck/Rubble
	30	5	3	2	Hd, Sf	Sand/Shell
	31	0	2	1	Hd, Hw, Sf	Sand/Rubble
	32	4	4	3	Hd, Hw, Sf, Tt	Sand
	33	1	4	3	Hw, Sf, Tt	Sand/Rubble
	34	7	5	4	Hd, Hw, Sf	Sand
	35	3	4	3	Hd, Hw, Sf, Tt	Sand/Rubble

Note: A zone of occurrence was noted at Transects 10 and 35 immediately east of the bed edge at the time of the survey; zone of occurrence is defined as a BB score of 0.1 referring to a single occurrence of seagrass within that segment.

Table 13. Approximate distance of the nearshore bed edge to the bulkhead at approximately 25 ft intervals between Transects 1-35 in the central segment

	Transect	Distance of Nearshore Bed Edge to Bulkhead (ft)
Central Segment	10.5	8
	11.5	12
	12.5	0
	13.5	2
	14.5	1
	15.5	4
	16.5	4
	17.5	2
	18.5	1
	19.5	0
	20.5	2
	21.5	4
	22.5	0
	23.5	4
	24.5	1
	25.5	1
	26.5	8
	27.5	1
	28.5	1
	29.5	3
	30.5	7
	31.5	0
	32.5	3
	33.5	0
	34.5	3
	35.5	0

Note: Distances were estimated in ArcGIS 10.2

Table 14. Average (±SE) macroalgal cover, and linear extent and percent cover of the dominant substrate at transects in the central segment, Transects 10-35

	Transect	Avg (±SE) Macroalgae BB	Dominant Substrate		
			Type	LI (ft)	% Cover
Central Segment	10	1.6 (±0.3)	Sand	312	95%
	11	0.7 (±0.1)	Sand	313	100%
	12	1.6 (±0.2)	Sand	303	100%
	13	1.0 (±0.3)	Sand	210	67%
	14	0.6 (±0.1)	Sand	257	100%
	15	1.4 (±0.4)	Sand	290	100%
	16	1.0 (±0.0)	Muck	170	68%
	17	0.7 (±0.1)	Sand	200	80%
	18	0.9 (±0.2)	Muck	150	60%
	19	0.9 (±0.3)	Muck	160	64%
	20	0.9 (±0.3)	Muck	150	60%
	21	0.9 (±0.3)	Sand	194	78%
	22	1.5 (±0.7)	Muck	220	88%
	23	1.0 (±0.5)	Muck	230	92%
	24	1.7 (±0.7)	Muck	220	88%
	25	1.3 (±0.5)	Muck	200	80%
	26	0.7 (±0.3)	Muck	160	62%
	27	0.8 (±0.5)	Muck	230	82%
	28	0.6 (±0.4)	Muck	279	100%
	29	0.7 (±0.4)	Muck	302	88%
	30	1.1 (±0.4)	Muck	250	83%
	31	0.7 (±0.4)	Muck	299	82%
	32	1.3 (±0.3)	Muck	275	85%
	33	0.7 (±0.3)	Muck	320	91%
	34	0.8 (±0.3)	Muck	320	91%
	35	0.7 (±0.3)	Muck	257	73%

Table 15. Linear extent (ft) of seagrass abundance classifications along transects in the south segment of the survey area, Transects 36-70

	Transect	Line Intercept (ft)					Line Intercept (ft)							
		Percent Cover					Braun-Blanquet Scale							
		0%	<25%	25-50%	50-75%	> 75%	0	0.1	0.5	1	2	3	4	5
South Segment	36	300	4	0	91	5	300	0	0	0	4	0	91	5
	37	286	0	50	64	0	286	0	0	0	0	50	64	0
	38	215	87	0	58	40	215	0	0	0	87	0	58	40
	39	231	0	0	169	0	231	0	0	0	0	0	169	0
	40	209	43	0	70	78	209	0	0	0	43	0	70	78
	41	212	0	0	188	0	212	0	0	0	0	0	188	0
	42	224	0	129	0	47	224	0	0	0	0	129	0	47
	43	76	264	60	0	0	76	60	194	10	0	60	0	0
	44	122	248	30	0	0	122	230	0	10	8	30	0	0
	45	85	295	20	0	0	85	215	0	80	0	20	0	0
	46	286	64	30	20	0	286	54	0	10	0	30	20	0
	47	338	0	62	0	0	338	0	0	0	0	62	0	0
	48	145	200	15	40	0	145	185	0	0	15	15	40	0
	49	252	0	50	0	98	252	0	0	0	0	50	0	98
	50	190	64	16	130	0	190	0	0	0	64	16	130	0
	51	156	5	0	239	0	156	0	0	0	5	0	239	0
	52	121	64	0	80	135	121	0	0	0	64	0	80	135
	53	100	3	50	247	0	100	0	3	0	0	50	247	0
	54	33	77	0	230	60	33	0	72	0	5	0	230	60
	55	5	65	210	120	0	5	0	0	0	65	210	120	0
	56	5	110	250	35	0	5	0	0	0	110	250	35	0
	57	5	95	250	50	0	5	0	0	0	95	250	50	0
	58	10	0	350	40	0	10	0	0	0	0	350	40	0
	59	15	0	185	200	0	15	0	0	0	0	185	200	0
	60	20	0	100	100	180	20	0	0	0	0	100	100	180
	61	25	0	0	155	220	25	0	0	0	0	0	155	220
	62	60	50	240	50	0	60	0	0	0	50	240	50	0
	63	40	100	50	210	0	40	0	0	0	100	50	210	0
	64	25	100	0	150	125	25	0	0	0	100	0	150	125
	65	25	105	50	100	120	25	0	50	0	55	50	100	120
	66	20	230	100	50	0	20	0	0	80	150	100	50	0
	67	80	100	100	120	0	80	0	0	0	100	100	120	0
	68	65	205	115	0	15	65	0	0	50	155	115	0	15
	69	105	205	50	40	0	105	0	100	50	55	50	40	0
	70	105	215	50	30	0	105	20	80	0	115	50	30	0

Note: All transects in the south segment were 400 ft in length.

Table 16. Location of the seagrass bed edges, linear extent (ft) of vegetated bottom, and percent cover of unvegetated bottom along the entire transect and within the first 20 ft and 50 ft of each transect in the south segment, Transects 36-70

	Transect	Nearshore Bed Edge (ft)	Offshore Bed Edge (ft)	Total Linear ft Vegetated Bottom	Total % Unvegetated Bottom	0-20 ft		0-50 ft	
						Linear ft Vegetated Bottom	% Unvegetated Bottom	Linear ft Vegetated Bottom	% Unvegetated Bottom
South Segment	36	1	100	100	75%	20	0%	50	0%
	37	2	114	114	72%	20	0%	50	0%
	38	2	187	185	54%	18	10%	48	4%
	39	4	169	169	58%	20	0%	50	0%
	40	1	193	191	52%	18	10%	48	4%
	41	2	188	188	53%	20	0%	50	0%
	42	3	179	176	56%	17	15%	47	6%
	43	7	324	324	19%	20	0%	50	0%
	44	5	280	278	31%	18	10%	48	4%
	45	4	385	315	21%	20	0%	50	0%
	46	3	254	114	72%	20	0%	50	0%
	47	5	67	62	85%	15	25%	45	10%
	48	7	255	255	36%	20	0%	50	0%
	49	3	152	148	63%	18	10%	48	4%
	50	4	214	210	48%	16	20%	46	8%
	51	5	244	244	39%	20	0%	50	0%
	52	3	284	279	30%	15	25%	45	10%
	53	1	300	300	25%	20	0%	50	0%
	54	5	372	367	8%	15	25%	45	10%
	55	8	400	395	1%	15	25%	45	10%
	56	3	400	395	1%	15	25%	45	10%
	57	8	400	395	1%	15	25%	45	10%
	58	12	400	390	3%	10	50%	40	20%
	59	22	400	385	4%	5	75%	35	30%
	60	20	400	380	5%	0	100%	30	40%
	61	21	400	375	6%	0	100%	25	50%
	62	28	400	340	15%	0	100%	0	100%
	63	26	400	360	10%	0	100%	10	80%
	64	22	400	375	6%	0	100%	25	50%
	65	28	400	375	6%	0	100%	25	50%
	66	27	380	380	5%	20	0%	50	0%
	67	22	350	320	20%	0	100%	20	60%
	68	26	400	335	16%	5	75%	35	30%
	69	19	350	295	26%	15	25%	45	10%
	70	5	350	295	26%	15	25%	45	10%

Table 17. Distance of the nearshore bed edge to the bulkhead, seagrass abundance, species composition, and substrate type at the nearshore bed edge at transects in the south segment, Transects 36-70

	Transect	Distance of Nearshore Bed Edge to Bulkhead (ft)	BB Score	LI Score	Species Present	Substrate
South Segment	36	1	2	1	Hd, Hw, Sf, Tt	Sand/Rubble
	37	2	3	2	Hw, Sf, Tt	Sand
	38	2	4	3	HD, Hw, Sf, Tt	Sand
	39	4	4	3	Hd, Hw, Sf	Sand
	40	1	5	4	Hd, Hw, Sf	Sand/Rubble
	41	2	4	3	Hd, Hw, Sf	Sand
	42	3	5	4	Hd, Hw, Sf	Sand
	43	7	3	2	Hd, Hw, Sf, Tt	Sand/Rubble
	44	5	2	1	Hd, Hw, Sf, Tt	Sand/Rubble
	45	4	3	2	Hd, Hw	Muck/Rubble
	46	3	3	2	Hd, Hw, Sf, Tt	Sand/Rubble
	47	5	3	2	Hd, Hw, Sf	Sand
	48	7	2	1	Hw, Sf	Sand/Shell/Rubble
	49	3	5	4	Hd, Hw, Sf	Sand/Rubble
	50	4	3	2	Hw, Sf	Sand/Rubble
	51	5	2	1	Hw	Sand/Rubble
	52	3	5	4	Hd, Hw, Sf	Sand
	53	1	4	3	Hw, Sf, Tt	Sand
	54	5	2	1	Sf	Sand
	55	8	2	1	Hw, Sf	Sand/Shell/Rubble
	56	3	2	1	Hw	Sand
	57	8	2	1	Hw, Sf	Sand
	58	12	3	2	Sf	Sand
	59	22	3	2	Hd, Hw, Sf	Sand
	60	20	5	4	Hw, Sf	Sand
	61	21	4	3	Hw, Sf	Sand
	62	28	3	2	Hd, Hw, Sf	Sand
	63	26	4	3	Hd, Hw, Sf, Tt	Sand
	64	22	5	4	Hw, Sf, Tt	Sand/Shell
	65	28	2	1	Hw	Sand
	66	27	2	1	Sf, Tt	Sand
	67	22	4	3	Hd, Hw, Sf, Tt	Sand
	68	26	2	1	Hw, Sf	Sand/Shell
	69	19	2	1	Hw, Sf	Sand
	70	5	2	1	Hw, Sf	Sand/Rubble

Table 18. Approximate distance of the nearshore bed edge to the bulkhead at approximately 25 ft intervals between Transects 36-70 in the south segment

	Transect	Distance of Nearshore Bed Edge to Bulkhead (ft)
South Segment	36.5	12
	37.5	1
	38.5	0
	39.5	3
	40.5	0
	41.5	0
	42.5	1
	43.5	2
	44.5	7
	45.5	3
	46.5	3
	47.5	3
	48.5	12
	49.5	10
	50.5	4
	51.5	2
	52.5	0
	53.5	0
	54.5	0
	55.5	4
	56.5	3
	57.5	8
	58.5	16
	59.5	17
	60.5	19
	61.5	21
	62.5	23
	63.5	16
	64.5	18
	65.5	22
	66.5	18
	67.5	20
	68.5	16
	69.5	11

Note: Distances were estimated in ArcGIS 10.2

Table 19. Average (±SE) macroalgal cover and linear extent and percent cover of the dominant substrate at transects in the south segment, Transects 36-70

	Transect	Avg (±SE) Macroalgae BB	Dominant Substrate		
			Type	LI (ft)	% Cover
South Segment	36	1.3 (±0.4)	Muck	355	89%
	37	0.7 (±0.3)	Muck	286	72%
	38	0.8 (±0.3)	Muck	380	95%
	39	0.7 (±0.3)	Muck	231	58%
	40	1.7 (±0.6)	Muck	350	88%
	41	0.5 (±0.5)	Muck	212	53%
	42	2.2 (±0.4)	Muck	380	95%
	43	0.9 (±0.6)	Muck	340	85%
	44	2.3 (±0.6)	Muck	360	90%
	45	0.4 (±0.3)	Muck	380	95%
	46	1.4 (±0.6)	Muck	370	93%
	47	1.1 (±0.6)	Muck	375	94%
	48	2.3 (±0.7)	Muck	330	83%
	49	1.3 (±0.5)	Muck	300	75%
	50	2.6 (±0.7)	Muck	186	47%
	51	1.3 (±0.3)	Sand	239	60%
	52	1.8 (±0.3)	Sand	220	55%
	53	1.5 (±0.3)	Sand	297	74%
	54	2.1 (±0.4)	Sand	300	75%
	55	2.3 (±0.1)	Sand/Shell	280	70%
	56	2.3 (±0.2)	Sand	245	61%
	57	2.1 (±0.2)	Sand	395	99%
	58	2.3 (±0.1)	Sand	390	98%
	59	1.3 (±0.3)	Sand	400	100%
	60	2.8 (±0.3)	Sand	380	95%
	61	2.3 (±0.3)	Sand	375	94%
	62	2.3 (±0.5)	Sand	400	100%
	63	2.5 (±0.8)	Sand	400	100%
	64	2.6 (±0.4)	Sand/Shell	375	94%
	65	2.4 (±0.3)	Sand	375	94%
	66	1.9 (±0.1)	Sand	400	100%
	67	1.8 (±0.4)	Sand	400	100%
	68	2.0 (±0.2)	Sand/Shell	385	96%
	69	2.0 (±0.1)	Sand/Shell	300	75%
	70	2.5 (±0.2)	Sand/Shell	250	63%

Tree Survey

GRB identified the locations of 67 trees along the bulkhead. **Tables 17a** and **17b** present the results of the tree survey, and **Figures 16a** through **16d** show the tree locations identified within the survey area. The locations of Trees 63 through 66 appear to be slightly off from their actual locations when comparing photographs of the trees in relation to the transect stakes. This positioning error is likely due to the loss of differential positioning/satellites from interference with the dense tree canopy. The photographs suggest that these trees may be up to 155 ft from their actual locations. Review of the digital photographs suggest that Tree 63 was located near the stake for Transect 62; Tree 64 was close to the stake for Transect 63; Tree 65 was by Transect 64; and Tree 66 was by Transect 66. Additionally, coordinates were not collected at Tree 35; the location of Tree 35 was estimated in ArcGIS using aerial photography and field data notes.

Table 20a. Upland tree survey results, Trees 1 through 30

Tree	Common Name	Scientific Name	Category	Circumference (inches)	Diameter (in.)	Height (Ft.)
1	Brazilian pepper	*Schinus terebinthifolius*	FLEPPC Category 1 invasive exotic	36	11.46	15
2	Golden Dewdrop	*Duranta erecta L.*	Non-native	15	4.77	11
3	Seagrape	*Coccoloba uvifera*		11	3.50	11
4	Seagrape	*Coccoloba uvifera*		16	5.09	8.8
5	Seagrape	*Coccoloba uvifera*		14	4.46	8.8
6	Seagrape	*Coccoloba uvifera*		13	4.14	14
7	Seagrape	*Coccoloba uvifera*		14	4.46	12
8	Seagrape	*Coccoloba uvifera*		16	5.09	12
9	Seagrape	*Coccoloba uvifera*		17	5.41	10
10	Seagrape	*Coccoloba uvifera*		14.5	4.62	14.5
11	Seagrape	*Coccoloba uvifera*		41	13.05	12
12	Seagrape	*Coccoloba uvifera*		24	7.64	15.5
13	Black Mangrove	*Avicennia germinans*		12	3.82	10.5
14	Seagrape	*Coccoloba uvifera*		16.5	5.25	9
15	Washington Fan Palm	*Washingtonia robusta*	Possible *Livistona spp* however both are non-native	22	7.00	9
16	Washington Fan Palm	*Washingtonia robusta*		22	7.00	6
17	Washington Fan Palm	*Washingtonia robusta*		19	6.05	10
18	Seagrape	*Coccoloba uvifera*		11	3.50	5.5
19	Washington Fan Palm	*Washingtonia robusta*	Possible *Livistona spp* however both are non-native	10	3.18	6.5
20	Washington Fan Palm	*Washingtonia robusta*		12	3.82	11
21	Seagrape	*Coccoloba uvifera*		12	3.82	9
22	Seagrape	*Coccoloba uvifera*		15	4.77	14
23	Seagrape	*Coccoloba uvifera*		15	4.77	Tree 1=22', Tree 2=19'
24	Seagrape	*Coccoloba uvifera*		14/Palm Tree 40	4.5/ 12.7	8
25	Pitch Apple	*Clusia rosea*		8	2.55	27
26	Black Olive	*Terminalia buceras*	Non-native	49	15.60	7
27	Seagrape	*Coccoloba uvifera*		23	7.32	10
28	Seagrape	*Coccoloba uvifera*		19 Left Trunk/22 Right Trunk	6 Left Trunk/ 7 Right Trunk	17
29	Black Olive	*Terminalia buceras*	Non-native	37	11.78	11
30	Silver Buttonwood	*Conocarpus erectus var. sericeus*		11	3.50	31

Note: Data collected by GRB.

Table 20b. Upland tree survey results, Trees 31 through 66.

Tree	Common Name	Scientific Name	Category	Circumference (inches)	Diameter (in.)	Height (Ft.)
31	Black Olive	*Terminalia buceras*	Non-native	58	18.46	31
32	Black Olive	*Terminalia buceras*	Non-native	49	15.60	28
33	Black Olive	*Terminalia buceras*	Non-native	39	12.41	31
34	Black Olive	*Terminalia buceras*	Non-native	33	10.50	31
35	Black Olive	*Terminalia buceras*	Non-native	49	15.60	31
36	Black Olive	*Terminalia buceras*		34	10.82	25
37	Black Olive	*Terminalia buceras*		40	12.73	25
38	Black Olive	*Terminalia buceras*	Non-native	40	12.73	24
39	Black Olive	*Terminalia buceras*	Non-native	48	15.28	29
40	Black Olive	*Terminalia buceras*	Non-native	50	15.92	29
41	Black Olive	*Terminalia buceras*	Non-native	29	9.23	38
42	Black Olive	*Terminalia buceras*	Non-native	68	21.65	13
43	Seagrape	*Coccoloba uvifera*		20.5 Left Trunk/20 Right Trunk	6.5 Left Trunk/ 6.3 Right Trunk	23
44	Black Olive	*Terminalia buceras*	Non-native	25	7.96	39
45	Black Olive	*Terminalia buceras*	Non-native	60	19.10	39
46	Black Olive	*Terminalia buceras*	Non-native	39	12.41	110-115
47	Australian Pine	*Casuarina equisetifolia*	FLEPPC Category 1 invasive exotic	60	19.10	80-90
47A	Silk Tree	*Albizia julibrissin*	FLEPPC Category 1 invasive exotic	24	7.64	25
48	Australian Pine	*Casuarina equisetifolia*	FLEPPC Category 1 invasive exotic	45	14.32	30
49	Australian Pine	*Casuarina equisetifolia*	FLEPPC Category 1 invasive exotic	28	8.91	50-60
50	Australian Pine	*Casuarina equisetifolia*	FLEPPC Category 1 invasive exotic	42	13.37	110-115
51	Australian Pine	*Casuarina equisetifolia*	FLEPPC Category 1 invasive exotic	64	20.37	80
52	Australian Pine	*Casuarina equisetifolia*	FLEPPC Category 1 invasive exotic	49.5	15.76	12
53	Seagrape	*Coccoloba uvifera*		11	3.50	25
54	Seagrape	*Coccoloba uvifera*		18	5.70	10
55	Seagrape	*Coccoloba uvifera*		18	5.73	30
56	Seagrape	*Coccoloba uvifera*		19	6.05	19
57	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	22	7.00	20
58	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	19	6.05	150
59	Australian Pine	*Casuarina equisetifolia*	FLEPPC Category 1 invasive exotic	70	22.28	45
60	Strangler Fig	*Ficus aurea*	On Brazillian Pepper	96	30.56	35
61	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	25	7.96	50
62	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	34	10.82	40
63	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	30	9.55	30
64	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	31	9.87	25
65	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	28	8.91	28
66	Seaside Mahoe	*Thespesia populnea*	FLEPPC Category 1 invasive exotic	20	6.37	25

Note: Data collected by GRB.

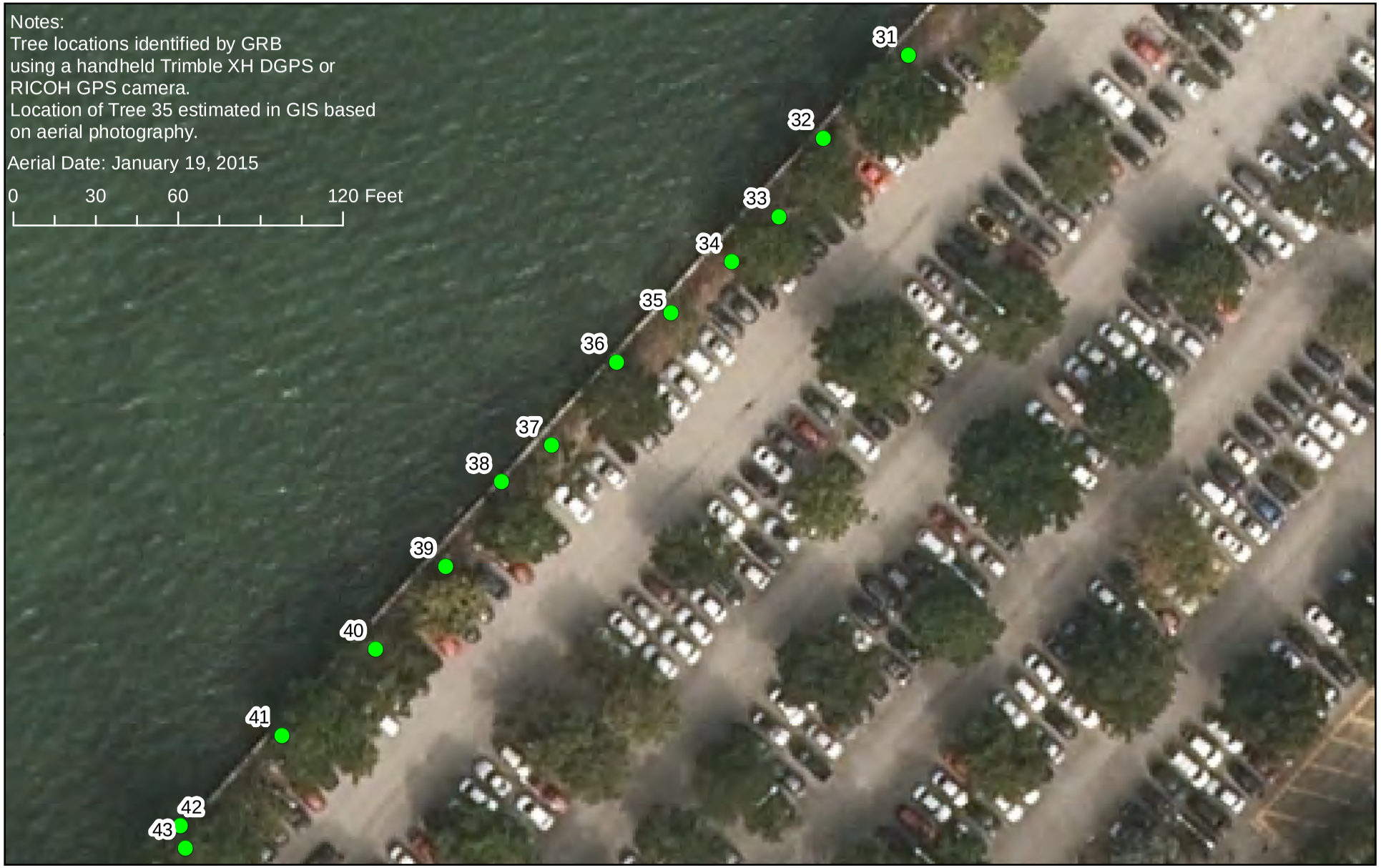
Mt. Sinai Hospital Bulkhead Replacement Tree Survey
North Segment Trees 1-13
Figure 16a

Coastal Eco Group Inc.

N
W E
S

Mt. Sinai Hospital Bulkhead Replacement Tree Survey
Central Segment Trees 14-30
Figure 16b

Coastal Eco Group Inc.



N
W
E
S

Mt. Sinai Hospital Bulkhead Replacement Tree Survey
South Segment Trees 31-43
Figure 16c

Coastal Eco Group Inc.

N
W E
S

Mt. Sinai Hospital Bulkhead Replacement Tree Survey
South Segment Trees 44-66
Figure 16d

Coastal Eco Group Inc.

CONCLUSIONS

A total of 11 scleractinian corals greater than 1 cm in diameter were identified at the 70 transects along the bulkhead, six colonies were greater than 10 cm in diameter. All coral colonies less than 10 cm in diameter were identified as *S. siderea* or *S*. cf *siderea*. Larger corals greater than 10 cm in diameter were *O. diffusa*, *O. robusta*, and *S. siderea*. Macroalgae, empty space, turf algae, and sponge cover, when combined, comprised 80% to 100% of the total cover at the encrusting organism transects.

A total of 17.04 acres of seagrass habitat are present within the 26.15-acre survey area, representing 65% of the survey area (**Table 21**). Seagrass habitat is dominated by a mixed species bed and a monospecific *H. decipiens* bed, each accounted for approximately 39% and 26% of the total seagrass area, respectively. The mixed species bed consists of *H. decipiens, H. wrightii, S. filforme,* and *T. testudinum*. The mixed bed is dominant along the first 50 ft to 100 ft of each transect and increases; this bed increases in extent in the south segment to a distance of 400 ft from the bulkhead. In areas where the mixed bed did not extend along the entire length of the transect, seagrass cover transitioned to a monospecific bed of *H. decipiens* in deeper water.

Table 21. Seagrass habitat acreages within the entire survey area and within 20 ft of the bulkhead, 21 to 50 ft of the bulkhead, and 51 to 400 ft from the bulkhead.

Habitat	Acreages			
	Total Survey Area	0 ft (Bulkhead) to 20 ft	21 ft to 50 ft	51 ft to Offshore Extent
Mixed Species Bed	10.16	0.67	1.77	7.72
HD Bed	6.75	0.02	0.34	6.38
HW Bed	0.10			0.10
TT Bed	0.03			0.03
Total Seagrass	**17.04**	**0.69**	**2.11**	**14.23**
Unvegetated	**9.11**	**0.78**	**0.07**	**8.27**
Total Survey Area	26.15	1.47	2.18	22.50

The distance of the nearshore bed edge to the bulkhead ranged between 0 and 28 ft and was closest to the bulkhead in the central segment (**Tables 7, 11,** and **15**). Seagrass density along the nearshore bed edge varied, but was generally higher in the central and south segments. The bed edge was characterized by mixed species along the majority of the edge; however, the nearshore edge at several transects was dominated by a single species, either *H. decipiens, H. wrightii,* or *S. filiforme*. Seagrass along the first 20 ft of each transect was generally characterized as low density with the majority of the segment comprised of less than 25% seagrass cover in all three segments (**Tables 22a-22c**). Seagrass was absent from the first 20 ft at several transects (Transects 7, 8, 9, 60-65, and 67). Seagrass density was higher when averaged over the first 50 ft of each transect (**Tables 23a-23c**). In the north segment, Category

1 (< 25% seagrass cover) had the greatest linear extent within the first 50 ft of each transect. However, in the central and south segments, the greatest linear extent of seagrass cover was between 50 and 75% cover.

There was a strong relationship between substrate type and seagrass bed throughout the survey area (**Table 24**). Sand was the dominant substrate along the bed edges. Muck was present along the offshore bed edge at 19 transects and along the nearshore edge at 3 transects (Transects 28, 29, and 45). The transects where muck was present at the offshore edge were located throughout the central and south segments between Transects 22 and 49. Muck was the dominant substrate throughout the central segment of the survey area. Thirty-three (33) transects were dominated by muck, 32 were dominated by sand, and 5 were dominated by a sand/shell matrix. At the muck-dominated transects, the average bed extent was 150 ft.

Table 22a. Average BB score (±SE), species composition, line intercept and dominant substrate within the first 20 ft of each transect in the north segment, Transects 1-9

	Transect	Avg BB (± SE)	Species Present	Line Intercept (ft)				Dominant Substrate
				<25%	25-50%	50-75%	> 75%	
North Segment	1	0.5 (±0.5)	Hd	20	0	0	0	Sand
	2	0.5 (±0.5)	Hd	20	0	0	0	Rubble
	3	1.7 (±0.9)	Hd Hw	16	4	0	0	Rubble
	4	1.0 (±1.0)	Hw Sf Tt	10	10	0	0	Sand
	5	1.0 (±1.0)	Hw Sf Tt	20	0	0	0	Sand
	6	2.0 (±1.2)	Hw Sf Tt	16	0	4	0	Sand
	7	0.0		20	0	0	0	Sand
	8	0.0		20	0	0	0	Sand
	9	0.0 (±0.0)		20	0	0	0	Rubble

Table 22b. Average BB score (±SE), species composition, line intercept and dominant substrate within the first 20 ft of each transect in the central segment, Transects 10-35

	Transect	Avg BB (± SE)	Species Present	Line Intercept (ft)				Dominant Substrate
				<25%	25-50%	50-75%	> 75%	
Central Segment	10	2.6 (±2.5)	Hw Tt	18	0	0	2	Sand
	11	2.7 (±1.3)	Hd Hw Sf	7	0	13	0	Sand
	12	4.7 (±0.3)	Hd Hw Sf	0	0	6	14	Sand
	13	3.5 (±1.5)	Hw Sf	10	0	0	10	Sand
	14	2.5 (±0.5)	Hd Hw Tt	7	13	0	0	Sand
	15	4.0	Hd Hw Sf Tt	0	0	20	0	Sand
	16	2.0 (±2.0)	Hd Hw Tt	5	0	15	0	Sand
	17	1.0 (±1.0)	Hd Hw	20	0	0	0	Sand
	18	1.0 (±1.0)	Hw	20	0	0	0	Sand
	19	1.3 (±0.7)	Hd Hw	20	0	0	0	Sand
	20	1.5 (±1.5)	Hw Tt	5	15	0	0	Sand
	21	2.0 (±2.0)	Hd Hw Sf Tt	6	0	14	0	Sand
	22	2.0 (±2.0)	Hd Hw Sf	6	0	14	0	Sand
	23	1.0 (±1.0)	Hw Tt	20	0	0	0	Sand
	24	3.5 (±0.5)	Hd Hw Sf Tt	0	5	15	0	Sand
	25	1.5 (±1.5)	Hd Hw Sf	4	16	0	0	Sand
	26	5.0 (±0.0)	Hd Hw Sf	0	0	0	20	Sand
	27	2.0 (±2.0)	Hd Hw Sf	3	0	17	0	Sand
	28	1.5 (±1.5)	Hd Hw Sf Tt	1	19	0	0	Muck
	29	2.0 (±2.0)	Hd Hw Sf Tt	5	0	15	0	Muck
	30	4.0 (±0.6)	Hd Hw Sf	0	8	5	7	Sand
	31	1.0 (±1.0)	Hd Hw Sf	20	0	0	0	Sand
	32	3.0 (±1.5)	Hd Hw Sf Tt	3	0	7	10	Sand
	33	2.0 (±2.0)	Hw Sf Tt	3	0	17	0	Sand
	34	2.5 (±2.5)	Hd Hw Sf	5	0	0	15	Sand
	35	2.1 (±2.0)	Hd Hw Sf Tt	3	0	17	0	Sand

Table 22c. Average BB score (±SE), species composition, line intercept and dominant substrate within the first 20 ft of each transect in the south segment, Transects 36-70

	Transect	Avg BB (± SE)	Species Present	Line Intercept (ft)				Dominant Substrate
				<25%	25-50%	50-75%	> 75%	
South Segment	36	3.0 (±1.0)	Hd Hw Sf Tt	4	0	16	0	Sand
	37	3.0	Hw Sf Tt	0	20	0	0	Sand
	38	3.0 (±1.5)	Hd Hw Sf	2	0	8	10	Sand
	39	4.0	Hd Hw Sf	0	0	20	0	Sand
	40	2.5 (±2.5)	Hd Hw Sf	2	0	0	18	Sand
	41	4.0	Hd Hw Sf	0	0	20	0	Sand
	42	3.3 (±1.7)	Hd Hw Sf	3	0	0	17	Sand
	43	3.0	Hd Hw Sf Tt	0	20	0	0	Sand
	44	1.7 (±0.9)	Hd Hw Sf Tt	10	10	0	0	Sand
	45	3.0	Hd Hw	0	20	0	0	Muck
	46	3.5 (±0.5)	Hd Hw Sf Tt	0	10	10	0	Sand
	47	1.5 (±1.5)	Hd Hw Sf	5	15	0	0	Sand
	48	3.0 (±1.0)	Hd Hw Sf	15	0	5	0	Sand
	49	2.5 (±2.5)	Hd Hw Sf	2	0	0	18	Sand
	50	1.5 (±1.5)	Hw Sf	4	16	0	0	Sand
	51	3.0 (±1.0)	Hd Hw Sf	5	0	15	0	Sand
	52	3.0 (±1.5)	Hd Hw Sf	5	0	10	5	Sand
	53	2.3 (±1.8)	Hw Sf Tt	3	0	17	0	Sand
	54	2.0 (±1.2)	Hw Sf	10	0	10	0	Sand
	55	1.0 (±1.0)	Hw Sf	20	0	0	0	Sand
	56	2.0 (±1.2)	Hw Sf Tt	15	0	5	0	Sand
	57	1.0 (±1.0)	Hw Sf	20	0	0	0	Sand
	58	1.5 (±1.5)	Sf	10	10	0	0	Sand
	59	1.5 (±1.5)	Hd Hw Sf	15	5	0	0	Sand
	60	0.0		20	0	0	0	Rubble
	61	0.0		20	0	0	0	Rubble
	62	0.0		20	0	0	0	Sand
	63	0.0		20	0	0	0	Sand
	64	0.0		20	0	0	0	Rubble
	65	0.0		20	0	0	0	Rubble
	66	2.0	Sf Tt	20	0	0	0	Sand
	67	0.0		20	0	0	0	Sand
	68	1.0 (±1.0)	Hw Sf	20	0	0	0	Rubble
	69	2.0 (±1.2)	Hw Sf Tt	10	0	10	0	Sand
	70	1.0 (±1.0)	Hw Sf	20	0	0	0	Sand

Table 23a. Average BB score (±SE), species composition, line intercept, and dominant substrate within the first 50 ft of each transect in the north segment, Transects 1-9

	Transect	Avg BB (± SE)	Species Present	Line Intercept (ft)				Dominant Substrate
				<25%	25-50%	50-75%	> 75%	
North Segment	1	1.0 (±0.6)	Hd	50	0	0	0	Sand
	2	2.0 (±0.9)	Hd	23	7	20	0	Sand
	3	1.7 (±0.9)	Hd Hw	16	34	0	0	Muck
	4	1.8 (±1.0)	Hd Hw Sf Tt	10	16	24	0	Sand
	5	1.7 (±0.4)	Hd Hw Sf Tt	44	6	0	0	Sand
	6	3.0 (±0.6)	Hd Hw Sf Tt	16	17	13	4	Sand
	7	2.3 (±0.9)	Hd Hw	24	26	0	0	Sand
	8	1.7 (±0.7)	Hd Hw Sf Tt	42	0	8	0	Sand
	9	1.6 (±0.7)	Hd Hw Sf	36	14	0	0	Sand

Table 23b. Average BB score (±SE), species composition, line intercept, and dominant substrate within the first 50 ft of each transect in the central segment, Transects 10-35

	Transect	Avg BB (± SE)	Species Present	Line Intercept (ft)				Dominant Substrate
				<25%	25-50%	50-75%	> 75%	
Central Segment	10	2.6 (±2.5)	Hw Tt	18	0	0	32	Sand
	11	3.2 (±0.7)	Hd Hw Sf	7	7	36	0	Sand
	12	4.5 (±0.3)	Hd Hw Sf	0	0	23	27	Sand
	13	3.8 (±0.6)	Hd Hw Sf	10	1	10	29	Sand
	14	3.3 (±0.5)	Hd Hw Tt	7	16	27	0	Sand
	15	4.0 (±0.4)	Hd Hw Sf Tt	0	1	36	13	Sand
	16	2.3 (±1.2)	Hd Hw Tt	5	20	25	0	Sand
	17	1.7 (±0.9)	Hd Hw Tt	30	20	0	0	Sand
	18	1.7 (±0.9)	Hd Hw	20	30	0	0	Sand
	19	1.3 (±0.7)	Hd Hw	50	0	0	0	Muck
	20	2.0 (±0.7)	Hd Hw Tt	15	35	0	0	Sand
	21	2.0 (±2.0)	Hd Hw Sf Tt	6	0	44	0	Sand
	22	2.0 (±1.2)	Hd Hw Sf	26	0	24	0	Sand
	23	0.8 (±0.6)	Hd Hw Tt	50	0	0	0	Muck
	24	3.3 (±0.3)	Hd Hw Sf Tt	0	25	25	0	Sand
	25	1.2 (±0.9)	Hd Hw Sf	24	26	0	0	Sand
	26	5.0 (±0.0)	Hd Hw Sf	0	0	0	50	Sand
	27	2.0 (±2.0)	Hd Hw Sf	3	0	47	0	Sand
	28	1.5 (±1.5)	Hd Hw Sf Tt	1	49	0	0	Muck
	29	1.3 (±1.3)	Hd Hw Sf Tt	12	0	38	0	Muck
	30	4.0 (±0.4)	Hd Hw Sf	0	8	35	7	Sand
	31	1.7 (±0.9)	Hd Hw Sf	30	20	0	0	Sand
	32	3.4 (±0.9)	Hd Hw Sf Tt	3	0	22	25	Sand
	33	2.3 (±1.2)	Hd Hw Sf Tt	3	20	27	0	Sand
	34	3.4 (±0.9)	Hd Hw Sf	5	0	10	35	Sand
	35	2.4 (±1.2)	Hd Hw Sf Tt	3	30	17	0	Sand

Table 23c. Average BB score (±SE), species composition, line intercept, and dominant substrate within the first 50 ft of each transect in the south segment, Transects 36-70

	Transect	Avg BB (± SE)	Species Present	Line Intercept (ft)				Dominant Substrate
				<25%	25-50%	50-75%	> 75%	
South Segment	36	3.8 (±0.6)	Hd Hw Sf Tt	4	0	41	5	Sand
	37	3.0 (±)	Hw Sf Tt	0	50	0	0	Sand
	38	3.8 (±1.0)	Hd Hw Sf	2	0	8	40	Muck
	39	4.0 (±)	Hd Hw Sf	0	0	50	0	Sand
	40	3.3 (±1.1)	Hd Hw Sf	2	0	20	28	Sand
	41	4.0 (±)	Hd Hw Sf	0	0	50	0	Sand
	42	3.8 (±1.3)	Hd Hw Sf	3	0	0	47	Muck
	43	3.0 (±)	Hd Hw Sf Tt	0	50	0	0	Sand
	44	1.8 (±0.6)	Hd Hw Sf Tt	20	30	0	0	Sand
	45	2.0 (±1.0)	Hd Hw Sf	30	20	0	0	Muck
	46	3.3 (±0.3)	Hd Hw Sf Tt	0	30	20	0	Sand
	47	2.0 (±1.0)	Hd Hw Sf	5	45	0	0	Sand
	48	3.0 (±0.6)	Hd Hw Sf	15	10	25	0	Sand
	49	2.5 (±2.5)	Hd Hw Sf	2	0	0	48	Sand
	50	2.8 (±0.9)	Hd Hw Sf	4	16	30	0	Sand
	51	3.3 (±0.7)	Hd Hw Sf	5	0	45	0	Sand
	52	3.5 (±1.2)	Hd Hw Sf	5	0	10	35	Sand
	53	2.8 (±1.2)	Hd Hw Sf Tt	3	0	47	0	Sand
	54	2.5 (±1.0)	Hw Sf	10	0	40	0	Sand
	55	2.3 (±0.9)	Hw Sf Tt	20	10	20	0	Sand
	56	2.0 (±1.2)	Hw Sf Tt	15	0	35	0	Sand
	57	1.3 (±0.7)	Hw Sf Tt	50	0	0	0	Sand
	58	2.5 (±0.9)	Hd Hw Sf	10	20	20	0	Sand
	59	1.5 (±1.5)	Hd Hw Sf	15	35	0	0	Sand
	60	2.5 (±2.5)	Hw Sf	20	0	0	30	Sand
	61	3.0 (±1.5)	Hd Hw Sf	25	0	5	20	Sand
	62	1.5 (±1.5)	Hd Hw Sf	50	0	0	0	Sand
	63	2.0 (±2.0)	Hd Hw Sf Tt	40	0	10	0	Sand
	64	2.5 (±2.5)	Hw Sf Tt	25	0	0	25	Sand
	65	2.3 (±1.5)	Hw Sf Tt	30	0	0	20	Sand
	66	2.0 (±0.0)	Hw Sf Tt	50	0	0	0	Sand
	67	2.0 (±2.0)	Hd Hw Sf Tt	30	0	20	0	Sand
	68	2.5 (±1.0)	Hw Sf Tt	20	15	0	15	Sand
	69	2.0 (±1.2)	Hw Sf Tt	10	0	40	0	Sand
	70	2.0 (±1.2)	Hw Sf Tt	20	0	30	0	Sand

Table 24. Average BB Score (±SE) of seagrass in muck versus sand in the central segment and northern half of the south segment where muck was the dominant substrate

	Transect	Muck	Sand
		Avg BB ± SE	Avg BB ± SE
Central Segment	10		2.8 (±0.7)
	11		2.5 (±0.4)
	12		2.2 (±0.5)
	13	2.5 (±0.5)	2.5 (±0.8)
	14		1.9 (±0.5)
	15		2.7 (±0.7)
	16	2.0 (±0.4)	2.3 (±1.8)
	17	2.0	1.3 (±0.4)
	18	1.3 (±0.3)	2.0 (±0.6)
	19	1.5 (±0.3)	1.8 (±0.7)
	20	1.6 (±0.6)	1.5 (±0.6)
	21	3.0	1.3 (±0.8)
	22	0.5 (±0.4)	0.0
	23	0.1 (±0.1)	2.0
	24	0.6 (±0.6)	3.0
	25	0.4 (±0.4)	3.0
	26	0.0 (±0.0)	3.5 (±1.5)
	27	0.0 (±0.0)	
	28	0.5 (±0.5)	
	29	0.0 (±0.0)	
	30	0.1 (±0.1)	4.0
	31	0.0 (±0.0)	3.0
	32	0.3 (±0.2)	4.3 (±0.3)
	33	0.4 (±0.4)	
	34	1.4 (±0.7)	5.0
	35	0.0 (±0.0)	3.0

	Transect	Muck	Sand
		Avg BB ± SE	Avg BB ± SE
South Segment	36	1.1 (±0.7)	4.0 (±0.0)
	37	0.0	3.5 (±0.5)
	38	2.0 (±0.8)	4.5 (±0.5)
	39	0.0	
	40	2.8 (±1.1)	
	41	0.0	
	42	2.7 (±1.5)	5.0 (±0.0)
	43	0.4 (±0.2)	
	44	0.4 (±0.3)	
	45	0.2 (±0.2)	
	46	0.8 (±0.6)	
	47	0.6 (±0.6)	
	48	0.1 (±0.1)	3.7 (±0.3)
	49	1.0 (±1.0)	
	50	0.0	4.0 (±0.0)

Notes: If the substrate type was not recorded along a transect, the cell is blank. An average BB of 0.0 means that seagrass was not recorded within the substrate type. No SE means that only a single BB cover score was recorded within the substrate type, suggesting that seagrass density did not change within the substrate type and does not restrict seagrass occurrence.

The offshore extent of seagrass is likely influenced by the location of the navigation channel. There was a significant ledge at the boundary of the navigational channel, which corresponded to the offshore seagrass bed edge along several transects in the central and south segments. These transects were also dominated by muck and characterized by deeper water depths in the offshore. Strong currents were noted during the survey; currents were strongest offshore and decreased in velocity along the transects towards shore with little to no current observed from approximately 100 ft to the bulkhead. The presence of the navigational channel combined with persistently strong currents and muck most likely limit seagrass expansion in this area.