Biological Monitoring Plan
FOR MIAMI-DADE COUNTY CONTRACT G (BAL HARBOR) PROJECT

Submitted by
Miami-Dade County Department of Regulatory and Economic Resources
Environmental Resources Management

To:
Florida Department of Environmental Protection,
Division of Water Resource Management
Tallahassee, FL

As partial fulfillment of provisions of the
U.S. ARMY CORPS OF ENGINEERS PLANS AND SPECIFICATIONS

and Specific Conditions of
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP)
Joint Coastal Permit 0307741-002-JC

MONITORING PROGRAM COMPONENT OUTLINE

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All resource protection and biological surveys, data collection, analysis, and reporting will be supervised by an advanced degreed marine biologist (M.S. minimum) from Miami-Dade County's Department of Regulatory and Economic Resources (RER) with at least 3 years experience in assessment and evaluation of coral reef and hardground habitats (please see Appendix A for resume).

I. Project Description. Contract G proposed activity includes placing approximately 300,000 cubic yards of sand along the Bal Harbor shoreline from R-27 to R-31. The borrow area is the ebb shoal at Bakers Haulover Inlet as shown in Figure 1. The proposed project would be the periodic nourishment of the federally authorized Beach Erosion Control and Hurricane Protection Project at Bal Harbor Beach.

II. Resources In and Adjacent to the Pipeline. The pipeline corridor for this project is located over sand and sparse rubble colonized by algae. Therefore, RER biologists do not anticipate marking the corridor or conducting any pre-placement surveys. RER biologist will conduct a post deployment survey to document the pipeline location. If impacted resources are observed, additional assessments will be conducted as described Appendix B.

Visual Surveys of Habitats Adjacent to the Pipeline. While RER reserves the right to conduct inspections of the pipeline throughout the period of construction, the surveys conducted relative to this section will be the responsibility of the contractor, and will not be conducted by RER. During construction, the following surveys will be conducted, weather and safety conditions permitting: visual inspection of the pipeline will be conducted while the pipeline is in operation to enhance the chance of detecting leaks (i.e., visible 'boils' from the surface or obvious sediment discharge observed through in-water inspections).

1. Surface surveys will be conducted daily by boat along the length of benthic resources proximal to the operational box and along the pipeline. The location of possible leaks will be noted, reported immediately as per notification requirements of the permit.
2. Upon detection of any leakage or substantial movement of the pipeline, the ACOE project manager/engineer, FDEP and RER are to be notified immediately, and utilization of the pipeline, will cease immediately.

III. Resources Adjacent to Bal Harbour Ebb Shoal Borrow Area

A. **Monitoring Stations.**

Monitoring stations will be established based on utilization of a Before-After-Control-Impact (BACI) monitoring program design[1]. This design establishes monitoring stations within an area of probable impact, and in areas of similar habitat outside the region of possible impact, which are used as "comparison" (e.g., control) sites. The inclusion of the "comparison" locations affords an ability to account for regional and/or system wide changes from project specific changes (i.e. 'system wide impacts such as storm effects, regional habitat disruptions, etc., versus impacts from project related activities). Installation of sediment depth transect reference stakes and benthic quadrat station markers will occur a minimum of 9 weeks prior to construction activity.

[1] Underwood, A.J., 1996. On Beyond BACI: Sampling Designs that might reliably detect environmental disturbances. *IN*: *Detecting Ecological Impacts Concepts and Applications in Coastal Habitats*. R.J. Schmitt, and C.W. Osenberg EDS. Associated Press. New York, NY. pp 151-178.

1. Four monitoring stations will be established on the hardbottom area just east of the borrow area as shown in Figure 1 to assess any potential impacts related to the dredging activity. These same stations were evaluated in the 2003 beach renourishment project that utilized this borrow area.
2. Four control or reference monitoring stations will be established one to two miles north of the borrow area as shown in Figure 2 in areas of similar benthic composition and densities and water depths (avoiding the mooring buoy areas and previously dredged reef areas) to serve as control or reference stations as per the (BACI) methodology.

B. Qualitative Monitoring. Prior to, during and after the active construction period, qualitative visual surveys will be conducted at each monitoring station at borrow area, and control locations by qualified biologists. Surveys will assess:

1. Sedimentation:
    a. Evaluating all benthic organisms (scleractinian corals, octocorals, sponges, etc.) for standing sediment that is not removed by normal currents or wave action.
    b. Evaluating scleractinian corals for additional indications of sedimentation stress such as excessive mucus, extruded polyps, and color changes (bleaching or paling). Sediment stress will be defined as a significant build-up of sediment sufficient to cause any one or more of the following conditions:
        1) A frequency of observed bleaching (partial or complete) of scleractinian coral colonies, significantly above the level found at the control or reference stations.
        2) Excessive mucus produced by scleractinian corals to remove sediment from their surface, resulting in binding of sediments and transport of bound sediments off the coral's surface and subsequent accumulation of the sediments at the base of the coral head. Such accumulations have been noted to initiate a "self burial" process, causing bleaching and/or death of the lower tissue of the coral head.
        3) Covering of benthic community components (i.e., sponge, algae) by sediment for sufficient time or sufficient sediment so as to note death or degradation (i.e., bleaching, pigmentation changes) of the underlying organisms.
2. Reef conditions: Digital photographs will be used during the surveys to document the general conditions of the reefs, to the limits allowed by variations in in-water ‘visibility’. Photographs will include:
    a. Wide angle reef scenes (as visibility allows).
    b. Close-up photographs documenting organism experiencing sediment stress (i.e., burial, excess mucus, extruding polyps, color change).
3. Survey Frequency (See Table 1)
    a. Before excavation or placement of fill material begins, stations will be monitored at least once a week for four (4) weeks to establish baseline conditions.
    b. During active construction (dredging or fill placement), stations will be surveyed twice per week if within 600’ of borrow area and once per week if between 600’ and 1000’ from borrow area.
    c. After placement of fill material is complete, the station will be surveyed at least once a week for four (4) weeks

4. Reporting.
   a. One pre-construction condition report will be submitted documenting the reef areas condition prior to sand dredging. This report, along with raw data, will be submitted within 90 days upon monitoring completion.
   b. During active fill placement, summary reports of the weekly surveys will be submitted via e-mail describing survey results within one week of completion of each week's surveys.
   c. A post-construction report detailing the results for the four week post construction surveys. This report, along with raw data, will be submitted within 90 days of monitoring completion.
   d. Notification of sediment stress violations will be by phone, fax, or e-mail, within 24 hours to FDEP, ACOE, and NMFS-PRD of the possibility of violation of sediment levels on the reefs (or on the next work day if the indicators are noted on a weekend or holiday). The notification will be followed by a written report, submitted within a week of the original notice.

C. Quantitative Monitoring.

1. *Interval Sediment Depth Measurements.* The depth of sediment on the hardbottom reef areas will be measured utilizing a fixed 50m transect and line-intercept method.
   a. Transects will be oriented perpendicular to the general orientation of the edge of the reef.
   b. Transects will initiate at the edge of exposed hardbottom most proximal to the dredging or placement activity. Rebar will be installed at that edge, 25m from the reef edge, and at the 50m endpoint in order to revisit the same transect each survey.
   c. Sediment depth measurements will be made at 1m intervals along the transect using a ruler graduated in millimeters. Measures will be recorded to the nearest millimeter.
2. *Line-intercept Survey of Sand patches*.
   a. A biologist will swim the length of each transect and note the location along the transect tape, and linear extent, of each sand patch that is at least 0.5 m in length and sand at least 1cm deep, and uninterrupted by benthic biota.
   b. Sediment depth will be measured in the center of sand patch if the interception is less than 2 m, and at three points if it is over 2 m (0.5 m into the sand patch from either line of interception and in the middle).
3. *Acropora Species Monitoring*. Baseline surveys were conducted to determine the location, and abundance of *Acropora* spp. in the hardbottom areas adjacent to the borrow area, and fill areas. The surveys followed the protocols outlined by the National Marine Fisheries Service[2] *A. cervicornis* colonies were observed on the reef east of the borrow area during the pre-project surveys, but not on the hardbottom habitat offshore of the fill area. *Acropora palmata* was not observed in either area. *Acropora cervicornis* colonies will be evaluated as outlined in below:

   a. Assessing and assigning a 'stress value' to representative *A. cervicornis* colonies based on four (4) health parameters: bleaching, excess mucus production, polyp extension, and disease. The 'stress value' scale will range from 0- 3 with 0 representing minimal to low stress and 3 represents advanced acute stress. A colony receiving a stress score of 1.5 or higher in two or more parameters will be classified as stressed and in declining health.

[2] National Marine Fisheries Services. Recommended Survey Protocol for Acropora spp. in Support of Section 7 Consultation (Revised October 2007).

b. Acropora health evaluation will be documented through approximately 15 seconds of video per colony. In the event a video camera is not available, digital photographs will be taken from the main directional headings and above each colony.

4. Long-term Benthic Quadrat Monitoring.
   a. Quadrat size and positioning. Each long term benthic monitoring station will be comprised of five randomly placed 2.1 m X 2.0 m quadrats (total sample area of 21.0 m^2/site) for determination of benthic community components.
      1. The location of each of the quadrats will be determined by randomly choosing a distance and direction from a reference point (max distance = 100 m or one-half the width of the reef at the reference point, which ever is less). The reference point will be at the reef edge and marked by a rebar which also serves at the origin for the sediment transects (II.C.2).
      2. Each quadrat will be oriented normal to the prevailing direction of the reef tract (i.e., N/S), marked with an iron bar, and all have corner points marked with stainless steel pins or masonry nails to allow precise relocation.
         i. Each quadrat will be subdivided into six 1.0 m X 0.7 meter subplots, to aid in photogrammetric analysis of the quadrat.
         ii. Each subplot will be marked with masonry nails and/or 1-2' rebar depending on bottom composition and relief to allow precise relocation.
   b. Sampling Methodology.
      1. All scleractinian and octocorals, macro-sponges, macro-algae, and other benthic invertebrates will be enumerated and field identified to the lowest possible taxonomic rank via mapping of 1.0 m X 0.7 m subplots of the 2.0 m X 2.1 m quadrats (six subplots per quadrat). All scleractinian corals will be measured (major and minor axis) to determine scleractinian coral coverage.
      2. Each subplot will be photographed using an underwater camera and strobe, mounted on a prefabricated "framer". The framer will hold and position the camera and strobe for optimal resolution of the subplot area. The photographs will be used to verify the percent of cover of scleractinian corals through planimetric analysis of projected images if necessary (Kohler and Gill, 2006[3]). Further, the photographs will serve as documentation of the benthic community components within the subplots.

5. Survey Frequency (see Table 1)
   a. Before active construction:
      1) Reef sediment accumulation measures will be surveyed along the fixed transect at least once a week for four (4) weeks to establish baseline conditions. If observed, *Acropora* species will also be scored accordingly during these surveys.
      2) Benthic quadrats surveys will be completed once prior to construction.
   b. For the duration of active construction:

      Reef sediment accumulation measures will be taken along the fixed transect once a week during construction. If observed, *Acropora* species will also be scored accordingly during these surveys. Qualitative visuals surveys will also be completed.

[3] Kohler, K.E. and S.M. Gill, 2006. Coral Point Count with Excel extensions (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. *Computers and Geosciences*: 32 1259-1269.

c. After active construction is completed:
   1) Reef sediment accumulation measures will be taken once a week for four weeks after construction work is completed. If observed, *Acropora* species will also be scored accordingly during these surveys.
   2) Benthic quadrat monitoring (five 2 x 2.1m quadrats at each station) will be completed within 6 weeks after construction. If impacts are noted during the initial post construction quadrat surveys, the quadrat surveys will be repeated at 1 year intervals for 3 years post construction in order to document any recovery or further decline.

6. Reporting.
   a. Sediment Depth Data. Weekly reports containing the raw data from the sediment depth transects will be submitted via e-mail describing sediment accumulation measurements and qualitative descriptions of sediment accumulation or stress. A summary report will be submitted within 90 days of completion.
   b. Benthic Quadrat Data. Raw data will be submitted within 60 days upon completion of monitoring. A summary report will also be submitted 90 days after completion of post construction monitoring and will include the pre and post project comparisons.
7. Notification of sediment violations will be by phone, fax, or e-mail, and followed by a written report to be submitted within 24 hours to FDEP, ACOE, and NMFS-PRD will be notified immediately of the possibility of violation of sediment levels on the reefs (or on the next work day if the indicators are noted on a weekend or holiday). If stress is recorded, the dredging operation must move to a new location or discontinue dredging until effected organisms have recovered.

IV. Nearshore Resources Adjacent to Fill Area

A. Monitoring Stations

Monitoring stations were identified based on pre-construction resources surveys. A total of six stations will be established as shown in Figure 3. These stations are offshore and down drift of the project fill area and will involve sediment and benthic monitoring

B. Hardbottom Edge Survey. The pre-construction resource boundaries were delineated by Miami-Dade County biologists from December 2012 through January 2013 for areas within 600m from shore adjacent to the fill area and down drift approximately 900m. Hard bottom edge surveys will be conducted again post construction and annually thereafter for three years with annual surveys conducted in summer months.

1. The nearshore hardbottom edge (western border of exposed hardbottom areas) was/will be mapped by recording the position of a diver swimming along the visible border between sand and exposed hardbottom. The diver will tow a buoy or surface float with a Garmin GPS unit mounted on it. The buoy will be on the shortest possible tether, such that the buoy is directly over the diver.
2. All data obtained will be saved to the computer at the end of each day in text and excel formats.

C. Transect Surveys. Six transect will be established beginning at the western edge of hardbottom or emergent benthic resources and extend east (seaward) 150m or to the seaward extent of

hardbottom if less than 150m. All four methods of surveys will be conducted along each transect as described below pre-construction, post construction, and annually thereafter for 3 years with annual sampling during summer months (see Table 1).

1. Interval sediment depth measurements
   a. Diver will collect standing sediment depth measurements (minimally to the nearest cm) at 1-m intervals along each monitoring transect, and additionally 30 m westward of hardbottom edge if emergent benthic resources are present.
   b. The sediment depth measurements shall be conducted first, before all other surveys along the transect, in order to record sediments undisturbed.
   c. A ruler or a T-bar, graduated minimally in centimeters (0 cm to 30 cm), is pressed through the sediment until the ruler reaches refusal. Sediment depth is recorded to the nearest centimeter. Measurements are recorded using printed table, labeled in one meter increments for data entry. Measurements greater than to 30 cm are recorded as >30 cm.
   d. The results of measurements will be used to estimate an average sediment depth during each survey for each transect, 10 m sections of a transect, and average for all transects and the same sections of transects. Collected data will be used for temporal analysis of sand movement through the nearshore environment.
2. Line-intercept survey of sand patches
   c. A biologist will swim the length of each transect and note the location along the transect tape, and linear extent, of each sand patch that is at least 0.5 m in length and sand at least 1cm deep, and uninterrupted by benthic biota.
   d. If/when hardbottom extends beyond the eastern end of an established transect, the diver will extend the transect to include that additional hardbottom out to a total transect length of 150m.
   e. Sediment depth will be measured in the center of sand patch if the interception is less than 2 m, and at three points if it is over 2 m (0.5 m into the sand patch from either line of interception and in the middle).
   f. As the data of interval sediment depth measurements, collected line-intercept data will be used for analysis of sand transport and accumulation within hardbottom communities.
3. Quadrat surveys. The quadrat method is based the *Benthic Ecological Assessment for Marginal Reefs*[4] on implies a non-invasive assessment. The topmost layers of sediment or epiphytes may obscure organisms living beneath. Small perturbations of the distribution of these topmost layers can bias assessments, especially of relatively scarce organisms such as corals; therefore, this survey likely under-represents the density of small corals.
   a. Benthic communities will be evaluated utilizing a 1 m X 1 m quadrat with 10 cm X 10 cm grid inside of a quadrat.
   b. The northwest corner of the quadrat will align with the precise point of the meter mark. Samples will be replicated along the length of each transect at 5m interval (at 0m, 5m, 10m, etc. marks).
   c. Quadrat datasheets will have a standardized layout to assess three main characteristics in each quadrat: habitat parameters (maximum relief and sediment depth measured in cm), percent cover and density of corals and octocorals (see Appendix C).

[4] Coastal Planning and Engineering, Inc. 2010. Benthic Ecological Assessment for Marginal Reefs (BEAMR) Standard Operating Procedure for the Western Atlantic and Gulf of Mexico. pp5.

d. Visual estimates of planar percent cover of all sessile benthos are pooled to 18 major functional groups. Functional groups are: sediment*, macroalgae, turf algae*, encrusting red algae, sponge, hydroid, octocoral, scleractinian coral, tunicate, bare hard substrate, seagrass, anemone, zoanthid, *Millepora* sp., sessile worm (including wormrock, *Phragmatopoma* spp.), bivalve, bryozoan, and sessile arthropod. Each functional group is given a percent cover value (0-100%, minimum <1% if present) and the total cover of all functional groups is 100%. Data collection is augmented for two functional groups (* above). Biologists circle all descriptors that apply: sediment (sand, shell-hash, mud), and turf algae less than 1cm in height (green, red, brown). The macroalgae percent cover data are augmented by a genus-level breakdown of macroalgae percent cover (for all genera with at least 1% cover).
e. Each colony of octocoral and scleractinian coral is identified and the maximum height (octocorals, scleractinian corals) and width (scleractinian corals) is measured to the nearest centimeter. Octocoral individuals are identified to at least genus level, and scleractinian corals are identified to species level. Corals less than or equal to one (1) centimeter recorded as "recruit". Abnormal conditions of each colony are recorded e.g., bleaching, disease, stress.
f. Macroalgae genera or species with less than 1% cover will be recorded as "present".
g. Qualified biologists will be trained in the survey protocol. All biologists conducting survey must survey the same transect for QA/QC at the beginning and at the end of survey season; difference in between surveyors shall not be more than 10%.

4. Video Documentation
   a. Video survey will provide additional set of data that can be used for verification of *in situ* results should any discrepancy or questions of data interpretation appear. Until than video data would not be used for quantitative interpretation.
   b. Video surveys will be conducted using digital video camera secured in an underwater housing unit.
   c. Transect line/tape will be stretched the length of each transect, in the way that meter marks will be clearly visible when video recorded, and used to guide the videographer as she/he swims the length of each video transect.
   d. Video of the seafloor along entire length of each transect will be taken at a height of 40 cm, and will progress no faster than five (5) m per minute. A convergent laser guidance system indicates the precise height of 40 cm from the substrate. The visible width of imagery taken from this height is 40 cm.
   e. Panoramic view of underwater landscape will be recorded at the beginning and the end of each transect or sharp changes in the landscape from the elevation of camera of 1 m above bottom at the angle of 30^{o} to the horizon.

D. Acropora surveys. *Acropora* species were not observed during pre-project resource surveys in the nearshore habitat. However, if *Acropora* species are observed during the transect monitoring, Acropora will be evaluated according to the protocols outlined in Section III.C.3.

E. Statistical Data, Treatment of Data and Interpretation

1. Quantitative data on the major benthic biological and physical components, e.g., percent cover, abundance, distribution by size, and species lists and statistical evaluation and

comparison for functional groups from quadrat survey, presented in tabulated and graphical format, reflecting the dynamic of each measured functional group.

2. Graphical representation of sediment measurements: a) interval sediment measurements by transects, and averaged through the monitoring area; b) line-intercept measurements by transects and averaged through the monitoring area.
3. Estimates of changes in between two hardbottom edge surveys, reflecting changes in distribution of two major types of hardbottom: ephemeral (with protruding biota and hardbottom visible within sand cover, e.g. between ripple marks), and permanent (with developed, several years old community).

F. Reporting.

1. The beginning, the completion of each survey will be reported to JCP Compliance officer.
2. Weekly progress of surveys will be also reported to JCP compliance officer.
3. All raw data, including video survey and photo documentation, data sheets, shape files, etc shall be provided within 30 days upon completion of the survey.
4. Pre-construction and annual monitoring reports will be provided within 90 days upon completion of survey.
5. All reports will include data analysis and interpretation, including appropriate statistical analysis, graphic representation, annual aerial photo, etc. (reports content shall have more details). Monitoring Reports for Nearshore Hardbottom and Reefs Adjacent to Borrow Area shall be provided for DEP/JCP as a separate document.

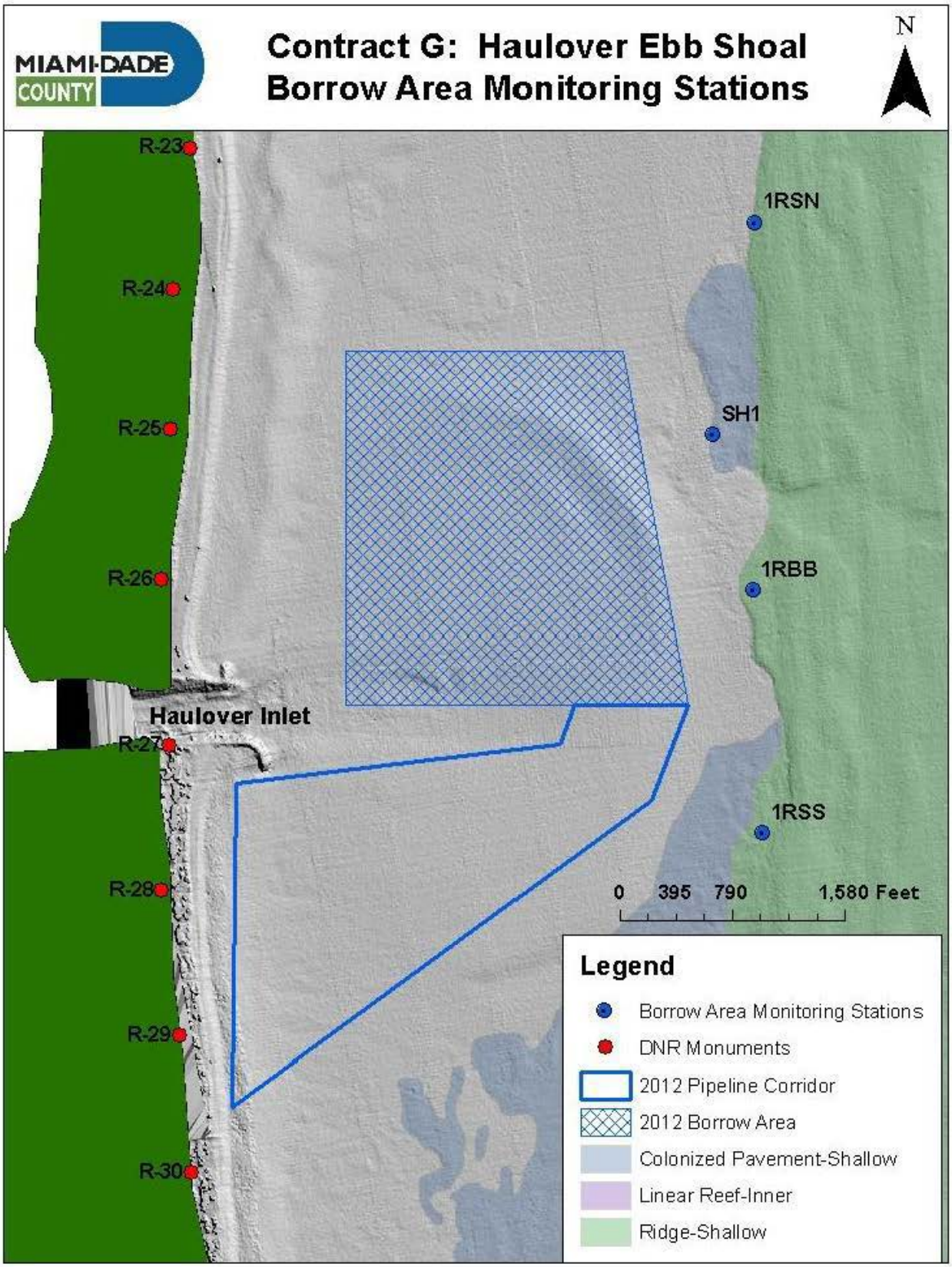

Figure 1. Project Map indicating locations of pipeline corridor, borrow area and associated monitoring stations.

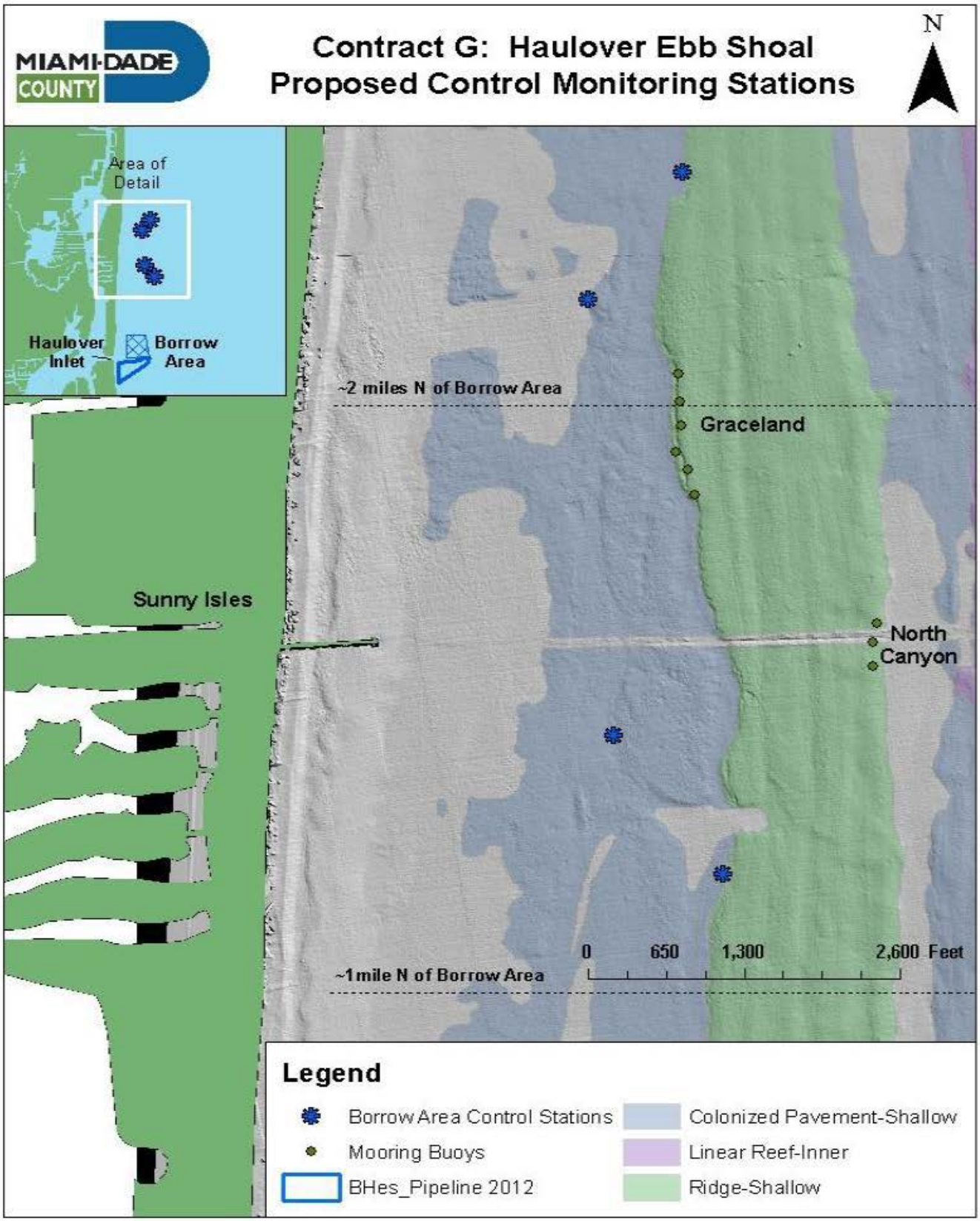

Figure 2. Control stations locations. Note station locations may change based on final reconnaissance.

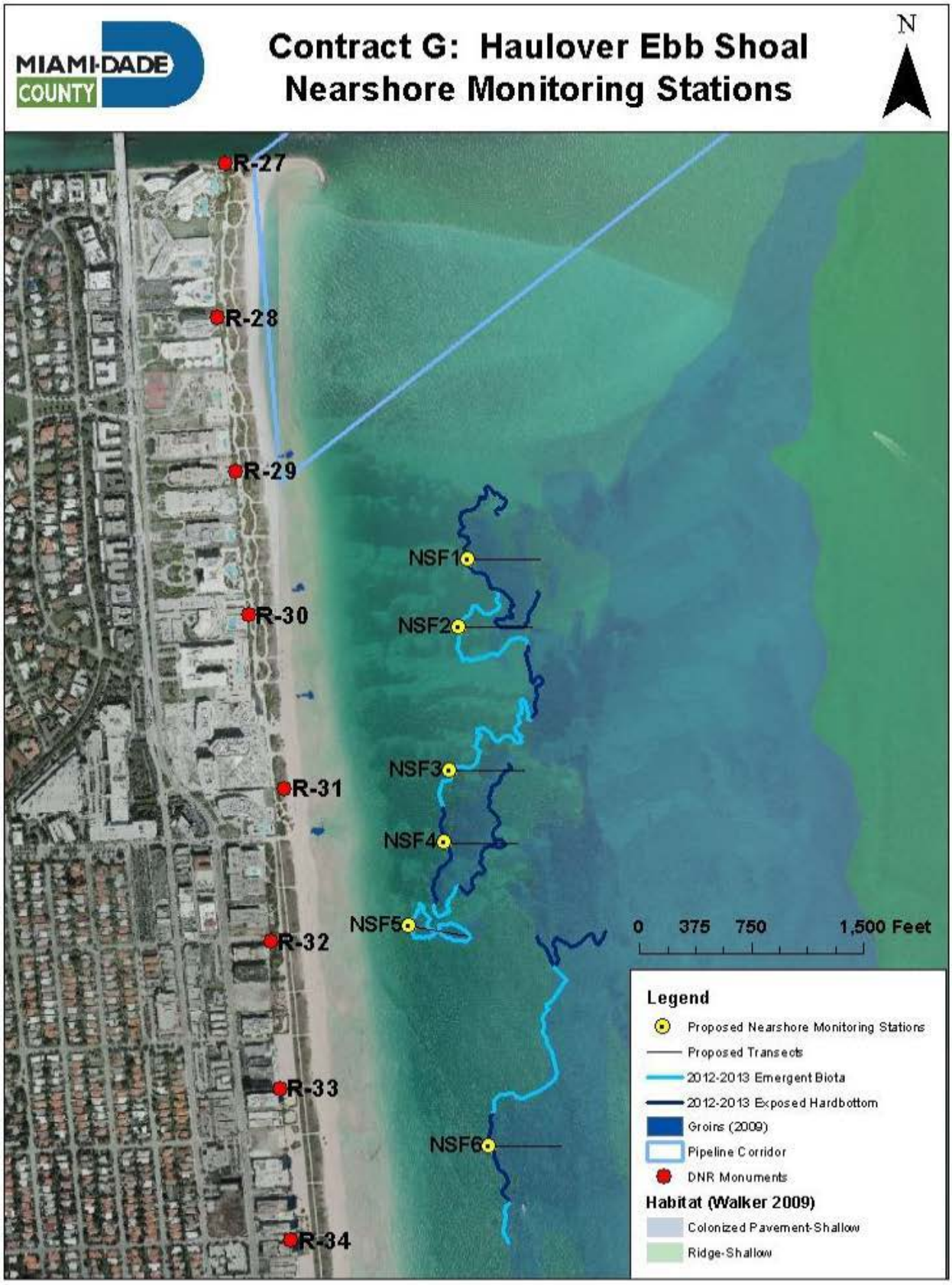

Figure 3. Proposed nearshore monitoring stations offshore of the beach fill area.

Table 1. Monitoring tasks and sampling periodicity for benthic resources conducted in association with Contract G.

	Task	Pre	Const.	Post	6 months	Year 1	Year 2	Year 3
Pipeline	Pipeline Survey		X					
	Scleractinian/Octo Coral Salvage*		X	X		X	X	X
	Scleractinian/Octo Coral Monitoring*		X					
	Post Pipeline Survey*			X				
Nearshore Fill Areas	Sediment Depth and Interval Surveys	X		X		X	X	X
	Quadrat Monitoring	X		X		X	X	X
Borrow Area	Qualitative Sediment Stress Surveys	X	X	X				
	Quantitative Sediment Monitoring	X	X	X	X		X	X
	Benthic Monitoring	X		X	X		X	X

*Scleractinian and octocoral salvage and subsequent monitoring as well as the post removal pipeline survey will only be conducted if resources are identified during the initial pipeline survey.

V. Marine Turtles. The following measures shall be taken to protect marine turtles from impacts and document any impacts from the project, in accordance with Chapter 379.2431(1), F.S.:

A. Beach nourishment may proceed during the sea turtle nesting season, provided early morning surveys for sea turtle nests are conducted daily from March 1 through September 15 or until two weeks after the last documented crawl.

1. Nesting surveys and egg relocations shall only be conducted by personnel with prior experience and training in nesting survey and egg relocation procedures. Surveyors must have a valid FWC permit issued pursuant to Rule 68E-1, F.A.C. Nesting surveys must be conducted daily between sunrise and 9 a.m. The contractor must not initiate work until daily notice has been received from the sea turtle permit holder that the morning survey has been completed. Surveys must be performed in such a manner so as to ensure that construction activity does not occur in any location prior to completion of the necessary sea turtle protection measures.
2. Only those nests that may be affected by sand placement activities will be relocated. Nests requiring relocation must be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation; the nest relocation site must be approved by FWC Marine Turtle Management staff. Relocated nests must not be placed in organized groupings; relocated nests must be randomly staggered along the length and width of the beach in settings that are not expected to experience daily inundation by high tides or known to routinely experience severe erosion and egg loss, that are subject to artificial lighting, or that are historically impacted by

predation. Nest relocations in association with construction activities must cease when sand placement activities no longer threaten nests.

3. Nests deposited within areas where construction activities have ceased or will not occur for 65 days must be marked and left in situ unless other factors threaten the success of the nest. The Marine Turtle Permit Holder must install an on-beach marker at the nest site and/or a secondary marker at a point landward as possible to assure that future location of the nest will be possible should the on-beach marker be lost. A series of stakes and highly visible survey ribbon or string must be installed to establish a 10-foot radius around the nest. No activity shall occur within this area that could result in impacts to the nest. Nest sites must be inspected daily to assure nest markers remain in place and the nest has not been disturbed.

B. No construction activity may commence until completion of the marine turtle survey each day.

C. Miami-Dade County shall ensure that the project area and access sites are surveyed for marine turtle nesting activity. All nesting surveys, nest relocations screening or caging activities, etc., shall be conducted only by persons with prior experience and training in these activities and who is duly authorized to conduct such activities through a valid permit issued by the Fish and Wildlife Conservation Commission (FWC), pursuant to 68E-1, F.A.C.

D. If available, staging areas for construction equipment shall be located off the beach during early (March 1 through April 30) and late (November 1 through November 30) nesting season for Brevard through Broward counties. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting located as far landward as possible without compromising the integrity of the dune system. Pipes placed parallel to the dune shall be 5 to 10 feet away from the toe of the dune if the width of the beach allows. Temporary storage of pipes shall be off the beach to the maximum extent possible. If the pipes are stored on the beach, they shall be placed in a manner that will minimize the impact to nesting habitat and shall not compromise the integrity ofthe dune systems.

E. Immediately after completion of the beach fill placement event and prior to April 15 for three (3) subsequent years if placed sand still remains on the beach, the beach shall be tilled as described below or Miami-Dade County may follow the procedure outlined below to request a waiver of the tilling requirement.

1. During tilling, at a minimum, the protocol provided below shall be followed:
   a. The area shall be tilled to a depth of 36 inches. All tilling activity must be completed prior to April 15. Compaction sampling stations shall be located at 500-foot intervals along the project area. One station shall be at the seaward edge of the dune/bulkhead line (when material is placed in this area) and one station shall be midway between the dune line and the high water line (normal wrack line).
   b. At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lie over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments.

c. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports shall include all 18 values for each transect line, and the final 6 averaged compaction values.

d. If the average value for any depth exceeds 500 psi for any two (2) or more adjacent stations, then that area shall be tilled prior to April 15. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the FWC shall be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling shall not be required.

2. An annual summary of compaction surveys and the actions taken shall be submitted to the FWC.
3. If the project is completed just before the nesting season, tilling shall not occur in areas where nests have been left in place or relocated unless authorized by the U.S. Fish and Wildlife Service in an Incidental Take Statement.
4. This condition shall be evaluated annually and may be modified if necessary to address sand compaction problems identified during the previous year.
5. To request a waiver of the tilling requirement, the Miami-Dade County may measure sand compaction in the area of restoration in accordance with a protocol agreed to by the FWC, the Department, the U.S. Fish & Wildlife Service, and Miami-Dade County to determine if tilling is necessary.

F. Visual surveys for escarpments along the beach fill area shall be made immediately after completion of the beach nourishment project and prior to May 1 for the following three years if placed sand still remains on the beach. All scarps shall be leveled or the beach profile shall be reconfigured to minimize scarp formation. In addition, weekly surveys of the project area shall be conducted during the two nesting seasons following completion of fill placement as follows:

1. The number of escarpments and their location relative to DNR-DEP reference monuments shall be recorded during each weekly survey and reported relative to the length of the beach surveyed (e.g., 50% scarps). Notations on the height of these escarpments shall be included (0 to 2 feet, 2 to 4 feet, and 4 feet or higher) as well as the maximum height of all escarpments.
2. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet shall be leveled to the natural beach contour by April 15. Any escarpment removal shall be reported relative to R-monument.
3. If weekly surveys during the marine turtle nesting season document subsequent reformation of escarpments that exceed 18 inches in height for a distance of 100 feet, the FWC shall be contacted immediately to determine the appropriate action to be taken. Upon written notification, the Miami-Dade County shall level escarpments in accordance with mechanical methods prescribed by the FWC.
4. Two surveys shall be conducted of all lighting visible from the beach placement area by the Applicant or local sponsor, using standard techniques for such a survey in the year following construction. The first survey shall be conducted between May 1 and May 15 and a brief summary provided to FWC. The second survey shall be conducted between July 15 and August 1. A summary report of the surveys, including any actions taken, shall be submitted to the Service by December 1 of the year in which surveys are conducted. After the annual report is completed, a meeting shall be set up with the Applicant or local sponsor, county or municipality, FWC, Corps, and the Service to discuss the survey report, as well as any documented sea turtle disorientations in or adjacent to the project area. If the

project is completed during the nesting season and prior to May 1, the contractor may conduct the lighting surveys during the year of construction.

G. Miami-Dade County shall arrange a meeting between representatives of the contractor, the Department, the FWC, and the permitted person responsible for marine turtle nest monitoring at least 30 days prior to the commencement of work on this project. At least 15 days advance notice shall be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.

H. Reports on all nesting activity shall be provided for the initial nesting season and for a minimum of three additional nesting seasons. Monitoring of nesting activity in the seasons following construction shall include daily surveys and any additional measures authorized by the FWC. Reports submitted shall include daily report sheets noting all activity, nesting success rates, hatching success of all relocated nests, hatching success of a representative sampling of nests left in place (if any), dates of construction and names of all personnel involved in nest surveys and relocation activities. Data should be reported separately for the nourished areas and for an equal length of adjacent beach that is not nourished in accordance with the attached Table. Summaries of nesting activity shall be submitted in electronic format (Excel spreadsheets). All reports should submitted by January 15 of the following year.

I. In the event a sea turtle nest is excavated during construction activities, all work shall cease in that area immediately and the permitted person responsible for egg relocation for the project shall be notified so the eggs can be moved to a suitable relocation site.

J. Upon locating a dead, injured, or sick endangered or threatened sea turtle specimen, initial notification must be made to the FWC at 1-888-404-FWCC. Care should be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Table 2: Marine Turtle Monitoring for Beach Restoration Projects. The following monitoring is required for beach restoration projects. Reports summarizing the nesting should be submitted to the Tequesta office with a copy to the Tallahassee office by January 15 of the subsequent year. Data for nesting activity on the nourished beach and on an equal length of beach that is not nourished shall be reported separately, and should include numbers of nests lost to erosion or washed out. Summaries of nesting activity shall be submitted in electronic format (Excel spreadsheets).

Characteristics	Parameter	Measurement	Variable
Nesting Success	False crawls - number	Visual assessment of all false crawls	Number and location of false crawls in project and adjacent areas: any interaction of the turtle with obstructions, such as groins, seawalls, or scarps, should be noted.
	False crawl - type	Categorization of the stage at which nesting was abandoned	Number in each of the following categories: emergence-no digging, preliminary body pit, abandoned egg chamber.

	Nests	Number	The number of marine turtle nests in the project and adjacent areas should be noted. Nest location along the profile, including the distance from the waterline and the landward structure, shall be recorded. Any abnormal cavity morphologies should be reported as well as whether turtle touched groins, seawalls, or scarps during nest excavation
		Lost Nests	The number of nests lost to inundation, erosion depredated, vandalized, or the number with lost markers that could not be found.
	Lighting Impacts	Disoriented sea turtles	The number of disoriented hatchlings and adults shall be documented and reported in accordance with existing FWC protocol for disorientation events.

VI. Shorebirds. The following measures shall be taken to protect migratory shorebirds from impacts or document impacts related to the project:

A. Shorebird Monitors. Shorebird surveys should be conducted by trained, dedicated individuals (Shorebird Monitor) with proven shorebird identification skills and avian survey experience. Credentials of the Shorebird Monitor shall be submitted to the FWC Regional Biologist for review and approval. Shorebird Monitors will use the survey protocols below.

B. Nesting Season Surveys. Shorebird Monitors shall review and become familiar with the general information and data collection protocols outlined on the FWC's Beach-Nesting Bird Website (http://myfwc.com/shorebirds/BNB/default.asp). An outline of what data should be collected, including downloadable field data sheets, is available on the website.

1. The nesting season is generally April 1 to September 1, but some nesting may occur through September.
2. Nesting season surveys shall begin on April 1 or 10 days prior to project commencement (including surveying activities and other pre-construction presence on the beach), whichever is later, and be conducted daily throughout the construction period or through August, whichever is earlier. Weekly surveys of the project site shall continue through August or through fledgling or loss of identified nests or hatchlings, whichever is later.
3. Nesting season surveys shall be conducted in all potential beach-nesting bird habitat within the project boundaries that may be impacted by construction or pre-construction activities during the nesting season. Portions of the project in which there is no potential for project-related activity during the nesting season may be excluded.
4. Surveys for detecting new nesting activity will be completed on a daily basis prior to movement of equipment, operation of vehicles, or other activities that could potentially disrupt nesting behavior or cause harm to the birds or their eggs or young
5. Surveys should be conducted by traversing the length of the project area and visually inspecting, using binoculars or spotting scope, for the presence of shorebirds exhibiting breeding behavior.

6. If an ATV or other vehicle is needed to cover large project areas, the vehicle must be operated at a speed **less than** 6 mph, shall be run at or below the high-tide line, and the Shorebird Monitor will stop at no greater than 200 meter intervals to visually inspect for nesting activity.

C. Once breeding is confirmed by the presence of a scrape, eggs, or young, the Bird Monitor will notify the Regional Nongame Biologist of the FWC at (561) 648-3205 within 24 hours.
1. All breeding activity will be reported to the Beach-Nesting Bird website within one week of data collection.
2. Observations of non-breeding shorebirds should be reported to the Shorebird-Seabird Occurrence Database, as described below

D. Non-Breeding Shorebird Surveys. Data collected on non-breeding shorebirds should be compatible with, and reported to, the Shorebird-Seabird Occurrence Database (http://myfwc.com/).
1. Surveys for non-breeding shorebirds should begin 14 days prior to construction commencement and be conducted once every 2 weeks for at least one year post-construction. Data collected during these surveys will provide valuable information on the use of nourished beaches to shorebirds.
2. Survey for non-breeding shorebirds will include all potential shorebird habitat within the project boundary.
3. Data should be entered into the database within one month of collection.

E. Buffer Zones and Travel Corridors. Within the project area, Miami-Dade shall establish a 300 ft-wide buffer zone around any location where shorebirds have been engaged in nesting behavior, including territory defense. Any and all construction activities, including movement of vehicles, shall be prohibited in the buffer zone.
1. The width of the buffer zone shall be increased if birds appear agitated or disturbed by construction or other activities in adjacent areas.
2. Site-specific buffers may be implemented upon approval by the FWC as needed.
3. Reasonable and traditional pedestrian access should not be blocked where nesting birds will tolerate pedestrian traffic. This is generally the case with lateral movement of beach-goers walking parallel to the beach at or below the highest tide line. Pedestrian traffic may also be tolerated when nesting was initiated within 300 feet of an established beach access pathway. Miami-Dade County shall work with FWC staff to determine if pedestrian access can be accommodated without compromising nesting success.
4. Designated buffer zones must be posted with clearly marked signs around the perimeter. If pedestrian pathways are approved within the 300-foot buffer zone, these should be clearly marked. These markings shall be maintained until nesting is completed or terminated. In the case of solitary nesters, nesting is not considered to be completed until all chicks have fledged.
5. No construction activities, movement of vehicles, or stockpiling of equipment shall be allowed within the buffer area.

F. Travel Corridors. FWC-approved travel corridors will be designated and marked by Miami-Dade County outside the buffer areas. Heavy equipment, other vehicles, or pedestrians may transit past nesting areas in these corridors. However, other activities such as stopping or turning shall be prohibited within the designated travel corridors adjacent to the nesting site. To the degree possible, Miami-Dade County or the contractor should maintain some activity within these corridors on a daily basis, without directly disturbing any shorebirds documented on site or interfering with sea turtle nesting, especially when those corridors are established prior to

commencement of construction. Passive methods to modify nesting site suitability must be approved by FWC Regional Biologist for that region.

G. Notification. If shorebird nesting occurs within the project area, a bulletin board shall be placed and maintained by the Miami-Dade County (unless otherwise provided by the USACE) in the construction area with the location map of the construction site showing the bird nesting areas and a warning, clearly visible, stating that "BIRD NESTING AREAS ARE PROTECTED BY THE FLORIDA THREATENED AND ENDANGERED SPECIES ACT AND THE STATE AND FEDERAL MIGRATORY BIRD ACTS".

H. Placement of Equipment and Sand. If it will be necessary to extend construction pipes past a known shorebird nesting site, then whenever possible those pipes should be placed landward of the site before birds are active in that area. No pipe or sand shall be placed seaward of a known shorebird nesting site during the shorebird nesting season.

Appendix A. QUALIFICATIONS OF THE BIOLOGICAL MONITORING STAFF SUPERVISOR

Sara E. Thanner

1055 NE 121st Street, North Miami, FL 33161 ∗ (305) 761-0990 ∗ thanns@miamidade.gov

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Education: Nova Southeastern University, Ft. Lauderdale—Florida
Masters of Science *(Marine Biology and Marine Environmental Sciences)*, March 2004

Barry University, Miami Shores—Florida
Bachelor of Science Degree in Biology (*Marine Science Track*) May 2000

Certifications and Skills:

Rescue Diver Certified (*PADI and NAUI*)
Enriched Air Certified – Nitrox (*PADI*)
DAN O2 Administer Certification
Small Boat Handling Experience (U.S. Coast Guard Auxiliary Boating Skills and Seamanship)
Certified Ground and Surface Water Sampler for the Florida Dept. of Environmental Protection

Professional Experience:

Department of Environmental Resources Management (DERM), Miami, Florida

Environmental Resources Project Supervisor **April 07 to present**

Manage the offshore reef monitoring program associated with beach renourishment projects and disaster response (vessel grounding, bleaching outbreaks, etc.).

- Manage the artificial reef construction and monitoring program.
- Mange the mooring buoy installation and maintenance program.
- Review and finalize various offshore and artificial reef monitoring reports and documents.
- Prepare grant proposals for offshore monitoring projects.
- Represent Miami-Dade DERM at conferences and other meetings.

Biologist II **March 04 to April 07**

- Coordinated, supervised, and participated in offshore monitoring projects associated with beach renourishment projects and the artificial reef program in Miami-Dade County including benthic and fish surveys and artificial reef habitat assessment.
- Managed the summary, entry into computer databases, and validation of the data collected in association with offshore projects.
- Responsible for maintenance of expense logs for the offshore projects as well as boat and equipment repair logs.
- Wrote various reports for offshore projects.
- Participated in a wide variety of field research and monitoring programs other than the offshore projects including water quality sampling.

Biologist I **April 02 to March 04**

- Participated in a wide variety of field research and monitoring programs throughout Dade County and the surrounding coastal waters from water quality sampling to offshore benthic and fish surveys.
- Responsible for the preparation and setup of offshore projects.
- Responsible for the summary, entry into computer databases, and validation of the data collected in association with offshore projects.
- Responsible for the maintenance of expense logs for the offshore projects and boat repair logs.
- Assisted in the writing of various reports for offshore projects.
- Assisted in lab related tasks such as equipment decontamination and solution preparation.

Sara E. Thanner
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Biology Assistant **November 00 to March 02**

- Assisted in a wide variety of field research and monitoring programs throughout Dade County and the surrounding coastal waters from water quality sampling to offshore benthic and fish surveys.
- Assisted in office related tasks such as data entry and ArcView projects.
- Assisted in lab related tasks such as equipment decontamination and solution preparation.

Intern **June 98 to February 00**

- Conducted sea turtle research in Miami-Dade County involving relocation, incubation, fluid and blood sampling, and excavation processes.

Publications, Posters, and Presentations:

Thanner S.E., T.L. McIntosh, S.M. Blair. 2006. Development of benthic and fish communities on artificial reef materials compared to adjacent natural assemblages in Miami-Dade County, Florida. Bull. Mar. Sci. 78 (1): 57-70. Poster also presented at the 8th Conference on Artificial Reefs and Artificial Habitats in Biloxi, MS—April 2005.

Thanner, S. and Blair, S. Artificial Reef Materials as Mitigation for Natural Reef Impacts: Comparison of Benthic and Fish Assemblages on Artificial and Adjacent Natural Reefs in Miami-Dade County, Florida. Poster presented at the 11th International Coral Reef Symposium in Fort Lauderdale, FL – July 2008.

Thanner, S., Blair, S., and McIntosh T. Comparison of the Benthic and Fish Assemblages on Three Types of Artificial Reef Modules. Poster presentation at the 11th International Coral Reef Symposium in Fort Lauderdale, FL – July 2008.

Thanner, S. Southeast Florida Region Artificial Reef Update. Oral presentation at the Florida Artificial Reef Summit in Cocoa Beach, FL—2010.

Thanner, S., Sathe, M., and Blair, S. Comparison of Fish and Benthic Assemblages on a Mitigation Artificial Reef and Adjacent Natural Reefs: Year 10 Post-placement Assessment. Poster presentation at the Florida Artificial Reef Summit in Cocoa Beach, FL—2010.

Sathe, M., Thanner, S., and Blair, S. Effects of Proximity and Depth of Placement on Benthic and Fish Assemblages on Miami-Dade County Artificial Reefs. Poster presentation at the Florida Artificial Reef Summit in Cocoa Beach, FL—2010.

Computer Skills:

Working knowledge of Microsoft Word, Excel, Access, and Power Point
Working knowledge of ArcView and ArcGIS (9.3)
Working knowledge of Primer Statistical Analysis software
Working knowledge of Coral Point Count software

APPENDIX B : Resources Surveys In and Adjacent to the Pipeline Corridor

A. **Post Placement Surveys**. As the pipeline corridor is through sand, and devoid of scleractinians and octocorals, no impact to scleractinian corals or octocorals are anticipated. If however, any impacts to corals are found, the procedures below are to be employed. To affect this, if needed, the contractor will notify RER within 24 hrs of completion of the pipeline placement.
   1. RER biologists will trace the entire length of the pipeline using a Garmin GPS unit attached to a surface float.
   2. RER biologists will document any observed impacts to the benthic organisms (in areas of sparse rubble colonized by algae) after pipeline placement by recording species (to lowest possible taxonomic rank), size, health, and injury type (dislodged, fractured, or abraded). Photographs will also be taken.
   3. If impacted scleractinians or octocorals are observed, the colonies would be relocated and stabilized outside of the pipeline corridor.
      a. Colonies will be stabilized in as natural a position as possible and reattached to a cleaned area of substrate (i.e., wire-brushed free of sediment and algae) at the transplant site using a Portland cement mixture or epoxy mixture.
      b. The following information will be recorded for each colony:
         1) Species (to the lowest taxonomic rank possible)
         2) Colony size.
            a) Scleractinian corals: This will include length (longest axis), width (perpendicular to longest axis), and height (in direction of growth).
            b) Octocorals: the height of the colony will be recorded.
         c) Depth
         d) Colony orientation
         e) Overall health (i.e., presence of disease or bleaching or description of damage if salvaged post pipeline placement)
         f) Percent live and dead tissue
         g) General description of original colony location (i.e., eastern Colonized Habitat – Shallow or segments) and depth
      c. All impacted corals will be salvaged when possible within 1 week of the notification of the pipeline placement.
   4. Monitoring of Salvaged Scleractinian and Octocorals. Each salvaged scleractinian and octocoral will be monitored within 1 week of relocation/salvage, semi-annually for the initial year after relocation and annually thereafter for an additional two years.
      a. Prior to relocation:
         1) A unique identifier will be assigned to each colony. This identifier will be used to 'mark' the colony at the transplant site.
         2) Each scleractinian colony will be photographed with a ruler present for scale. At least one photograph will be above the colony, and parallel with its surface to allow estimation of the surface area of the colony. For octocoral colonies and clippings, representative photos will be taken.
         3) The following information will be recorded for each colony:
            a) Species (to the lowest taxonomic rank possible)
            b) Colony size.

(1) Scleractinian corals: This will include length (longest axis), width (perpendicular to longest axis), and height (in direction of growth).
(2) Octocorals: the height of the colony will be recorded.

c) Depth
d) Colony orientation
e) Overall health (i.e., presence of disease or bleaching or description of damage if salvaged post pipeline placement)
f) Percent live and dead tissue
g) General description of original colony location (i.e., eastern Colonized Habitat – Shallow or segments) and depth

b. After relocation:

1) Each relocated scleractinian colony will be photographed with a ruler present for scale. At least one photograph will be above the colony, and parallel with its surface to allow estimation of the surface area of the colony and at least one photograph will contain the unique identifier label assigned prior to relocation. For *Acropora* colonies, photographs will be taken before and after fragment collection. For octocoral colonies, representative photographs will be taken
2) The following information will be recorded for each relocated scleractinian colony:
   a) Any incidental damaged that may have occurred during relocation efforts.
   b) GPS coordinates for the colony or GPS coordinates for the origin of the relocation site and distance and compass bearing from origin.
   c) For *Acropora* colonies, fragment collection, recorded, and tracked protocols will be established in cooperation with the nursery recipients.
3) The following information will be recorded for relocated octocoral colonies or clippings:
   a) Any incidental damaged the may have occurred during relocation efforts.
   b) GPS coordinates for the corners of each 10m by 10m transplantation area.
   c) Species and number of relocated colonies and clippings.
4) For each relocated species, five (5) reference colonies will be identified in a similar habitat and in a similar size class or 10 reference colonies of any size will be identified for each relocated species if at least 5 cannot be found within a similar size class. The reference colonies will be 'healthy' colonies free of obvious disease or bleaching tissue. They will serve as controls to evaluate changes that may occur in the relocated colonies independent of the relocation activities (i.e. reef wide coral bleaching due to thermal stress).
   a) The reference colonies will be assigned a unique identifier.
   b) Each reference colony will be photographed with a ruler present for scale. At least one photograph should be above the colony from fixed distance to be able to estimate surface area of the colony. At least one photograph should contain the unique identifier label assigned prior to relocation.
   c) The following information will be recorded for each reference colony:
      (1) Species (to the lowest taxonomic rank possible)
      (2) Colony size. For scleractinian corals, this will include length (longest axis), width (perpendicular to longest axis), and height (in direction of growth). For octocorals, only height will be recorded.
      (3) Depth

(4) Colony orientation
(5) Overall health (i.e. presence of disease or bleaching, percent live tissue). Reference colonies will, to the greatest extent possible be free of notable disease, bleaching or other indicators of stress. It is recognized, however, that this may not be possible when regional or broader scale stress inducing events occur.
(6) Location of the colony, through either GPS coordinates of the colony or GPS coordinates for a reference location (or relocation) and distance and compass bearing from the reference location.

c. Semi-annual and annual monitoring will involve documenting the condition of the relocated and reference corals and will minimally include the following:
   1) Photographing each colony with a ruler present for scale. At least one photograph should be above the colony from fixed distance to be able to estimate surface area of the colony. At least one photograph should contain the assigned unique identifier label.
   2) Colony size. For scleractinian corals, this will include measurement of the length (longest axis), width (perpendicular to longest axis), and height (in direction of growth) with a ruler graduated in millimeters. For octocorals, only height will be recorded.
   3) Overall health (i.e., presence of disease or bleaching or description of damage if salvaged post pipeline placement)
   4) Percent live and dead tissue.
d. Reporting
   1) The raw data on the status and location of corals relocated prior to the pipeline placement or during post pipeline placement salvage efforts will be submitted within 60 days after completion of the post pipeline placement salvage work is completed. A summary report will be submitted within 90 days.
   2) Raw data from the semi-annual and annual monitoring will be submitted within 60 days upon completion of monitoring. A summary report will be submitted on an annual basis for the duration of the 3 year monitoring.

A. Post-Construction Pipeline Removal Assessment

This Post-construction pipeline removal assessment will only be conducted if damage was observed by RER biologist during the post-placement survey (Section A above.). The contractor will notify RER a minimum of 48 hrs prior to, and within 24 hours of the completion of, removal of the pipeline location.

1. The contractor will provide to RER coordinates of the pipeline immediately prior to removal. Additionally the contractor may be requested to place marker buoys spaced at 200’ intervals to mark the true location of the pipeline. The buoys are to remain in place until the post assessment is complete.
2. Video documentation of impact. Qualified biologist will document the condition of the corridor after pipeline removal via video camera. The video survey will cover the entire length of the corridor where the pipeline was on or over hardbottom and will cover the ‘aerial’ width where the pipeline was placed.

3. Quantification of impact. In any areas identified as impacted, qualified biologists will also survey the pipeline's length to determine the actual impact to the bottom and benthic resources.
   a. The width of the path will be considered the area within which the limestone "bedrock" has been cleared and exposed, and/or benthic organisms directly in the path or adjacent to the pipeline are crushed, fractured, abraded, heavily bleached or otherwise damaged.
   b. Impact to organisms and areas of benthic damage will be quantified by direct measurement and will include:
      1) Measurement of all fractured, abraded, bleached or otherwise impacted scleractinian corals.
      2) Count of all damaged (abraded, broken, loose) octocorals.
      3) Measurement of fractured, scarified, abraded or otherwise damaged substrate, where encrusting or low-profile organisms were growing.
      4) Digital photographs will be taken as warranted.
   c. Impact from the pipeline will be the total sum of impacts to scleractinian coral, octocorals, and substrate after the placement of the pipeline (initial post-placement survey, and whatever was not remediated after the impact) and after removal. The calculated area of damage and subsequently used to calculate mitigation requirements.

B. **Reporting**

Weekly progress reports will be submitted via e-mail as needed during relocation efforts both before and after pipeline placement. Raw data collected before and after pipeline placement will be submitted within 90 days upon completion of the monitoring. A summary report documenting the impacts associated with the pipeline placement along with a summary table including all data will be submitted within 90 days of the post-construction Pipeline Removal Assessment.

Appendix C. Sample quadrat fieldsheet.

Project Name			**Site Name / Transect Name**		
Date			**Data Collector**	**Data Entry**	

Quad Label: **Sample Name or #**		List indiv coral sp. size (cm), Macroalgae Genus %, Clionaid spg sp. % + Cyano %	% cover or max size (cm)	**Quad Label:** **Sample Name or #**		List indiv coral sp. size (cm), Macroalgae Genus %, Clionaid spg sp. % + Cyano %	% cover or max size (cm)
Max Relief (cm)				Max Relief (cm)			
Max Sediment Depth (cm)				Max Sediment Depth (cm)			
Sessile Benthos...	**% Cover**			**Sessile Benthos...**	**% Cover**		
Sediment- (circle all: sand shell mud)				Sediment- (circle all: sand shell mud)			
Macroalgae- Fleshy+Calcareous				Macroalgae- Fleshy+Calcareous			
Turf-algae+cyanobacteria				Turf-algae+cyanobacteria			
Encrusting Red Algae				Encrusting Red Algae			
Sponge				Sponge			
Hydroid				Hydroid			
Octocoral				Octocoral			
Stony Coral				Stony Coral			
Tunicate				Tunicate			
Bare Hard Substrate				Bare Hard Substrate			
Clionaid sponge present?	Y or N			Clionaid sponge present?	Y or N		
other-...				other-...			
Total Must = 100%				Total Must = 100%			

Quad Label: **Sample Name or #**		List indiv coral sp. size (cm), Macroalgae Genus %, Clionaid spg sp. % + Cyano %	% cover or max size (cm)	**Quad Label:** **Sample Name or #**		List indiv coral sp. size (cm), Macroalgae Genus %, Clionaid spg sp. % + Cyano %	% cover or max size (cm)
Max Relief (cm)				Max Relief (cm)			
Max Sediment Depth (cm)				Max Sediment Depth (cm)			
Sessile Benthos...	**% Cover**			**Sessile Benthos...**	**% Cover**		
Sediment- (circle all: sand shell mud)				Sediment- (circle all: sand shell mud)			
Macroalgae- Fleshy+Calcareous				Macroalgae- Fleshy+Calcareous			
Turf-algae+cyanobacteria				Turf-algae+cyanobacteria			
Encrusting Red Algae				Encrusting Red Algae			
Sponge				Sponge			
Hydroid				Hydroid			
Octocoral				Octocoral			
Stony Coral				Stony Coral			
Tunicate				Tunicate			
Bare Hard Substrate				Bare Hard Substrate			
Clionaid sponge present?	Y or N			Clionaid sponge present?	Y or N		
other-...				other-...			
Total Must = 100%				Total Must = 100%			

Standard Abbreviations:	Macroalgae: Pool to Genus = Genu or Genus: Avra, Bryopsis, Bryothamnion, Caul, Codi, Dasya, Dasycladus, Grac, Hali, Hypn, Sarg...
and abbreviation formats	Octocoral: Genus of each colony = Genu: Gorg, Lept, Plex... except Pseudopterogorgia=Pspt, Plexaurella=Plla, Pseudoplexaura=Pspl
	Stony Coral: Genus species of each colony = G spe: A cer, A aga, C nat, M ann, M cav, P ame, O dif, S rad, S sid, S bou, S hya, S int...
	Coral condition: W=white disease(s), O=other disease(s), B=bleaching, Coral Stress Index # 0 1 2 3
	Other- includes: Anemone, Wormrock, Annelid (excluding wormrock), Barnacle, Bivalve, Bryozoan, *Millepora* sp., Seagrass, Zoanthid.