

# TIGERTAIL LAGOON/ SAND DOLLAR ISLAND ECOSYSTEM RESTORATION PROJECT

## BIOLOGICAL MONITORING PLAN

DEP PERMIT NO. 0401778-001-JC

DECEMBER 20, 2021



**APPROVED**

December 20, 2021

Beaches Inlets and Ports

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## 1.0 INTRODUCTION

The following outlines monitoring survey protocols associated with the Tigertail Lagoon/ Sand Dollar Island Ecosystem Restoration Project (DEP File No. 0401778-001-JC). Pre-construction and post-construction monitoring will include surveys for berm vegetation, mangroves, submerged aquatic vegetation (SAV), and water quality. This monitoring plan details the methods that shall be used for data collection and analyses to determine if unauthorized impacts have occurred due to the project. Monitoring results shall also be used for adaptive management of berm vegetation and to document water quality over time. Documented improvements associated with the project may be evaluated if compensatory mitigation is necessary.

### 1.1 SITE AND HISTORICAL BACKGROUND

Sand Dollar Island is a half-enclosed peninsular spit, which is the result of the collapse of the Big Marco Pass ebb shoal migrating east towards the mainland of Marco Island over many years and eventually fusing to the mainland at its southern end. Storm events and general wave hydrodynamics have molded and reshaped what is now a system attached to the mainland at the southern terminus, with open shallow waters from the south end (Tigertail Lagoon) to what is the mouth of the system now at Hideaway Beach and Big Marco Pass on the north end. Maintenance dredging (File No. 0309260-010-JM) has been conducted at the north end every two to three years, which has prevented the north end of the system from attaching to the mainland becoming a closed, likely stagnant, lagoon system.

The area was designated as a Critical Wildlife Area (CWA) in 1988 by the Florida Fish and Wildlife Conservation Commission (FWC). In 2001, it was also designated as Critical Habitat for the piping plover by the US Fish and Wildlife Service (FWS). Several protected shorebirds utilize the spit for nesting and foraging and this use is another component of the system which must be considered and protected under any management operations.

The Hideaway Beach Taxing District, through the City of Marco Island, conducts regular maintenance dredging of the mouth of the lagoon system under Florida Department of Environmental Protection (FDEP or Department) Permit (0309260-010-JM) and U.S. Army Corps of Engineers (USACE) Permit (SAJ-1998-00290). Activities associated with those permits include the re-shaping of Sand Dollar Island's northern terminus and keeping that pass open between each dredge event, maintenance of a sand borrow area inside of the northern lagoon, and Hideaway beach renourishment with sand removed from the spit and/or borrow locations.

The southern lagoon system known as Tigertail Lagoon (also Tigertail Park), identified in drawings as Area 4, has largely stabilized with wide perimeter beaches and mature



mangroves lining a sizable portion of the lagoon. Few changes in this portion of the system have been noted over the last few years.

With the exception of the dredging at the north end of the system, nothing has been done to manage the areas in between the north and south ends. This area, which will be referred to hereafter as Areas 2 and 3, are some of the most critical bird foraging areas within the entire system due to their extreme shallow depths and fairly abundant seagrass beds, yet they are disappearing at an alarming rate as the spit shifts 40 to 50 feet a year towards the mainland. There was an approximate foraging grass bed habitat loss of 3 acres from 2017 to 2020 in just the southern half of Area 2.

## **1.2 PROJECT DESCRIPTION**

This ecosystem restoration project includes re-aligning Area 2 with its 2017 footprint utilizing sand dredged from the system mouth as well as dredging sand from the backside of the beach and placing it seaward. This will expand and reshape the oceanfront habitat into a functional beach, provide additional protection and restore nesting habitat for shorebirds and sea turtles. Sand will be dredged out of the current over wash zone resulting in the creation of a flushing channel along the back side of the beach connecting north and south portions of the system. Existing grass and mudflats along the backside of the beach, which provide essential foraging habitat for listed and migratory avian species, should be better protected from future loss following proposed activities.

## **1.3 MONITORING COORDINATION**

Prior to survey commencement the FDEP ([JCPCompliance@floridadep.gov](mailto:JCPCompliance@floridadep.gov)) and U.S. Army Corps of Engineers (USACE) compliance staff will be notified of the anticipated start and completion dates. If non-permitted wetland or SAV or mangrove impacts are located during surveying, then the JCP Compliance Officer, the USACE and the National Marine Fisheries Service (NMFS) will be notified within 24 hours, and coordination will begin on further investigations and whether mitigation is warranted.

Any correspondence/ deliverables regarding the various monitoring events will be provided to the JCP Compliance Officer ([JCPCompliance@floridadep.gov](mailto:JCPCompliance@floridadep.gov)) and the U.S. Army Corps of Engineers Compliance Office. The permit number and project name will be referenced along with the specific conditions relating to the issue or report.

## **1.4 QA/QC**

During regular monitoring sampling events, all data sheets will be brought back to the office, inspected for issues and then upon approval will be entered into a digital format.

Another staff member will then verify the accuracy of the data entry upon completion and before the results are posted in a monitoring report and discussed.

If a field data sheet has inaccuracies, then that sample will be re-duplicated in the field and then entered with the others.

## **1.5 SCHEDULE OF MONITORING & REPORTING**

All resources (SAV, mangrove, dune vegetation) within the potential influence of the project as well as water quality shall be monitored before and after each construction event. A pre-construction survey shall be conducted during the summer immediately prior to each construction event. An immediate post-construction survey (the summer immediately following project completion) and four annual post-construction surveys (Years 1, 2, 3, and 4 post-construction) shall be required following each construction event.

One biological monitoring report will be prepared each year that monitoring is conducted to report the results from the SAV, mangrove, dune vegetation and water quality surveys. The report and all data deliverables shall be submitted to the Department by March 1<sup>st</sup> the following year. Data deliverables will include the raw data (scanned field / lab data sheets, Sonde files, observation notes, and Excel spreadsheets), ArcGIS files, and photographs from each survey conducted during that reporting year. Preconstruction data deliverables for SAV and mangrove / marsh surveys are due no later than 45 days prior to construction commencement.

All data shall be carefully checked (as described above) prior to submittal. Digital photographs submitted to the Department shall be organized (sorted within file folders) by survey event and survey site.

## 2.0 MONITORING PROTOCOLS

Upland, wetland, and aquatic habitats will be monitored using the protocols provided in this plan. Comprehensive monitoring will be conducted to document the condition of vegetation and habitats in the vicinity of the project over time and provide input for adaptive management of the project area.

### 2.1 VEGETATION- BERM AND BEACH

To keep vegetation relatively sparse along the restored shoreline in Areas 1, 2, and 3, so it remains favorable for shorebird and sea turtle nesting, monitoring shall be conducted to inform if adaptive management is needed to prevent dense vegetation and sandburs from becoming established.

#### 2.1.1 Desktop Survey

Prior to fieldwork each year a desktop survey shall be conducted by overlaying aerials of the prior and current survey periods to determine spatial extent of the fieldwork. Physical attributes such as recent surveys or beach enhancement work will be included in overlays for the desktop survey.

The sampling work done in this area shall be used to address needed vegetation management as discussed below.

#### 2.1.2 Qualitative Assessment

##### Characterization

Characterization of the Berm and Beach habitats will include the following data collection:

- Survey dates and times,
- Tidal conditions,
- Ambient conditions,
- Wind speed and direction,
- Surveyor's name(s),
- GPS coordinates,
- Photographs and directions (and GPS locations),
- Plant cover (Genus, species, listing status- if applicable, and FLEPPC status- if applicable)
- FLUCFCS Code,
- Wildlife observations,
- Other pertinent observations, and

- Indicators of function: Location & Landscape Support, Water Environment (if pertinent), and Community Structure.

### **2.1.3 Quantitative Assessment**

#### **Sampling**

Point line intercept surveys shall be conducted along the berm and beach habitats within 300 meters of any beach berm construction activity. Each transect will be 100 meters in length due to tape limitations but placed end-to-end for the length of the beach/berm habitat. Transects will cover the entirety of the construction zones from north to south (or east to west as along the north island tip), with 7 meter spacing between transects to ensure that the majority of the area is sampled.

Along the tape at every meter, a wire flag will be dropped and anything intersecting that wire or flag will be documented. Sampling sheets will have three columns, Top Layer for vegetation (genus and species), Lower Layer for leaf litter, and Soil Surface for sand or shell.

The percent cover for each species or category within each layer will be approximated by dividing the number of observations of an individual species/category by the total number of observation points along the transects. Total percent cover of the top vegetated layer will be estimated by dividing the number of points at which any vegetation was observed by the total number of observation points (i.e., number of meter points measured).

Since adaptive management for wildlife is the primary purpose of vegetative monitoring in these habitats, if vegetative cover on the newly constructed beach-berm habitats exceeds 10% total cover then management actions such as the manual thinning of plant material and elimination of all sandburs shall be coordinated with permitting agencies.

### **2.1.4 Surveys and Deliverables**

A pre-construction survey shall be conducted immediately prior to each construction event. An immediate post-construction survey (outside nesting season) and four annual post-construction surveys (Years 1, 2, 3, and 4 post-construction) shall be required following each construction event.

#### **Schedule**

All surveys for the new berm and beach zone will be conducted annually in November, outside of bird nesting season (February 15<sup>th</sup> to September 1<sup>st</sup>) and sea turtle nesting season (May 1<sup>st</sup> to October 31<sup>st</sup>).

Quarterly, between annual survey events, the berm and beach will be visually assessed for vegetation cover in a manner that will not disturb bird or sea turtle nests. Photographs and notes will be taken in the newly established zones to verify that vegetation has not reached the 10% cover threshold and that sandburs have not recruited since the last maintenance event. Notes and photographs will be reviewed for inconsistencies in data or if something is observed that would suggest adaptive management is needed. Notes and photographs will be stored until the annual monitoring event. Both photographs and notes will be provided as a deliverable.

If plant cover or sandbur recruitment issues are noted, then the permittee's consultants, stakeholders (i.e., FWC, Rookery Bay and Audubon), and FDEP will be alerted immediately to the need for a vegetation management event.

### *Deliverables*

The data deliverables shall include raw data (scanned field data sheets and Excel spreadsheets), a geo-referenced map of dune vegetation transect results, quarterly field notes and photographs, and annual monitoring photographs. The data deliverables shall be submitted by March 1<sup>st</sup> the following year. All data results and the analysis of that data will be included in the March 1<sup>st</sup> annual monitoring report.

The annual monitoring report will provide the following information:

- Data collection sheets (see 2.1.2 for details),
- Analyses of the vegetation data, and calculated total percent cover and percent cover per species,
- Recommendations for vegetation control,
- Documentation of previous adaptive management measures taken to control the vegetation density since the previous monitoring effort,
- Photographs of the habitats by GPS location,
- Maps of the sampling transects,
- Maps of areas which require vegetative management for the next annual cycle,
- Data and photographs from quarterly surveys,
- Site conditions and functional indicators will be described for each habitat, and
- Communities will be identified on an aerial using Florida Land Use Cover and Classification System (FLUCFCS) codes and will include the acreages of each FLUCFCS type. (The aerial scale will not exceed 1 inch = 300 feet.)

## **2.2 VEGETATION- WETLAND (MARSH AND MANGROVE)**

### **2.2.1 Desktop Survey**

Prior to fieldwork each year a desktop survey will be conducted by overlaying arials of the prior and current survey periods. Physical attributes such as recent surveys or beach enhancement work will be included in overlays for the desktop survey.

### **2.2.2. Qualitative Assessment**

#### **Characterization**

Characterization of the wetland habitats will entail the following data collection:

- Survey dates and times,
- Tidal conditions,
- Ambient conditions,
- Wind speed and direction,
- Surveyor's name(s),
- GPS coordinates,
- Photographs and directions (and GPS locations),
- Plant cover by stratum and percent cover of each species per stratum (Genus, species, listing status- if applicable, and FLEPPC status- if applicable)
- FLUCFCS Code,
- Wildlife observations,
- Other pertinent observations, and
- Indicators of function: Location & Landscape Support, Water Environment (if pertinent), and Community Structure.

### **2.2.3 Quantitative Assessment**

#### **Sampling**

Permanent monitoring stations will be established during the Baseline monitoring event at locations noted on the monitoring maps attached as exhibits to this plan. Stations will either be denoted by a PVC pole or a tree tag. Vegetation at each station will be documented within a 10 meter x 10 meter plot unless physical constraints limit the area of sampling to 5 meter x 5 meter. The total percent cover of canopy, midstory and groundcover vegetation will be recorded, as well as the percent cover of all species occupying each stratum. Vegetative coverage will be presented in a tabular format each year with the previous year's data for comparison and trend observations.

Photographs will be taken at each station in the same direction during each survey for comparison.

## **2.2.4 Surveys and Deliverables**

A pre-construction survey shall be conducted immediately prior to each construction event. An immediate post-construction survey and four annual post-construction surveys (Years 1, 2, 3, and 4 post-construction) shall be required following each construction event.

### **Schedule**

All surveys for the marsh and mangrove habitats shall be conducted during the period of April to October each year.

### **Deliverables**

Pre-construction raw data deliverables (scanned field sheets and Excel spreadsheets), a geo referenced map of sampling locations, and geo-referenced photographs are due no later than 45 days prior to construction commencement. All data results and the analysis of that data will be included in the March 1<sup>st</sup> annual monitoring report.

Each monitoring report will provide the following information:

- Data collection sheets (see 2.2.2 for details),
- Identified vegetation at each station listed in a tabular format by percent cover of species per stratum,
- Observations and recommendations (if needed),
- Photographs of the habitats by GPS location,
- Maps of the sampling stations, and
- Site conditions and functional indicators will be described for each habitat.

## **2.3 SUBMERGED AQUATIC VEGETATION (SAV)**

For the purposes of this monitoring plan, Submerged Aquatic Vegetation (SAV) is defined as seagrasses and rhizophytic macroalgae, including both calcareous and non-calcareous taxa.

All SAV resources within the potential influence of the project shall be monitored before and after each construction event. All SAV monitoring surveys shall be conducted within the summer growing season (June 1 - September 30). A pre-construction survey shall be conducted during the summer immediately prior to each construction event. An immediate post-construction survey (the summer immediately following project completion) and four annual post-construction surveys (Years 1, 2, 3, and 4 post-construction) shall be required following each construction event.

### 2.3.1 QA/QC

Any biologist involved in the SAV survey will participate in cross-training and calibration exercises of species identification and survey practices. Results of the training will be documented for each individual on field data sheets with a consistency of 90% for each cover metric used and 100% consistency on seagrass and macroalgae species identification. Genus and species will be required for all seagrasses and the genus, at a minimum, will be required for all macroalgae. Cross-training data sheets will be collected and submitted with the monitoring report as an appendix.

During SAV surveys biologists will check field data sheets to ensure completeness, legibility, and accuracy. Each sheet will be initialed after it has been checked. Field sheets will be cleaned and dried in the office, re-verified by the data entry person, then data will be entered into an Excel spreadsheet. The final spreadsheet will be cross-checked against the original. If changes are needed during data entry, then the field biologist will be consulted, and it will be noted on the data sheet in colored marker.

If conditions warrant a change in the survey protocol outlined below then the resource staff in the FDEP Beaches, Inlets and Ports Program will be notified and the proposed changes submitted, coordinated, and approved prior to implementation. It is understood that a major change to the monitoring protocol could require a permit modification.

#### 2.3.1.1 Qualifications

Survey staff must have at least a Bachelor of Science degree from an accredited institution in marine biology, biology with a concentration in marine sciences, environmental science with a minor in biology or a similar degree. Biologists should also have professional experience and expertise in surveying SAV and scientific knowledge of SAV. Biologists should also have experience collecting data while snorkeling and certification for SCUBA.

Resumes will be submitted to the FDEP at least 15 days prior to survey commencement.

#### 2.3.1.2 Notification of Commencement/ Completion

Prior to each survey the FDEP JCP ([ICPCCompliance@dep.state.fl.us](mailto:ICPCCompliance@dep.state.fl.us)) will be notified of the anticipated start date of the survey work, then again within 48 hours of the work commencing and lastly when the survey has been completed.

### 2.3.2 Desktop Survey

Prior to initiation of any field work for the pre-construction survey, the biologists shall conduct a desktop assessment to identify potential SAV habitats within 300 meters of the area(s) to be dredged using the best available information (e.g., historical aerial



photography, data from previous surveys in the vicinity). Potential SAV habitats include areas known to be currently vegetated, as well as areas that have historically supported SAV and currently possess the appropriate water environment and sediment characteristics necessary for SAV growth. The results of this desktop assessment shall be provided in a Summary of Existing Information on SAV, which shall be provided to the Department as a deliverable.

### **2.3.3 Reconnaissance Survey**

The reconnaissance survey will cover all potential habitats within a 300-meter area of project influence to determine where resources are located. Monitoring transects will be spaced 5 to 10 meters apart where historical resources have been found and 20 meters apart where resources have never been identified. In very narrow zones 5 meter (or less) transect spacing will be utilized.

### **2.3.4 Edge Delineation**

SAV bed edge delineation will be accomplished using a sub-meter GPS unit either using a continuous line or points taken every 5 meters.

All SAV resources within the project area shall be delineated and qualitatively assessed to produce a Map of SAV Resources that illustrates the spatial distribution of SAV resources. During each survey, the edge of each SAV patch (e.g., seagrass bed) shall be visually assessed by divers *in situ*, and divers shall record the position of the edge as accurately as possible using a sub-meter-accurate GPS unit. The positioning data shall be recorded, and the total acreage of seagrass within each patch / bed during each survey shall be reported. For portions of the project where SAV is extensive and continuous, it is sufficient to delineate only the SAV edge that is proximate to the dredged area(s).

Delineation data shall be used to evaluate changes in the distribution and acreage of SAV over time. Any signs of physical impacts shall be noted. Additionally, water depth for each area shall be measured and reported to the Department in metric units. The Map of SAV Resources shall clearly distinguish between areas containing distinct resource types based on qualitative and quantitative data collected within each patch / bed (as below).

### **2.3.5 Qualitative Assessment**

#### **2.3.5.1 Characterization**

The characterization aspect of the report will include the following information on each quadrat field sampling data form.

- *Where taken* indicators for Location and Landscape Support, Water Environment, and Community Structure will be documented.

- Sediment type.
- Sediment depth (m).
- Salinity.
- Water temperature (°F).
- Flushing characteristics.
- Water depth in meters at the location and time of sampling.
- Any observed issues (algal blooms, eutrophication, cyanobacteria mats, etc.)
- Any landscape features (natural communities, shoals, man-made structures, etc.)
- Proximity of the site to channels, boat traffic and/or recreational use (m).
- Any anthropogenic impacts.
- Any wildlife observations, including evidence of bioturbation.
- A description of site conditions.
- Any signs of potential impacts (sloughing, scouring, exposed rhizomes, burial, or sedimentation, etc.).
- Photographs of the various quadrats and other observations.

#### **2.3.5.2 Community Structure**

A general description of vegetation will be given which includes the following information on each quadrat field sampling form:

- Whether the bed is patchy or continuous.
- Canopy height (cm).
- Whether the plant is flowering.
- Epiphyte type and cover (Light, Medium, Heavy).
- Sediment cover (Light, Heavy).
- Drift algae (Sparse, Moderate, Abundant).
- Any noted disease.

### **2.3.6 Quantitative Assessment**

#### **2.3.6.1 Transect Placement**

In the northern persistent SAV bed (Area 1) adjacent to the existing borrow area, random quadrat sampling will occur instead of transect-based.

Where SAV beds are in, adjacent to or near the proposed work path permanent transects will be established perpendicular to the construction limits every 50 meters. This includes areas 1, 2 and 3. All transects shall be marked (e.g., installation of PVC pipe or sub-surface buoy), and the starting ending positions of each transect shall be recorded as accurately as possible using a sub-meter DGPS. If SAV is not present during the preconstruction survey where a transect is currently designated, then that transect will be eliminated. If

new SAV locations are found, then additional transects will be established using the same methodology.

In the southern portion of Area 3 four transects (spaced 50 meters apart) will be used to assess the system's improvement following construction and assessing for secondary impacts from construction activities.

In the southern lagoon (Area 4) random quadrat sampling will be established to determine if there has been seagrass expansion or water quality improvements associated with the proposed project in Tigertail Lagoon.

#### ***2.3.6.2 Quadrat Placement***

Quantitative data shall be collected using 0.5-m<sup>2</sup> (0.7 m x 0.7 m) quadrats. Fifty (50) quadrats shall be sampled in the northern Area 1 and another fifty (50) quadrats shall be sampled in Area 4. For all transects containing SAV, cover abundance of SAV (as described below) shall be documented every 15 meters along the entire length of each transect. The positions of quadrats along permanent transects should be consistent across surveys (e.g., ensuring line is stretched tightly and that quadrats are placed on same side of transect line). Post-construction quadrat positions shall match the pre-construction quadrat positions, even if SAV is no longer present. If new SAV locations are found, or existing SAV beds have expanded, then additional quadrats will be placed along existing and/or new transects following the same methodology. Once transects and / or quadrats have been added, these shall continue to be sampled in subsequent post-construction surveys. Removal of any transects or quadrats from the sampling grid shall be coordinated with the Department. The data from any additional transects and / or quadrats surveyed during post-construction monitoring events (i.e., that were not included in the pre-construction survey) shall be noted separately and shall not be included in the summary statistics or statistical analyses comparing pre- and post-construction cover of SAV. Additional quadrats are meant to document expansion of SAV beds but should not be used for analyses as they could skew results when evaluating the project for unanticipated impacts.

#### ***2.3.6.3 Visual Assessment***

Cover abundance shall be visually assessed and reported to the nearest 5%. Any drift algae within the quadrat shall be recorded in the field notes as sparse, moderate, or abundant and then carefully removed prior to visually assessing rooted or anchored SAV taxa (seagrass and rhizophytic macroalgae, respectively). Once drift algae have been removed from the quadrat, the biologist shall assess the total cover-abundance of SAV, which is the total cover of all seagrass and rhizophytic macroalgae taxa. The total cover-abundance of all seagrass species and the total cover-abundance of all rhizophytic macroalgae genera shall also be reported. The biologist shall also report the cover-abundance of each seagrass species and each rhizophytic macroalgae genera present

within the quadrat. The results of this assessment should be used to calculate the frequency of occurrence (percentage of all quadrats that contained SAV), the density (average cover-abundance for all quadrats sampled) and the abundance (average cover-abundance for only those quadrats containing SAV). These metrics shall be calculated for 1) all SAV, 2) all seagrass, 3) all rhizophytic macroalgae, 4) each seagrass species, and 5) each rhizophytic macroalgae genera.

### **2.3.7 Surveys & Deliverables**

A pre-construction survey shall be conducted immediately prior to each construction event. An immediate post-construction survey and four annual post-construction surveys (Years 1, 2, 3, and 4 post-construction) shall be required following each construction event.

#### **Schedule**

All surveys for the SAV habitats shall be conducted during the summer growing season (June 1<sup>st</sup> to September 30<sup>th</sup>).

#### **Deliverables**

Pre-construction deliverables, including a summary of existing information on SAV, raw data (scanned field sheets and Excel spreadsheets), geo-referenced SAV bed delineation, geo-referenced transects and quadrats, and photographs are due no later than 45 days prior to construction commencement. All data results and the analysis of that data will be included in the March 1<sup>st</sup> annual monitoring report.

Pre- and post-construction SAV beds will be overlain and compared to evaluate changes. Maps created will include the following items.

- Field located SAV bed edges.
- The latitude and longitude of coordinates in NAD83 to the fifth decimal place.
- An ArcGIS Map (file format .mpk) or an AutoCAD file (format .dwf) from spatial and meta data.
- The types of habitats distinguished using an identifying symbol such as a color or hatch specific to that habitat.
- A legend, an easily discernable metric scale, and a north arrow on all maps.
- A map set with the project footprint and signature features as polygons and lines overlain.
- Map figures should be overlaid on recent aerial imagery and should include polygons or lines depicting project boundaries and significant features (e.g., dredge or fill template, footprint of structures).

All reports shall include georeferenced maps with SAV boundaries, photographs, and a description of the SAV bed condition based on the quantitative and qualitative analyses. The report shall include the results for each monitored metric; all data collected shall be reported. Also included in each report will be statistical comparisons of pre- and post-construction cover-abundance data and the spatial extent (acreage) of SAV, and summary statistics (including average and standard deviation) for comparison of pre- and post-construction for each SAV patch and/or transect within the survey area.

#### ***2.3.7.1 Evaluation of As-Built Survey Results and Physical Monitoring Data***

Following construction and prior to the post-construction SAV survey, as-built surveys will be overlain on the pre-construction SAV maps to determine if any dredge or fill occurred within SAV patches.

#### ***2.3.7.2 Impact Assessment Report (If Unauthorized Impacts Occur)***

If unauthorized impacts to SAV are suspected or verified to have occurred, then the permittee will notify the FDEP JCP ([JCPCCompliance@dep.state.fl.us](mailto:JCPCCompliance@dep.state.fl.us)) and the USACE compliance staff via email as soon as possible, but no later than 24 hours from discovery. The notification will include all available information on impacts/incidents which may have caused the impact.

An in-water assessment of potential impacts to SAV shall be completed by qualified biologists as soon as practicable but no more than 30 days after receiving notification from the Department that an assessment will be required. An Impact Assessment Report will be submitted within 30 days of the completion of the assessment. The Report shall include:

- descriptions of the habitat affected,
- photographs,
- Information to do a UMAM,
- GPS coordinates of impacted SAV,
- a georeferenced map to show spatial extent of the impacts,
- a description of the functional loss,
- the acreage of impacts to SAV and SAV habitat, and
- any visually conspicuous signs of impact.

The Permittee shall coordinate with the Department regarding corrective actions that may be required to monitor, remediate, and / or mitigate the unauthorized impacts.

#### ***2.3.7.3 Distribution Channel (Area 3)***

Prior to construction of the distribution channel, the permittee will submit the information required by the permit regarding the proposed location and limits of the distribution channel as well as the current condition and location of adjacent SAV

resources. The path for the distribution channel will be sited such that it reduces direct and secondary impacts to benthic resources to the greatest extent possible. If impacts to benthic resources are unavoidable, it will be necessary to formally show that those impacts are offset by the project.

## 2.4 WATER QUALITY

### 2.4.1 Discrete Quarterly Water Quality Sampling

Discrete water quality sampling events have taken place so far on July 23<sup>rd</sup> and October 7<sup>th</sup> (2021) by Benchmark Labs in the lagoon system with samples taken at the mouth of the system in the river, one just north of the pinch point in an open shallow area west of monument R-129, and the third in the southern portion of Tigertail Lagoon (see Figure 1). Another event is scheduled for December 2021. These sampling events included the following parameter suites:

- Overall depth (ft.)
- Secchi depth (in.)
- Conductivity (µmho/cm)
- Dissolved Oxygen (mg/L and %)
- pH (s.u.)
- Turbidity (NTU)
- Air Temperature (°C)
- Water Temperature (°C)
- BOD<sub>5</sub>
- Ammonia Nitrogen
- Nitrate-Nitrite as N
- Total Kjeldal Nitrogen
- Total Nitrogen (calc only)
- ortho-Phosphorous as P
- Total Phosphorus as P

Quarterly discrete water quality sampling using the above parameter set will continue throughout the period of the permit and annual monitoring events. Data collected will be analyzed and included in each monitoring report.

#### 2.4.1.1 Schedule & Deliverables

##### Schedule

Data will be collected by a lab quarterly and the lab results forwarded to the project managers. The data will be input into Excel spreadsheets and analyzed, then stored for later reporting.

##### Deliverables

The data deliverable (lab results and Excel spreadsheets) shall be submitted by March 1st the following year. Data spreadsheets shall be cumulative and include all water quality data from the initiation of monitoring through the last quarterly discrete sampling event of the calendar year. All data results and the analysis of that data will be included in the March 1<sup>st</sup> annual monitoring report. The report shall include cumulative analyses of

water quality trends since pre-construction monitoring was initiated (i.e., initial discrete samples).

## **2.4.2 Continuous Water Quality Sampling Sonde**

In addition to the discrete sampling a continuous water quality sampling device (Sonde) will be installed in Tigertail Lagoon in December 2021 (see Figure 2 for approximate location). The datasonde will measure Temperature, Dissolved Oxygen, Water Level, and Salinity.

The Sonde will be attached to a pile in the southern lagoon and set to collect data every 30 minutes. Sensors will be positioned such that they will fall in the mid-water column to cover the lowest tides. The Sonde will be cleaned, and data downloaded at least every 6 weeks, at which time the battery will be checked for needed recharging. Given the data collection and download frequencies the battery should only require charging every 60 to 90 days.

### ***2.4.2.1 Schedule & Deliverables***

#### **Schedule**

Sonde data will be collected during the cleaning and battery changing events at a minimum every 6 weeks. Data will be downloaded to a laptop, taken to be backed up at the office and then examined to ensure there were no malfunctions. The data will be then input into Excel spreadsheets, verified by another biologist for accuracy, analyzed, and then stored for later reporting.

#### **Deliverables**

The data deliverable (Sonde files and Excel spreadsheets) shall be submitted by March 1st the following year. Data spreadsheets shall be cumulative and include all water quality data from the initiation of monitoring to the end of the most recent calendar year. All data results and the analysis of that data will be included in the March 1st annual monitoring report. The report shall include cumulative analyses of water quality trends since pre-construction monitoring was initiated (i.e., installation of datasonde).

Figure 1: Approximate Discrete Water Quality Sampling Locations

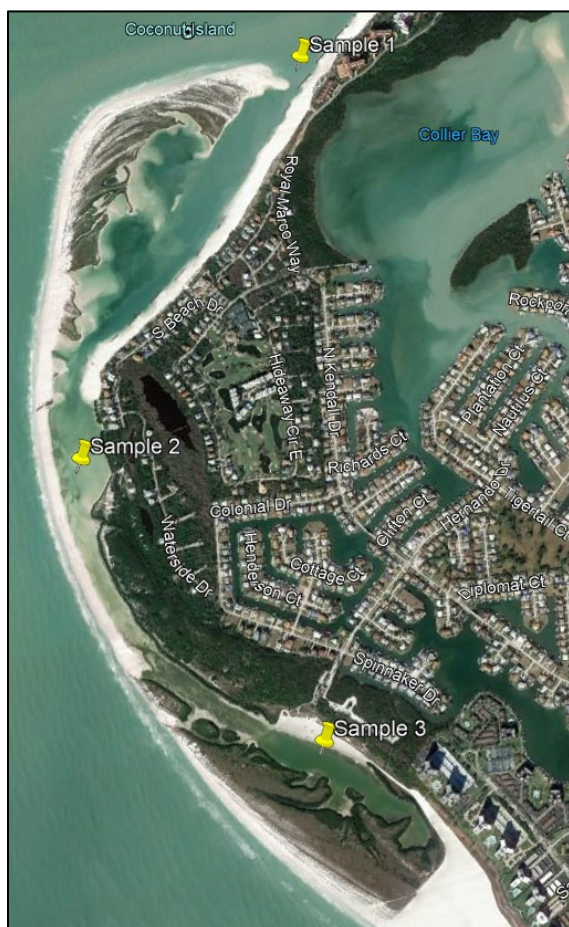
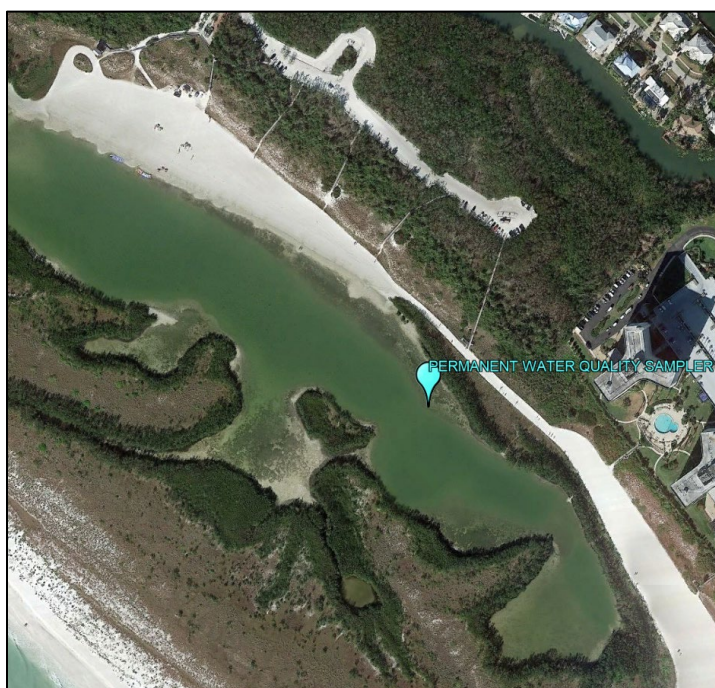


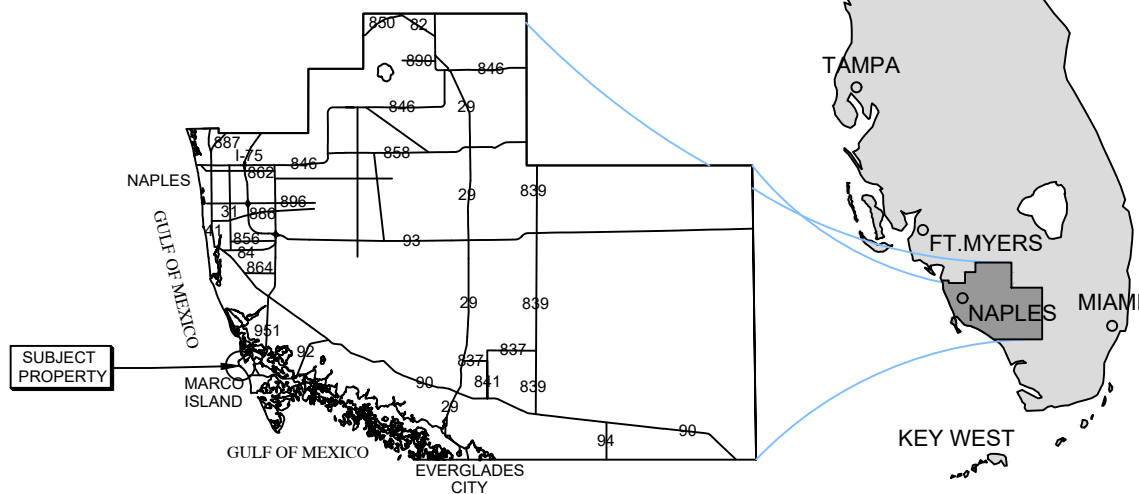
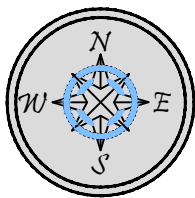
Figure 2: Water Quality Sonde Location





# EXHIBITS

# STATE OF FLORIDA



## COLLIER COUNTY

### SITE ADDRESS:

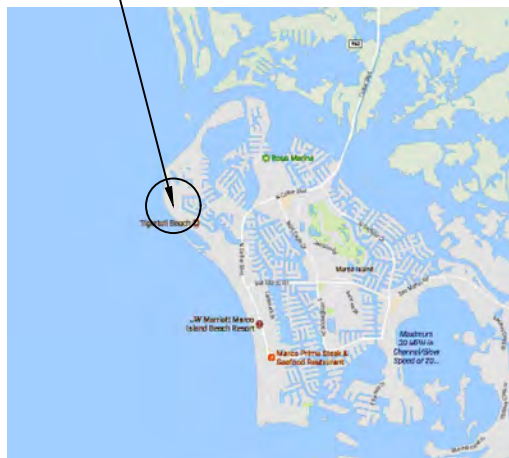
<> 250 S BEACH DRIVE  
MARCO ISLAND, FL 34145

### NOTES:

<> THESE DRAWINGS ARE FOR PERMITTING PURPOSES ONLY  
AND ARE NOT INTENDED FOR CONSTRUCTION USE.

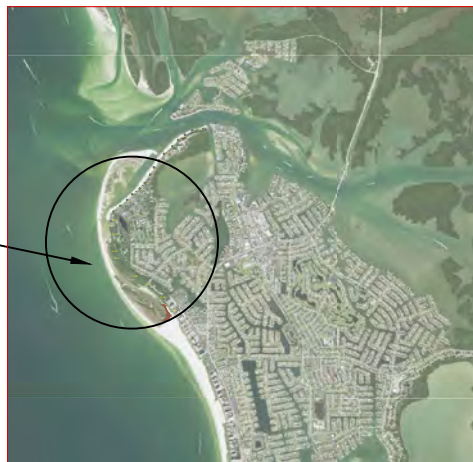
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SUBJECT  
PROPERTY

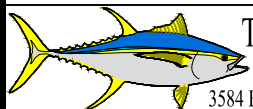


## VICINITY MAP

SUBJECT  
PROPERTY



## COUNTY AERIAL



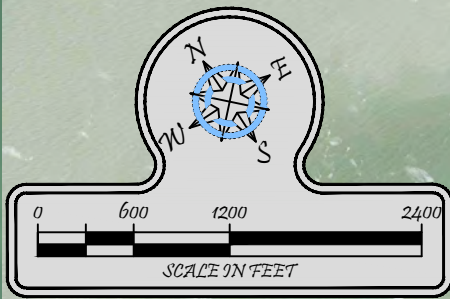
Turrell, Hall & Associates, Inc.  
Marine & Environmental Consulting  
3584 Exchange Ave. Suite B. Naples, FL 34104-3732

Email: tuna@turrell-associates.com Phone: (239) 643-0166 Fax: (239) 643-6632

TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
LOCATION MAP

DESIGNED	MN	REVISION		TAB NAME	Location
DRAWN	RMJ	N/A		SHEET	01 OF 12
DATE	08-04-21	N/A		SCALE	
JOB NO.	1782	N/A			
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E					





Dive Transects

AREA/ ZONE 1

AREA/ ZONE 2

Monitoring Transects

AREA/ ZONE 3

AREA/ ZONE 4

APPROXIMATE PROJECT  
BOUNDARY

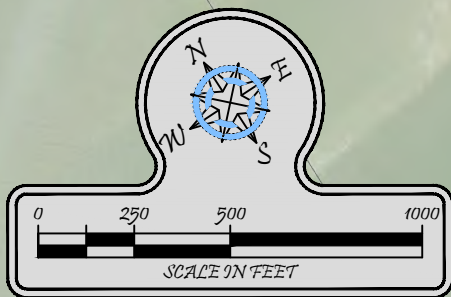


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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
OVERALL SURVEY AREA**

DESIGNED	MN	REVISION	TAB NAME	Overall
DRAWN	RMJ	N/A	SHEET	02 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7		TOWNSHIP- 52 S RANGE-26 E		





Dive Transects

Existing Permitted Borrow Area

SITE PLAN PROVIDED BY HUMISTON MOORE

Proposed Dredge in Open Water and Sand

AREA/ ZONE 1

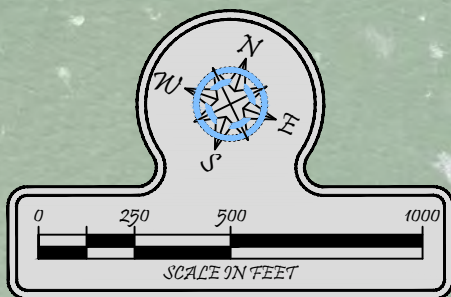


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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
 ESCOSYSTEM RESTORATION PROJECT  
 DIVE TRANSECTS AREA 1**

DESIGNED	MN	REVISION	TAB NAME	Area 1
DRAWN	RMJ	N/A	SHEET	03 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E				





AREA/ ZONE 1

Proposed Fill  
on Sand Beach

AREA/ ZONE 2

Dive Transects

AREA/ ZONE 3

SITE PLAN PROVIDED BY  
HUMISTON MOORE

Proposed Fill in  
the Gulf of Mexico

Proposed Dredge in  
Open Water and Sand

R-128

R-129

R-130

R-131

V-316

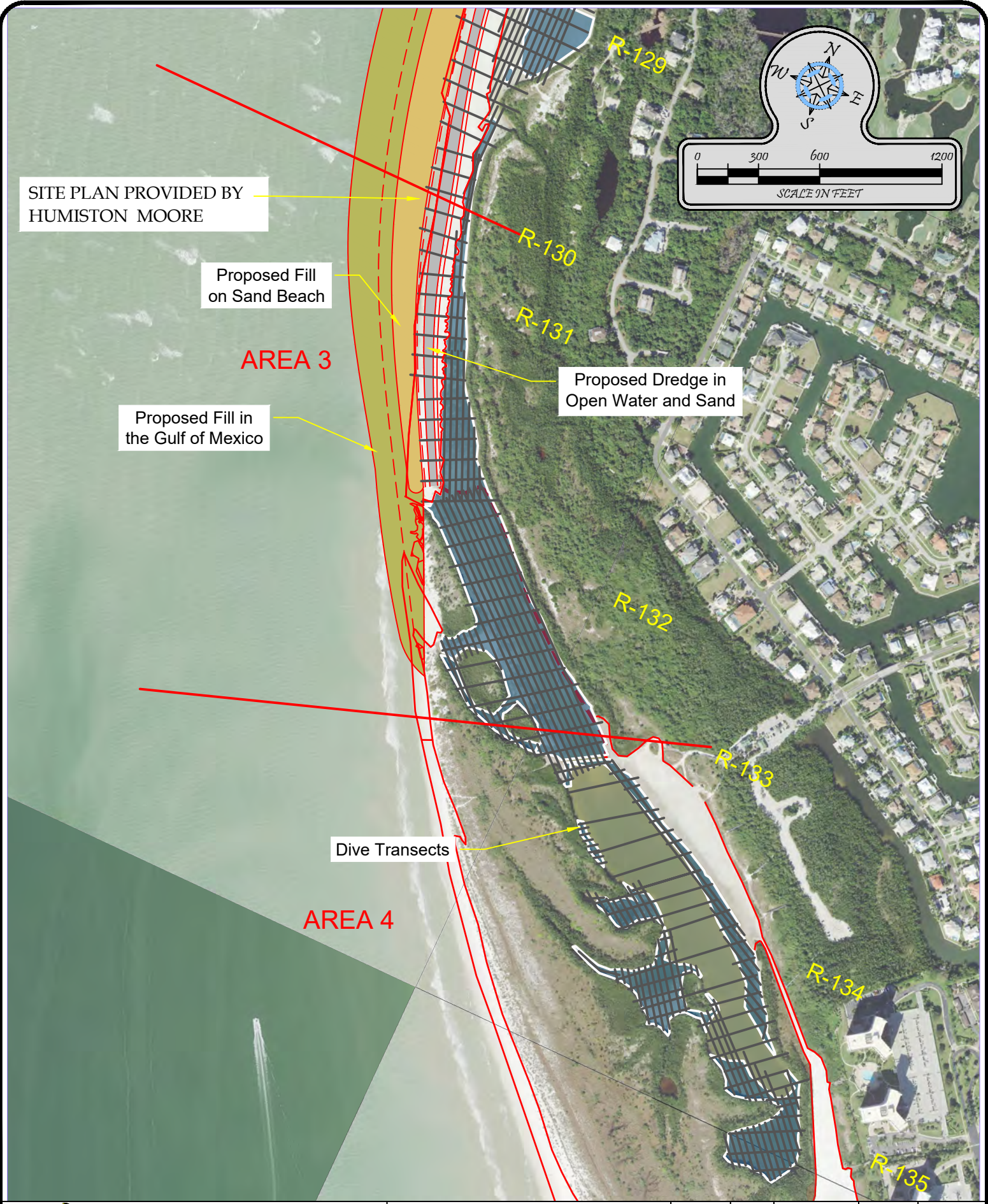


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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
DIVE TRANSECTS AREA 2**

DESIGNED	MN	REVISION	TAB NAME	Area 2
DRAWN	RMJ	N/A	SHEET	04 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				





SITE PLAN PROVIDED BY  
HUMISTON MOORE

Proposed Fill  
on Sand Beach

AREA 3

Proposed Fill in  
the Gulf of Mexico

Proposed Dredge in  
Open Water and Sand

Dive Transects

AREA 4

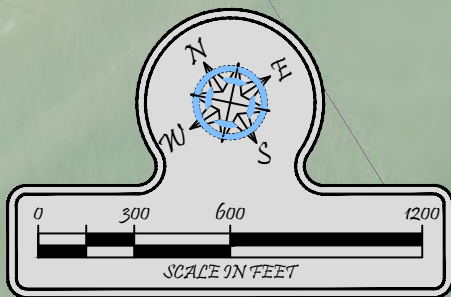


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TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
DIVE TRANSECTS AREAS 3 & 4

DESIGNED	MN	REVISION	TAB NAME	Area 4
DRAWN	RMJ	N/A	SHEET	05 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				





Random SAV Quadrat Sampling

SAV Sampling Transects and Quadrats

Mangrove Sampling

Vegetative Line-Intercept Sampling

Proposed Fill on Sand Beach

**AREA 1**

Proposed Fill in the Gulf of Mexico

37+06

32+41

27+39

17+42

Existing Permitted Borrow Area

SITE PLAN PROVIDED BY HUMISTON MOORE

Proposed Dredge in Open Water and Sand

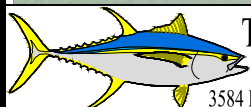
V-314

V-315

V-316

R-128

R-129

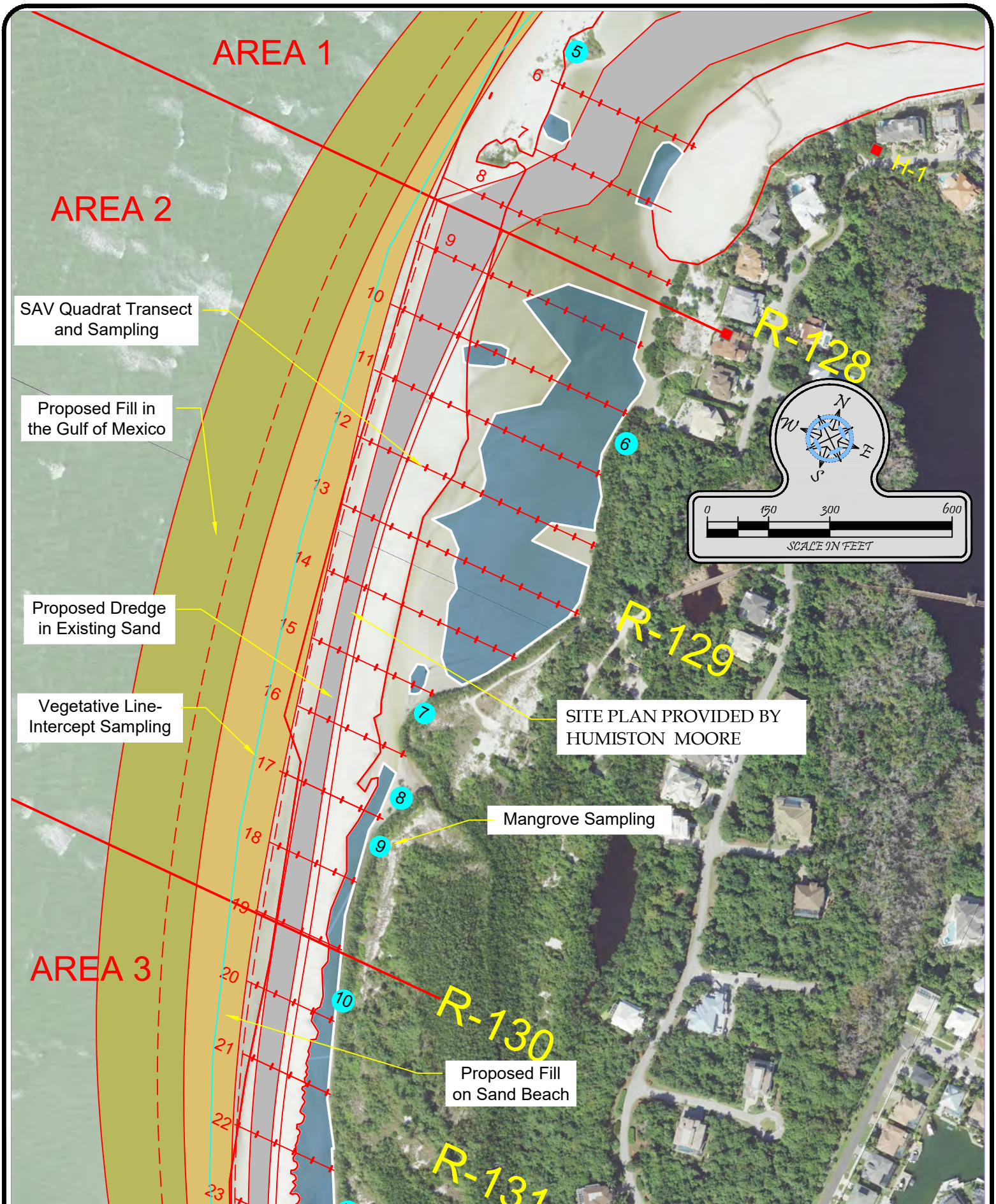


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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
VEGETATIVE SAMPLING AREA 1**

DESIGNED	MN	REVISION	TAB NAME	Area 1
DRAWN	RMJ	N/A	SHEET	06 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E				





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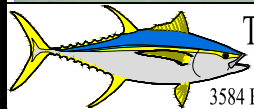
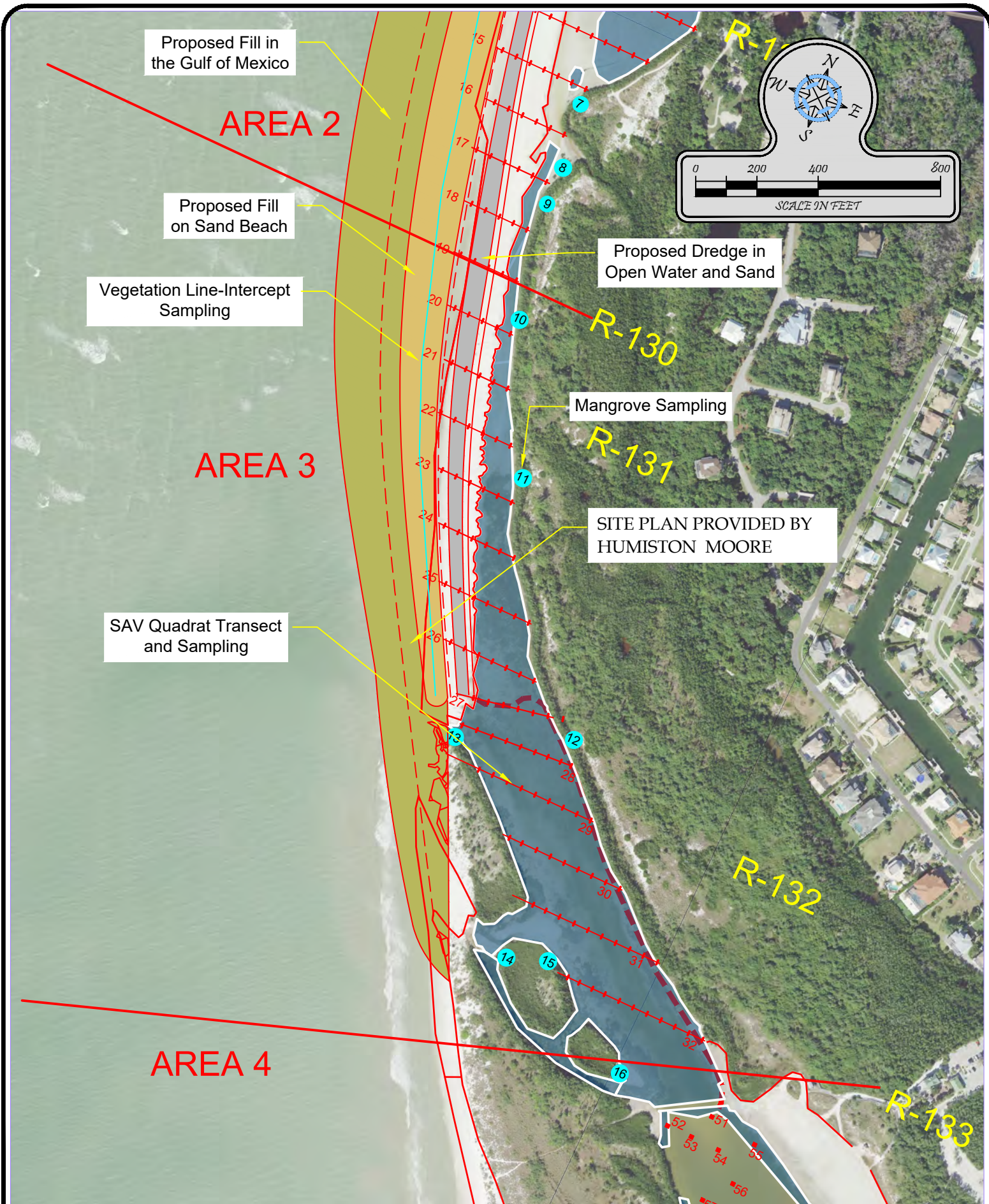
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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
VEGETATIVE SAMPLING AREA 2**

DESIGNED	MN	REVISION	TAB NAME	Area 2
DRAWN	RMJ	N/A	SHEET	07 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				



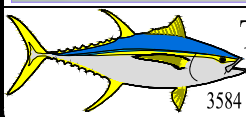
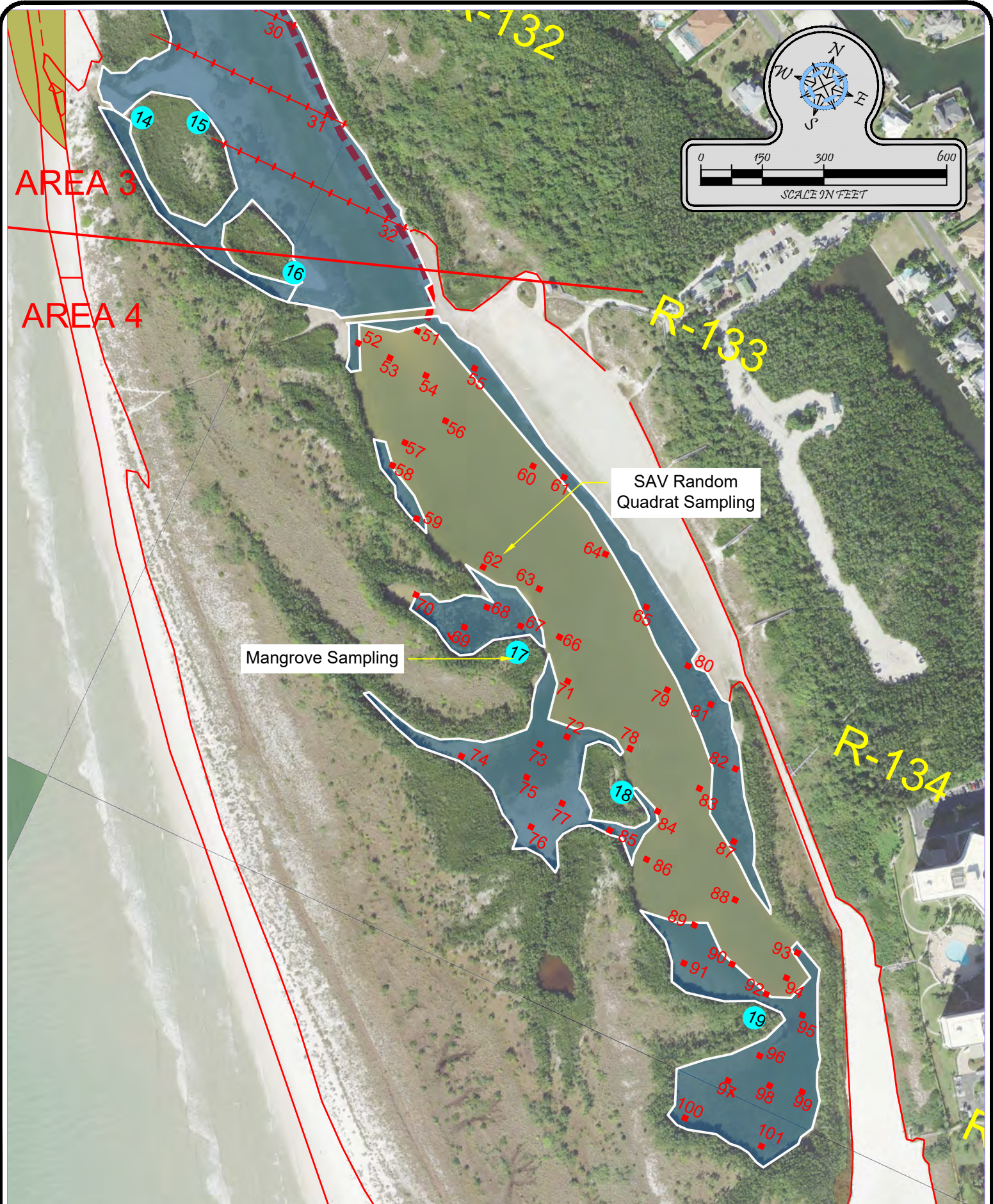


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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
VEGETATIVE SAMPLING AREA 3**

DESIGNED	MN	REVISION	TAB NAME	Area 3
DRAWN	RMJ	N/A	SHEET	08 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				





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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
 ECOSYSTEM RESTORATION PROJECT  
 VEGETATIVE SAMPLING AREA 4**

DESIGNED	MN	REVISION	TAB NAME	Area 4
DRAWN	RMJ	N/A	SHEET	09 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				





FLUCFCS			
HATCH	CODE	DESCRIPTION	ACRES
	320	COASTAL SHRUB & BRUSH	33.0
	322	COASTAL SCRUB	1.2
	329	OTHER SHRUBS (COINVINE)	0.5
	426	TROPICAL HARDWOODS	27.0
	540	BAYS AND ESTUARIES	108.8
	612	MANGROVE	68.4
	642	SALTWATER MARSH	44.4
	911	SEAGRASS	35.3
	181	BEACH SAND	64.0
			382.6



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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
 ESCOSYSTEM RESTORATION PROJECT  
 FLUCFCS MAP**

DESIGNED	MN	REVISION	TAB NAME	WATER SAMPLING
DRAWN	RMJ	N/A	SHEET	10 OF 12
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E				



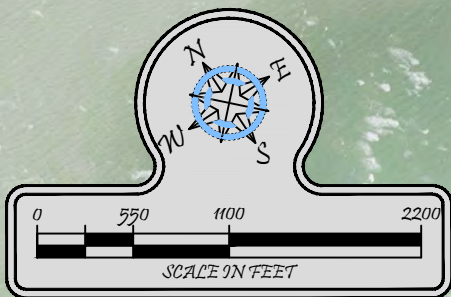



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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
 ESCOSYSTEM RESTORATION PROJECT  
 SITEPLAN**

DESIGNED	MN	REVISION	TAB NAME	WATER SAMPLING
DRAWN	RMJ	N/A	SHEET	11 OF 12
DATE	06-14-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E				





 SAMPLING DATASONDE LOCATION

 WATER QUALITY SAMPLING LOCATION



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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND  
ECOSYSTEM RESTORATION PROJECT  
WATER QUALITY SAMPLING MAP**

DESIGNED	MN	REVISION	TAB NAME	WATER SAMPLING
DRAWN	RMJ	N/A	SHEET	12 OF 12
DATE	03-21-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7		TOWNSHIP- 52 S RANGE-26 E		