TAYLOR ENGINEERING, INC.

Submerged Resource and Shoreline Vegetation Survey

Fort Pierce Harbour Pointe

St. Lucie County, Florida

October 2016

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Submerged Resource and Shoreline Vegetation Survey
Ft. Pierce Harbour Pointe
St. Lucie County, Florida

Prepared for

St. Lucie County

by

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C2016-042

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TABLE OF CONTENTS

1.0 INTRODUCTION **1**

2.0 SURVEY AREA DESCRIPTION **1**

3.0 TECHNICAL APPROACH **1**

3.1 Survey Methodology **1**

3.1.1 Preliminary Visual Reconnaissance *3*

3.1.2 Line Intercept Sampling *3*

3.1.3 Quadrat Sampling *3*

3.1.4 Shoreline Vegetation Assessment *6*

3.2 Seagrass Data Analysis **6**

4.0 RESULTS AND DISCUSSION **7**

4.1 General Submerged Resource Occurrence and Distribution **7**

4.2 Seagrass Frequency of Occurrence **10**

4.3 Seagrass Abundance **11**

4.4 Seagrass Density **11**

4.5 Hardbottom **11**

4.6 Shoreline Vegetation **12**

5.0 CONCLUSIONS **15**

REFERENCES **16**

APPENDIX A Summary of Transect Data
APPENDIX B Site Photographs
APPENDIX C Shoreline Vegetation Summary

LIST OF FIGURES

Figure 1 Location Map 2
Figure 2 Survey Boundary and Transect Locations – North 4
Figure 3 Survey Boundary and Transect Locations – South 5
Figure 4 Submerged Resource Map – North 8
Figure 5 Submerged Resource Map – South 9
Figure 6 Shoreline Vegetation Map – North 13
Figure 7 Shoreline Vegetation Map – South 14

1.0 INTRODUCTION

St. Lucie County is proposing to improve the Harbour Pointe property located in Fort Pierce, St. Lucie County, Florida, on the west bank of the Indian River between the Port of Fort Pierce and the mouth of Taylor Creek (Figure 1). A primary component of the proposed improvement plan includes construction of a bulkhead to stabilize the shoreline along portions of the property. St. Lucie County contracted Taylor Engineering to survey the project area shoreline and adjacent submerged lands to map and characterize shoreline vegetation and submerged natural resources. Data collected during the survey will support the planning, design, and permitting phases of the proposed improvements and will provide the basis for assessing potential natural resource impacts related to the project. This report documents the results of the survey.

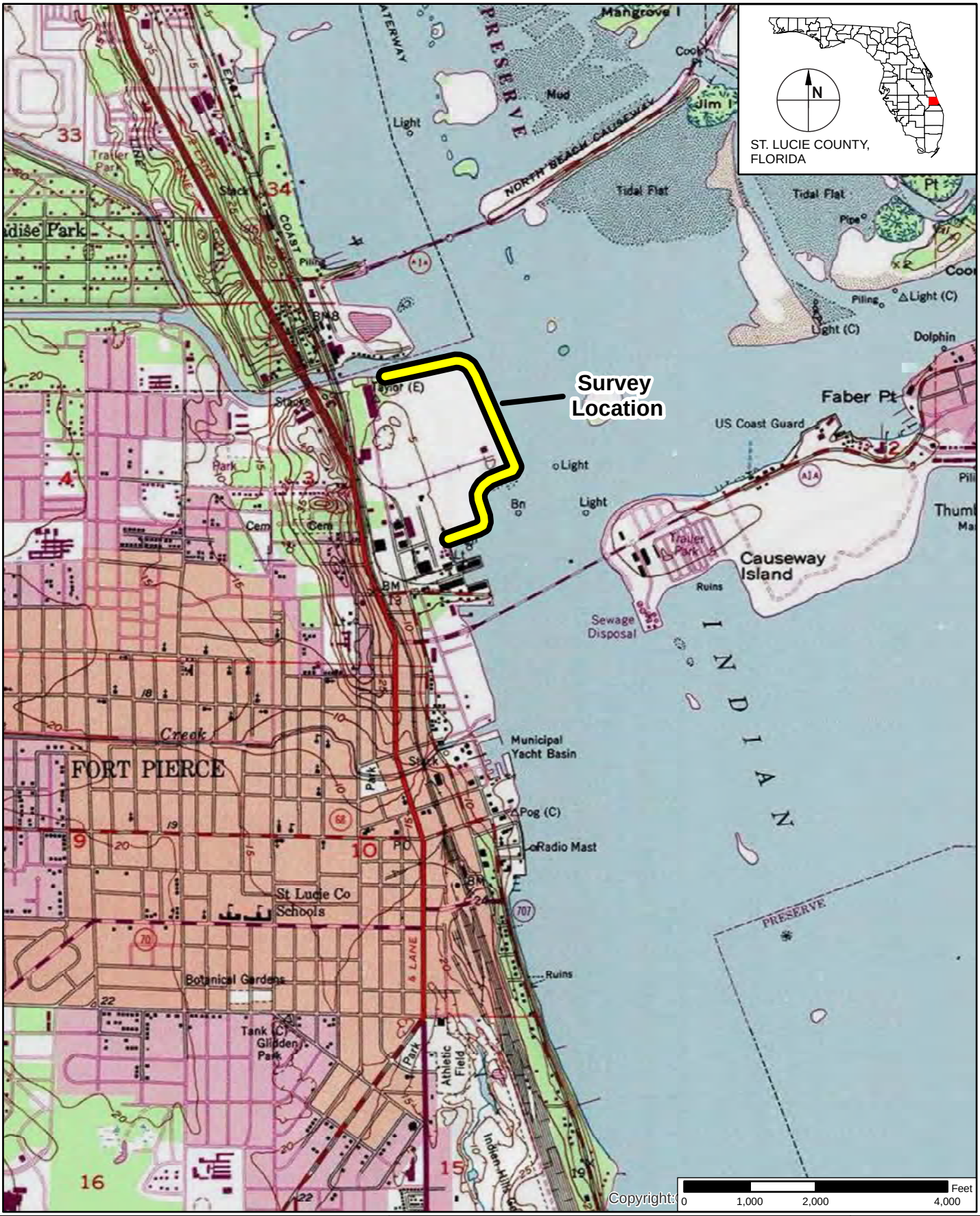
2.0 SURVEY AREA DESCRIPTION

The survey area spans approximately 4,600 linear feet of shoreline and comprises approximately 18.39 acres. A 10-foot landward offset from the mapped shoreline wrack line (field-approximated mean high water line [MHWL]) defined the survey area's landward boundary. Per the survey scope of work, the seaward survey boundary was defined by distance (300 feet seaward of the shoreline) or depth (-8 feet mean low water), whichever the surveyor first encountered. Figures 2 and 3 depict the survey boundary.

3.0 TECHNICAL APPROACH

3.1 Survey Methodology

The study area falls within the natural range of *Halophila johnsonii* (Johnson's seagrass), a federally-listed threatened species. Accordingly, Taylor Engineering employed a survey methodology consistent with the recommendations of the Johnson's Seagrass Recovery Team for large sites (National Marine Fisheries Service [NMFS], 2002). The survey recommendations for large sites apply to investigation areas greater than one hectare (2.47 acres). The survey included a preliminary visual reconnaissance of the study area followed by intensive sampling within areas identified as seagrass habitat. In addition, Taylor Engineering mapped and characterized shoreline vegetation and hardbottom habitat occurring within the study area. The following subsections detail the field survey approach.



Taylor Engineering Inc. 10151 Deerwood Park Blvd. Bldg. 300, Suite 300 Jacksonville, FL 32256 CERTIFICATE OF AUTHORIZATION # 4815	FIGURE 1 LOCATION MAP FORT PIERCE HARBOUR POINTE SUBMERGED RESOURCE AND SHORELINE VEGETATION SURVEY ST. LUCIE COUNTY, FLORIDA	PROJECT C2016-042 DRAWN BY NA SHEET DATE OCT 2016

3.1.1 Preliminary Visual Reconnaissance

In accordance with Johnson's seagrass survey protocol, Taylor Engineering environmental staff performed a preliminary in-water visual reconnaissance to determine the general occurrence and distribution of seagrasses within the project area and to confirm the presence of *H. johnsonii*. The preliminary reconnaissance consisted of a Taylor Engineering biologist snorkeling along sinuous transects spaced approximately 50 – 100 feet extending the entire length of the survey area (Figures 2 and 3). The diver used marker buoys to delineate the extent of seagrass habitat or the location of other sensitive submerged resources encountered during the preliminary assessment. Taylor Engineering environmental staff used a Trimble™ differentially-corrected global positioning system (DGPS) with sub-meter accuracy to record the horizontal location of the marker buoys.

3.1.2 Line Intercept Sampling

For the detailed portion of the survey, Taylor Engineering environmental staff established a series shore-perpendicular transects within the study area. Twenty-nine transects spaced at approximate 30-meter intervals along the submerged bottom extended across the length of the study area (Figures 2 and 3). Field staff used the DGPS to navigate to each transect endpoint. Flagged PVC stakes or weighted buoys marked the transect endpoints. A weighted nylon line marked in one meter increments extended along the submerged bottom between the transect endpoints to establish the transect line. Field staff swam along each transect and collected line intercept data to delineate resource habitat and substrate along the entire transect length. Additional qualitative data recorded along each transect included seagrass species composition and estimates of relative cover (i.e., sparse, low, moderate, dense). Field staff used the DGPS to record the location of seagrass bed and other submerged resource (e.g., hardbottom) edges along each transect and between transects as necessary. These data provided the basis for developing resource maps in ArcGIS.

3.1.3 Quadrat Sampling

Taylor Engineering environmental staff collected quantitative data along each transect using a quadrat sampling approach. This approach deployed a 1-square meter quadrat subdivided into 100 sub-units at the 0 point and at 10-meter intervals along each transect. Quadrat data collection only occurred if the sampling station fell within areas identified as seagrass habitat. In areas were only a narrow band of seagrass habitat occurred, field staff deployed quadrats at 5-meter intervals to ensure adequate data collection to appropriately characterize the seagrass resources present. At each quadrat location, field staff

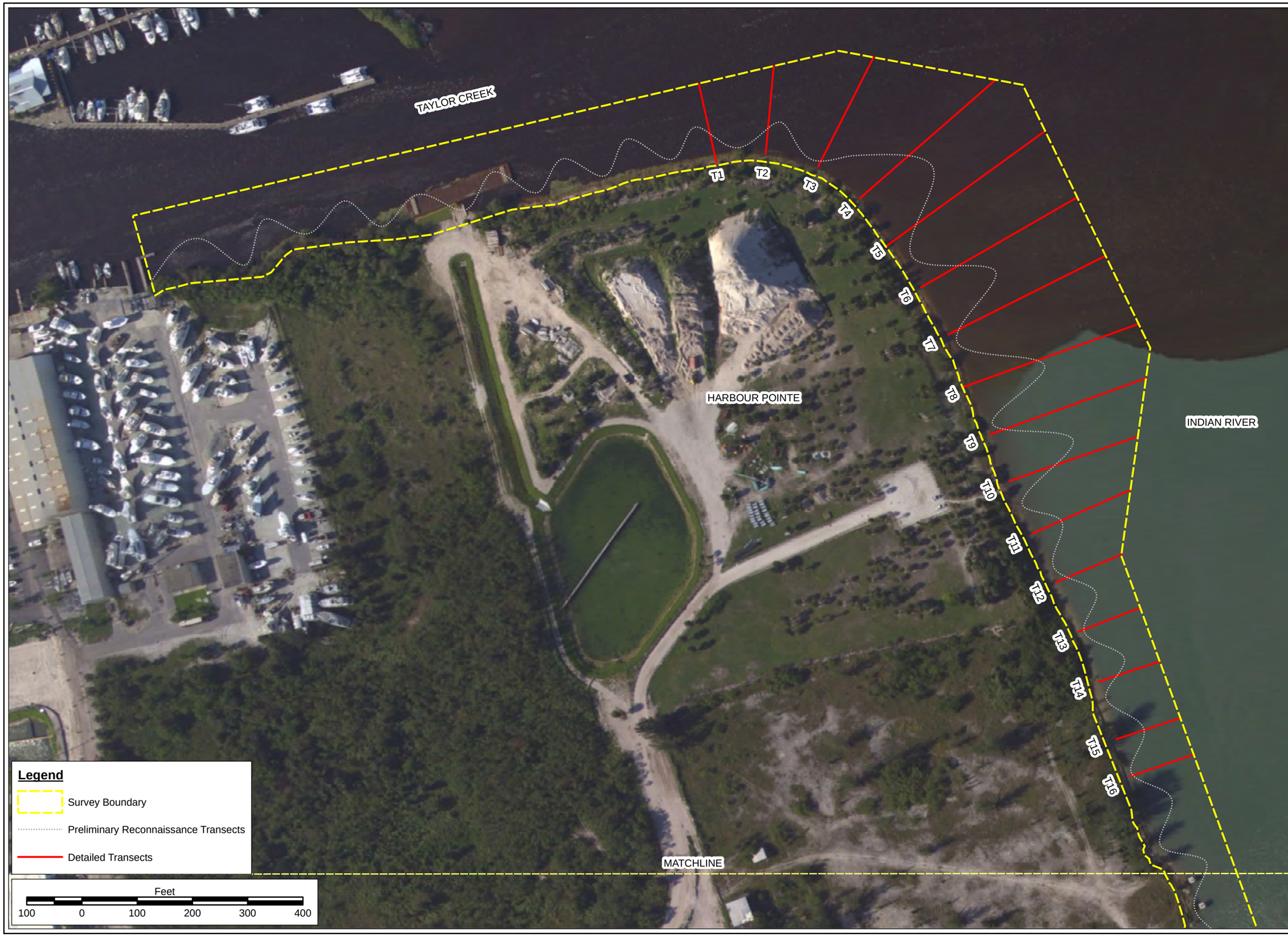


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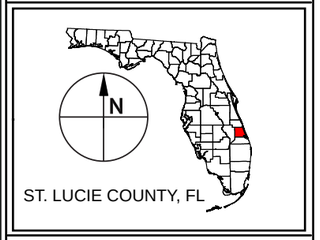
FIGURE 2

SURVEY BOUNDARY
AND
TRANSECT LOCATIONS - NORTH

FORT PIERCE
HARBOUR POINTE
SUBMERGED
RESOURCE AND
SHORELINE VEGETATION
SURVEY

ST. LUCIE COUNTY,
FLORIDA



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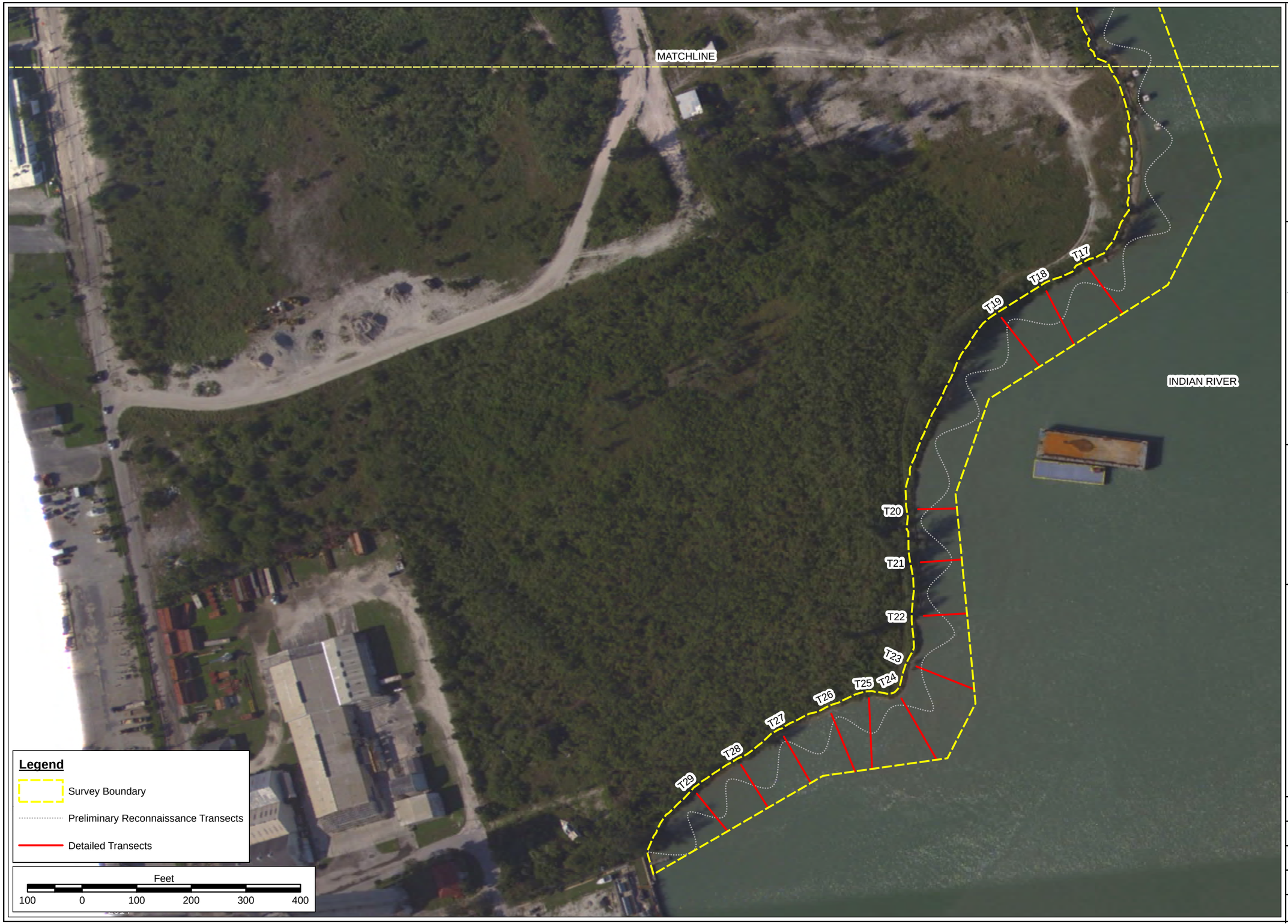

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FIGURE 3

SURVEY BOUNDARY
AND
TRANSECT LOCATIONS - SOUTH

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SUBMERGED
RESOURCE AND
SHORELINE VEGETATION
SURVEY

ST. LUCIE COUNTY,
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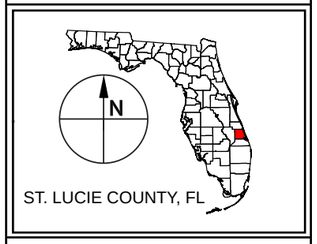

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collected data for each species present including the number of sub-units containing at least one seagrass shoot, the average cover abundance score (Braun-Blanquet, 1965), and additional information (e.g., water depth, substrate conditions) as appropriate. For each quadrat, field staff assigned a cover abundance score for each species present based on the following cover scale values (Braun-Blanquet scale):

0.1 = Solitary shoot
0.5 = Few shoots with less than 5% cover
1.0 = Numerous shoots but less than 5% cover
2.0 = Any number of shoots with 5 – 25% cover
3.0 = Any number of shoots with 25 – 50% cover
4.0 = Any number of shoots with 50 – 75% cover
5.0 = Any number of shoots with greater than 75% cover

3.1.4 Shoreline Vegetation Assessment

Field staff evaluated vegetation along the study area shoreline. No recent topographic or bathymetric survey data were available for this survey. In the absence of such data, field staff used the DGPS to map the observed wrack (debris) line along the shoreline to generally approximate the MHWL. A 10-foot landward offset of the mapped wrack line defined the vegetation assessment landward boundary; field staff mapped shoreline vegetation occurring seaward of the assessment boundary. Field staff collected qualitative data (e.g., species and general characteristics) and used the DGPS to map the seaward extent of vegetation and breaks along the shoreline where species dominance or characteristics substantially changed.

3.2 Seagrass Data Analysis

Following data collection, Taylor Engineering staff used the quadrat data and applied the Braun-Blanquet (1965) methodology to calculate the frequency of occurrence, abundance, and density for each species present along each transect. The equations for each of these metrics follow.

Frequency of occurrence (%) = (Number of occupied sub-units / total number of sub-units) x 100
Abundance = Sum of Braun-Blanquet cover score values / number of occupied quadrats
Density = Sum of Braun-Blanquet cover score values / total number of quadrats

4.0 RESULTS AND DISCUSSION

Taylor Engineering environmental staff conducted the submerged resource portion of the survey on August 23 – 25, 2016 within the annual survey window (June 1 – September 30) recommended by NMFS. Weather during the submerged resource survey included sunny to mostly cloudy skies, 80 – 90 degree temperatures, and light (5 – 10 mph) east to northeasterly winds. The in-water work occurred during incoming tides with variable water clarity and underwater visibility conditions. In general, underwater visibility ranged from about two to ten feet. Shallow water depths (less than ten feet) allowed for using snorkeling equipment to complete the survey.

The shoreline vegetation assessment occurred on September 6, 2016. Weather during the shoreline vegetation assessment consisted of partly to mostly cloudy skies, 80 – 85 degree temperatures, and light to moderate (5 – 15 mph) east to northeasterly winds.

4.1 General Submerged Resource Occurrence and Distribution

Marine seagrass species observed within survey area included paddle grass (*Halophila decipiens*), Johnson's seagrass (*Halophila johnsonii*), shoal grass (*Halodule wrightii*), and manatee grass (*Syringodium filiforme*) comprising monospecific beds and multi-species beds containing up to three species (Figures 4 and 5). Table 1 lists the species associations and total area for each distinct seagrass habitat type recorded during the survey.

Table 1 Seagrass Habitat Types Mapped within the Fort Pierce Harbour Pointe Survey Area

Seagrass Habitat	**Total Area**
Monospecific Beds	
H. decipiens	100,396 sq. ft. (2.31 ac.)
H. johnsonii	10,353 sq. ft. (0.24 ac.)
H. wrightii	3,536 sq. ft. (0.08 ac.)
Multi-species Beds	
H. decipiens / H. johnsonii	4,409 sq. ft. (0.10 ac.)
H. decipiens / H. wrightii	2,189 sq. ft. (0.05 ac.)
H. johnsonii / H. wrightii	46,499 sq. ft. (1.07 ac.)
H. johnsonii / S. filiforme	2,797 sq. ft. (0.06 ac.)
H. johnsonii / H. wrightii / S. filiforme	1,878 sq. ft. (0.04 ac.)
Total	**171,631 sq. ft. (3.95 ac.)**

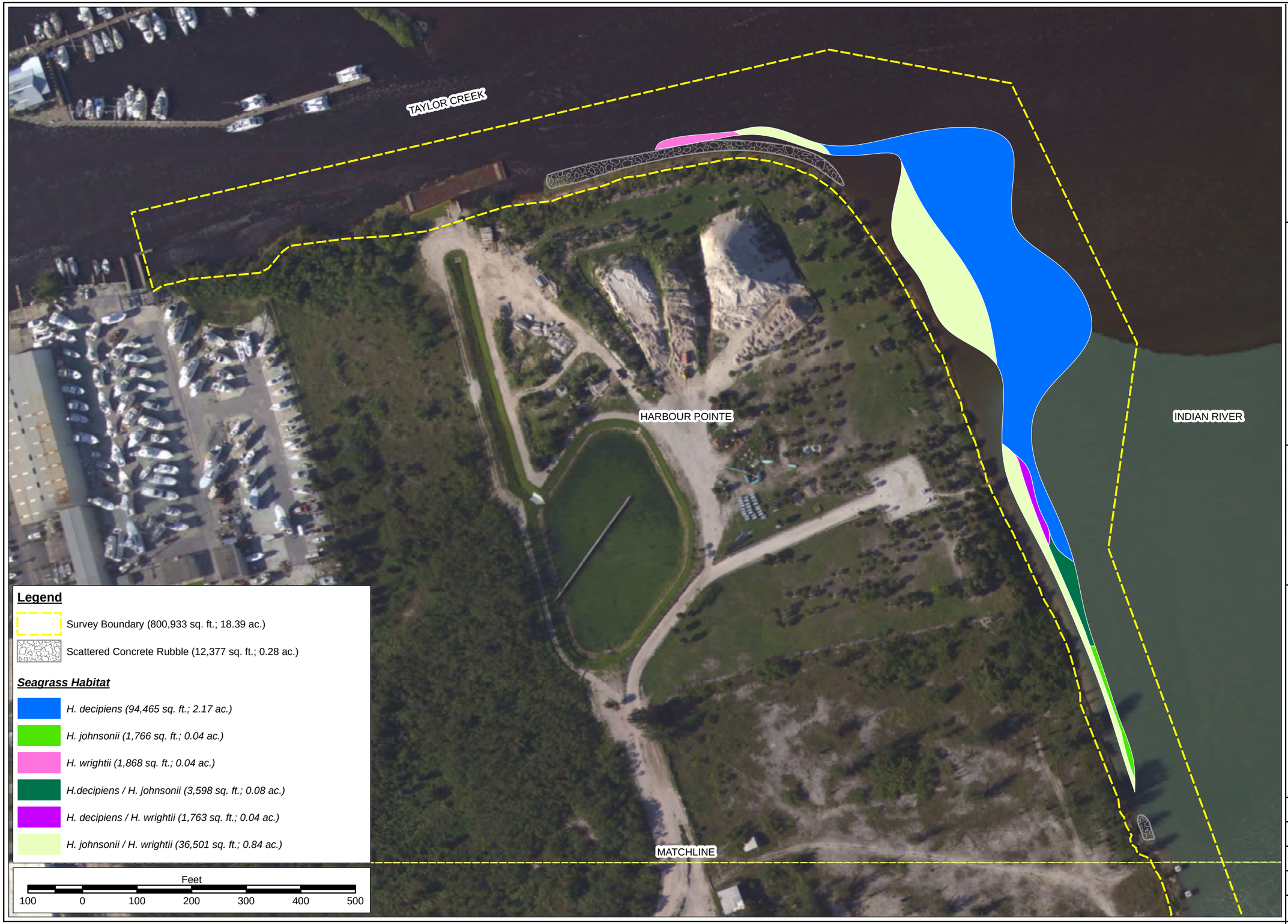

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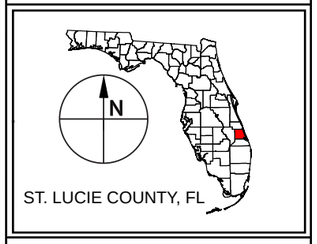
FIGURE 4

SUBMERGED RESOURCE MAP - NORTH

FORT PIERCE HARBOUR POINTE SUBMERGED RESOURCE AND SHORELINE VEGETATION SURVEY

ST. LUCIE COUNTY, FLORIDA



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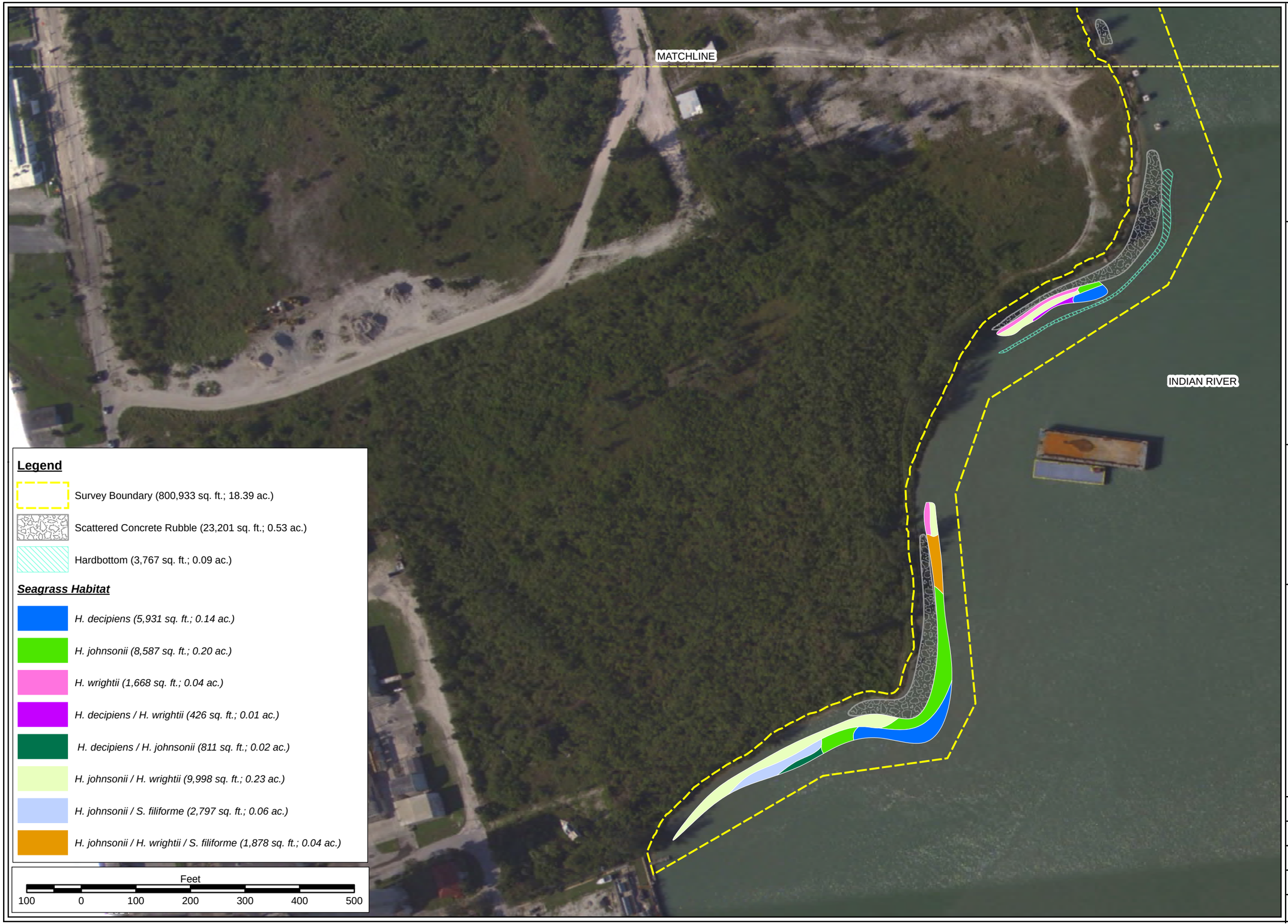

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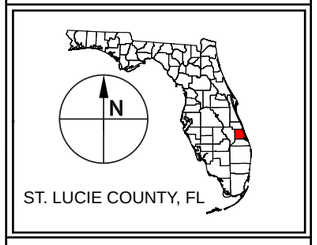
FIGURE 5

SUBMERGED RESOURCE MAP - SOUTH

FORT PIERCE HARBOUR POINTE SUBMERGED RESOURCE AND SHORELINE VEGETATION SURVEY

ST. LUCIE COUNTY, FLORIDA



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The primary seagrass habitat identified during the survey consisted of monospecific beds of *H. decipiens* occurring in the northeast portion of the survey area offshore Harbour Pointe Park. Shallow water depths extended furthest offshore in this area allowing for more expansive seagrass habitat. *H. decipiens* beds extended up to 300 feet offshore. Seagrass habitat within the remainder of the survey area generally occurred within 75 feet of the shoreline with narrow, longshore beds ranging from approximately 10 to 60 feet in width. In general, water depths in these areas increased rapidly from the shoreline, thereby limiting the seaward extent of seagrass habitat. This was especially evident in southern portion of the project area where the Port of Fort Pierce turning basin lies just offshore. *H. johnsonii* occurred in monospecific beds and multi-species beds spread throughout the survey area. In total, Taylor Engineering mapped 3.95 acres of seagrass habitat within the 18.39-acre survey area. Appendix A contains a summary of seagrass metrics for each transect where seagrasses occurred. Appendix B contains representative photographs depicting site conditions.

Surface sediments within the study area ranged from fine sand to silt with and without shell hash. In general, the finest sediments occurred near the mouth of Taylor Creek and within the seagrass habitat occupied by *H. decipiens* in the northern portion of the survey area. Sediments within the higher energy zone along the shoreline commonly included varying fractions of shell hash and pebble-size rock or concrete. Taylor Engineering mapped three distinct areas that contained larger (up to cobble size) concrete rubble in greater concentrations along the shoreline (Figures 4 and 5). The concrete material likely originated from a previous shoreline stabilization effort. The concrete rubble at the north end of the survey area included some attached relic oysters in low density. Field staff did not observe any living oysters or any other significant sessile organism growth in this area. Sessile organism growth on the mapped concrete rubble in the southern portion of the survey area included turf algae (dominant) with occasional macroalgae (*Caulerpa* sp.). Field staff mapped a narrow band of limestone hardbottom in deeper water near the central portion of the survey area. Section 4.5 describes the mapped hardbottom community in greater detail.

4.2 Seagrass Frequency of Occurrence

Frequency of occurrence, expressed as a percentage, estimates how often a particular species occurs at a specific location (e.g. quadrat, transect, study area). *H. johnsonii* occurred within quadrats along 22 of 29 transects and had the highest frequency of occurrence within the study area with a mean of 23.2% and a range of 1.8 – 100%. Considering only the transects where *H. johnsonii* occurred, the frequency of occurrence increased to 30.5%. *H. decipiens* occurred at 13 of the 29 transects and had a mean frequency of occurrence of 9.2% (range = 5.0 – 28.0%) over the entire study area. Considering only the 13 transects

where *H. decipiens* occurred, the mean frequency of occurrence increased to 20.4%. The frequency of occurrence for *H. wrightii* ranged from 1.8 – 56.0% with a mean of 8.0% across all transects and a mean of 12.3% for the 19 transects where the species occurred. *S. filiforme* only occurred at one transect and had the lowest mean frequency of occurrence — 0.1% across all transects and 4% at the transect where the species occurred.

4.3 Seagrass Abundance

Abundance provides a metric to evaluate the density of a particular species where it occurs. *H. decipiens* abundance values ranged from 1.50 to 4.00 with a mean of 2.20. This abundance value generally corresponds to a percent cover between 5 and 25% (see Section 3.1.3). *H. johnsonii* had a mean abundance value of 1.94 (range = 0.50 – 4.00). A mean abundance value of 1.94 corresponds to a percent cover between 5 and 25%. *H. wrightii* and *S. filiforme* had similar mean abundance values of 1.30 and 1.00, respectively. These abundance values generally correspond to percent cover less than 5%.

4.4 Seagrass Density

The density metric evaluates a species' density over the entire transect rather than only where the species occurs. For this reason, density values are generally lower than abundance values.

Density values for *H. johnsonii* ranged from 0.25 to 4.00 with mean values of 1.28 across all transects and 1.68 for the transects where the species occurred. Density values for *H. decipiens* ranged from 0.93 to 4.00 with a mean of 1.64 for transects where the species occurred. Taking into account all transects within the study area, the mean density of *H. decipiens* decreased to 0.74. *H. wrightii* had density values ranging from 0.25 to 3.00 with a mean of 0.68 across all transects. Considering only the transects where the species occurred, the mean density value increased to 1.03. *S. filiforme* had the lowest mean density values of 0.03 for all transects and 1.00 for transects occupied by this species.

4.5 Hardbottom

Taylor Engineering mapped and characterized a narrow band of hardbottom habitat totaling 0.09 acre in the central portion of the survey area (Figure 5). The hardbottom habitat occurs in deeper water (8 feet +) beginning just south of the mooring dolphins and extending southwest approximately 500 feet. The hardbottom consists of partially-exposed limestone and a low-relief (0.5 – 2 feet) limestone ledge,

both intermixed with sand/shell substrate. Past dredging likely exposed the limestone ledge. The exposed limestone (up to boulder size) is limited to the northern end (wider portion) of the mapped habitat. Sessile organisms encrusting the hardbottom include turf algae, macroalgae, and occasional sponges and hydroids. Recorded macroalgal species include *Acanthophora* sp., *Caulerpa* sp., *Gracilaria* sp., *Hypnea musciformis*, and *Laurencia* sp. Hydroids and sponges observed included *Sertularella speciosa* and *Cliona* sp. In addition, the survey identified three stony corals — two small (less than 8 centimeters) ivory brush corals (*Oculina diffusa*) and one small (~ 6 centimeters) lesser starlet coral (*Siderastrea radians*) – in the northern portion of hardbottom habitat. Both ivory brush corals appeared dead with no living tissue observed.

4.6 Shoreline Vegetation

The survey identified ten distinct vegetation areas based on species composition and dominance (Figures 6 and 7). Appendix C lists observed species and calculated areas above and below the wrack line for each vegetation area depicted in Figures 6 and 7. Most of the vegetation within the survey area occupied habitat above the wrack line. Vegetation above the wrack consisted of a mix of native and non-native upland and transitional wetland species typical of disturbed shoreline environments. Commonly occurring tree and shrub species above the wrack line include Brazilian pepper (*Schinus terebinthifolius*), buttonwood (*Conocarpus erectus*), beach naupaka (*Scaevola taccada*), sea grape (*Coccoloba uvifera*), Australian pine (*Casuarina equisetifolia*), and senna (*Senna* sp.). Typical herbaceous and vine species above the wrack line include seashore paspalum (*Paspalum vaginatum*), sea oxeye (*Borrichia frutescens*), creeping oxeye (*Wedelia trilobata*), common ragweed (*Ambrosia artemisiifolia*), seashore dropseed (*Sporobolus virginicus*), coin vine (*Dalbergia ecastaphyllum*), railroad vine (*Ipomoea pes-caprae*), and hairypod cowpea (*Vigna luteola*). Trees and shrubs growing below wrack line in a wetland condition include species such as Brazilian pepper, red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and sea oxeye. Commonly occurring herbaceous species growing below the wrack line include seashore paspalum, sea purslane (*Sesuvium portulacastrum*), and saltmeadow cordgrass (*Spartina patens*). Appendix B contains representative photographs of mapped shoreline vegetation.

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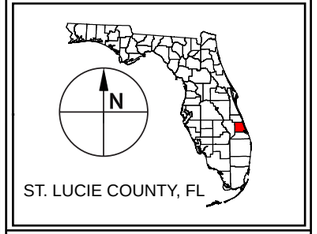
FIGURE 6

SHORELINE VEGETATION MAP - NORTH

FORT PIERCE HARBOUR POINTE SUBMERGED RESOURCE AND SHORELINE VEGETATION SURVEY

ST. LUCIE COUNTY, FLORIDA



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Aerial imagery source: NOAA, October 2016

Refer to report Appendix C for vegetation area descriptions.

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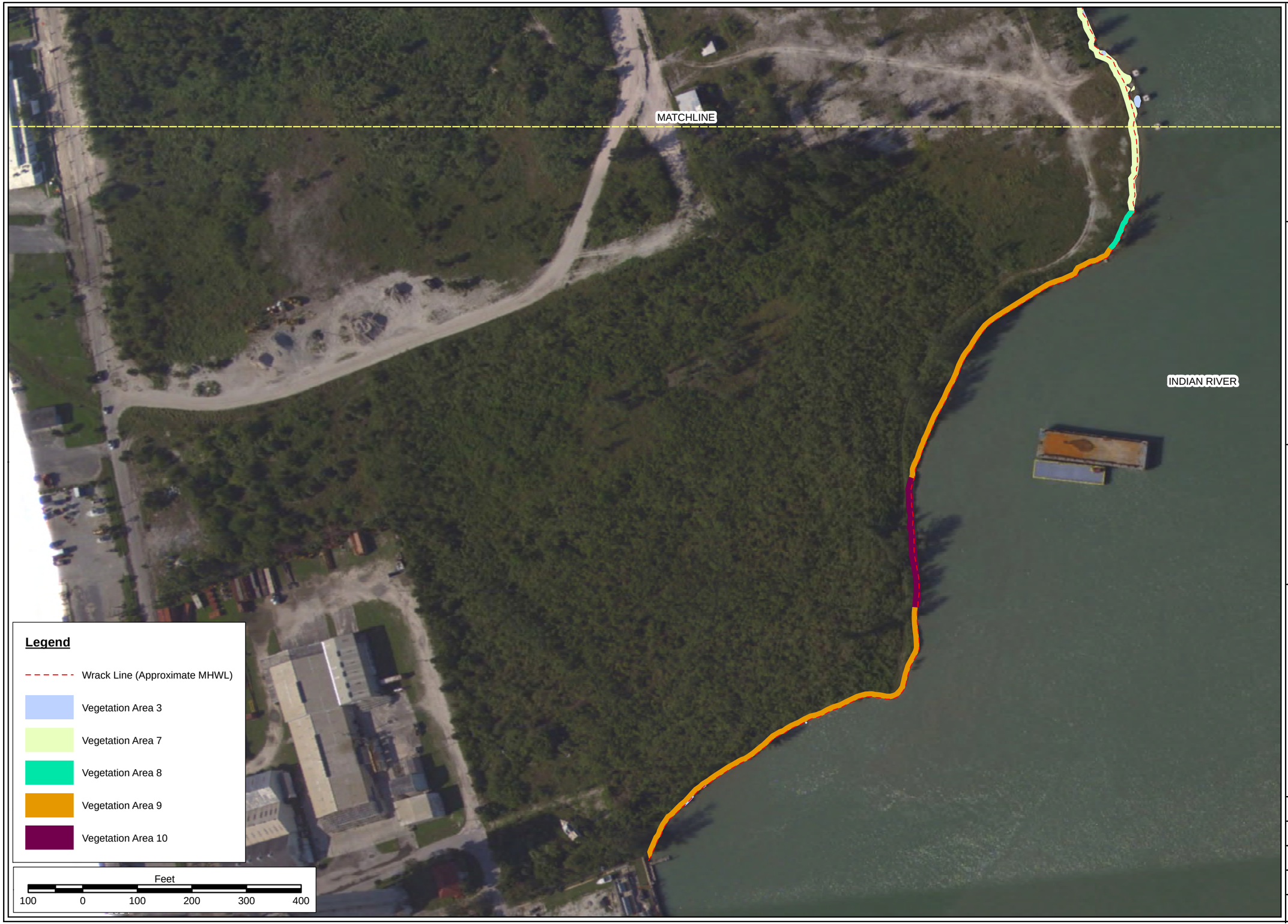

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FIGURE 7

SHORELINE VEGETATION MAP - SOUTH

FORT PIERCE HARBOUR POINTE SUBMERGED RESOURCE AND SHORELINE VEGETATION SURVEY

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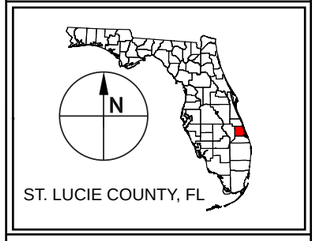

Notes:

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5.0 CONCLUSIONS

The Harbour Pointe study area contains a substantial quantity of seagrass habitat and smaller areas of hardbottom and wetland resources. State and federal regulations protect these aquatic resources. Accordingly, lead state and federal regulatory agencies (in this case, the Florida Department of Environmental Protection and the U.S. Army Corps of Engineers) will require the applicant to demonstrate that the proposed project design avoids and minimizes potential resource impacts to the greatest extent practicable. Unavoidable impacts to protected resources will require compensatory mitigation.

For seagrass, typical mitigation projects include measures such as transplanting the seagrass out of harm's way; restoring existing, damaged seagrass habitat; or creating new seagrass habitat (e.g., filling or excavating an area to create suitable elevations for seagrass growth). Given the species and densities at the Harbour Pointe site, seagrass transplantation may be difficult. Therefore, seagrass habitat restoration or creation may provide more viable seagrass mitigation solutions. For seagrass restoration or creation projects, regulatory agencies typically require annual mitigation area monitoring for a permit-specified period (e.g., once per year for five years following mitigation construction) to ensure that the mitigation project is successful and adequately offsets the seagrass impact. For unsuccessful mitigation projects, regulatory agencies will require corrective measures and, potentially, additional mitigation to ensure full compensation for the impact.

Relatively small areas of wetland vegetation occur below the mapped wrack line (approximate MHWL). Mitigation solutions for unavoidable wetland impacts generally include purchasing in-kind credits from an approved wetland mitigation bank (e.g., Bear Point Mitigation Bank) or by creating, restoring, or enhancing wetlands, preferably onsite. State and federal regulatory agencies prefer the use of a mitigation bank, if available.

Hardbottom mitigation typically involves creating new hardbottom habitat (artificial reef) by deploying hard substrate (e.g, limestone boulders, clean concrete) in a suitable area, preferably nearby the impact site, with the goal of creating habitat comparable to that of the impacted resource. After construction of the artificial reef, the regulatory agencies will require monitoring to demonstrate the success of the mitigation. In addition to mitigation for the hardbottom habitat, NMFS will likely require relocation of all living stony corals (e.g, *Oculina diffusa*) greater than 10 centimeters to a suitable habitat out of harm's way.

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APPENDIX A

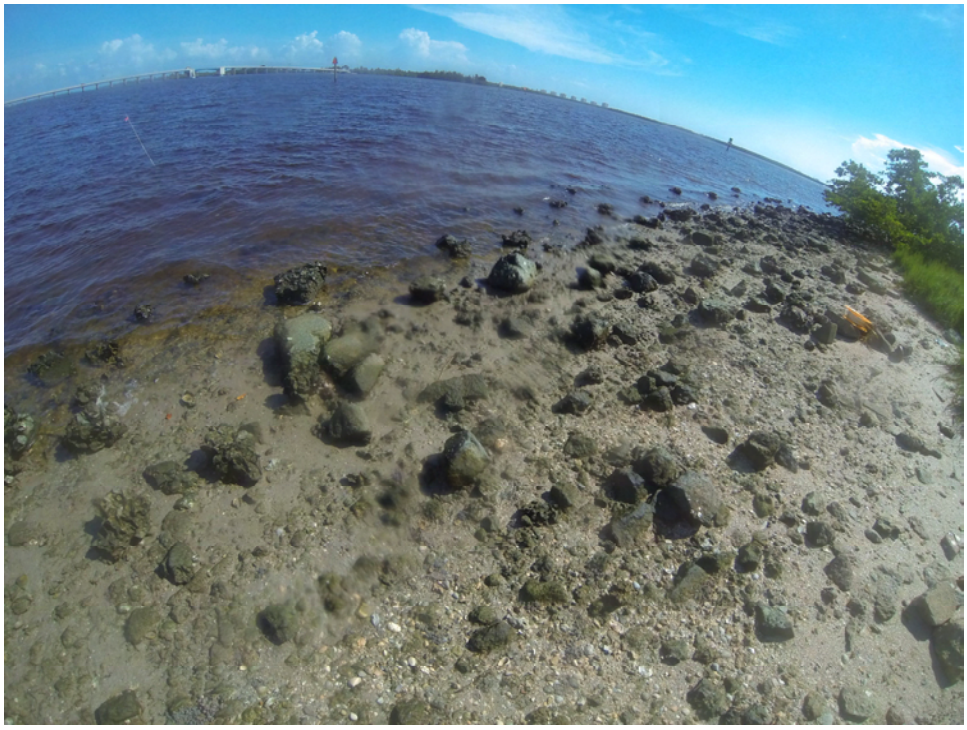
Summary of Transect Data

Summary of Transect Data

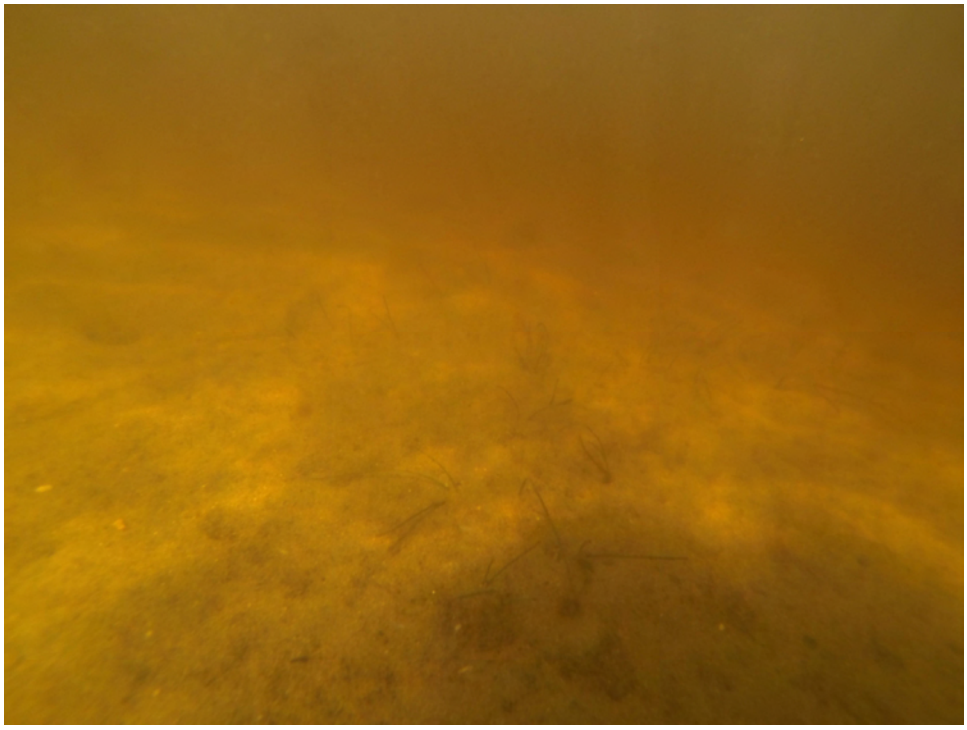
Transect	Species	Total Quadrats	Occupied Quadrats	Total Sub Units	Occupied Sub Units	Sum Cover Scores	Frequency of Occurrence (%)	Abundance	Density
1	Hw	1	1	100	2	0.5	2.0	0.50	0.50
2	Hj	1	1	100	8	1	8.0	1.00	1.00
2	Hw	1	1	100	4	1	4.0	1.00	1.00
3	Hj	1	1	100	14	2	14.0	2.00	2.00
3	Hw	1	1	100	3	0.5	3.0	0.50	0.50
4	Hd	3	3	300	28	4.5	9.3	1.50	1.50
5	Hd	8	6	800	184	12.5	23.0	2.08	1.56
5	Hj	8	2	800	14	2	1.8	1.00	0.25
5	Hw	8	2	800	14	2	1.8	1.00	0.25
6	Hd	6	3	600	120	7	20.0	2.33	1.17
6	Hj	6	3	600	117	5	19.5	1.67	0.83
6	Hw	6	3	600	119	5	19.8	1.67	0.83
7	Hd	7	4	700	67	6.5	9.6	1.63	0.93
7	Hj	7	2	700	43	3	6.1	1.50	0.43
7	Hw	7	2	700	65	4	9.3	2.00	0.57
8	Hd	5	4	500	56	6	11.2	1.50	1.20
9	Hd	2	2	200	39	4	19.5	2.00	2.00
10	Hd	2	1	200	10	2	5.0	2.00	1.00
10	Hj	2	1	200	55	3	27.5	3.00	1.50
10	Hw	2	1	200	9	1	4.5	1.00	0.50
11	Hd	2	2	200	43	5	21.5	2.50	2.50
11	Hw	2	1	200	6	1	3.0	1.00	0.50
12	Hd	2	1	200	45	3	22.5	3.00	1.50
12	Hj	2	2	200	72	4	36.0	2.00	2.00
12	Hw	2	1	200	16	1	8.0	1.00	0.50
13	Hd	2	1	200	56	2	28.0	2.00	1.00
13	Hj	2	2	200	19	2	9.5	1.00	1.00
13	Hw	2	1	200	15	1	7.5	1.00	0.50
14	Hj	1	1	100	2	0.5	2.0	0.50	0.50
14	Hw	1	1	100	22	2	22.0	2.00	2.00
15	Hj	1	1	100	42	3	42.0	3.00	3.00
16	Hj	1	1	100	75	3	75.0	3.00	3.00
16	Hw	1	1	100	7	1	7.0	1.00	1.00
17	Hj	1	1	100	62	3	62.0	3.00	3.00
18	Hd	1	1	100	12	2	12.0	2.00	2.00
18	Hj	1	1	100	26	2	26.0	2.00	2.00
19	Hj	1	1	100	36	2	36.0	2.00	2.00
19	Hw	1	1	100	10	1	10.0	1.00	1.00
20	Hw	1	1	100	16	2	16.0	2.00	2.00
21	Hj	1	1	100	4	1	4.0	1.00	1.00
21	Hw	1	1	100	8	1	8.0	1.00	1.00
21	Sf	1	1	100	4	1	4.0	1.00	1.00
22	Hj	1	1	100	87	3	87.0	3.00	3.00
23	Hj	1	1	100	100	4	100.0	4.00	4.00
24	Hd	1	1	100	78	4	78.0	4.00	4.00
25	Hd	2	1	200	12	2	6.0	2.00	1.00
25	Hj	2	1	200	92	3	46.0	3.00	1.50
26	Hj	1	1	100	42	2	42.0	2.00	2.00
26	Hw	1	1	100	56	3	56.0	3.00	3.00
27	Hj	1	1	100	8	1	8.0	1.00	1.00
27	Hw	1	1	100	30	2	30.0	2.00	2.00
28	Hj	1	1	100	10	1	10.0	1.00	1.00
28	Hw	1	1	100	15	1	15.0	1.00	1.00
29	Hj	1	1	100	9	1	9.0	1.00	1.00
29	Hw	1	1	100	6	1	6.0	1.00	1.00

APPENDIX B

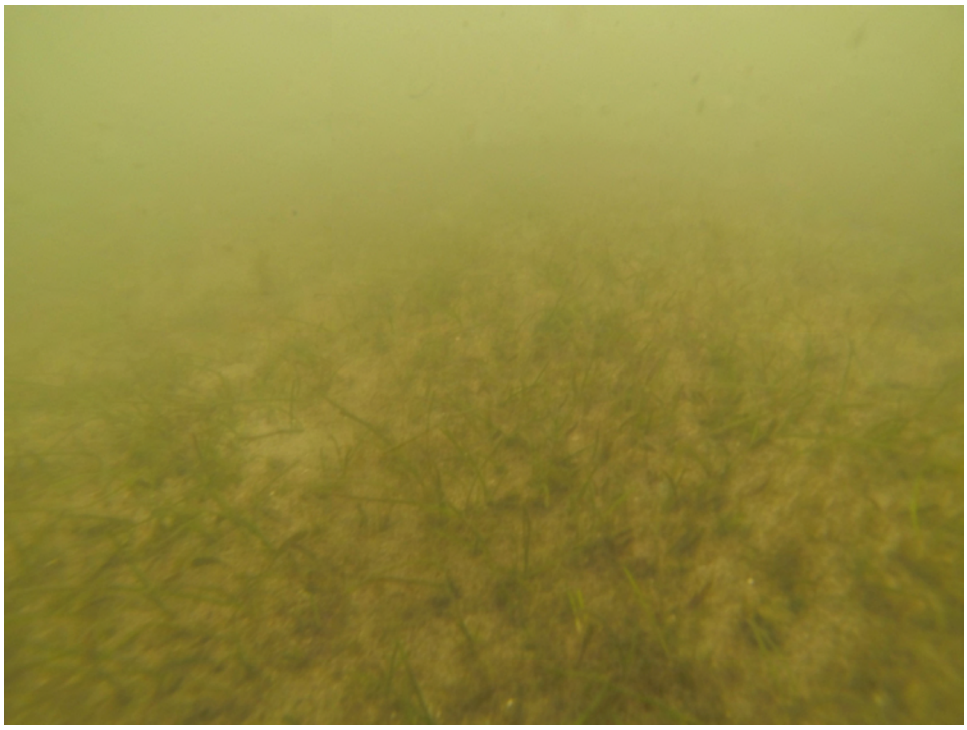
Site Photographs



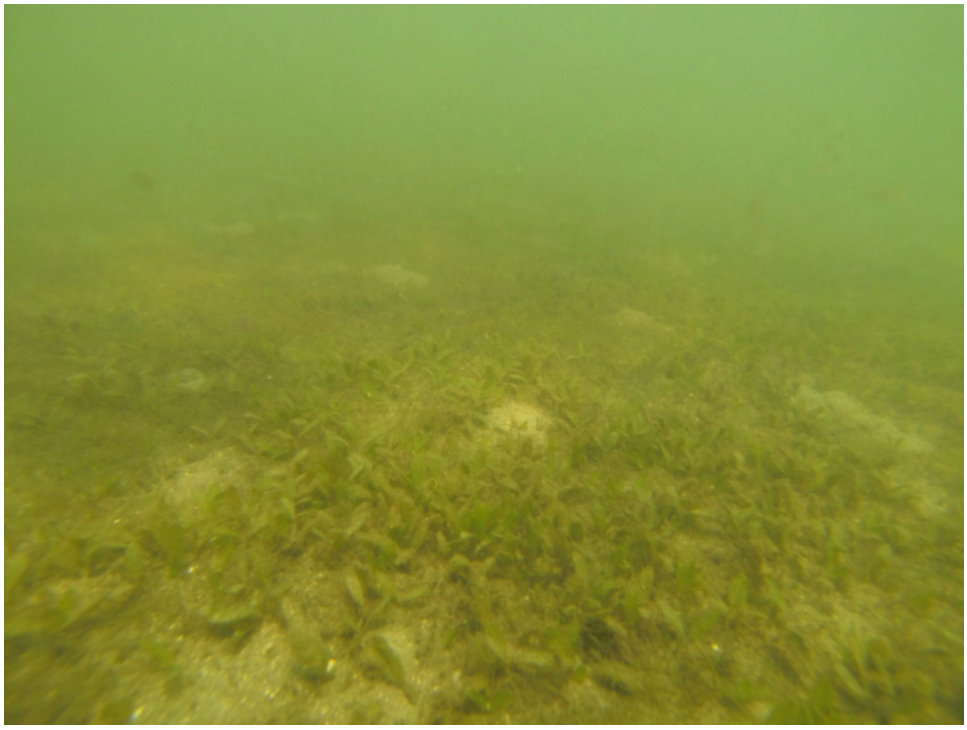
Photograph 1 Concrete rubble at mouth of Taylor Creek



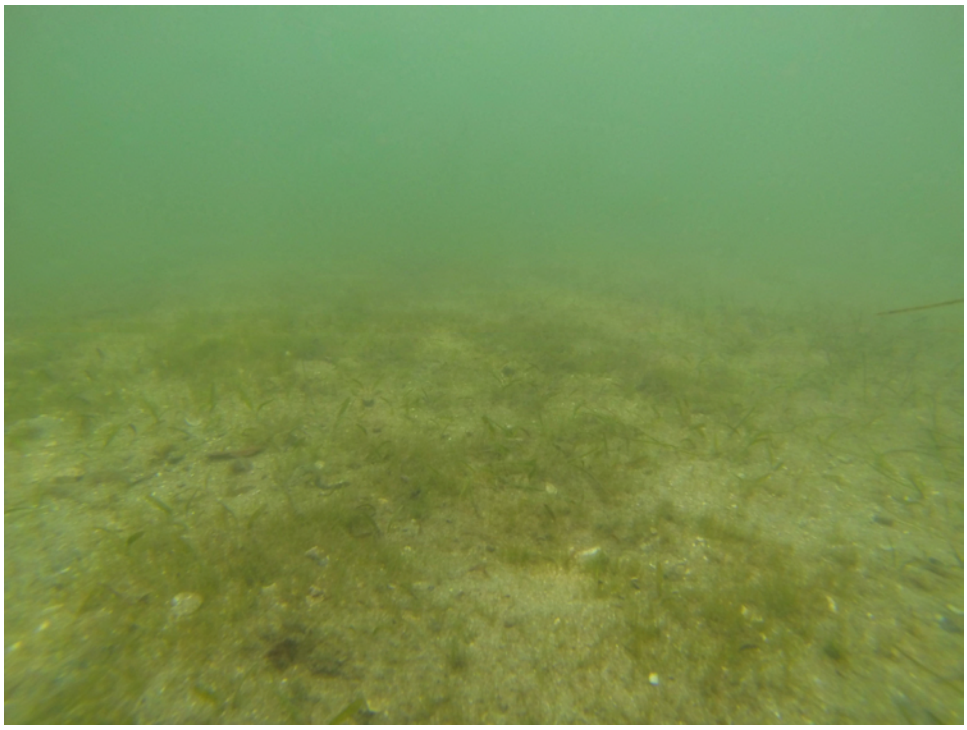
Photograph 2 Sparse *H. wrightii* at Transect 1



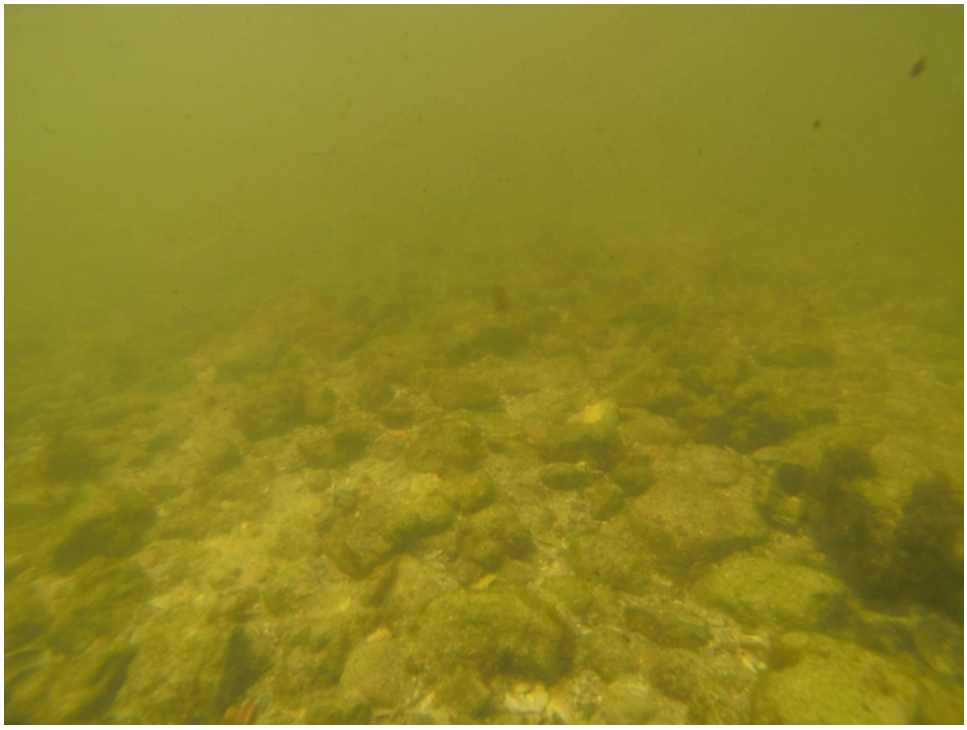
Photograph 3 *H. johnsonii* mixed with *H. wrightti* at Transect 7



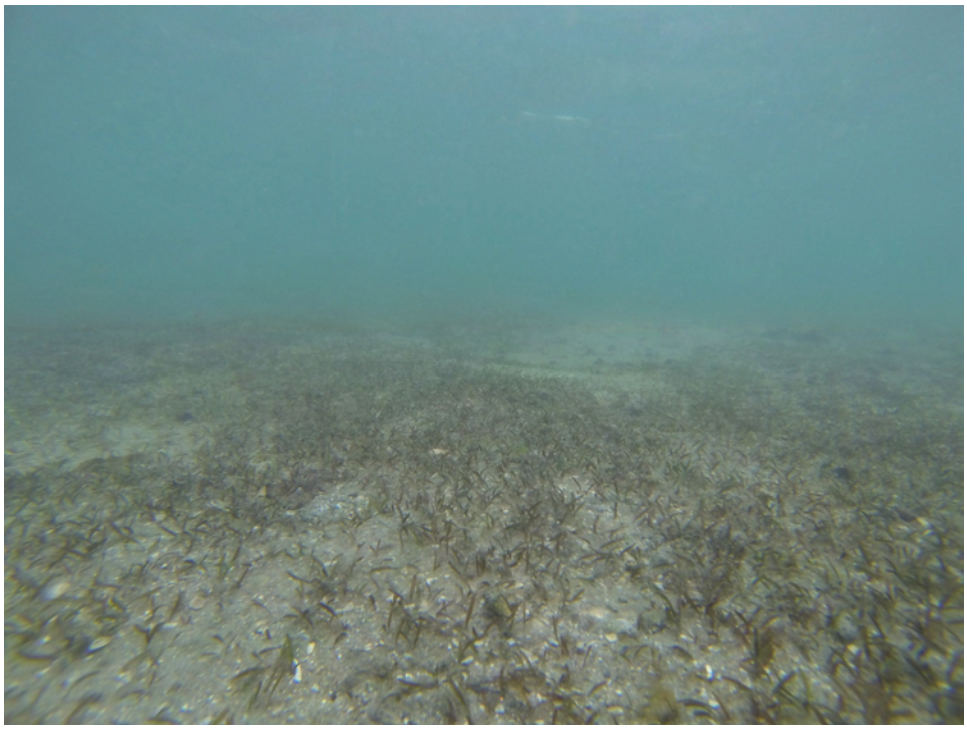
Photograph 4 *H. decipiens* at Transect 12



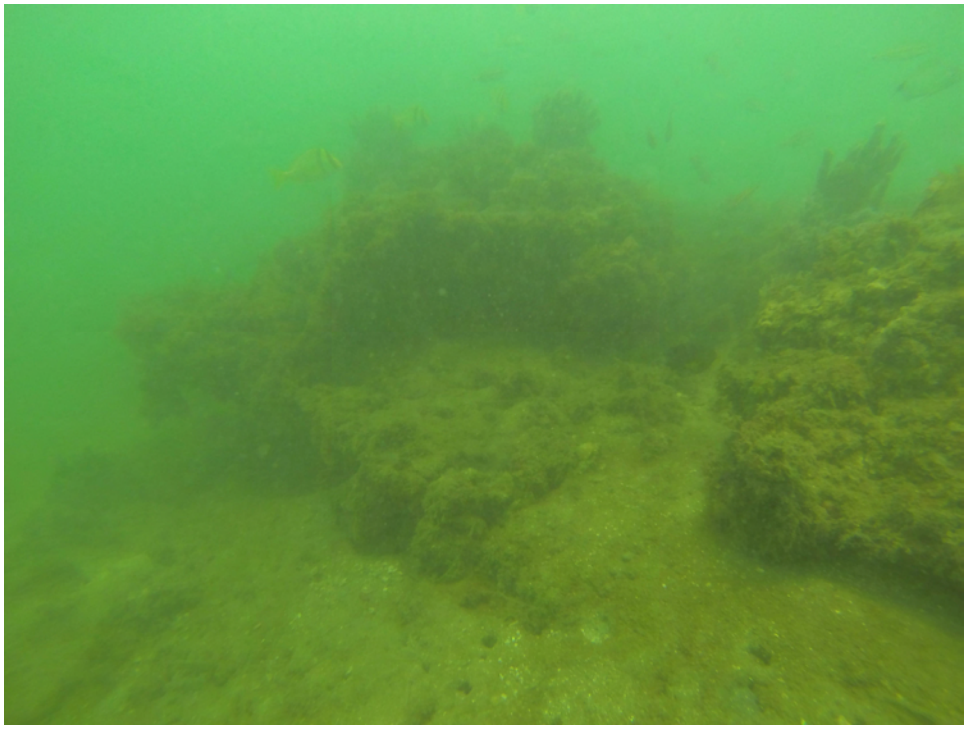
Photograph 5 Low density *H. johnsonii* mixed with *H. wrightii* at Transect 18



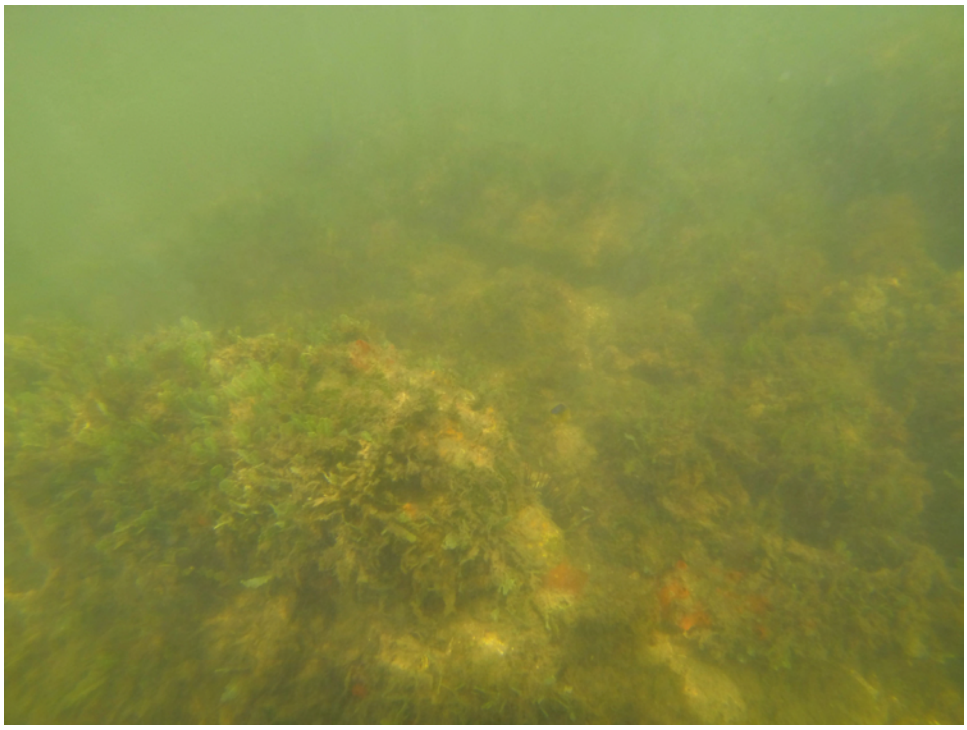
Photograph 6 Concrete rubble south of Transect 19



Photograph 7 *H. johnsonii* at Transect 23

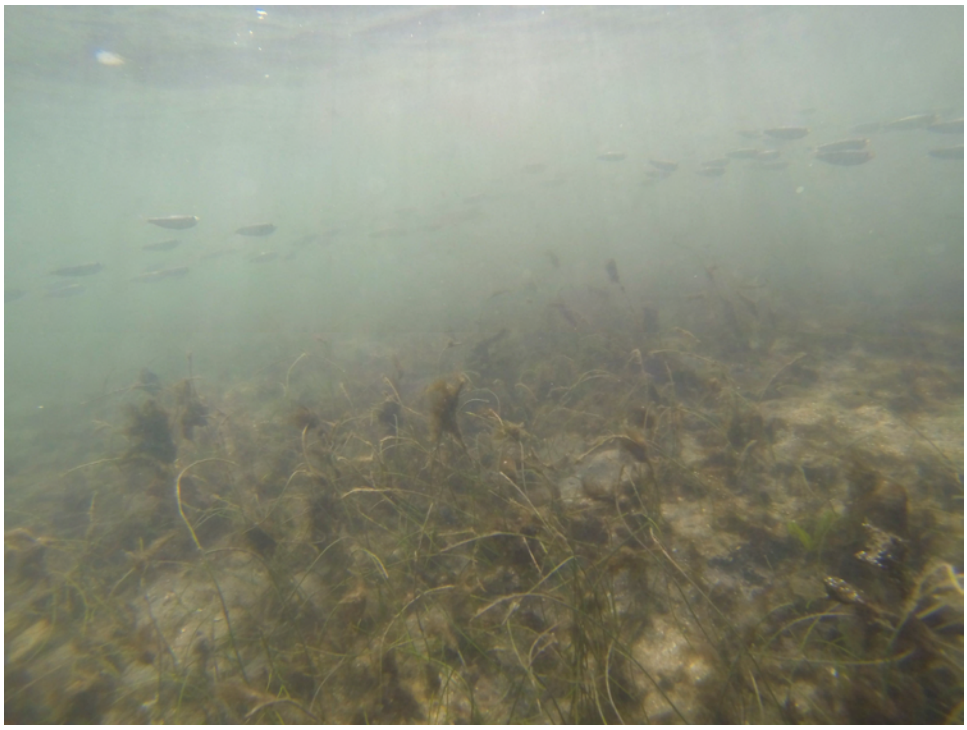


Photograph 8 Typical hardbottom habitat conditions



Photograph 9 Typical hardbottom habitat conditions

Photograph 10 Typical hardbottom habitat conditions



Photograph 11 *S. filiforme* mixed with *H. johnsonii* at Transect 28

Photograph 12 Brazilian pepper (non-native species) along northern shoreline (Vegetation Area 1)

Photograph 13 Large red mangrove on northern shoreline (Vegetation Area 3)

Photograph 14 Typical shoreline vegetation within Vegetation Area 4

Photograph 15 White mangrove on northern shoreline (Vegetation Area 3)

Photograph 16 Typical shoreline vegetation within Vegetation Area 5

Photograph 17 Beach naupaka (non-native species) on northeast shoreline (Vegetation Area 5)

Photograph 18 Typical shoreline vegetation within Vegetation Area 6

Photograph 19 Shoreline vegetation patches below the wrack line within Vegetation Area 7

Photograph 20 Typical shoreline vegetation within Vegetation Area 7

Photograph 21 Typical shoreline vegetation within Vegetation Area 9

Photograph 22 Typical shoreline vegetation within Vegetation Area 10

Photograph 23 Typical shoreline vegetation within Vegetation Area 10

Photograph 24 Typical shoreline vegetation along southern shoreline (Vegetation Area 9)

Photograph 25 Shoreline vegetation at southern end of survey area (Vegetation Area 9)

APPENDIX C

Shoreline Vegetation Summary

Shoreline Vegetation Observed within the Fort Pierce Harbour Pointe Study Area
(Refer to Report Figures 6 – 7)

ID	Size (square feet / acres)		Observed Species	
	AW [1]	**BW** [2]	**AW**	**BW**
Vegetation Area 1	5,186 / 0.119	7,227 / 0.166	Brazilian pepper (*Schinus terebinthifolius*)*†	Brazilian pepper (*Schinus terebinthifolius*)*†
Vegetation Area 2	404 / 0.009	158 / 0.004	Coin vine (*Dalbergia ecastaphyllum*) Virginia creeper (*Parthenocissus quinquefolia*) Seashore paspalum (*Paspalum vaginatum*) Brazilian pepper (*Schinus terebinthifolius*)*† Hairypod cowpea (*Vigna luteola*) Creeping oxeye (*Wedelia trilobata*)†	Seashore paspalum (*Paspalum vaginatum*)* Sea purslane (*Sesuvium portulacastrum*)
Vegetation Area 3	401 / 0.009	1,424 / 0.033	Black mangrove (*Avicennia germinans*) White mangrove (*Laguncularia racemose*)	Black mangrove (*Avicennia germinans*) White mangrove (*Laguncularia racemose*) Red mangrove (*Rhizophora mangle*)
Vegetation Area 4	4,133 / 0.095	2,016 / 0.046	Common ragweed (*Ambrosia artemisiifolia*) Hairy beggarticks (*Bidens pilosa*) Buttonwood (*Conocarpus erectus*) Railroad vine (*Ipomoea pes-caprae*) Seashore paspalum (*Paspalum vaginatum*)* Senna (*Senna* sp.) Hairypod cowpea (*Vigna luteola*) Creeping oxeye (*Wedelia trilobata*)†	Seashore paspalum (*Paspalum vaginatum*)*
Vegetation Area 5	9,839 / 0.226	185 / 0.004	Sea oxeye (*Borrichia frutescens*) Buttonwood (*Conocarpus erectus*) Coin vine (*Dalbergia ecastaphyllum*) Seashore paspalum (*Paspalum vaginatum*)* Beach naupaka (*Scaevola taccada*)† Brazilian pepper (*Schinus terebinthifolius*)† Sea purslane (*Sesuvium portulacastrum*) Seashore dropseed (*Sporobolus virginicus*)* Hairypod cowpea (*Vigna luteola*) Creeping oxeye (*Wedelia trilobata*)†	Seashore paspalum (*Paspalum vaginatum*)

Shoreline Vegetation Observed within the Fort Pierce Harbour Pointe Study Area (cont.)
(Refer to Report Figures 6 – 7)

Vegetation Area 6	1,385 / 0.032	--	Hairy beggarticks (*Bidens pilosa*) Sea grape (*Coccoloba uvifera*) Coin vine (*Dalbergia ecastaphyllum*) Seashore paspalum (*Paspalum vaginatum*) Beach naupaka (*Scaevola taccada*)*† Senna (*Senna* sp.) Hairypod cowpea (*Vigna luteola*)	No vegetation
Vegetation Area 7	5,964 / 0.137	1,511 / 0.035	Common ragweed (*Ambrosia artemisiifolia*) Sea oxeye (*Borrichia frutescens*) Australian pine (*Casuarina equisetifolia*)† Beach pennywort (*Hydrocotyle bonariensis*) Torpedo grass (*Panicum repens*)*† Seashore paspalum (*Paspalum vaginatum*)* Sea purslane (*Sesuvium portulacastrum*) Seashore dropseed (*Sporobolus virginicus*)	Sea oxeye (*Borrichia frutescens*) Dune elder (*Iva imbricata*) White mangrove (*Languncularia racemosa*) Seashore paspalum (*Paspalum vaginatum*)* Sea purslane (*Sesuvium portulacastrum*)* Saltmeadow cordgrass (*Spartina patens*) Hairypod cowpea (*Vigna luteola*)
Vegetation Area 8	816 / 0.019	--	Common ragweed (*Ambrosia artemisiifolia*) Australian pine (*Casuarina equisetifolia*)† Sea purslane (*Sesuvium portulacastrum*) Seashore dropseed (*Sporobolus virginicus*)*	No vegetation
Vegetation Area 9	13,216 / 0.303	--	Common ragweed (*Ambrosia artemisiifolia*) Sea oxeye (*Borrichia frutescens*) Australian pine (*Casuarina equisetifolia*)† Sea grape (*Coccoloba uvifera*) Coin vine (*Dalbergia ecastaphyllum*)* Railroad vine (*Ipomoea pes-caprae*) Guinea grass (*Panicum maximum*)† Torpedo grass (*Panicum repens*)† Seashore paspalum (*Paspalum vaginatum*) Senna (*Senna* sp.) Sea purslane (*Sesuvium portulacastrum*) Hairypod cowpea (*Vigna luteola*)	No vegetation

Shoreline Vegetation Observed within the Fort Pierce Harbour Pointe Study Area (cont.)
(Refer to Report Figures 6 – 7)

Vegetation Area 10	2,400 / 0.055	758 / 0.017	Sea oxeye (*Borrichia frutescens*) Australian pine (*Casuarina equisetifolia*)† Seashore paspalum (*Paspalum vaginatum*) Sea purslane (*Sesuvium portulacastrum*)	Black mangrove (*Avicennia germinans*) Sea oxeye (*Borrichia frutescens*)* White mangrove (*Languncularia racemosa*) Seashore paspalum (*Paspalum vaginatum*) Red mangrove (*Rhizophora mangle*) Sea purslane (*Sesuvium portulacastrum*)
Total	**43,744 / 1.004**	**11,097 / 0.305**		

[1] AW = Above mapped wrack line (above approximate mean high water line)
[2] BW = Below mapped wrack line (below approximate mean high water line)
* Denotes dominant species
† Denotes non-native species