

SAND DOLLAR ISLAND RESTORATION PROJECT

MONITORING PLAN

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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-JCP). Pre-construction and post-construction monitoring will include surveys for dune vegetation, mangroves, wildlife habitat, 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 dune 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 that 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 (0309260-001-JC) 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 as well, resulting in 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 Permit (0309260-001-JC) and U.S. Army Corps of Engineers 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 large 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 potential 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@dep.state.fl.us) and Army Corps of Engineers (USACE) compliance staff will be notified of the anticipated start and completion dates. If non-permitted wetland or SAV impacts are located during surveying, then the JCP compliance officer, the USACE and the National Marine Fisheries Service 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) 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

Raw data files are due within 45 days of the survey completion. Pre-construction data shall be submitted at least 30 days prior construction or 15 days prior to the pre-construction conference. Monitoring reports are due 90 days after completion of the survey.

A baseline (Pre-Con) survey shall be conducted prior to construction. Pre-construction data will be submitted at least 30 days prior to construction commencement or 15 days prior to the pre-construction conference. Monitoring reports are due 90 days after the completion of the survey

Monitoring is scheduled to occur annually after each construction event for the design life of the project (5 years). In Area 2 quarterly visual inspections will be made to ensure that unanticipated effects are not occurring. Inspection notes will be kept and provided with the annual report.

All Submerged Aquatic Vegetation Surveys (SAV) shall be conducted during the growing season each year between June 1st and September 30th.

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- DUNE 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 adaptive management needed to prevent thick vegetation from becoming established.

2.1.1 Desktop Survey

Prior to fieldwork each year a desktop survey will be conducted by overlaying aerials of the prior and current survey periods and the current 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 will be used instead to address needed vegetation management as discussed below.

2.1.2 Physical Monitoring

2.1.2.1 Qualitative

Characterization

Characterization of the Dune 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.

2.1.2.2 Quantitative

Sampling

Point line intercept sampling will be utilized for the dune and beach habitats within 300 meters of any 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/dune 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 5 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.

Calculations will be made of total percent cover in the three layers and then percent cover of individual species or types within each layer will be calculated using the same method for that individual.

Since adaptive management for wildlife is the primary purpose of vegetative monitoring in these habitats, if vegetative cover on the newly constructed beach-dune habitats exceeds 10% total cover then manual thinning of plant material will occur and all sand burs will be eliminated entirely.

2.1.3 Surveys and Deliverables

2.1.3.1 Baseline Survey

The Baseline Survey will document existing conditions in locations where bird nesting is not occurring in October 2021 based on sampling as described above. The baseline survey information will be included in the pre-construction baseline monitoring report for comparison to future efforts.

2.1.3.2 Post-Construction Survey

There will be a post-construction survey conducted of the beach-dune habitats immediately following construction completion, but outside of bird nesting season (February 15th to September 1st) to encompass the entire habitat area. Quarterly visual

inspections will occur throughout the year where able to ensure vegetative cover remains within the 10% allowable limits.

2.1.3.3 Annual Surveys

Monitoring will be required for the design life of the project (5 years) after each construction event. It is expected that maintenance events will be required to maintain the proposed changes to the system every 4 to 5 years, so annual surveying will be ongoing until such time that the permits expire. Annual surveys will be conducted as the post-construction survey with quarterly visual inspections to ensure that vegetation does not exceed threshold.

2.1.3.4 Deliverables

Each monitoring report will provide the following information:

- Data collection sheets (see 2.1.2.1 for details),
- Analyses of the vegetation found within data collect tables, 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,
- 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 aerials 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 Physical Monitoring

2.2.2.1 Qualitative

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.

2.2.2.2 Quantitative

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 plot unless physical constraints limit the area of sampling to 5 meters. The total percent cover of canopy, midstory and groundcover vegetation will be recorded, as well as the percent cover of each species occupying each stratum. Vegetative coverage will be presented in a tabular format each year with the previous year's data in a for comparison and trend observations.

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

2.2.3 Monitoring and Deliverables

2.2.3.1 Baseline Survey

The Baseline Survey will document existing (pre-construction) conditions at each monitoring station from the months of June through October.

2.2.3.2 Post-Construction Survey

The immediate Post-Construction Survey will document conditions during the growing season following construction.

2.2.3.3 Annual Surveys

It is expected that maintenance events will be required to maintain the proposed changes to the system every 4 to 5 years, so annual surveying will be ongoing until such time that the permits expire. Annual surveys will be conducted using the same scope with results included in the annual monitoring report for that year.

2.2.3.4 Deliverables

Each monitoring report will provide the following information:

- Data collection sheets (see 2.2.2.1 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 transects,
- 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.)

2.3 WILDLIFE HABITAT AND UTILIZATION

With a number of listed avian and sea turtle species utilizing the beaches of Sand Dollar Island for nesting, resting, and foraging, creation or loss of their preferred habitat will be identified each year during the various surveys. Shorebird and sea turtle nesting habitat will be qualified and quantified, while nesting data collected during the shorebird surveys as well as by various stakeholders between surveys will be summarized for comparison to pre- and post-construction counts and locations.

Data Collection Parties

Pre-construction and immediately post construction piping plover (and other shorebird) surveys as required by the Programmatic Piping Plover Biological Opinion (P3BO) will be conducted by qualified biologists on behalf of the City of Marco specific to this project. In addition to the City pre- and post-con surveying required, regular data collected by stakeholders which is entered into the FWC Florida Shorebird Database will be utilized and analyzed as well.

Collier County, who conducts the sea turtle nest surveys for Sand Dollar Island will provide sea turtle nesting data and false crawls for comparison and mapping to be included in each monitoring report.

2.3.1 Desktop Assessment

Information collected during the SAV, vegetative, shorebird (both and sea turtle nesting) surveys will be compiled, examined, mapped, and compared to pre-construction conditions in an effort to determine if the available habitat for nesting, resting, and foraging activities has been improved and if it is being utilized as expected.

Triggers for specific area monitoring might include the addition of newly established nesting/foraging habitat, habitat that has disappeared since the previous survey, if vegetation in those zones has changed (naturally or by management techniques), and if mapping of previous year's nesting data shows that certain areas have been abandoned, then those areas will be identified for surveying.

2.3.2 Physical Survey

Shorebirds

There are several groups that may conduct shorebird monitoring in this area. It is the intent of the project to compile this data if available and include it in the annual reporting through discussion and GIS mapping. If the annual data will not be collected by other stakeholders, then shorebird monitoring will be conducted as required by permit according to the FWC's Breeding Bird Protocol for Florida's Shorebirds and Seabirds (Feb. 2021). This will also allow for information collected to be submitted to the Florida Shorebird Database (FSD).

A brief summary of the Breeding Bird Protocol involves the following:

1. Creating a route survey with a start and end point that is short enough to survey in a day.
2. Survey hours will depend on the types of birds/nests expected (See FWC plan Count Window Calendar)
3. Survey monthly at a minimum during breeding season (March to August), but weekly are preferred.
4. Check for shorebird nests, seabird colonies, and chicks and once documented, re-check during every site visit.
5. GPS locate any colonies or nests from far enough away as to not disturb them and record the data on a Route Form.
6. Maintain Shorebird Nest and Seabird Colony Forms for each site.
7. Conduct counts- direct preferred but extrapolated if not able.
8. Maintain a Roving Chicks/Staging Young Form.
9. All data should be uploaded to the Florida Shorebird Database (FSD)

The full protocol can be found at <https://public.myfwc.com/crossdoi/shorebirds/PDF-files/BreedingBirdProtocol.pdf>.

In addition to the information collected as a part of the Breeding Bird Protocol, particular emphasis will be given to documenting shorebird and seabird use of the recreated habitat areas. The work proposed is anticipated to improve nesting and resting habitat and protect foraging habitat in the interior mud flats. Information on bird use of these areas will be collected to include the activity type, vegetative components (if any), slope of shoreline, etc. to document the habitats being used so that future monitoring efforts can be designed to provide and protect the habitats being used most productively by the birds following the restoration activities.

Sea Turtles

Sea turtle nest and false crawl documenting will continue to be conducted by Collier County and that data will be included in the annual reporting for each nesting season.

2.3.3 Monitoring & Deliverables

2.3.3.1 Baseline and Post-Construction Surveys

In the case of for the proposed pre-construction (2021) and post-construction (2022) activities, consultant-initiated bird and nesting surveys will be conducted as well to add to the list of what is reported to the Florida Fish and Wildlife Conservation Commission (FWC).

2.3.3.2 Annual Surveys

Monitoring in subsequent years following the proposed work will depend on data provided by surveys on the FSD site. Monitoring will be required for the design life of the project (5 years) after each construction event.

2.3.3.3 Deliverables

Each monitoring report will provide the following information:

- Data collection sheets from bird surveys (unless information provided by FSD),
- Identified birds, nests, colonies, chicks, etc. by genus and species,
- Photographs of the habitats by GPS location (unless from FSD),
- Maps of the sampling transects (unless from FSD),
- Maps of findings or recorded findings from FSD in GIS. GIS maps will plot the project footprint with the findings and note the changes over time within those footprint areas.
- GIS maps of sea turtle false crawls and nests overlain on the site plan with counts in the areas of creation/impact specifically identified by year.

- A discussion of nesting trends and if any adaptive management efforts are recommended to improve habitat quality.

2.4 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.

The survey period will extend from June 1st through September 30th.

Monitoring will be required for the design life of the project (5 years) after each construction event. It is expected that maintenance events will be required to maintain the proposed changes to the system every 4 to 5 years, so annual surveying will be ongoing until such time that the permits expire.

2.4.1 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 macro algae species identification. Genus and species will be required for all seagrasses and the genus, at a minimum, will be required for all macro algae. Cross-training data sheets will be collected and submitted with the monitoring report as an appendices.

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 FDEP permitting office 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.

2.4.1.1 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.

2.4.1.2 Notification of Commencement/ Completion

Prior to each survey the FDEP JCP (JCPCompliance@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.

2.4.2 Desktop Survey

A desktop survey will be performed by overlaying aerials of historical survey periods and the current to determine spatial extent of the fieldwork. Physical attributes such as depth, tidal range, tide speed, wave exposure, fetch, flushing, visibility, etc., will be compiled for background information. Included will also be data from existing sources such as recent bathymetry, surveys, Florida State Seagrass Maps, Google Earth Pro images, and water quality monitoring.

Post-construction, the desktop survey will be performed in the same manner before monitoring commences with the previous year's SAV delineated. Other pertinent information such as as-built surveys, bathymetry and water quality information will be added and/or utilized during this phase.

2.4.3 Physical Monitoring

2.4.3.1 Reconnaissance Survey

The reconnaissance survey will cover all potential habitats within a 300-meter area of project influence to determine where resources are located following transects 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.

2.4.3.2 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. 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).

2.4.3.3 Qualitative Assessment

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.

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.

2.4.3.4 Quantitative Assessment

Transect Placement

In the northern persistent SAV bed (Area 1) adjacent to the existing borrow area, random 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.

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

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

Quadrat Placement

The Cover Abundance (CA) measurements will be taken by using a 0.5-meter square quadrat every 15 meters along each transect. Current estimates for quadrat and transect placement based on the 2020 SAV survey are as follows. Total quadrats for all areas of the system equates to 342 samples taken and recorded. If SAV is not noted in 2021 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.

- Along Transects 1 to 28, which is adjacent to the construction footprint. Using this methodology there are 174 Baseline sampling stations within/adjacent to the construction footprint. Once construction has occurred there will be 29 additional samples required for newly opened areas along pre-existing quadrats.
- South of the construction area (Area 3) the additional 4 transects (29 to 32) provide another 39 quadrat samples.

- In Tigertail Lagoon (Area 4) random quadrat sampling in 50 locations will be conducted.
- In the random sampling zone (Area 1) there are a total of 50 quadrats which will be sampled and documented.

Visual Assessment

Cover and abundance will be visually assessed and reported to the nearest 5%, including total SAV cover and cover of individual species (seagrass and macro algae) by genera and species. Drift algae in a quadrat will be reported as: sparse, moderate, or abundant, then it will be removed to ascertain the SAV abundance. If no SAV is observed once drift algae has been removed, then the area will be considered bare ground. Both seagrasses and rhizophytic macroalgae will be reported, with the genera noted for the macroalgae at a minimum.

2.4.4 Deliverables

2.4.4.1 Maps

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 Arc GIS Map (file format .mpk) and 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 polygon 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).

2.4.4.2 Data

Pre-construction survey pre-con data will be due no later than 30 days prior to construction commencement or 15 days prior to the pre-construction conference. A georeferenced map of SAV resources will be used by the contractor to minimize impacts during construction.

Raw data (field sheets, excel spreadsheets, ArcView GIS files and photographs) are due within 45 days of survey completion. The final report of findings with exhibits is due no more than 90 days from the date of survey completion.

2.4.4.3 Reports

All data collected and all metrics evaluated in the field will be submitted, analyzed, and discussed in the monitoring reports.

All reports will include georeferenced maps with SAV boundaries, photographs, and a description of the SAV bed condition based on the quantitative and qualitative analyses. Also included in each report will be statistical comparisons of pre- and post-construction cover-abundance data, and summary statistics for comparison of pre- and post-construction for each SAV patch and/or transect within the survey area.

All seagrass, rhizophytic macroalgae, species specific seagrasses, and genera- specific macro algae will have the following metrics calculated for reporting:

1. Frequency of occurrence (percent of all quadrats containing seagrass).
2. Density (average abundance in all quadrats sampled).
3. Abundance (average cover-abundance for those quadrats containing seagrass).

These metrics will be calculated for transects, patches, continuous beds and for the entire system as a whole.

2.4.4.4 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.

2.4.4.5 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) 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 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.

2.5 WATER QUALITY

One July (2021) water quality sampling event took place 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 for locations). This sampling event included the following parameter suite:

- Overall depth (ft.)
- Secchi depth (in.)
- Conductivity ($\mu\text{mho}/\text{cm}$)
- Dissolved Oxygen (mg/L and %)
- pH (s.u.)
- Turbidity (NTU)
- Air Temperature ($^{\circ}\text{C}$)
- Water Temperature ($^{\circ}\text{C}$)
- BOD₅
- Ammonia Nitrogen
- Nitrate-Nitrite as N
- Total Kjeldal Nitrogen
- Total Nitrogen (calc only)
- ortho-Phosphorous as P
- Total Phosphorus as P

A second similar sample will be taken in September 2021 and the final in December 2021 then this type of sampling will be discontinued.

A water sampling sonde is installed in Tigertail Lagoon (see Figure 2 for approximate location) this fall with a water level meter. The data sonde will measure for Temperature, Dissolved Oxygen and Salinity. The water quality sampling schedule is found below in Table 6.

Figure 1: Approximate Water Quality Sampling Locations for 2021

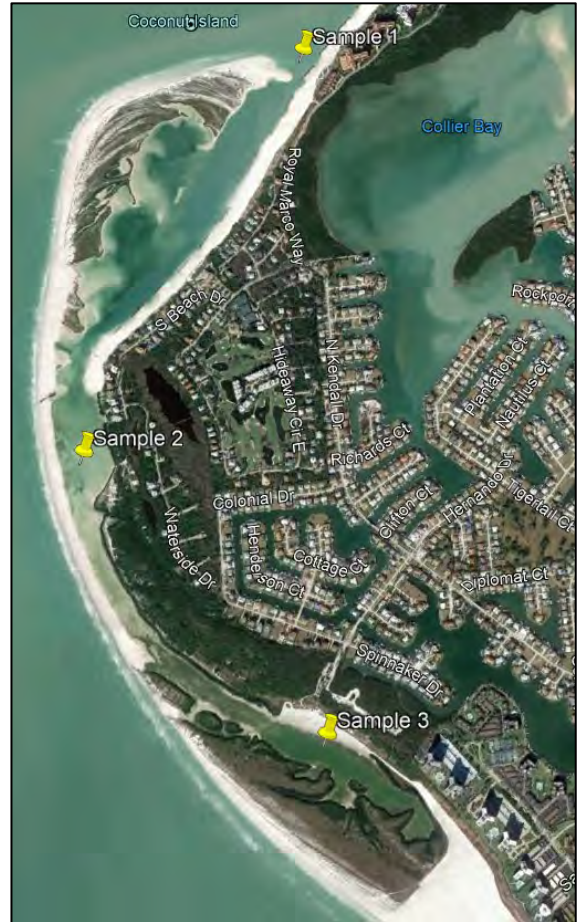
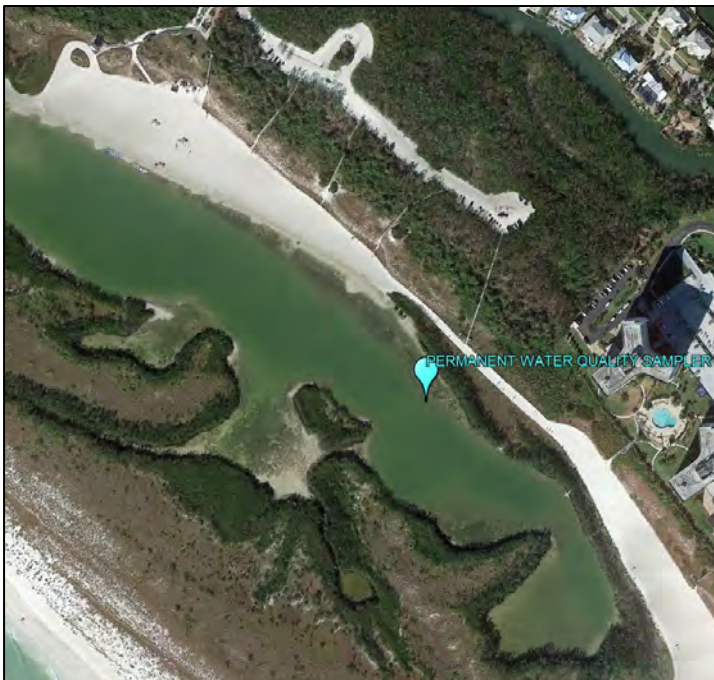
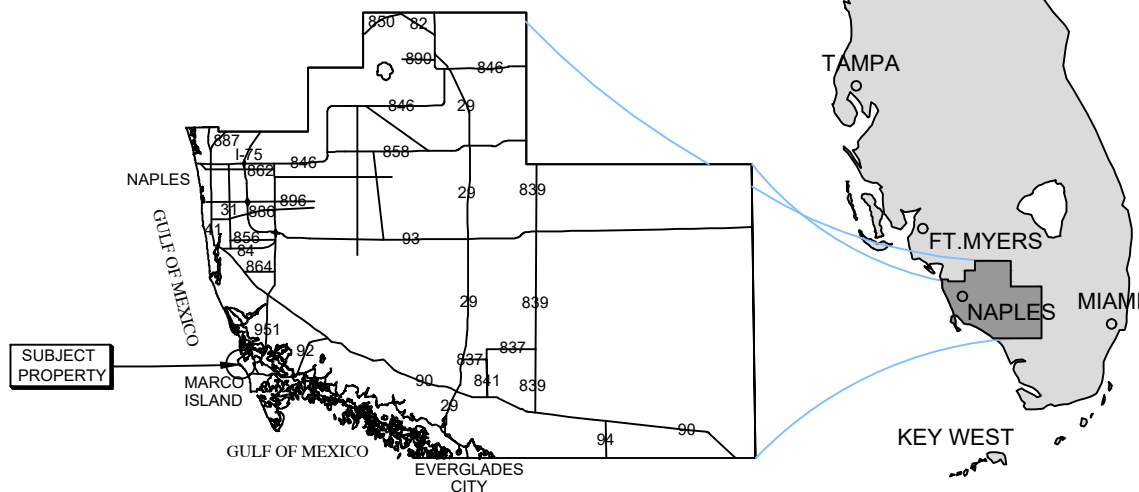
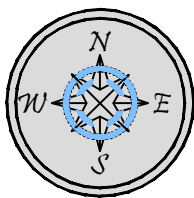


Figure 2: Permanent Water Quality Sonde Location



EXHIBITS

STATE OF FLORIDA



COLLIER COUNTY

SITE ADDRESS:

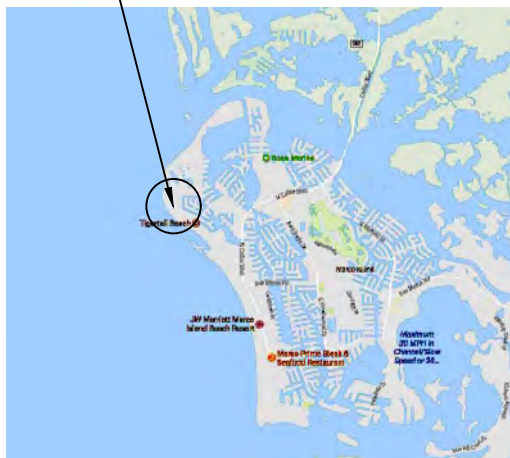
<> 250 S BEACH DRIVE
MARCO ISLAND, FL 34145

NOTES:

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

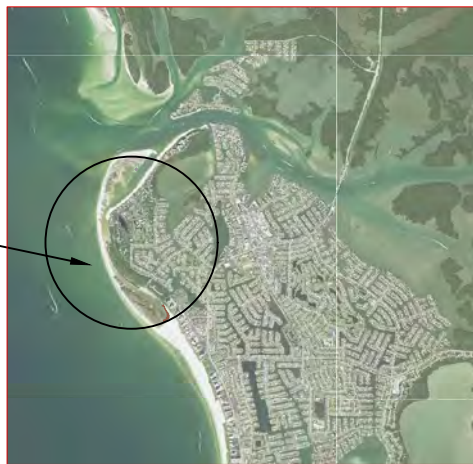
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SUBJECT
PROPERTY

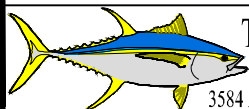


VICINITY MAP

SUBJECT
PROPERTY



COUNTY AERIAL

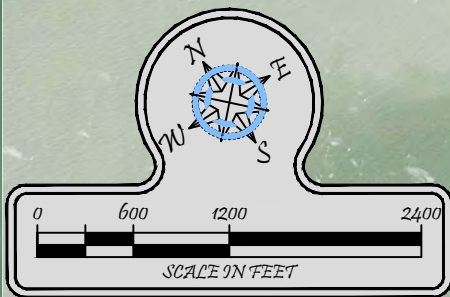


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TIGERTAIL LAGOON / SAND DOLLAR ISLAND
ECOSYSTEM RESTORATION PROJECT
LOCATION MAP

DESIGNED	MN	REVISION		TAB NAME	Location
DRAWN	RMJ	N/A		SHEET	01 OF 10
DATE	08-04-21	N/A		SCALE	
JOB NO.	1782	N/A			
SECTION- 6&7 TOWNSHIP- 52 S RANGE-26 E					



Dive Transects

Monitoring Transects

APPROXIMATE PROJECT
BOUNDARY

R-128

R-129

R-130

R-131

R-132

R-133

R-134

R-135

V-314

V-315

V-316



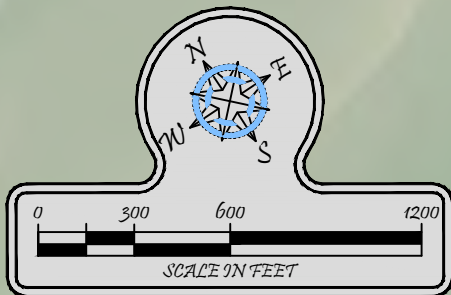
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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND
ECOSYSTEM RESTORATION PROJECT
OVERALL SURVEY AREA**

DESIGNED	MN	REVISION		TAB NAME	Overall
DRAWN	RMJ		N/A	SHEET	02 OF 10
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

V-314

SITE PLAN PROVIDED BY HUMISTON MOORE

V-315

Proposed Dredge in Open Water and Sand

AREA 1

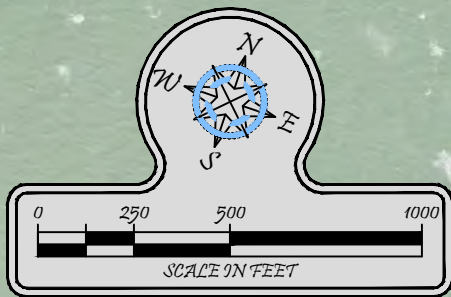
AREA 2



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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 10
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
ECOSYSTEM RESTORATION PROJECT
DIVE TRANSECTS AREA 2**

DESIGNED	MN	REVISION	TAB NAME	Area 2
DRAWN	RMJ	N/A	SHEET	04 OF 10
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				

AREA 2 AREA 3&4

Proposed Fill
on Sand Beach

Proposed Dredge in
Open Water and Sand

SITE PLAN PROVIDED BY
HUMISTON MOORE

R-132

Proposed Fill in
the Gulf of Mexico

Dive Transects

R-133

R-134

R-135



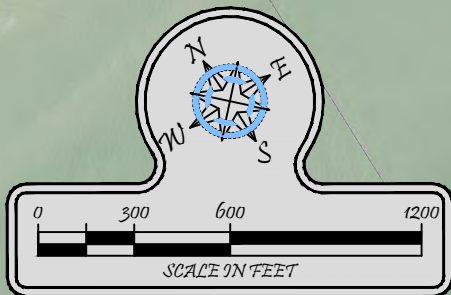
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TIGERTAIL LAGOON / SAND DOLLAR ISLAND ECOSYSTEM RESTORATION PROJECT DIVE TRANSECTS AREAS 3 & 4

DESIGNED	MN	REVISION	TAB NAME	Area 4
DRAWN	RMJ	N/A	SHEET	05 OF 10
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				



RANDOM SAV SAMPLING

VEGETATIVE
LINE-INTERCEPT
SAMPLING

MANGROVE SAMPLING

SAV SAMPLING

VEGETATIVE
LINE-INTERCEPT
SAMPLING

Proposed Fill
on Sand Beach

AREA 1

AREA 2

Proposed Fill in
the Gulf of Mexico

V-314

V-315

SITE PLAN PROVIDED BY
HUMISTON MOORE

V-316

Proposed Dredge in
Open Water and Sand

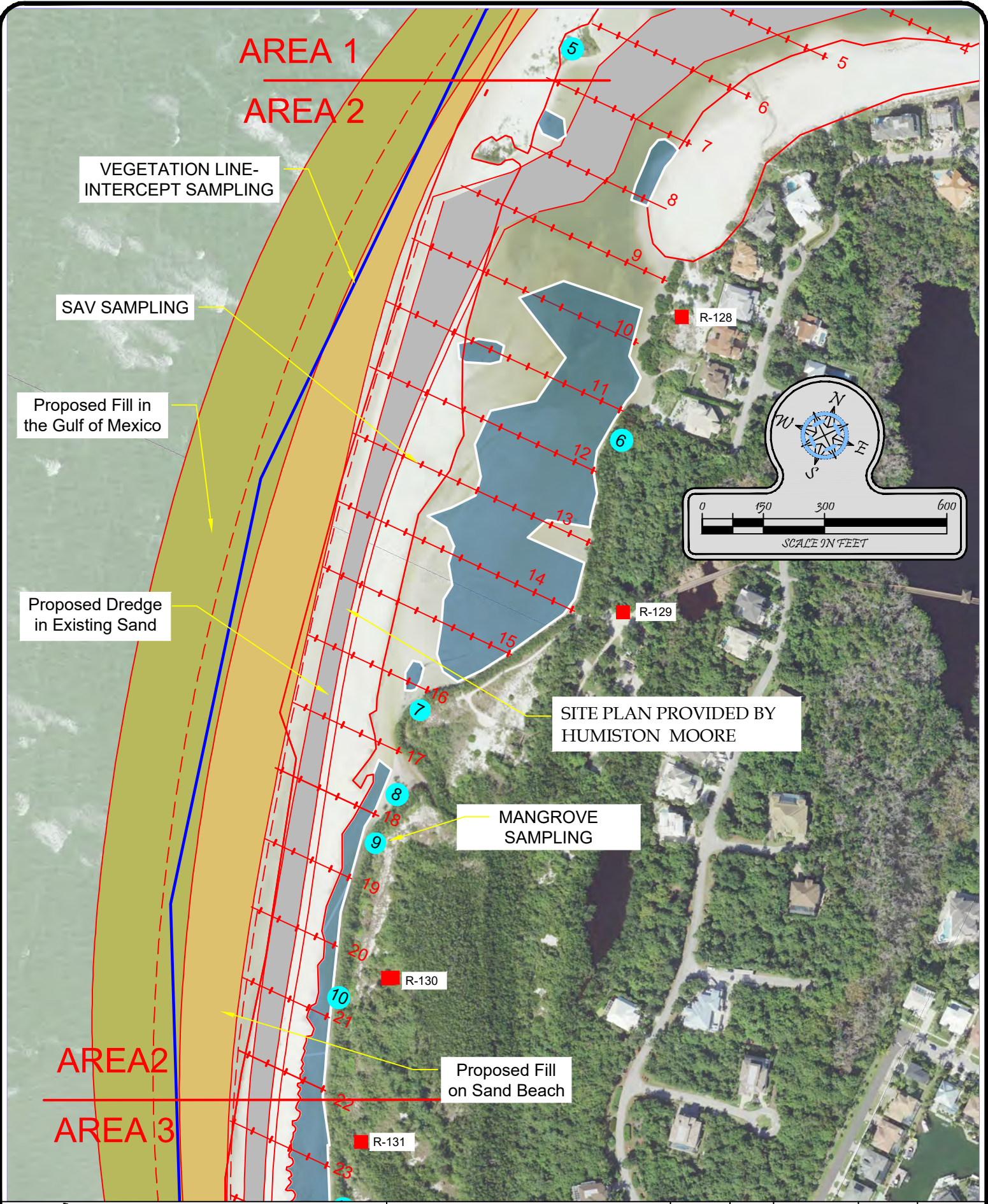
R-128



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

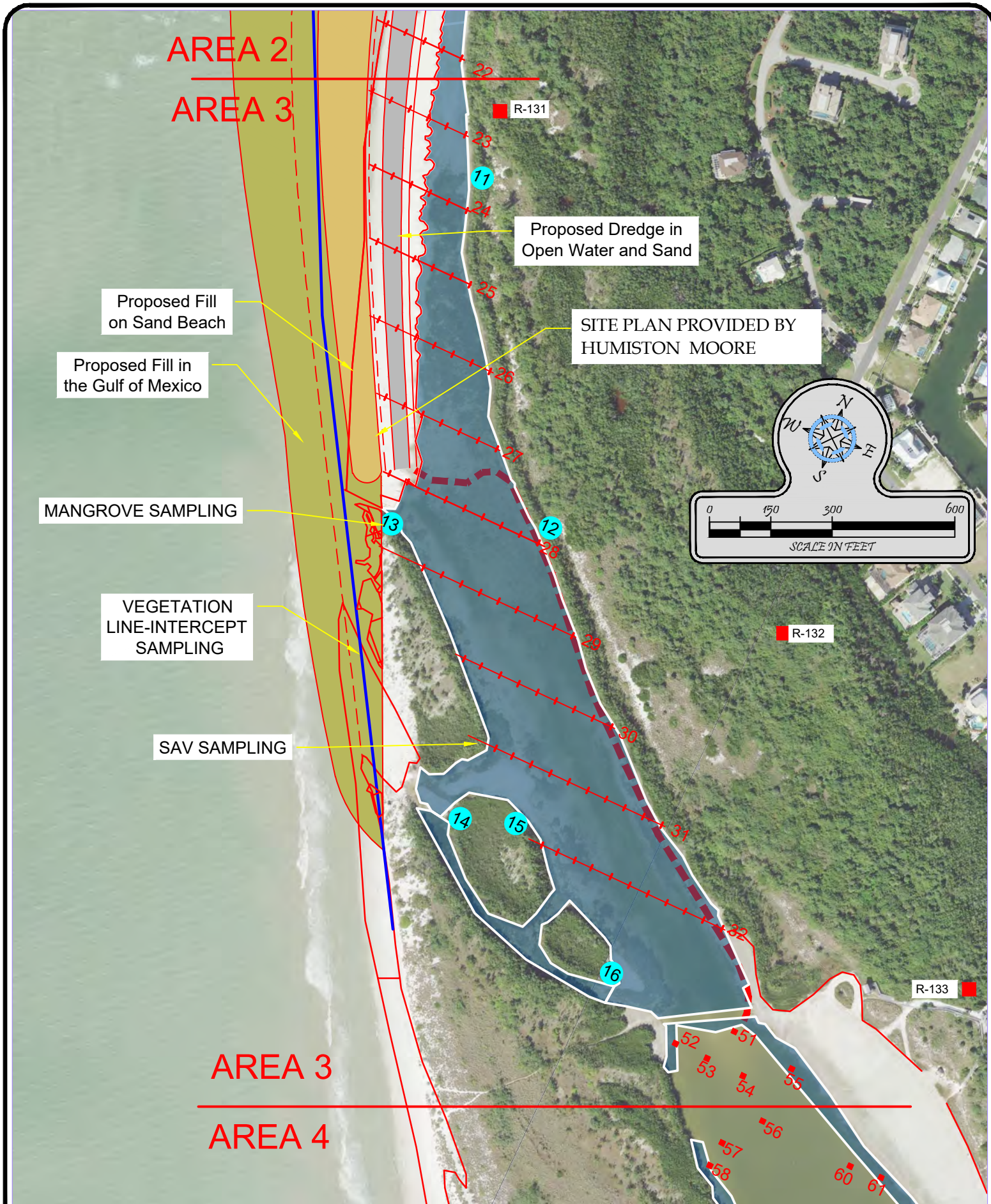
DESIGNED	MN	REVISION	TAB NAME	Area 1
DRAWN	RMJ	N/A	SHEET	06 OF 10
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E				



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

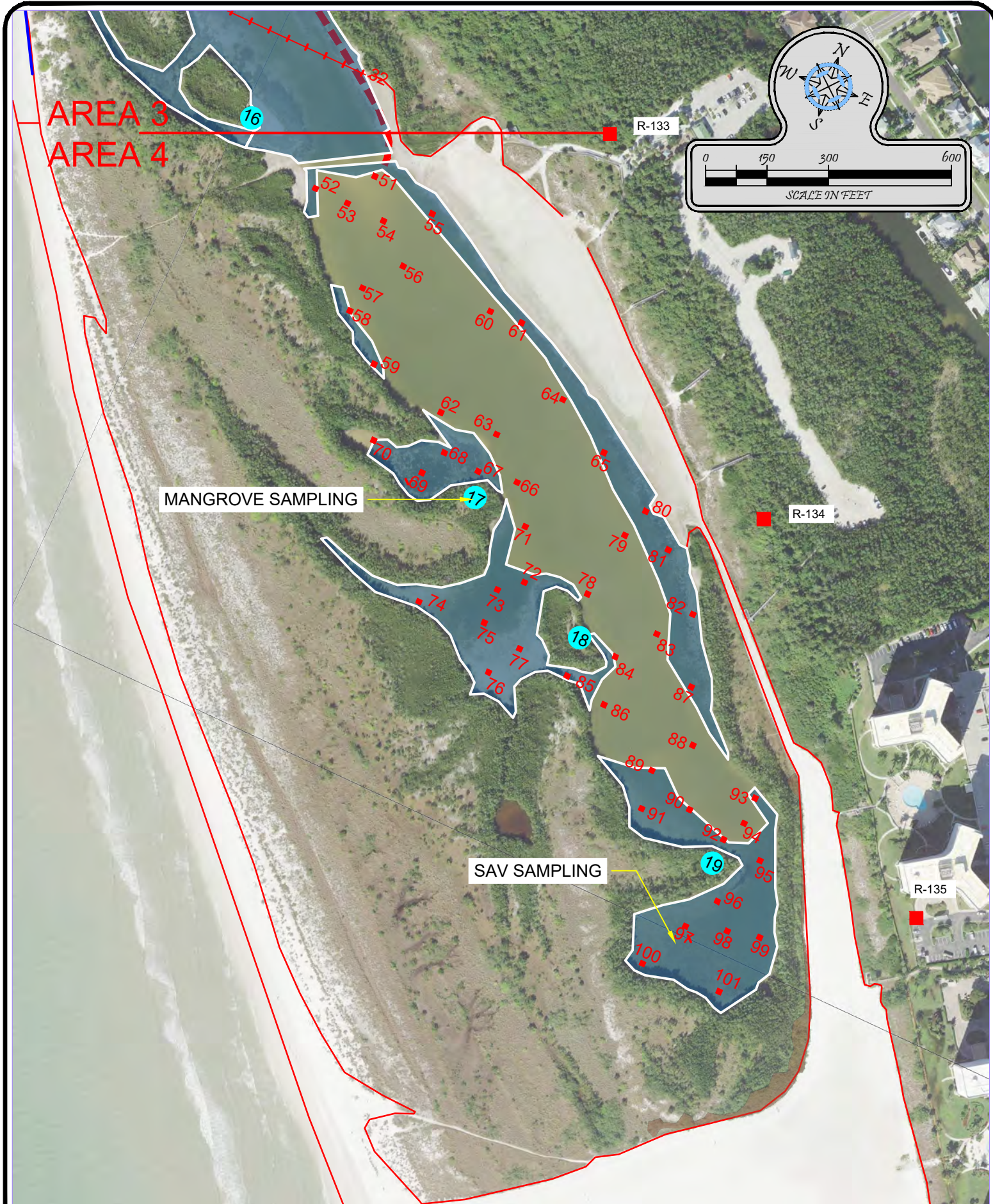
DESIGNED	MN	REVISION	TAB NAME	Area 2
DRAWN	RMJ	N/A	SHEET	07 OF 10
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION-7 TOWNSHIP- 52 S RANGE-26 E				



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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 10
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 10
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 10
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 11
DATE	06-14-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E				

Proposed Dredge in
Gulf of Mexico and Sand

Existing Permitted
Borrow Area

Proposed Dredge in
Open Water and Sand

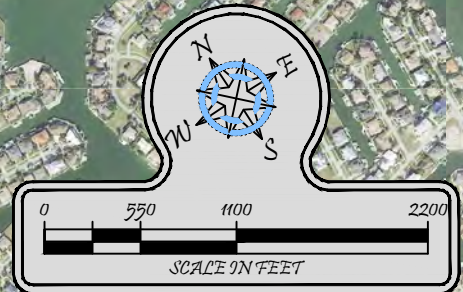
SITE PLAN PROVIDED BY
HUMISTON MOORE


Open Water

Proposed Fill
on Sand Beach

Proposed Fill in
the Gulf of Mexico

Proposed Dredge in
Open Water and Sand



 IMPACTS

IMPACTS TABLE			
HABITAT TYPE	SAND (AC) CODE 181	OPEN WATER (AC) CODE 540	TOTAL (AC)
PROPOSED DREDGE IN GULF	7.24	19.14	26.38
PROP. DREDGE IN OPEN WATER AND SAND	8.12	8.48	16.60
PROP. FILL ON SAND BEACH	1.83	8.87	10.70
PROP. FILL IN THE GULF OF MEXICO	1.86	23.07	24.93
TOTAL	19.05	59.56	78.61



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**TIGERTAIL LAGOON / SAND DOLLAR ISLAND
ECOSYSTEM RESTORATION PROJECT
IMPACTS MAP**

DESIGNED	MN	REVISION	TAB NAME	WATER SAMPLING
DRAWN	RMJ	N/A	SHEET	12 OF 11
DATE	08-04-21	N/A	SCALE	
JOB NO.	1782	N/A		
SECTION- 6 & 7 TOWNSHIP- 52 S RANGE-26 E				