FINAL PROJECT REPORT
FOR THE
PALM BEACH COUNTY
2007 HABITAT MAPPING PROJECT

Prepared under Task Order 0688-01A
by:

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Report Date: 6/30/08

TABLE OF CONTENTS

1.0 Overview

Avineon Inc. was contracted to complete aerotriangulation, digital orthophotography, fieldwork, photointerpretation, mapping, trend analysis, and GIS data delivery within the Lake Worth Lagoon and the adjacent Intracoastal Waterway. Avineon performed the project under subcontract to Applied Technology and Management (ATM) for Palm Beach County's Environmental Resources Management (ERM) department. The 2007 mapping effort will enable ERM to determine the aerial extent selected estuarine habitats existing within the county.

Avineon has completed and delivered a final geodatabase to the County depicting seagrass, unvegetated bottom, tidal flats, algae beds, mangrove swamp, oyster bars/reefs, cordgrass (spartina sp.), and shoreline.

This report summarizes the project results and explains the methodology used to produce the project deliverables. It also contains references to additional reports that were delivered during the course of the project.

1.1 Project Participants

The following is a listing of the project management staff who participated on the project.

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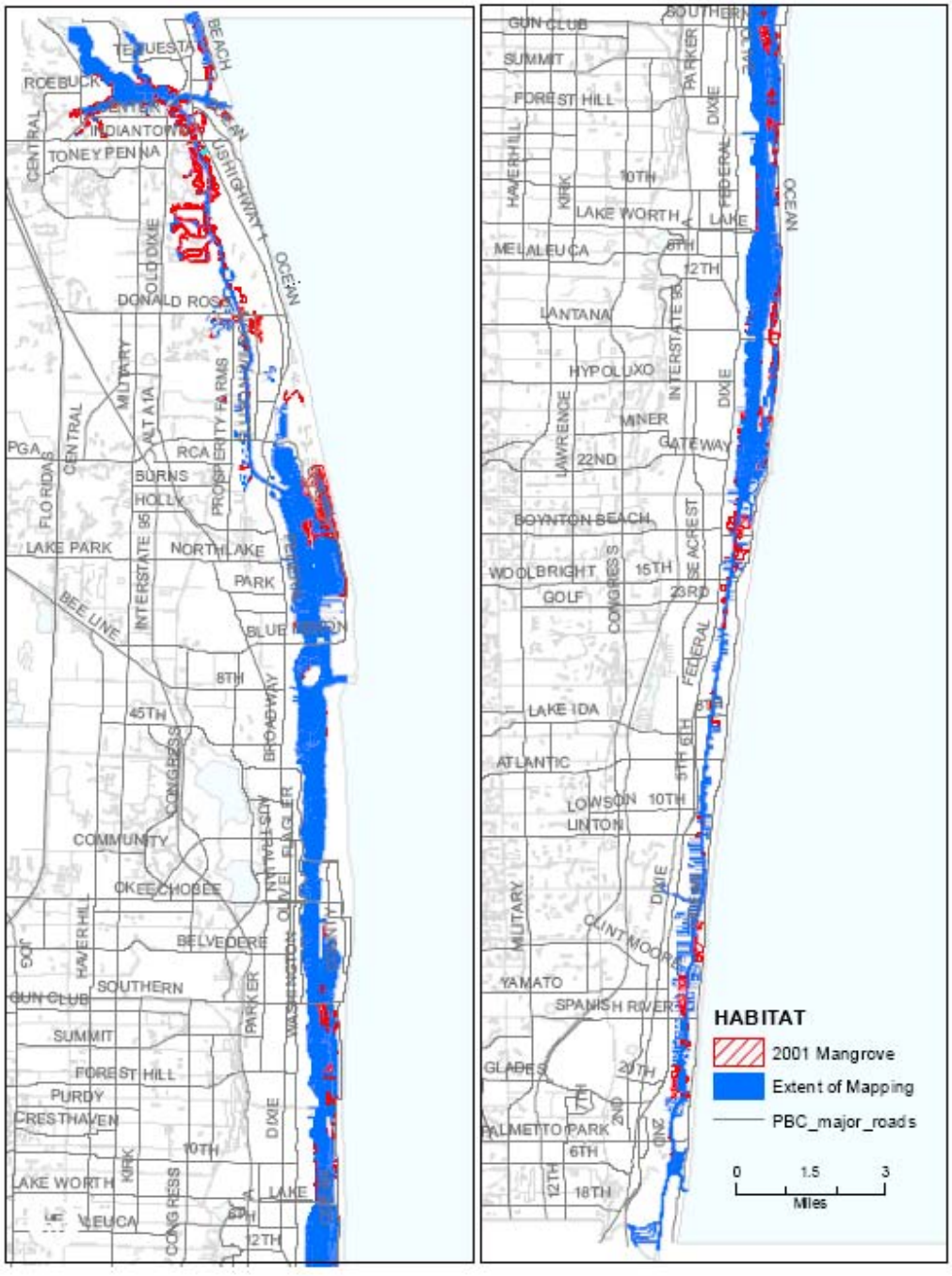
2.0 Project Area

The overall project area includes the entire Lake Worth Lagoon system and the Intracoastal Waterway (ICW) throughout Palm Beach County.

The map contained on the following page depicts the area mapped by Avineon.

Extent of Seagrass and Mangrove Mapping By Avineon



3.0 Mapping Methodology

The following section outlines the methodology that Avineon used for the creation of the deliverables for the project.

3.1 Source Information

The following items were provided by the County and used during the project:

- 1985 and 2001/2003 habitat shapefiles from past mapping projects
- Winter 2007 Countywide digital orthophotography imagery
- ArcView shapefiles of the county shoreline and waterways
- ERM's metadata requirements
- Printed copy of the 1990 Lake Worth Lagoon Resource Inventory
- A .dwg file of the 1990 Lake Worth Lagoon Resource Inventory
- Existing maps and shapefiles of ERM and Florida Department of Environmental Protection (FDEP) Boat Facility Siting Plan
- ArcGIS Shapefile of the seagrass map created from 2001 aerial photography by ATM/Avineon
- All deliverables created from the 1985 and 2001 aerial photography previously delivered by ATM/Avineon. These include the GIS maps, digital orthophotography, and reports generated for the previous 2004 effort
- ArcGIS Shapefiles of the 1985 and 2001 mangrove maps created by ATM/Avineon
- PLSS Section corner coordinates covering the project area
- Sub-basin boundary files in ArcGIS

3.2 Aerial Photography

The following aerial photography was utilized for the project.

Photography Date	Scale	Type	Coverage Area	Source
June 20, 2007	1:10,000	natural color	Lake Worth Lagoon and ICW	ATM/ U.S. Imaging, Inc. for this project
June 22, 2007	1:10,000	natural color	Lake Worth Lagoon and ICW	ATM/U.S. Imaging, Inc. for this project
July 1, 2007	1:4,800	natural color	Loxahatchee Estuary	SFWMD
July 21, 2007	1:10,000	natural color	Lake Worth Lagoon and ICW	ATM/U.S. Imaging, Inc. for this project
August 4, 2007	1:10,000	natural color	Lake Worth Lagoon and ICW	ATM/U.S. Imaging, Inc. for this project
August 8, 2007	1:10,000	natural color	Lower Indian River Lagoon	SJRWMD

The ATM/U.S. Imaging, Inc. aerial photography acquired for the project produced 134 stereo models from 12 flight lines. These aerial photographs were captured using a Wild RC30 photogrammetric camera, serial number 5334, with a Wild Universal Aviogon /4-S lens with serial number 13374. This camera has a calibrated focal length of 153.799 mm and the calibration date was January 5, 2007.

In addition to the ATM/U.S. Imaging aerial photography acquired specifically for the part of the project area, the St. Johns River and South Florida Water Management Districts provided existing aerial photography for northern areas of the project.

3.3 Aerial Photography Comparison

Avineon compared the project's summer 2007 aerial photography to the countywide imagery captured during the winter of 2007. This task was performed in order to estimate whether or not a significant difference in benthic habitat signatures is apparent on imagery captured during the winter versus the summer.

Aerial imagery captured for the east coast of Florida has historically been acquired during the late spring/summer months (i.e. May through August). Severe weather and water conditions in fall/winter may cause submerged seagrasses to lose most of their leaves, thus making them difficult to see on aerial photography until new blades emerge in spring. In mild years, this wholesale leaf loss does not occur.

In terms of weather conditions, generally there are more predictably clear skies during the winter months on the east coast of Florida. This fact allows for more windows of opportunity to capture suitable aerial photography. Sun angles are also more favorable in winter allowing for longer flight days than in the summer. In practice, the project was delayed a year due to the absence of suitable conditions in 2006.

When visually comparing the two imagery sets it appears that more areas of silt/sediment/turbidity are present within study area on the summer photography. However the clearer conditions evident on the winter photography do not necessarily reflect a better camera system or a more optimal season to fly. They merely could reflect conditions on a particular day rather than a season. The conditions could have easily been reversed between summer and winter. While more areas of turbidity were present in the summer photography, the summer photos did capture submerged features better in the portion of the lagoon south of image 434403.

We compared distinct edges of seagrass beds on the summer and winter photography. No visual trend was evident between the two photography sets where gain or loss was greater in one set or the other, meaning both imagery sets showed losses and both showed gains. Additionally, both imagery sets showed edges of beds clearly with no apparent difference in area extent. One area of focus was in the southern portion of Palm Beach County on summer mosaic 434717. This area depicts clear water conditions in both imagery sets and clearly shows no change in the edge of bed.

Our evaluation concluded that both the summer and winter aerial photography sets adequately depict seagrass habitats suitable for aerial mapping efforts. However, the winter photography was captured strictly by chance during optimal water conditions. The winter photography acquisition was only confined by weather conditions rather than water conditions within the study area. A more reliable comparison would be to compare seasonal imagery sets that are *both* designed for benthic habitat mapping and *both* acquired under the same specifications. Our evaluation was based off of visual comparisons of the same features located within the different imagery sets. No linework was compiled for this study.

3.4 Digital Aerotriangulation Methods and Digital Orthophotography

Avineon utilized ground control acquired from previous mapping efforts within Palm Beach County. Most of these control points were recovered from documentation and were photo-identifiable on the 2007 imagery. Additional photo-identifiable ground control coordinates were extracted from the digital orthophotography provided by the county.

An aerotriangulation solution was computed across the project area, using ImageStation Automatic Triangulation (ISAT) software issued by Z/I Imaging Corporation. Utilizing ground control coordinates, camera calibration reports, and the raw scans of photography,

ISAT created a solution that meets the USGS National Map Accuracy Standards for 1:24,000 scale maps. Checkpoint coordinates were then used to test and verify the solution.

Upon completion and quality assurance acceptance of the aerotriangulation solution, the adjusted control points and camera orientation parameters were used to set up the stereo models for photointerpretation and to produce the project's digital orthophotography.

APPENDIX A: Fully Analytical Aerial Triangulation Report contains the aerotriangulation report (i.e. Report of Survey) certified by a Florida PSM

The orthophotography process was performed in an automated batch process. By using the raw imagery in combination with the aerotriangulation results described above along with a USGS digital elevation model, our softcopy system generated the digital orthophotography. These were then mosaiced and tiled by PLSS sections according to the PLSS section file supplied by the County.

3.5 Photointerpretation Key

Avineon delivered a photointerpretation key for the project. The key contains examples of all Florida Land Use Cover and forms Classification System (FLUCCS) covertypes delineated for the study. The Key includes textural descriptions of the classification types along with several examples of delineated aerial photography to show users the representative habitat signatures appearing on the photos.

APPENDIX B: Photointerpretation Key contains a copy of the photointerpretation key.

3.6 Photointerpretation

Photointerpretation for the project was accomplished on Avineon's ImageStation Stereo Displays (ISSD) software. These photogrammetric workstations allow stereo 3D viewing and stereo-compilation of the project's imagery.

Habitat covertype boundaries were photogrammetrically digitized using CadMap/dgn software in conjunction with ISSD, running on workstations with the Windows XP operating system. The software facilitates digitizing into MicroStation (Bentley Microsystems, Inc.) for later importation to ArcGIS.

Photointerpreters utilized previously collected field data along with other available collateral data such as transect data provided by Palm Beach County to assist in their interpretation. Throughout the photointerpretation process, positional accuracy of habitat boundaries were maintained according to the photographic signatures apparent on the photography.

The following coding and classification system was applied during photointerpretation:

CODE	CLASS NAME
9116	Seagrass — Continuous, Dense
9113	Seagrass — Patchy
5400	Unvegetated Bottom
6510	Tidal Flats
9121	Algae Beds
6120	Mangrove Swamp
6540	Oyster Bars/Reefs
6421	Cordgrass (Spartina sp.)
0	Not Classified (Land, islands, etc)

The following classification conventions were used in order to ensure consistency of delineation:

1. **Seagrass, continuous, dense** -- FLUCCS code 9116. The dominant feature of these seagrass beds is that they are continuous in nature, with interconnected areas of seagrass. These beds may contain many small, interspersed patches of sparsely vegetated or unvegetated bottom. The dense aspect means that the area should contain more vegetated bottom than unvegetated bottom, and thus would have a lower limit of about 50% cover of seagrass. Only sand patches greater than 0.25 acres should be distinguished within a continuous, dense bed. Species composition is not mapped.

2. **Seagrass, patchy** -- FLUCCS code 9113. Areas 0.25 acres or greater in size that consist of primarily (greater than 50%) bare bottom in which many small patches (each less than 0.25 acres) of seagrass are scattered, and where the seagrass patches are not interconnected.

3. **Unvegetated bottom** -- FLUCCS code 5400. Barren substrate with little or no perceptible seagrass (< 10%) or algae. For this study, the lower limit of what constitutes a seagrass bed is approximately 10% cover; areas with <10 % cover are considered “unvegetated bottom”.

4. **Tidal Flats** -- FLUCCS code 6510. Non-vegetated areas of sand or mud that are exposed at least once during the year or are capable of supporting seagrass populations for that segment of the water body (i.e. approximately six feet of depth). It is recognized that the typical depth for tidal flats to be exposed once a year is -1 feet. However, the -6 feet depth was retained for consistency with other studies.

5. **Algae beds** -- FLUCCS code 9121. In a few cases, beds of algae may be distinguishable from seagrass. Where these areas have been identified on the photography AND field checked during the field trips conducted for seagrass mapping, they should be mapped (if > than 10% cover), although this is not a high priority and there is no intent to accurately map all algae beds as part of this project. (In many cases, drift algae will accumulate in seagrass beds. In these cases, the area should be mapped as seagrass).

6. **Mangrove Swamp –** FLUCCS code 6120. This coastal hardwood community is dominated by red, white, and/or black mangrove. The major associated species include buttonwood, Brazilian pepper, cabbage palm and sea grape. Mangrove Swamp will be classified where mangroves occupy 75% or more of an area.

7. **Oyster Bars / Reefs –** FLUCCS code 6540. This classification includes oyster bars / reefs and oyster shell hash. Both live and dead oyster habitat will be classified under this class if they achieve dominance within the covertype and meet the minimum mapping unit.

8. **Cordgrass (Spartina sp.) –** FLUCCS code 6421. This class will be mapped if Spartina occupies 66 percent of the community.

9. **Not Classified –** FLUCCS code 0. Not Classified for the project will be considered all covertypes that are not included within the other classification types. Mainland, islands, and other land normally above the high tide line are also considered Not Classified.

The following guidelines were followed as a means of standardizing the photo-interpretation for this task:

1. Outer boundaries of beds are more important than internal structure (patchiness, shapes of sand patches within, etc.) of beds.

2. Outer boundaries of beds are more important than density categorization within beds.

3. The minimum mapping unit is 0.25 acres. It's more important to include small isolated patches than similar sized patches that are part of a large matrix. Care should be taken in mapping small areas of seagrass when only a small amount of seagrass is present, e.g., around a spoil island.

(a) When deciding whether an area with patches of seagrass is one polygon of patchy seagrass or individual seagrass polygons, apply Guideline #3 with a

minimum mapping unit of 0.25 acres. Err on the side of lumping except in areas where small patches are the only seagrasses present.

(b) If an area has only a few patches, all <0.25 acres: Include the area within the polygon of patchy seagrass if the total seagrass area is >0.25 acres. Err on the side of including these rather than excluding them.

The 2001 shoreline provided by the County was re-used during photointerpretation wherever possible. The shoreline remained unchanged for most of the project area. However in selected areas where the shoreline experienced significant change, it was re-digitized to reflect the 2007 imagery.

At the conclusion of the photointerpretation task the Cadmap/dgn data file produced on Avineon's ImageStation Stereo Displays (ISSD) was translated to ArcGIS. Once the data was exported to ArcGIS, processes for building topology and validating the map coverage were completed.

3.7 Trend Analysis

Habitat acreage totals were summarized for each map timeframe using ArcGIS. Trend analysis was completed by comparing 2007 habitat acreages to the historical acreages on the 2001 and 1985 map coverages.

Changes in the area coverage for each habitat were calculated except for Cordgrass and Oysters which were not mapped in 1985 and 2001.

A bounding polygon was first established to ensure that the total project area between 1985, 2001, and 2007 remained identical. The shoreline was not used to define the project boundary for statistical reporting because it changed in area extent between map eras.

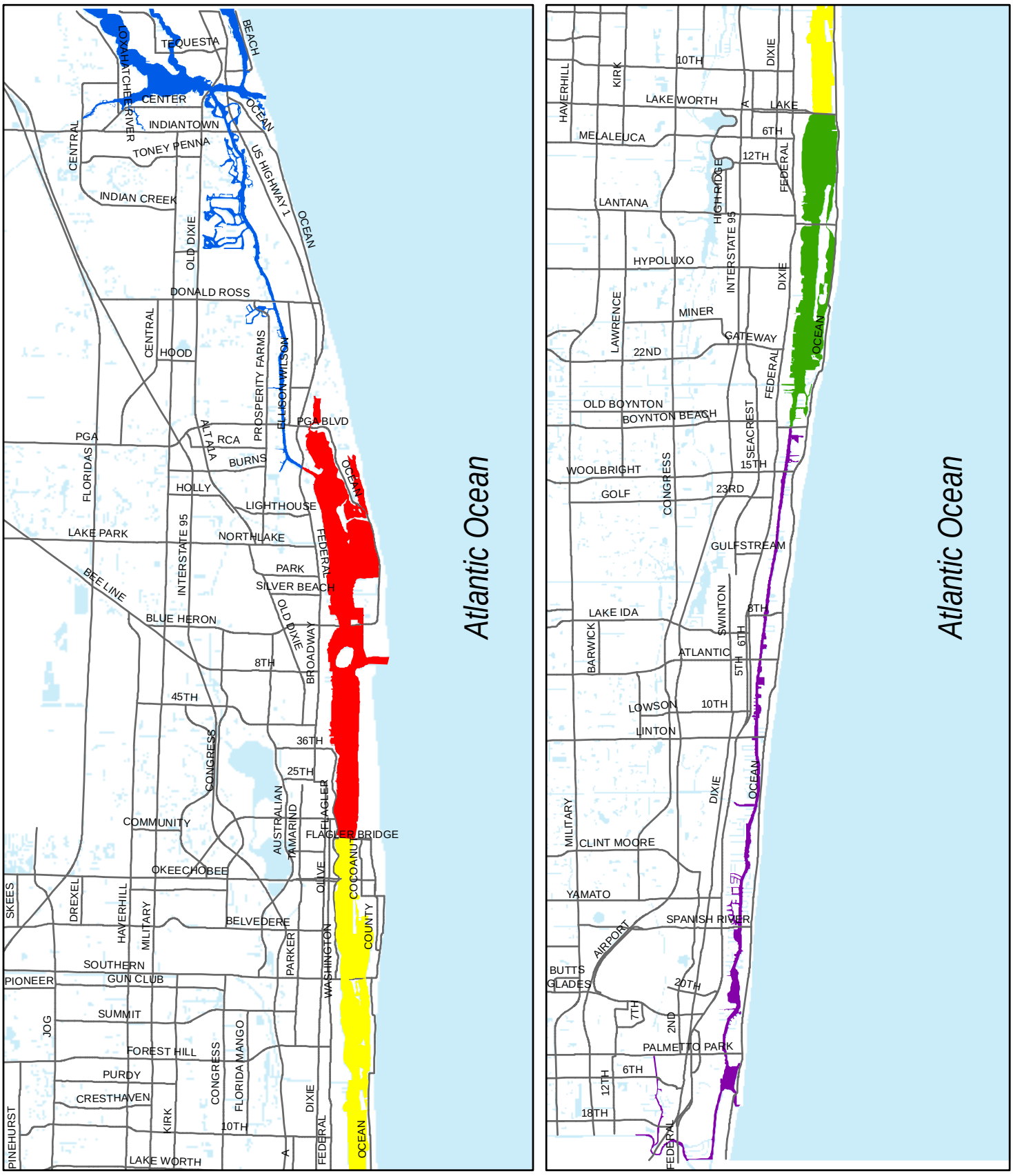
Acreage statistics were further broken down by pre-defined segments within the project study area. Shapefiles of each of the segment boundaries were provided by PBC ERM for segmenting the study area.

Acreages were summarized according to the segments as defined below.

1. **PBC General Distribution Segments -** The project study area was divided into three general distribution segments:

    a. **North Intracoastal Waterway (NICW):** Begins at the northern county line and continues south to the line where the AIWW meets the LWL.

PBC General Distribution Segments



PBC General Distribution Segments

- PBC Major Roads
- LWL North
- LWL Central
- LWL South
- ICW North
- ICW South
- PBC Water Bodies

N W E S

0 4,550 9,100 18,200 27,300 36,400 Feet

Lake Worth Lagoon Sub-Basin Segments

Lake Worth Lagoon

- PBC Major Roads
- PBC Water Bodies
- LWL North
- LWL Central
- LWL South

0 2,950 5,900 11,800 17,700 23,600 Feet

b. **Lake Worth Lagoon (LWL):** Begins at the line where the ICW meets the LWL, includes Little Lake Worth, and continues south to the Ocean Avenue Bridge in Boynton Beach.

c. **South Intracoastal Waterway (SICW):** Begins at the Ocean Avenue Bridge in Boynton Beach and continues south to the county line.

2. **Lake Worth Lagoon Sub-Basin Segments** - The Lake Worth Lagoon General Distribution segment was further divided into three sub-basins categories:

a. **Northern Zone**: Begins at the PGA Boulevard Bridge and continues south to the Royal Park Bridge in West Palm Beach.

b. **Central Zone**: Begins at the Royal Park Bridge in West Palm Beach and continues south to the Ocean Ave. Bridge in Lantana.

c. **Southern Zone**: Begins at the Ocean Avenue Bridge in Lantana and continues south to the Ocean Avenue Bridge in Boynton Beach.

Totals for each of the habitats were calculated from shapefiles and were summarized in Microsoft Excel spreadsheets.

Acreages within the above segments were calculated within the following acreage statistics spreadsheets which were delivered for the project.

1. PBC 2001 Summary by General Distribution
2. LWL 2001 Summary by General Distribution

3. PBC 2007 Summary by General Distribution
4. LWL 2007 Summary by General Distribution

5. PBC 2001-2007 Submerged Habitat Change
6. LWL 2001-2007 Submerged Habitat Change

7. PBC 1985-2001-2007 Mangrove Habitat Change
8. LWL 1985-2001-2007 Mangrove Habitat Change

9. PBC 2007 Oyster Reef Habitat
10. LWL 2007 Oyster Reef Habitat

11. PBC 2007 Cordgrass Habitat
12. LWL 2007 Cordgrass Habitat

13. PBC 2007 Seagrass General Distribution
14. LWL 2007 Seagrass General Distribution

APPENDIX C: Trend Analysis Acreage Statistics contains the trend analysis tables delivered to Palm Beach County for the project

Selected map plots were also generated for the project.

APPENDIX D: Plotted Maps contain plotted maps generated for the project.

3.8 Project Metadata

A digital metadata template was completed for the project and delivered to the County. The metadata provides additional documentation on the project and the ArcGIS data produced as a deliverable.

APPENDIX E: Metadata Documentation contains a printed copy of the metadata.

3.9 Quality Assurance and Quality Control

Avineon establishes, documents, implements and maintains a quality management system and continually improves its effectiveness in accordance with the requirements of our ISO 9001:2000, Quality Management System.

Quality control reviews were ongoing throughout the project. The datasets were examined for adherence to mapping conventions, the PI Key, spatial and classification accuracy, and photointerpretation consistency. Below is a description of the quality control steps that were used for the project.

Aerial Photography Quality Assurance

Avineon inspected the project's aerial photography for tonal balance and contrast, completeness of aerial coverage, and defects prior to acceptance. Specifically, the aerial photography was inspected for its suitability for mapping submerged features within the Lake Worth Lagoon and ICW.

Spatial Accuracy

Residuals from the AT solution were checked and approved by a Florida licensed Professional Surveyor and Mapper (PSM) prior to stereo-compilation.

The positional accuracy of the photointerpreted data was checked by comparing it with positions extracted from ancillary digital orthophotography. The accuracy of the orthophotography was additionally checked by surveyed ground control collected by a Trimble Pro XR receiver during field work performed for the project.

In-Process Photointerpretation Quality Assurance

Avineon's Project Manager and the designated quality assurance (QA) photointerpreter systematically reviewed seagrass, tidal flat, mangrove, oyster/reef, and spartina delineations and classifications interpreted from the aerial photographs.

During quality control reviews, all the delineations interpreted on the aerial photographs were inspected by the QA photointerpreter who made revision comments where necessary. The original photointerpreter completed the required revisions and resubmitted the data back to the QA photointerpreter. The work was checked again by the QA photointerpreter prior to delivery as a draft product to the County.

Logical Consistency Checks

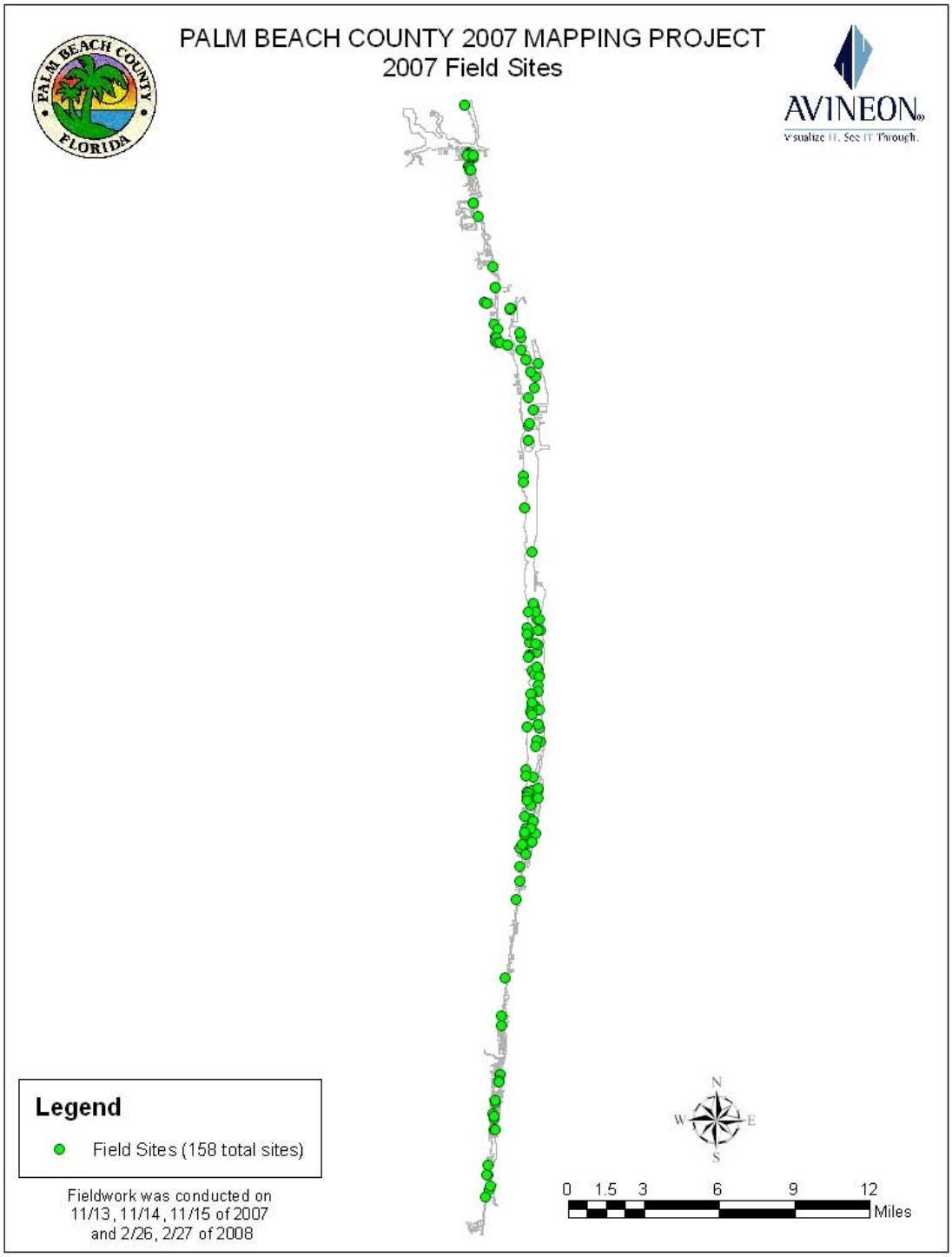
Logical consistency checking was done during photointerpretation and quality assurance. This check involved quality assurance to ensure that a certain habitat was not classified within deep water, deep channels, or other areas where it is unlikely to occur. The overall distribution of each photointerpreted class was reviewed in association with surrounding classes to ensure logical consistency.

GIS Quality Control

The quality of the ArcGIS digital data was monitored by a combination of manual and automated analyses. A set of automated quality control programs were used to check for errors, such as missing polygon label points, label points with no attributes, invalid attribute codes, missing attributes, and two adjacent polygons with the same attribute.

Groundtruthing

The project's photointerpreters conducted field trips to compare mapped data with actual field conditions. The field trips were utilized to answer photointerpretation questions and to check representative areas of the map during photointerpretation. Fieldwork was conducted on 11/13, 11/14, 11/15 of 2007 and 2/26, 2/27 of 2008. A total of 158 checksites were attributed in shapefile format while in the field. A rugged field laptop coupled with a GPS allowed for navigation and attribution in real-time. This also allowed the field crew to access the digital imagery and linework while assessing the locations habitat.



Map of PBC 2007 field checksites.

3.10 Final Deliverables

Avineon submitted selected draft products for inspection by the County during the course of the project. Below is a listing of the final deliverables produced by Avineon for the project.

1. A seagrass polygon and shoreline file in ArcView shapefile format of the entire mapping project boundary area.

2. A seagrass polygon and shoreline file in ArcGIS geodatabase format of the entire mapping project boundary area.

3. A seagrass change map that shows 2001-2007 trends in seagrass presence or absence in ArcView shapefile, and ArcGIS geodatabase format of the entire mapping project boundary area.

4. A mangrove polygon and shoreline file in ArcView shapefile format of the entire mapping project boundary area.

5. A mangrove polygon and shoreline file in ArcGIS geodatabase format of the entire mapping project boundary area.

6. A mangrove change map that details 1985-2001-2007 trends in mangrove presence or absence in ArcView shapefile and ArcGIS geodatabase format of the entire mapping project boundary area.

7. An oyster reef polygon and shoreline file in ArcView shapefile format of the entire mapping project boundary area.

8. An oyster reef polygon and shoreline file in ArcGIS geodatabase format of the entire mapping project boundary area.

9. A spartina and shoreline map in ArcView shapefile format of the entire mapping project boundary area.

10. A spartina polygon and shoreline file in ArcGIS geodatabase format of the entire mapping project boundary area.

11. Photointerpretation Key

12. Digital Orthophotography

13. Metadata Report

14. Final Report

4.0 Project Problems and Their Solutions

No significant problems were encountered with photointerpretation, trend analysis, map production, or during field work.

The project was delayed due to the delay in acquiring the aerial photography for the study area. The timing of aerial photography acquisition is critical and the photography must be captured during ideal conditions. It is important to allow sufficient time for the acquisition of aerial photography for benthic habitat mapping due the mission constraints which must be considered within the imagery acquisition schedule.

As mentioned above, Avineon produced digital orthophotos and mosaic tiles as one of the final deliverables. Upon receipt of this deliverable Palm Beach County noticed a green hue to the imagery and requested that this hue be removed. This green hue was also apparent in Avineon's raw source photography eliminating the mosaic and ortho process as a contributing cause. After much research, it was determined that this hue was the result of the negative Kodak masked color film which contains a heavy orange-red acetate base. When processed, the orange-red base scans as green. To correct this problem Avineon re-processed the images by applying a modified tonal lookup table to the images that reduced the green tones and redelivered the digital orthos and mosaics. This green hue was not as noticeable when zoomed in and was corrected on the fly by photointerpreters using Z/I's Image Station Stereo Display, so photointerpretation was not compromised.

5.0 Conclusion

The project was a success and the resultant data is accurate and suitable for the future trend analysis of selected habitats within Palm Beach County. The data produced provides a valuable inventory of the mapped habitats and summarizes the changes to those habitats over time.

APPENDIX

APPENDIX A: Fully Analytical Aerial Triangulation Report

APPENDIX B: Photointerpretation Key

APPENDIX C: Trend Analysis Acreage Statistics

APPENDIX D: Plotted Maps

APPENDIX E: Metadata Documentation

APPENDIX A: Fully Analytical Aerial Triangulation Report

APPENDIX B: Photointerpretation Key

PHOTOINTERPRETATION KEY
FOR THE
PALM BEACH COUNTY
2007 HABITAT MAPPING PROJECT

Report Date:
November 20, 2007

Prepared by:
Avineon, Inc.

AVINEON®
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PREFACE

Avineon Inc. of Clearwater, Florida was contracted by Applied Technology and Management (ATM) and Palm Beach County ERM to produce a spatially, thematically, and technically accurate Geodatabase of the Submerged Aquatic Vegetation and other selected covertypes occurring within the Lake Worth Lagoon system and the ICW throughout Palm Beach County. The classification system used for this project was a modification of the Florida Land Use / Cover Classification System (FLUCCS), which was originally compiled by the Florida Department of Transportation, State Topographic Bureau.

The following Photointerpretation Key was developed in order to document the decisions and mapping conventions applied during the photointerpretation process. The key was used to help ensure that the photointerpretation was consistent throughout the project. It was designed to provide descriptions of the visual and spatial distribution characteristics of the classification types used for the project and to document any special mapping conventions that were developed. The key also serves to provide insight for future users into the rationale for the delineation and classifications appearing within the database.

PHOTOINTERPRETATION KEY
FOR THE
2007 HABITAT MAPPING PROJECT

Table of Contents

I. CLASSIFICATION CODES

9116	**Seagrass, continuous, dense**
9113	**Seagrass, patchy**
5400	**Unvegetated bottom**
6510	**Tidal Flats**
9121	**Algae Beds**
6120	**Mangrove Swamp**
6540	**Oyster Bars / Reef**
6421	**Cordgrass (Spartina sp.)**
0	**Not Classified (Land, islands etc)**

II. CLASSIFICATION SYSTEM

The following section describes the classification system used for the 2007 Habitat Mapping Project.

For each classification type, a definition is included along with a written description of the photosignature. The photosignature describes how each classification category appears on the 1:10,000 scale natural color aerial photography, from a photointerpretation perspective. Tone, color, shape, size, association, texture, and typical location are described. Also included is a Digital photograph taken in the field along with a digitized aerial photograph showing the photointerpreted delineations.

Seagrass, continuous, dense (9116)

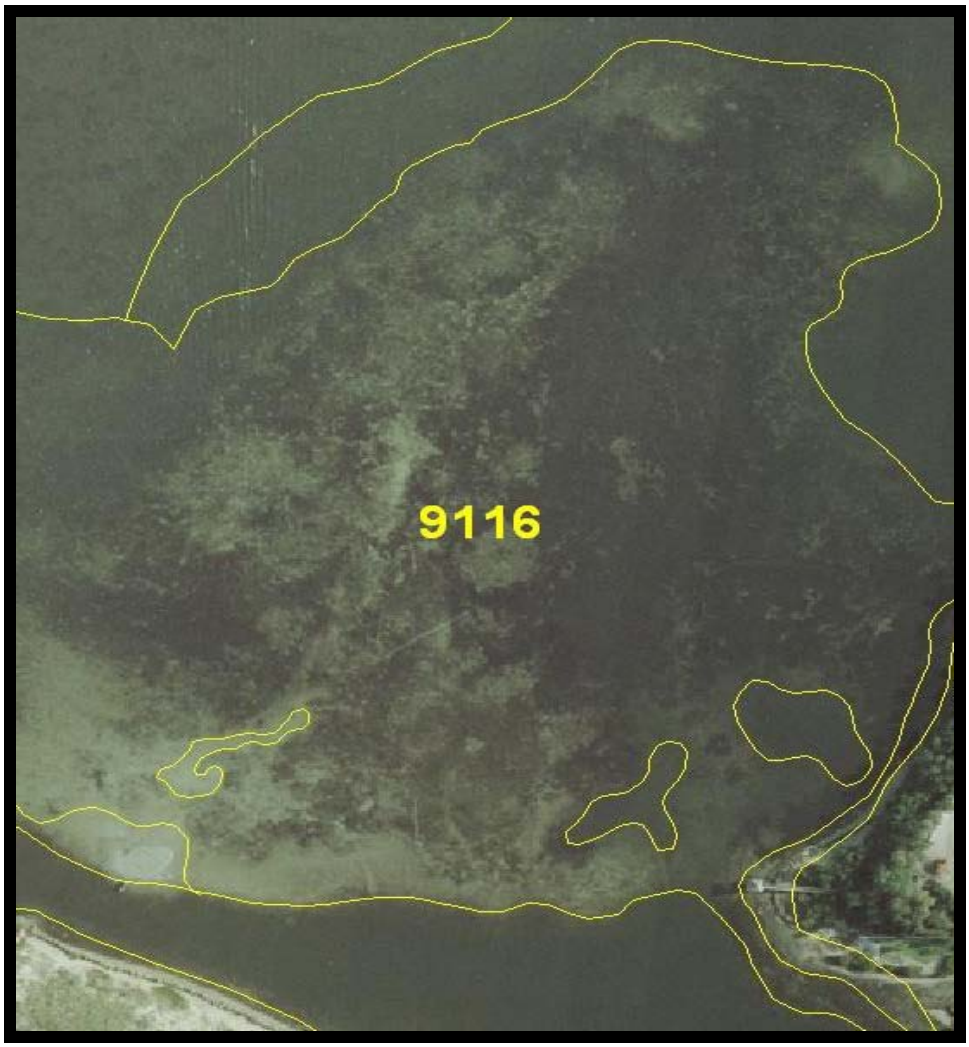
Definition

The dominant feature of these seagrass beds is that they are continuous in nature, with interconnected areas of seagrass. These beds may contain many small, interspersed patches of sparsely vegetated or unvegetated bottom. The dense aspect means that the area should contain more vegetated bottom than unvegetated bottom, and thus would have a lower limit of about 50% cover of seagrass. Only sand patches of greater than 0.25 acres are distinguished within a continuous, dense bed. Species composition is not mapped.

Description

The photosignature for 9116 is smoother than that of 9113 but still has some texture. It also can be bluish-gray to almost black, but has only a few areas of open bottom showing through to interrupt the continuous signature. 9116 usually can be found in the center of large, healthy seagrass beds and sometimes runs parallel to the shoreline for hundreds of meters. These larger beds usually have some sparse growth between the continuous areas (i.e. they are not always composed of a uniform thickness, but are still considered continuous).

9116 Continuous Seagrass



Delineated photograph showing 9116

Seagrass, patchy (9113)

Definition

Areas 0.25 acres or greater in size that consist primarily of greater than 50% bare bottom in which many small patches (each less than 0.25 acres) of seagrass are scattered, and where the seagrass patches are not interconnected.

Description

The photosignature for the 9113 classification usually has a rough texture when viewed through a stereoscope and is bluish-gray to almost black depending on water depth and

turbidity. Patchy seagrass polygons can be found on the deeper and shallower edges of continuous seagrass beds or can be large and expansive and cover the entire bed. The actual seagrass beds will look like small circular colonies that are close enough together to be combined into a seagrass polygon. These areas can occur because of new growth on a previously unvegetated substrate, or within areas of previously continuous seagrass that is deteriorating due to changing water conditions such as salinity, turbidity, and temperature or pollution levels.

9113 Patchy seagrass

Delineated photograph showing 9113

Unvegetated bottom (5400)

Definition

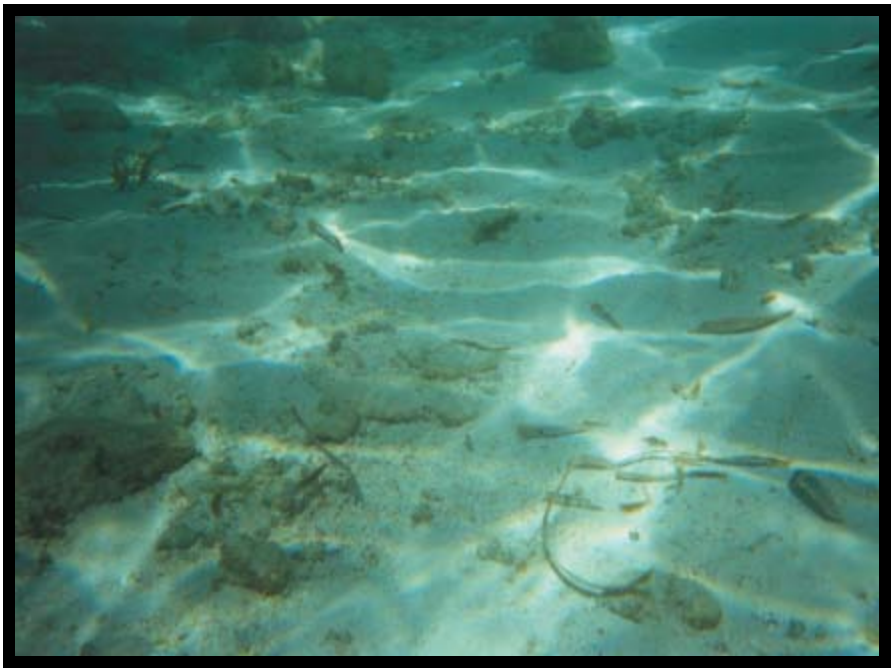
Barren substrate with little or no perceptible seagrass (<10%) or algae. The lower limit of what constitutes a seagrass bed is approximately 10% cover. Areas with <10% cover are considered "Unvegetated bottom".

Description

The 5400 classification has many different photosignatures and will depend on the characteristics of the area where it is occurring. These signatures can be divided into two distinctly different categories, which are dependent on depth.

Deepwater 5400 is usually a smooth, bluish-green color, but can sometimes appear dark blue or brown depending on water depth and turbidity levels. It can usually be found on the deeper edges of seagrass beds and in residential canals. Sometimes a deepwater 5400 polygon will be elongated and linear with straight edges, denoting a man-made channel dredged through a shallow water area (i.e. the Intracoastal Waterway and inlets).

The photosignature for the shallower water 5400 classification is usually a very smooth and flat area (i.e. sandbars). This signature can be many different colors depending on water depth and turbidity levels. If the water is relatively clear, the very shallow, sandy areas will appear white as opposed to the light green or turquoise of the slightly deeper sandy areas. Murky or tannin-stained water will create a gray or light brown colored photosignature respectively. Most of these types of 5400 polygons will be found on the shallower edges of seagrass beds, either along the shoreline or on the crest of a barrier-type seagrass bed.



5400 Unvegetated Bottom

Delineated photograph showing 5400

Tidal Flats (6510)

Definition

Non-vegetated areas of sand or mud that are exposed at least once during the year or are capable of supporting seagrass populations for that segment of the water body (i.e. approximately six feet of depth).

Description

The photo signature for 6510 is very smooth and obviously unvegetated. The signature can be different colors depending on water depth and turbidity levels. It can appear white (very shallow, sandy areas), light green (deeper, sandy areas), gray (murky water), or even light brown in some tannin-stained areas. 6510 is usually found on the shallower edges of seagrass beds, either along the shoreline or on the crest of a barrier-type seagrass bed

6510 (Tidal Flat)

Delineated photograph showing 6510

Algae beds (9121)

Definition

In a few cases, beds of algae may be distinguishable from seagrass. Where these areas have been identified on the photography and field checked, they are mapped (if > 10% cover), although this is not a high priority and there was no intent to accurately map all algae beds as part of the mapping project. In many cases, drift algae accumulates in seagrass beds. In these cases, the area should be mapped as seagrass, and the density should be based on seagrass density only, not algae density.

Description

The photosignature for the 9121 classification is very similar to that of the patchy and continuous seagrass beds. It exhibits the same bluish-gray color and can have either a rough or smooth texture depending upon the amount and thickness of the algae present. Algae beds can consist of either attached algae or drift algae. The attached algae photosignature is exactly the same as that of seagrass and can only be differentiated through field reconnaissance. On the other hand, the drift algae can usually be found in clumps and windrows (chevron shaped accumulations) that have been affected by the current. It is usually found spread out over large, flat areas (which are on the deeper edges of the seagrass beds), or in thick accumulations that are clumped together against some type of current blocking structure (i.e. spoil islands or channel edges). It is also identifiable by depth (anything deeper than 2 meters is probably algae).

9121 Caulerpa *prolifera*

9121 Caulerpa *taxifolia*

Algae beds (9121), continued

9121 Drift Algae beds (9121), continued

Delineated photograph showing 9121

Mangrove Swamp (6120)

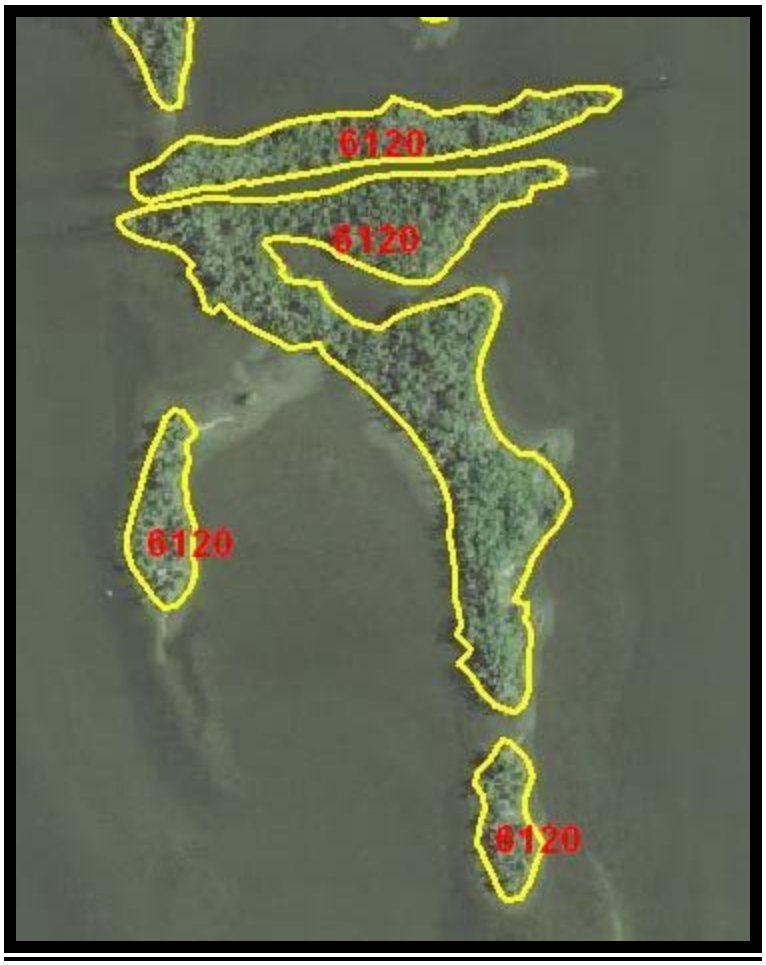
Definition

This coastal hardwood community is dominated by red, white, and/or black mangrove. The major associated species include buttonwood, Brazilian pepper, cabbage palm and sea grape. Mangrove Swamp will be classified where mangrove occupies 75% or more of an area.

Description

Primarily found in, but not limited to, coastal areas subject to periodic or continual inundation by salt or brackish water. Red mangroves extend to the open water, with black mangroves towards the landward edge, and white mangrove in the most landward, least inundated.

6120 Mangrove Swamp



Delineated photograph showing 6120

Oyster Bars / Reefs (6540)

Definition

This classification includes oyster bars / reefs and oyster shell hash. Both live and dead oyster habitat will be classified under this class if they achieve dominance within the covertype and meet the minimum mapping unit.

Description

The photo signature for 6540 is bright white to light gray with a distinctive ridge often visible when the beds are exposed at the surface. The beds can also appear dark gray to black in color when algae are growing or have accumulated on the shells. The texture of submerged oyster beds is mottled in appearance when viewed in stereo while exposed beds are smooth in texture. 6540 is usually found in shallow brackish water creeks (10% salinity or more), flats, and near docks and jetties.

6540 Oyster Bars / Reef

Delineated photograph showing 6540

Cordgrass Spartina sp. (6421)

Definition

This community of non-woody, salt-tolerant plants occupying intertidal zones that are at least occasionally inundated with salt water. They exist at the interface of land and marine waters, wherever wave energy is sufficiently low to allow their development and where mangrove trees are not dense enough to shade out the characteristic vegetation. This class will be mapped if Spartina occupies 66 percent of the community.

6421 Cordgrass Spartina

Delineated photograph showing 6421

Not Classified Land (0)

Definition

Land for the 2007 Habitat Project will be considered all covertypes that are not included within the other classification types.
Mainland, islands and other land normally above the high tide line are also considered Land. The line delineating the water/land interface may be formed anywhere between the extreme low and extreme high tide marks.

0 Not Classified (Land, islands etc)

Delineated photograph showing 0 Not Classified (Land, islands etc)

APPENDIX C: Trend Analysis Acreage Statistics

Palm Beach County
2007 Habitat Mapping Project

Habitat Acreage Statistics

Avineon, Inc.
August 12, 2008

LIST OF TABLES CONTAINED WITHIN THIS WORKBOOK

Table 1a. Palm Beach County Habitat
Based on 2001 Aerial Photography

Segment	Habitat Type	FLUCCS Code (2)	Total Estuarine Acres (3)	% of Total Estuarine Habitat Acres in Segment (4)	% of Total Estuarine Habitat Acres in PBC (5)
North ICW	Patchy SAV (1)	9113	19.17	0.84	0.17
	Continous SAV (1)	9116	232.00	10.18	2.06
	Algae beds	9121	3.48	0.15	0.03
	Tidal flats	6510	143.15	6.28	1.27
	Unveg. Bottom	5400	1638.92	71.89	14.53
	Mangrove	6120	243.08	10.66	2.16
Subtotal			**2279.79**	**100.00**	**20.21**
North LWL	Patchy SAV (1)	9113	12.97	0.35	0.12
	Continous SAV (1)	9116	1135.61	30.62	10.07
	Algae beds	9121	1.21	0.03	0.01
	Tidal flats	6510	361.46	9.75	3.20
	Unveg. Bottom	5400	2063.38	55.63	18.30
	Mangrove	6120	134.29	3.62	1.19
Subtotal			**3708.92**	**100.00**	**32.89**
Central LWL	Patchy SAV (1)	9113	0.72	0.03	0.01
	Continous SAV (1)	9116	194.62	8.91	1.73
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	461.16	21.10	4.09
	Unveg. Bottom	5400	1472.63	67.38	13.06
	Mangrove	6120	56.30	2.58	0.50
Subtotal			**2185.43**	**100.00**	**19.38**
South LWL	Patchy SAV (1)	9113	0.28	0.01	0.00
	Continous SAV (1)	9116	302.17	16.20	2.68
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	334.01	17.90	2.96
	Unveg. Bottom	5400	1155.93	61.96	10.25
	Mangrove	6120	73.32	3.93	0.65
Subtotal			**1865.70**	**100.00**	**16.54**
South ICW	Patchy SAV (1)	9113	16.44	1.33	0.15
	Continous SAV (1)	9116	57.48	4.64	0.51
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	37.03	2.99	0.33
	Unveg. Bottom	5400	980.25	79.15	8.69
	Mangrove	6120	147.24	11.89	1.31
Subtotal			**1238.45**	**100.00**	**10.98**
PBC (all segments)	Patchy SAV (1)	9113	49.58	0.44	0.44
	Continous SAV (1)	9116	1921.89	17.04	17.04
	Algae beds	9121	4.69	0.04	0.04
	Tidal flats	6510	1336.80	11.85	11.85
	Unveg. Bottom	5400	7311.11	64.82	64.82
	Mangrove	6120	654.23	5.80	5.80
Total Estuarine Habitat			**11,278.30**	**100.00**	**100.00**
Total Not Classified Area		0	**163,125.71**		
Total PBC Project Area			**174,404.01**		

Footnotes:

1. SAV: Submerged Aquatic Vegetation (Seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total Estuarine Habitat Acres in Segment excluding Not Classified
5. % of Total Estuarine Habitat Acres in Palm Beach County excluding Not Classified

Table 1b. Lake Worth Lagoon Habitat
Based on 2001 Aerial Photography

Segment	Habitat Type	FLUCCS Code [2]	Total Acres [3]	% of Total Estuarine Habitat Acres in Segment [4]	% of Total Estuarine Habitat Acres in PBC [5]
North LWL	Patchy SAV [1]	9113	12.97	0.35	0.17
	Continous SAV [1]	9116	1135.61	30.62	14.63
	Algae beds	9121	1.21	0.03	0.02
	Tidal flats	6510	361.46	9.75	4.66
	Unveg. Bottom	5400	2063.38	55.63	26.59
	Mangrove	6120	134.29	3.62	1.73
Subtotal			**3708.92**	**100.00**	**47.80**
Central LWL	Patchy SAV [1]	9113	0.72	0.03	0.01
	Continous SAV [1]	9116	194.62	8.91	2.51
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	461.16	21.10	5.94
	Unveg. Bottom	5400	1472.63	67.38	18.98
	Mangrove	6120	56.30	2.58	0.73
Subtotal			**2185.43**	**100.00**	**28.16**
South LWL	Patchy SAV [1]	9113	0.28	0.01	0.00
	Continous SAV [1]	9116	302.17	16.20	3.89
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	334.01	17.90	4.30
	Unveg. Bottom	5400	1155.93	61.96	14.90
	Mangrove	6120	73.32	3.93	0.94
Subtotal			**1865.70**	**100.00**	**24.04**
LWL (all segments)	Patchy SAV [1]	9113	13.97	0.18	0.18
	Continous SAV [1]	9116	1632.41	21.04	21.04
	Algae beds	9121	1.21	0.02	0.02
	Tidal flats	6510	1156.62	14.90	14.90
	Unveg. Bottom	5400	4691.94	60.46	60.46
	Mangrove	6120	263.91	3.40	3.40
Total LWL Estuarine Habitat			**7,760.06**	**100.00**	**100.00**
Total Not Classified Area		0	**74,718.74**		
Total LWL Project Area			**82,478.80**		

Footnotes:

1. SAV: Submerged Aquatic Vegetation (Seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total Estuarine Habitat Acres in Segment excluding Not Classified
5. % of Total Estuarine Habitat Acres in Lake Worth Lagoon excluding Not Classified

Table 2a. Palm Beach County Habitat
Based on 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [2]	Total Acres [3]	% of Total Estuarine Habitat Acres in Segment [4]	% of Total Estuarine Habitat Acres in PBC [5]
North ICW	Patchy SAV [1]	9113	21.69	0.95	0.19
	Continous SAV [1]	9116	227.92	9.94	2.01
	Algae beds	9121	0.27	0.01	0.00
	Tidal flats	6510	197.11	8.60	1.74
	Unvegetated Bottom	5400	1580.36	68.92	13.97
	Mangrove	6120	265.68	11.59	2.35
	Oyster Bar/Reef	6540	0.00	0.00	0.00
	Cordgrass (Spartina sp.)	6421	0.00	0.00	0.00
Subtotal			**2293.02**	**100.00**	**20.27**
North LWL	Patchy SAV [1]	9113	21.15	0.57	0.19
	Continous SAV [1]	9116	1069.26	28.68	9.45
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	430.31	11.54	3.80
	Unvegetated Bottom	5400	2055.23	55.12	18.17
	Mangrove	6120	152.59	4.09	1.35
	Oyster Bar/Reef	6540	0.35	0.01	0.00
	Cordgrass (Spartina sp.)	6421	0.00	0.00	0.00
Subtotal			**3728.88**	**100.00**	**32.96**
Central LWL	Patchy SAV [1]	9113	20.92	0.96	0.18
	Continous SAV [1]	9116	183.59	8.45	1.62
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	429.94	19.79	3.80
	Unvegetated Bottom	5400	1474.18	67.87	13.03
	Mangrove	6120	58.19	2.68	0.51
	Oyster Bar/Reef	6540	3.85	0.18	0.03
	Cordgrass (Spartina sp.)	6421	1.35	0.06	0.01
Subtotal			**2172.02**	**100.00**	**19.20**
South LWL	Patchy SAV [1]	9113	10.36	0.56	0.09
	Continous SAV [1]	9116	382.91	20.53	3.38
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	226.13	12.12	2.00
	Unvegetated Bottom	5400	1173.29	62.90	10.37
	Mangrove	6120	72.56	3.89	0.64
	Oyster Bar/Reef	6540	0.00	0.00	0.00
	Cordgrass (Spartina sp.)	6421	0.16	0.01	0.00
Subtotal			**1865.41**	**100.00**	**16.49**
South ICW	Patchy SAV [1]	9113	14.31	1.14	0.13
	Continous SAV [1]	9116	81.17	6.47	0.72
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	29.85	2.38	0.26
	Unvegetated Bottom	5400	967.11	77.12	8.55
	Mangrove	6120	161.58	12.89	1.43
	Oyster Bar/Reef	6540	0.00	0.00	0.00
	Cordgrass (Spartina sp.)	6421	0.00	0.00	0.00
Subtotal			**1254.01**	**100.00**	**11.08**
PBC (all segments)	Patchy SAV [1]	9113	88.43	0.78	0.78
	Continous SAV [1]	9116	1944.84	17.19	17.19
	Algae beds	9121	0.27	0.00	0.00
	Tidal flats	6510	1313.33	11.61	11.61
	Unvegetated Bottom	5400	7250.17	64.09	64.09
	Mangrove	6120	710.60	6.28	6.28
	Oyster Bar/Reef	6540	4.20	0.04	0.04
	Cordgrass (Spartina sp.)	6421	1.51	0.01	0.01
Total Estuarine Habitat			**11,313.35**	**100.00**	**100.00**
Total Not Classified Area		0	**163,090.66**		
Total PBC Project Area			**174,404.01**		

Footnotes:

1. SAV: Submerged Aquatic Vegetation (Seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total Estuarine Habitat Acres in Segment excluding Not Classified
5. % of Total Estuarine Habitat Acres in Palm Beach County excluding Not Classified

Table 2b. Lake Worth Lagoon Habitat
Based on 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [2]	Total Acres [3]	% of Total Estuarine Habitat Acres in Segment [4]	% of Total Estuarine Habitat Acres in LWL [5]
North LWL	Patchy SAV [1]	9113	21.15	0.57	0.27
	Continous SAV [1]	9116	1069.26	28.68	13.77
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	430.31	11.54	5.54
	Unvegetated Bottom	5400	2055.23	55.12	26.46
	Mangrove	6120	152.59	4.09	1.96
	Oyster Bar/Reef	6540	0.35	0.01	0.00
	Cordgrass (Spartina sp.)	6421	0.00	0.00	0.00
Subtotal			**3728.88**	**100.00**	**48.01**
Central LWL	Patchy SAV [1]	9113	20.92	0.96	0.27
	Continous SAV [1]	9116	183.59	8.45	2.36
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	429.94	19.79	5.54
	Unvegetated Bottom	5400	1474.18	67.87	18.98
	Mangrove	6120	58.19	2.68	0.75
	Oyster Bar/Reef	6540	3.85	0.18	0.05
	Cordgrass (Spartina sp.)	6421	1.35	0.06	0.02
Subtotal			**2172.02**	**100.00**	**27.97**
South LWL	Patchy SAV [1]	9113	10.36	0.56	0.13
	Continous SAV [1]	9116	382.91	20.53	4.93
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	226.13	12.12	2.91
	Unvegetated Bottom	5400	1173.29	62.90	15.11
	Mangrove	6120	72.56	3.89	0.93
	Oyster Bar/Reef	6540	0.00	0.00	0.00
	Cordgrass (Spartina sp.)	6421	0.16	0.01	0.00
Subtotal			**1865.41**	**100.00**	**24.02**
LWL (all segments)	Patchy SAV [1]	9113	52.43	0.68	0.68
	Continous SAV [1]	9116	1635.76	21.06	21.06
	Algae beds	9121	0.00	0.00	0.00
	Tidal flats	6510	1086.38	13.99	13.99
	Unvegetated Bottom	5400	4702.70	60.55	60.55
	Mangrove	6120	283.34	3.65	3.65
	Oyster Bar/Reef	6540	4.20	0.05	0.05
	Cordgrass (Spartina sp.)	6421	1.51	0.02	0.02
TOTAL LWL Estuarine Habitat			**7,766.31**	**100.00**	**100.00**
Total Not Classified Area		0	**74,712.48**		
Total LWL Project Area			**82,478.80**		

Footnotes:

1. SAV: Submerged Aquatic Vegetation (Seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total Estuarine Habitat Acres in Segment excluding Not Classified
5. % of Total Estuarine Habitat Acres in Lake Worth Lagoon

Table 3a. Palm Beach County Submerged Habitat Change
Based on 2001 and 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [2]	2001 Total Acres [3]	2007 Total Acres [3]	Total Acres Difference 2001-2007	2001 % of Total Acres in PBC [4]	2007 % of Total Acres in PBC [4]	% Change between 2001 -2007
North ICW	Patchy SAV [1]	9113	19.17	21.69	2.52	0.18	0.20	13.16
	Continous SAV [1]	9116	232.00	227.92	-4.09	2.18	2.15	-1.76
	Algae beds	9121	3.48	0.27	-3.21	0.03	0.00	-92.32
	Tidal flats	6510	143.15	197.11	53.96	1.35	1.86	37.69
	Unvegetated Bottom	5400	1638.92	1580.36	-58.55	15.43	14.91	-3.57
Subtotal			**2036.72**	**2027.34**	**-9.4**	**19.2**	**19.1**	**-0.46**
North LWL	Patchy SAV [1]	9113	12.97	21.15	8.17	0.12	0.20	63.01
	Continous SAV [1]	9116	1135.61	1069.26	-66.35	10.69	10.09	-5.84
	Algae beds	9121	1.21	0.00	-1.21	0.01	0.00	-100.00
	Tidal flats	6510	361.46	430.31	68.85	3.40	4.06	19.05
	Unvegetated Bottom	5400	2063.38	2055.23	-8.15	19.42	19.39	-0.39
Subtotal			**3574.63**	**3575.94**	**1.3**	**33.6**	**33.7**	**0.04**
Central LWL	Patchy SAV [1]	9113	0.72	20.92	20.20	0.01	0.20	2810.13
	Continous SAV [1]	9116	194.62	183.59	-11.03	1.83	1.73	-5.67
	Algae beds	9121	0.00	0.00	0.00	0.00	0.00	0.00
	Tidal flats	6510	461.16	429.94	-31.21	4.34	4.06	-6.77
	Unvegetated Bottom	5400	1472.63	1474.18	1.54	13.86	13.91	0.10
Subtotal			**2129.13**	**2108.63**	**-20.5**	**20.0**	**19.9**	**-0.96**
South LWL	Patchy SAV [1]	9113	0.28	10.36	10.09	0.00	0.10	3651.92
	Continous SAV [1]	9116	302.17	382.91	80.73	2.84	3.61	26.72
	Algae beds	9121	0.00	0.00	0.00	0.00	0.00	0.00
	Tidal flats	6510	334.01	226.13	-107.87	3.14	2.13	-32.30
	Unvegetated Bottom	5400	1155.93	1173.29	17.36	10.88	11.07	1.50
Subtotal			**1792.38**	**1792.69**	**0.3**	**16.9**	**16.9**	**0.02**
South ICW	Patchy SAV [1]	9113	16.44	14.31	-2.13	0.15	0.14	-12.94
	Continous SAV [1]	9116	57.48	81.17	23.68	0.54	0.77	41.20
	Algae beds	9121	0.00	0.00	0.00	0.00	0.00	0.00
	Tidal flats	6510	37.03	29.85	-7.18	0.35	0.28	-19.40
	Unvegetated Bottom	5400	980.25	967.11	-13.15	9.23	9.13	-1.34
Subtotal			**1091.20**	**1092.43**	**1.2**	**10.3**	**10.3**	**0.11**
PBC all segments	Patchy SAV [1]	9113	49.58	88.43	38.85	0.47	0.83	78.37
	Continous SAV [1]	9116	1921.89	1944.84	22.95	18.09	18.35	1.19
	Algae beds	9121	4.69	0.27	-4.42	0.04	0.00	-94.30
	Tidal flats	6510	1336.80	1313.33	-23.46	12.58	12.39	-1.76
	Unvegetated Bottom	5400	7311.11	7250.17	-60.94	68.82	68.42	-0.83
TOTAL PBC Estuarine Habitat			**10,624.06**	**10,597.04**	**-27.02**	**100.00**	**100.00**	**-0.25**
Total Not Classified Area		0	**163,779.94**	**163,806.96**				
Total PBC Project Area			**174,404.01**	**174,404.01**				

Footnotes:

1. SAV: Submerged Aquatic Vegetation (seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total acres within Palm Beach County excluding Not Classified

Table 3b. Lake Worth Lagoon Submerged Habitat Change
Based on 2001 and 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [2]	2001 Total Acres [3]	2007 Total Acres [3]	Total Acres Difference 2001-2007	2001 % of Total Acres in LWL [4]	2007 % of Total Acres in LWL [4]	% Change Between 2001-2007
North LWL	**Patchy SAV (1)**	9113	12.97	21.15	8.17	0.17	0.28	63.01
	Continous SAV (1)	9116	1135.61	1069.26	-66.35	15.15	14.30	-5.84
	Algae beds	9121	1.21	0.00	-1.21	0.02	0.00	-100.00
	Tidal flats	6510	361.46	430.31	68.85	4.82	5.75	19.05
	Unvegetated Bottom	5400	2063.38	2055.23	-8.15	27.53	27.49	-0.39
Subtotal			**3574.63**	**3575.94**	**1.3**	**47.7**	**47.8**	**0.04**
Central LWL	**Patchy SAV (1)**	9113	0.72	20.92	20.20	0.01	0.28	2810.13
	Continous SAV (1)	9116	194.62	183.59	-11.03	2.60	2.46	-5.67
	Algae beds	9121	0.00	0.00	0.00	0.00	0.00	0.00
	Tidal flats	6510	461.16	429.94	-31.21	6.15	5.75	-6.77
	Unvegetated Bottom	5400	1472.63	1474.18	1.54	19.65	19.72	0.10
Subtotal			**2129.13**	**2108.63**	**-20.5**	**28.4**	**28.2**	**0.07**
South LWL	**Patchy SAV (1)**	9113	0.28	10.36	10.09	0.00	0.14	3651.92
	Continous SAV (1)	9116	302.17	382.91	80.73	4.03	5.12	26.72
	Algae beds	9121	0.00	0.00	0.00	0.00	0.00	0.00
	Tidal flats	6510	334.01	226.13	-107.87	4.46	3.02	-32.30
	Unvegetated Bottom	5400	1155.93	1173.29	17.36	15.42	15.69	1.50
Subtotal			**1792.38**	**1792.69**	**0.3**	**23.9**	**24.0**	**0.07**
LWL all segments	**Patchy SAV (1)**	9113	13.97	52.43	38.46	0.19	0.70	275.33
	Continous SAV (1)	9116	1632.41	1635.76	3.35	21.78	21.88	0.21
	Algae beds	9121	1.21	0.00	-1.21	0.02	0.00	-100.00
	Tidal flats	6510	1156.62	1086.38	-70.24	15.43	14.53	-6.07
	Unvegetated Bottom	5400	4691.94	4702.70	10.76	62.59	62.89	0.23
TOTAL LWL Estuarine Habitat			**7,496.14**	**7,477.27**	**-18.88**	**100.00**	**100.00**	**0.07**
Total Not Classified Area		0	**74,982.65**	**75,001.53**				
Total LWL Project Area			**82,478.80**	**82,478.80**				

Footnotes:

1. SAV: Submerged Aquatic Vegetation (seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total acres within Palm Beach County excluding Not Classified

Table 4a. Palm Beach County 2007 Mangrove Change
Based on 1985, 2001 and 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [1]	1985 Mangrove Acres [2]	2001 Mangrove Acres [2]	2007 Mangrove Acres [2]	Mangrove Acres Difference 1985-2001	Mangrove Acres Difference 1985-2007	Mangrove Acres Difference 2001-2007	1985 % of Total Mangroves in PBC [3]	2001 % of Total Mangroves in PBC [3]	2007 % of Total Mangroves in PBC [3]	% Change Between 1985-2001 [4]	% Change Between 1985-2007 [4]	% Change Between 2001-2007 [4]
North ICW	Mangrove	6120	231.45	243.08	265.68	11.62	34.22	22.60	36.66	37.15	37.39	5.02	14.79	9.30
North LWL	Mangrove	6120	119.42	134.29	152.59	14.88	33.17	18.30	18.92	20.53	21.47	12.46	27.78	13.63
Central LWL	Mangrove	6120	52.37	56.30	58.19	3.93	5.81	1.89	8.30	8.61	8.19	7.50	11.10	3.35
South LWL	Mangrove	6120	76.23	73.32	72.56	-2.91	-3.67	-0.76	12.07	11.21	10.21	-3.82	-4.81	-1.04
South ICW	Mangrove	6120	151.85	147.24	161.58	-4.61	9.73	14.34	24.05	22.51	22.74	-3.03	6.41	9.74
PBC all segments	**Mangrove**	**6120**	**631.32**	**654.23**	**710.60**	**22.91**	**79.27**	**56.37**	**100.00**	**100.00**	**100.00**	**3.63**	**12.56**	**8.62**

Footnotes:

1. FLUCCS: Florida Land Use, Cover and Forms Classification System
2. Total Acres from GIS shapefile
3. % Total Acres within PBC
4. % Change within PBC

Table 4b. Lake Worth Lagoon 2007 Mangrove Change
Based on 1985, 2001 and 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [1]	1985 Mangrove Acres [2]	2001 Mangrove Acres [2]	2007 Mangrove Acres [2]	Mangrove Acres Difference 1985-2001	Mangrove Acres Difference 1985-2007	Mangrove Acres Difference 2001-2007	1985 % of Total Mangroves in LWL [3]	2001 % of Total Mangroves in LWL [3]	2007 % of Total Mangroves in LWL [3]	% Change Between 1985-2001 [4]	% Change Between 1985-2007 [4]	% Change Between 2001-2007 [4]
North LWL	Mangrove	6120	119.42	134.29	152.59	14.88	33.17	18.30	48.15	50.89	53.86	12.46	27.78	13.63
Central LWL	Mangrove	6120	52.37	56.30	58.19	3.93	5.81	1.89	21.12	21.33	20.54	7.50	11.10	3.35
South LWL	Mangrove	6120	76.23	73.32	72.56	-2.91	-3.67	-0.76	30.74	27.78	25.61	-3.82	-4.81	-1.04
LWL all segments	**Mangrove**	**6120**	**248.02**	**263.91**	**283.34**	**15.89**	**35.32**	**19.42**	**100.00**	**100.00**	**100.00**	**6.41**	**14.24**	**7.36**

Footnotes:

1. FLUCCS: Florida Land Use, Cover and Forms Classification System
2. Total Acres from GIS shapefile
3. % Total Acres within LWL
4. % Total Change within Lale Worth Lagoon

Table 5a. Palm Beach County Oyster Reef Habitat
Based on 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code (1)	Total Acres (2)	% of Total Oysters in PBC (3)
North ICW	Oyster Bar/Reef	6540	0.00	0.00
North LWL	Oyster Bar/Reef	6540	0.35	8.29
Central LWL	Oyster Bar/Reef	6540	3.85	91.71
South LWL	Oyster Bar/Reef	6540	0.00	0.00
South ICW	Oyster Bar/Reef	6540	0.00	0.00
PBC all segments	**Oyster Bar/Reef**	**6540**	**4.20**	**100.0**

Footnotes:

1. FLUCCS: Florida Land Use, Cover and Forms Classification System
2. Total Acres from GIS shapefile.
3. % Total Acres within PBC

Table 5b. Lake Worth Lagoon Oyster Reef Habitat
Based on 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code (1)	Total Acres (2)	% of Total Oysters in LWL (3)
North LWL	Oyster Bar/Reef	6540	0.35	8.29
Central LWL	Oyster Bar/Reef	6540	3.85	91.71
South LWL	Oyster Bar/Reef	6540	0.00	0.00
LWL all segments	**Oyster Bar/Reef**	**6540**	**4.20**	**100.0**

Footnotes:

1. FLUCCS: Florida Land Use, Cover and Forms Classification System
2. Total Acres from GIS shapefile.
3. % Total Acres within Lake Worth Lagoon

Table 6a. Palm Beach County Cordgrass (Spartina sp.) Habitat
Based on 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code (1)	Total Acres (2)	% of Total Oysters in PBC (3)
North ICW	Cordgrass (Spartina sp.)	6421	0.00	0.00
North LWL	Cordgrass (Spartina sp.)	6421	0.00	0.00
Central LWL	Cordgrass (Spartina sp.)	6421	1.35	89.43
South LWL	Cordgrass (Spartina sp.)	6421	0.16	10.57
South ICW	Cordgrass (Spartina sp.)	6421	0.00	0.00
PBC all segments	**Cordgrass (Spartina sp.)**	**6421**	**1.51**	**100.0**

Footnotes:

1. FLUCCS: Florida Land Use, Cover and Forms Classification System
2. Total Acres from GIS shapefile.
3. % Total Acres within PBC

Table 6b. Lake Worth Lagoon Cordgrass (Spartina sp.) Habitat
Based on 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code (1)	Total Acres (2)	% of Total Oysters in LWL (3)
North LWL	Cordgrass (Spartina sp.)	6421	0.00	0.00
Central LWL	Cordgrass (Spartina sp.)	6421	1.35	89.43
South LWL	Cordgrass (Spartina sp.)	6421	0.16	10.57
LWL all segments	**Cordgrass (Spartina sp.)**	**6421**	**1.51**	**100.0**

Footnotes:

1. FLUCCS: Florida Land Use, Cover and Forms Classification System
2. Total Acres from GIS shapefile.
3. % Total Acres within Lake Worth Lagoon

Table 7a. Palm Beach County Seagrass Habitat Change
Based on 2001 and 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [2]	2001 Total Acres [3]	2007 Total Acres [3]	Total Acres Difference 2001-2007	2001 % of Total Seagrass Acres in PBC [4]	2007 % of Total Seagrass Acres in PBC [4]	% Change Between 2001-2007
North ICW	**Patchy SAV (1)**	9113	19.17	21.69	2.52	0.97	1.07	13.16
	Continous SAV (1)	9116	232.00	227.92	-4.09	11.77	11.21	-1.76
Subtotal			**251.2**	**249.6**	**-1.6**	**12.7**	**12.3**	**-0.62**
North LWL	**Patchy SAV (1)**	9113	12.97	21.15	8.17	0.66	1.04	63.01
	Continous SAV (1)	9116	1135.61	1069.26	-66.35	57.60	52.59	-5.84
Subtotal			**1148.6**	**1090.4**	**-58.2**	**58.3**	**53.6**	**-5.07**
Central LWL	**Patchy SAV (1)**	9113	0.72	20.92	20.20	0.04	1.03	2810.13
	Continous SAV (1)	9116	194.62	183.59	-11.03	9.87	9.03	-5.67
Subtotal			**195.3**	**204.5**	**9.2**	**9.9**	**10.1**	**4.69**
South LWL	**Patchy SAV (1)**	9113	0.28	10.36	10.09	0.01	0.51	3651.92
	Continous SAV (1)	9116	302.17	382.91	80.73	15.33	18.83	26.72
Subtotal			**302.4**	**393.3**	**90.8**	**15.3**	**19.3**	**30.03**
South ICW	**Patchy SAV (1)**	9113	16.44	14.31	-2.13	0.83	0.70	-12.94
	Continous SAV (1)	9116	57.48	81.17	23.68	2.92	3.99	41.20
Subtotal			**73.9**	**95.5**	**21.6**	**3.7**	**4.7**	**29.16**
PBC all segments	**Patchy SAV (1)**	9113	49.58	88.43	38.85	2.51	4.35	78.37
	Continous SAV (1)	9116	1921.89	1944.84	22.95	97.49	95.65	1.19
TOTAL PBC			**1971.47**	**2033.27**	**61.80**	**100.00**	**100.00**	**3.13**

Footnotes:

1. SAV: Submerged Aquatic Vegetation (seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total acres within Palm Beach County

Table 7b. Lake Worth Lagoon Seagrass Habitat Change
Based on 2001 and 2007 Aerial Photography

Segment	Habitat Type	FLUCCS Code [2]	2001 Total Acres [3]	2007 Total Acres [3]	Total Acres Difference 2001-2007	2001 % of Total Seagrass Acres in LWL [4]	2007 % of Total Seagrass Acres in LWL [4]	% Change Between 2001-2007
North LWL	**Patchy SAV (1)**	9113	12.97	21.15	8.17	0.79	1.25	63.01
	Continous SAV (1)	9116	1135.61	1069.26	-66.35	68.98	63.34	-5.84
Subtotal			**1148.6**	**1090.4**	**-58.2**	**69.8**	**64.6**	**-5.07**
Central LWL	**Patchy SAV (1)**	9113	0.72	20.92	20.20	0.04	1.24	2810.13
	Continous SAV (1)	9116	194.62	183.59	-11.03	11.82	10.88	-5.67
Subtotal			**195.3**	**204.5**	**9.2**	**11.9**	**12.1**	**4.69**
South LWL	**Patchy SAV (1)**	9113	0.28	10.36	10.09	0.02	0.61	3651.92
	Continous SAV (1)	9116	302.17	382.91	80.73	18.35	22.68	26.72
Subtotal			**302.4**	**393.3**	**90.8**	**18.4**	**23.3**	**30.03**
LWL all segments	**Patchy SAV (1)**	9113	13.97	52.43	38.46	0.85	3.11	275.33
	Continous SAV (1)	9116	1632.41	1635.76	3.35	99.15	96.89	0.21
TOTAL LWL			**1646.37**	**1688.19**	**41.81**	**100.00**	**100.00**	**2.54**

Footnotes:

1. SAV: Submerged Aquatic Vegetation (seagrass).
2. FLUCCS: Florida Land Use, Cover and Forms Classification System
3. Total Acres from GIS shapefile
4. % of Total acres within Lake Worth Lagoon

APPENDIX D: Plotted Maps

D1: 2007 Palm Beach County Habitat (all habitats)

D2: 2007 Palm Beach County Submerged Habitat

D3: 2001 Submerged Habitat

D4: 2001 – 2007 Change in Seagrass Distribution

D5: 2007 Mangrove Habitat

D6: 2001 Mangrove Habitat

D7: 1985 Mangrove Habitat

D8: 2001- 2007 Change in Mangrove Habitat

D9: 1985 – 2007 Change in Mangrove Habitat

D10: 1985 – 2001 Change in Mangrove Habitat

D11: 2007 Oyster Habitat

D12: 2007 Cordgrass Habitat

PALM BEACH COUNTY 2007 MAPPING PROJECT

2007 Palm Beach County Habitat

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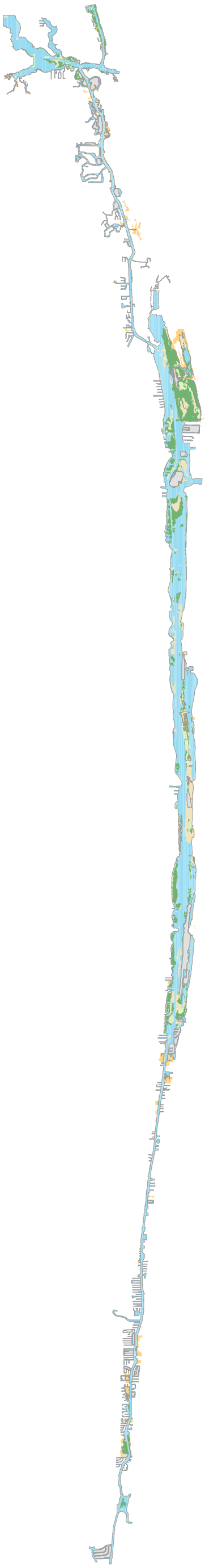

Legend

FLUCCS Code	Habitat	Total Acres	% in PBC Excluding Not Classified
0	Not classified		
5400	Unvegetated bottom	*7250.17*	*64.09%*
6120	Mangrove swamp	*710.60*	*6.28%*
6421	Cordgrass (Spartina sp.)	*1.51*	*0.01%*
6510	Tidal flats	*1313.33*	*11.61%*
6540	Oyster bars/reef	*4.20*	*0.04%*
9113	Seagrass, patchy	*88.43*	*0.78%*
9116	Seagrass, continuous	*1944.84*	*17.19%*
9121	Algae beds	*0.27*	*0.002%*

2007 Palm Beach County Mapping Project
Photointerpreted from 1:10000 and
1:4800 natural color aerial photography.
All habitat data was stereoscopically
collected using photogrammetric techniques.
Photo Date:
2007 era photo dates: June, July and August of 2007

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PALM BEACH COUNTY 2007 MAPPING PROJECT

2007 Palm Beach County Submerged Habitat

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Legend

FLUCCS Code	Habitat	Total Acres	% in PBC Excluding Not Classified
0	Not classified		
5400	Unvegetated bottom	*7250.17*	*64.09%*
6510	Tidal flats	*1313.33*	*11.61%*
9113	Seagrass, patchy	*88.43*	*0.78%*
9116	Seagrass, continuous	*1944.84*	*17.19%*
9121	Algae beds	*0.27*	*0.002%*

Photointerpreted from 1:10000 and
1:4800 natural color aerial photography.
All habitat data was stereoscopically
collected using photogrammetric techniques.
Photo Date:
2007 era photo dates: June, July and August of 2007

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PALM BEACH COUNTY 2007 MAPPING PROJECT
2001 Submerged Habitat

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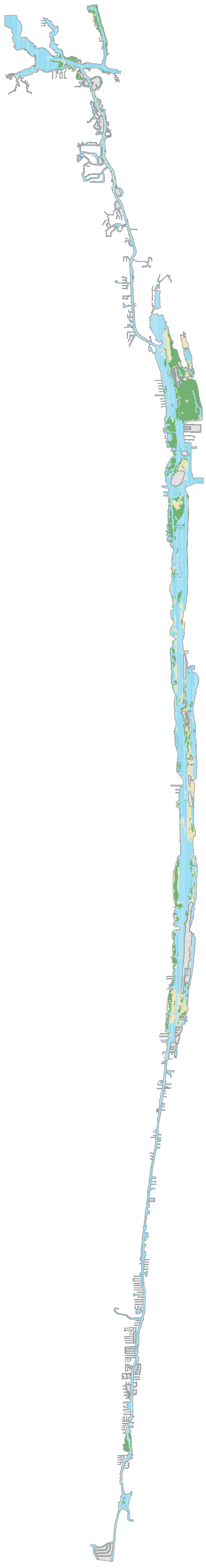

Legend

FLUCCS Code	Habitat	Total Acres	% in PBC Excluding Not Classified
0	Not classified		
5400	Unvegetated bottom	*7311.11*	*64.82%*
6510	Tidal flats	*1336.80*	*11.85%*
9113	Seagrass, patchy	*49.58*	*.44%*
9116	Seagrass, continuous	*1921.89*	*17.04%*
9121	Algae beds	*4.69*	*0.04%*

Photointerpreted from 1:10000 natural color aerial photography.
All submerged habitat data was stereoscopically collected using photogrammetric techniques.
Photo Dates:
2001 era photo dates: May, June and July of 2001

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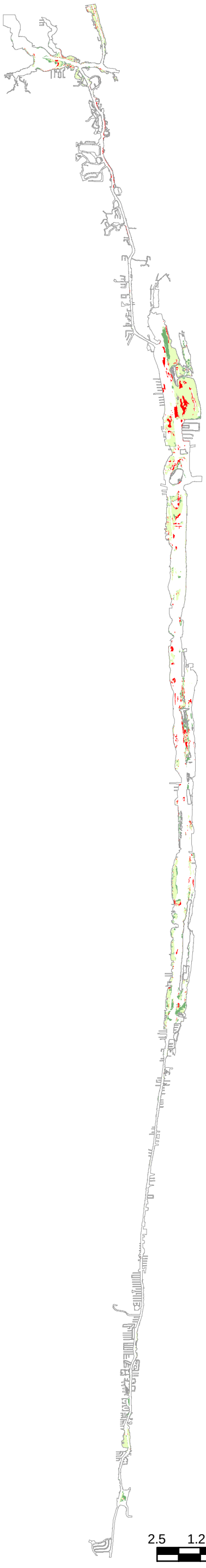
PALM BEACH COUNTY 2007 MAPPING PROJECT
2001 To 2007 Change in Seagrass Distribution



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Legend

	Gain in Acres	Change
Gain	**61.81**	**(3.13%)**
Loss		
No Change		

Photointerpreted from 1:10000 and 1:4800
natural color aerial photography.
All seagrass data was stereoscopically collected
using photogrammetric techniques.
Photo Dates:
2001 era photo dates: May, June and July of 2001
2007 era photo dates: June, July and August of 2007

Gain represents a increase in patchy or continuous seagrass.
Loss represents a decrease in patchy or continuous seagrass.

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2.5 1.25 0 2.5 5 7.5 10
Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT

2007 Mangrove Habitat

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Legend

	FLUCCS Code	Habitat	Total Acres	% in PBC Excluding Not Classified
	6120	Mangrove swamp	***710.60***	***6.28%***

Photointerpreted from 1:10000 and
1:4800 natural color aerial photography.
Mangrove habitat data was stereoscopically
collected using photogrammetric techniques.
Photo Date:
2007 era photo dates: June, July and August of 2007

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Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT

2001 Mangrove Habitat

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Legend

	FLUCCS Code	Habitat	Total Acres	% in PBC Excluding Not Classified
	6120	Mangrove swamp	***654.23***	***5.80%***

Photointerpreted from 1:10000 and
1:4800 natural color aerial photography.
Mangrove habitat data was stereoscopically
collected using photogrammetric techniques.
Photo Date:
2001 era photo dates: May, June and July of 2001

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Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT

1985 Mangrove Habitat

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Legend

	FLUCCS Code	Habitat	Total Acres
	6120	Mangrove swamp	***631.32***

Photointerpreted from 1:58000 CIR
All mangrove data was stereoscopically collected using photogrammetric techniques.
Photo Dates:
1985 era photo dates: Spring of 1985

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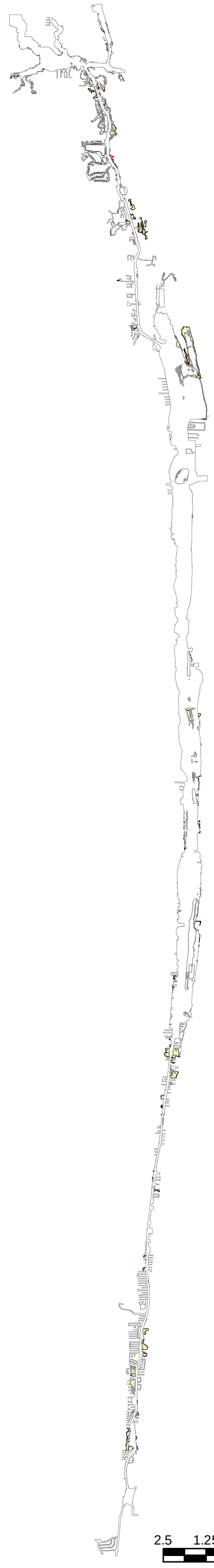
Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT
2001 To 2007 Change in Mangrove Habitat



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Legend

	Gain in Acres	Change
Gain	56.37	(8.62%)
Loss		
No Change		

Photointerpreted from 1:10000 and 1:4800
natural color aerial photography.
All mangrove data was stereoscopically collected
using photogrammetric techniques.
Photo Dates:
2001 era photo dates: May, June and July of 2001
2007 era photo dates: June, July and August of 2007

Gain represents a increase in mangroves.
Loss represents a decrease in mangroves.

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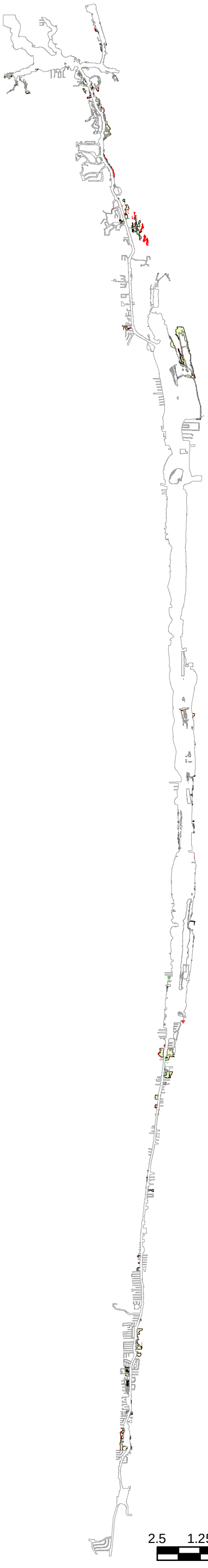
2.5 1.25 0 2.5 5 7.5 10
Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT
1985 To 2007 Change in Mangrove Habitat



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Legend

	Gain in Acres	Change
Gain	79.27	(12.56%)
Loss		
No Change		

Photointerpreted from 1:10000, 1:4800
natural color aerial photography and 1:58000 CIR .
All mangrove data was stereoscopically collected
using photogrammetric techniques.
Photo Dates:
1985 era photo dates: Spring of 1985
2007 era photo dates: June, July and August of 2007

Gain represents a increase in mangroves.
Loss represents a decrease in mangroves.

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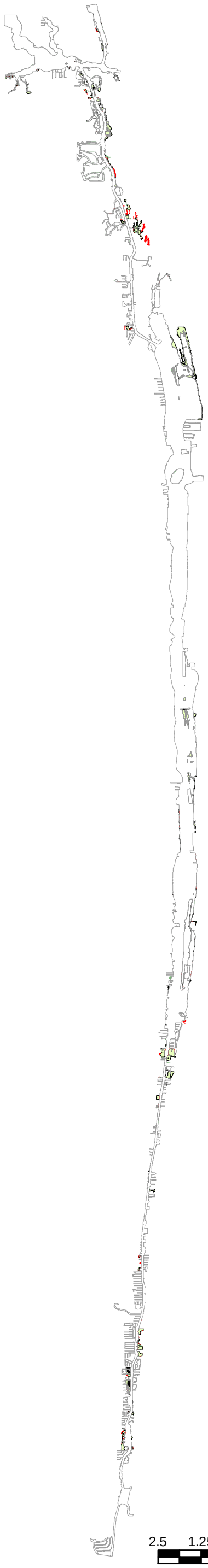
2.5 1.25 0 2.5 5 7.5 10
Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT
1985 To 2001 Change in Mangrove Habitat



AVINEON®
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Legend

	Gain in Acres	Change
Gain	**22.91**	**(3.63%)**
Loss		
No Change		

Photointerpreted from 1:10000 natural color aerial photography
and 1:58000 CIR aerial photography.
All mangrove data was stereoscopically collected
using photogrammetric techniques.
Photo Dates:
1985 era photo dates: Spring of 1985
2001 era photo dates: May, June and July of 2001

Gain represents a increase in mangroves.
Loss represents a decrease in mangroves.

N
W E
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2.5 1.25 0 2.5 5 7.5 10
Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT
2007 Oyster Habitat

Legend

FLUCCS Code	Habitat	Total Acres	% in PBC Excluding Not Classified
6540	Oysters	***4.20***	***0.04%***

Photointerpreted from 1:10000 and
1:4800 natural color aerial photography.
Oyster habitat data was stereoscopically
collected using photogrammetric techniques.
Photo Date:
2007 era photo dates: June, July and August of 2007

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0 1.25 2.5 5 7.5 10 Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT
2007 Cordgrass (Spartina sp.) Habitat

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Legend

	FLUCCS Code	Habitat	Total Acres	% in PBC Excluding Not Classified
	6421	Cordgrass (Spartina sp.)	***1.51***	***0.01%***

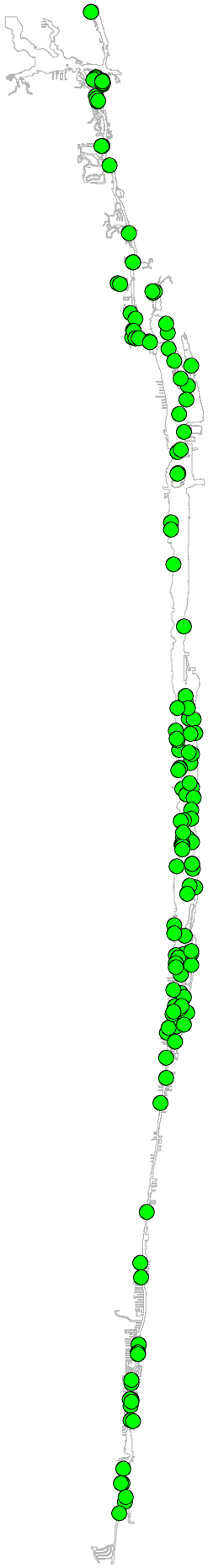
Photointerpreted from 1:10000 and
1:4800 natural color aerial photography.
Cordgrass habitat data was stereoscopically
collected using photogrammetric techniques.
Photo Date:
2007 era photo dates: June, July and August of 2007

N
W E
S

0 1.5 3 6 9 12
Miles

PALM BEACH COUNTY 2007 MAPPING PROJECT
2007 Field Sites

AVINEON
Visualize IT. See IT Through.



Legend

- Field Sites (158 total sites)

Fieldwork was conducted on
11/13, 11/14, 11/15 of 2007
and 2/26, 2/27 of 2008

N
W E
S

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APPENDIX E: Metadata Documentation

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