BIOLOGICAL MONITORING PLAN

For The

BROWARD COUNTY SHORE PROTECTION PROJECT,

SEGMENT III

FDEP PERMIT NUMBER: 0163435-001-JC

FDEP PERMIT NUMBER: 0226688-001-JC

U.S. ARMY COE PERMIT NUMBER: SAJ-1999-5545 (IP-SLN)

Introduction

This BIOLOGICAL MONITORING PLAN was prepared in compliance with the Broward County SHORE PROTECTION PROJECT (Segment III) Florida Department of Environmental Protection (FDEP) Permit No.: 0163435-001-JC; Specific Condition 9.d.

The proposed SHORE PROTECTION project involves:

1) Nourishment of the beach at John U. Lloyd State Park from R-86 to R-92;
2) Nourishment of the beach at Hollywood/Hallandale from R-98 (Dania Beach Pier) to R-128 (Broward/Dade County line);
3) Installation of a spur connected to the south jetty of Port Everglades Inlet;
4) Installation of two T-head groins in John U. Lloyd State Park;
5) Construction of 8.9 acres of artificial reef as mitigation;
6) Transplantation of scleractinian corals from the impacted areas to 0.67 acres of mitigation reef within Segment III.

As required by Specific Condition 15 of the above referenced permit This BIOLOGICAL MONITORING PLAN consists of:

1) Sedimentation surveys of the reef edges adjacent to the borrow areas before, during and after the construction phase;
2) pre-construction and post-construction surveys of the pipeline corridors to document impacts to hardbottom communities along the routes, and bi-weekly inspections of the pipelines during construction to check for leaks;
3) a long-term, County-wide reef community health assessment;
4) construction phase and long-term post-construction surveys of the nearshore hardbottom to monitor for secondary impacts;
5) a long-term mitigation monitoring program, which includes monitoring of epibenthos, including transplanted corals and coral recruitment, fish, and algal recruitment; and
6) a construction phase and long-term post-construction sea turtle monitoring program. (Broward County Beach Nourishment Project (Segment III) FDEP Permit No.: 0163435-001-JC)

1.0 REEF EDGE SEDIMENTATION MONITORING AND CORAL STRESS SURVEYS INCLUDING ACCUMULATED SEDIMENT DEPTH MEASUREMENT AND OBSERVATIONS OF SEDIMENT STRESS ON INDICATOR CORAL SPECIES.

1.1 SEDIMENT MONITORING SITES

1.1.1 On the reef adjacent to each borrow area, when an adequate area or distance of reef substrate is present at the eastern and western edges of the borrow area in question (e.g. Borrow Area II has very little reef habitat on its' western side), CONSULTANT (Consultant for this portion of the Biological Monitoring Plan is

Nova Southeastern University Oceanographic Center – NSUOC) will establish, normal to the borrow orientation, 3 quadrats, one 10 meters from the reef edge, one 20 meters from the reef edge, and one 30 meters from the reef edge. Each quadrat will be 3 square meters in area (divided into 4 sub-quads, 0.75 x 1 meter each) and will have at least three centerline orientation pins along the east-west axis for occupation and re-occupation of the quadrat with a photo quadrat platform (Figures 8 & 9 and the pins shall be the same as described in Section 3 below). The following list of borrow areas (Figures 1-5) will have the indicated number of sediment monitoring sites (SM sites): BA1 - 3 east, 3 west (numbered BA1SM1-6); BA2 - 3 east, 3 west (numbered BA2SM1-6); BA3 - 3 east, 3 west (BA3SM1-6); BA4 - 2 east, 2 west (BA4SM1-4); BA6 – 2 east, 2 west (BA6SM1-4). Additionally, there will be 8 control sediment monitoring sites, three in the area at the BOCA permanent reef monitoring site (26^0 20.8030' N, 80^0 03.8830' W) north of the Boca Raton Inlet (BOCA-SMC1-3), and one each on the reefs at or adjacent to permanent reef monitoring sites FTL1, FTL2, FTL3, FTL5 and FTL6 (FTL1SMC, FTL2SMC, FTL3SMC, FTL5SMC, and FTL6SMC). This is a total of 34 sites (SM site locations in Lat/Long and State plane values are listed in Table 1). Once per week starting 8 weeks before construction of Segment III, once per week throughout construction of Segment III and once per week for 8 weeks after construction of Segment III CONSULTANT shall visit each of these sediment monitoring locations for each borrow area for qualitative biological assessment. CONSULTANT shall conduct photography of the substrate every other week and use these images as a record of each of the reef sites. Results shall be reported to COUNTY and to the Permit agencies once per week. All sites will be revisited, photographed and examined for cumulative sediment impact 6 months after construction of Segment III and again one year after construction of Segment III. Broward County Environmental Protection Department (EPD), Biological Resources Division will also visit SM sites BA3SM1 and BA3SM2 an additional one time per week during the first 28 days of dredge operations in compliance with COE permit conditions.

1.1.2 At each quadrat that is 10 meters from the reef edge CONSULTANT shall establish two sediment accumulators (Figure 10) consisting of a stainless steel (or otherwise suitable material) plate mounted on a concrete building block and cemented to the reef substrate. The orientation of the plate surface will be level and not follow the contour angle of the reef substrate at the deployment location. During each weekly visit the CONSULTANT shall measure the sediment depth in each accumulator plate to the nearest 0.5 mm. The first plate will be cleaned off at each week's visit and the second plate will not, allowing a comparative measurement of net accumulated sediment depth with week long sediment depth. Sediment depth will be measured and recorded as an average of 5 measurements at 5 locations on each of the plates. If any two of the week long plates (Sediment Collection Plate #1) at any individual borrow area has an average measure of 1.5 mm depth of sediment per day or greater then the CONSULTANT shall notify the COUNTY within twenty-four (24) hours which Borrow Area(s) and which Sediment Monitoring Sites (SM's) have met the above

threshold. The COUNTY will then turn off that (or those) Borrow Area(s) from usage for a week. Upon the next week's re-measure of the week long plate (Plate #1), if the accumulated sediment is then less than an average of 1.5 mm per day, then usage of that borrow area can resume. Work for this service for Segment III will start with 2 months survey of preconstruction conditions, continued monthly surveys during the construction of the beach, followed by two months of post construction surveys.

1.1.3 CONSULTANT shall also install one additional sediment accumulator plate at each of the four (4) Sediment Monitoring Sites surrounding Borrow Area 6 (Figure 4). These four (4) (BA6SMC 1-4) Sediment Monitoring Sites will be visited every day (if dredge and fill construction is conducted with 2 dredges) or every other day (if dredge and fill construction is conducted using a single dredge) during the first twenty-eight (28) days of beach construction dredge and fill activity utilizing Borrow Area 6. The results of this daily or bi-daily sediment accumulator monitoring will be compared to the weekly sediment monitoring conducted during the same time period. CONSULTANT shall also make daily or bi-daily observations of stress indicators on coral species as described below.

1.2 CORAL STRESS OBSERVATIONS AND INDEX DEVELOPMENT

1.2.1 At each of the Sediment Monitoring Sites (treatments and controls, 34 sites total, 3 quads per site, 4 sub-quads per site quad) CONSULTANT shall make weekly observations of stress indicators on coral species to determine the influence of sediment suspension and fallout on coral bleaching, coral mucus production and coral polyp extension. Stress indicator “index values” will be assigned by the CONSULTANT and are designed to evaluate the level of polyp extension, mucus production, and/or bleaching. A level of 0 represents minimal to low stress and a level of 3 represents advanced to acute stress. A threshold value for each stress indicator was determined during developmental laboratory experiments conducted prior to commencement of dredging activity for target stony coral species *Montastrea cavernosa* (great star coral), *Solenastrea bournoni* (smooth star coral), and *Siderastrea spp*. (starlet corals). The threshold “stress value” developed in the laboratory for this project is 1.5 on a scale of 0 – 3. Initial field observations starting 8 weeks before construction of the beach begins will use this threshold value. Each quadrat will have at least two specimens to be monitored. These two specimens can be represented by any combination of two individuals of the species listed above.

1.2.2 CONSULTANT shall also develop laboratory and field protocols for histological analysis of coral tissues from these species to determine and/or measure tissue thickness, the presence or absence of mucus cells, and the presence or absence of zooxanthellae. These will be compared to developed stress indicator “index values”. Histological tissue collection will commence at sediment monitoring sites for any borrow area that has accumulated daily average sediment values below 1.5 mm and visual observations have shown that two out of the three

average stress indicator index values for any two of the borrow area sediment monitoring sites are above the laboratory determined threshold. Additionally, should sediment accumulation as described above, not be enough to close a borrow area but should visual observations show that the average stress indicator index values for any two of the borrow area sediment monitoring sites exceed the laboratory determined threshold then the CONSULTANT shall notify the COUNTY within twenty-four (24) hours which borrow area and which sediment monitoring sites have exceeded that threshold. This threshold level shall be adaptive and dependant upon both the initial development experiments and upon continuing tissue analysis and calibration of field collected specimens. The COUNTY will then turn off that (those) borrow area(s) from usage for one week. Upon the following week's re-measure of the appropriate sediment collector plates and observations of the stress indicator index values, if the accumulated sediment in the weekly plate is less than an average of 1.5 mm per day and the average stress indicator index value is less than the specified observational threshold then usage of the that borrow area can resume.

1.2.3 **Executive Summary of the Experimental Development and Implementation/Calibration of a Tissue-Based Indicator and Stress Index Values for Sedimentation Impacts in Scleractinian Corals.**

The laboratory study was aimed at developing an experimental rating scale (Stress Index) to assess coral and coral tissue responses to increased sedimentation, with potential application as a tool for biomonitoring during dredging activities. Thirty-two colonies of each *Montastraea cavernosa*, *Solenastrea bournoni*, and *Siderastrea siderea* were collected from the local reefs, laboratory-acclimated, and randomly assigned to experimental groups (treatment vs. control). Four specimens of each species were placed in each of eight 20 gallon tanks, for a total of 4 treatment tanks and 4 control tanks. Treatment specimens were exposed to applications of locally collected sand at a rate of approx. 200–225 mg cm^{-2} day^{-1}, during a four-week period.

The gross morphological condition of treatment and control corals was carefully examined daily to assess general condition and stress responses to increased sedimentation. Observations and assessment were conducted taking into consideration, but limited to the following criteria: 1) polyp swelling; 2) changes in polyp extension/retraction; 3) changes in coloration (intensification, and/or bleaching); 4) loss of natural texture lines; 5) algal and fungal overgrowth; and 6) lesions and/or tissue necrosis. Additionally, at the end of each week, one specimen of each species from each tank was randomly selected for histopathological studies. Prior to fixation, each specimen was photographed, and the digitized picture semi-quantitatively scored on scale of 0 to 3, based on the above criteria. Specimens for histology were fixed and processed following standard procedures, stained with H&E, and examined under the light microscope at three different polyp regions: outer epidermis and oral disk, middle polyp, and lower polyp. The histopathological condition of tissues for each

species was semi-quantitatively scored on a scale of 0 to 5 (for *M. cavernosa*) or 0 to 4 (for *S. siderea* and *S. bournon*i), based primarily on the following criteria: 1) swelling of mucous secretory cells (MSC) and changes in staining properties of mucous secretions, 2) changes in the appearance of the epidermal columnar cells, 3) accumulation of cell debris and tissue granularity, 4) changes in zooxanthellae densities (increase or decrease) and/or zooxanthellae degeneration, 5) swelling of the calicoblastic epithelium, 6) associated organisms; protozoa, algal and fungal infiltrates, and 7) necrosis.

Results indicated that all specimens experienced some degree of stress due to tank conditions, and there was much variability in gross morphological condition of control and sanded specimens for all species throughout the duration of the experiment. Statistically significant ($p<0.05$ Mann-Whitney rank sum) differences between treatments and among weeks ($p< 0.05$ Kruskal-Wallis analyses of variance) were only observed for *M. cavernosa*. For *S. bournoni* and *S. siderea*, statistical differences ($p<0.05$ Mann-Whitney rank sum) in gross morphological condition between treatments were apparent only for week 1 and week 4, respectively.

Histopathological examination of sanded and control corals also revealed a great deal of within and between treatment variability for all the species. Nonetheless, the histopathological condition scores were consistently higher in sanded vs. control specimens of *M. cavernosa* and *S. bournoni*, and those differences were statistically significant ($p<0.05$; Mann-Whitney rank sum test). With increasing stress, the outer epidermis in these species showed a clear tendency for atrophy, progressing from swelling of the MSC, to increased granularity of columnar cells, to thinning and decreased number and size of MSC. In addition, the gastrodermal cells in the middle and lower polyp regions exhibited increasing granularity and debris and thickening of the calicoblastic epithelium. Algal and fungal infiltrates also proliferated; they were observed in both control and treatment corals, however, more prevalent and insidious in sanded corals. Tissue condition scores for *S. siderea* also revealed statistically significant differences between sanded and control corals, however only for week 1. Suboptimal laboratory conditions may have yielded the above results.

Rank correlations analyses between gross morphology condition scores and histopathological condition scores revealed statistically positive and statistically significant levels of association between these two variables for all three species ($r = 0.64$ for *M. cavernosa*; $r = 0.82$ for *S. bournoni*, and $r = 0.65$ for *S. siderea*; $p<0.05$, Pearson Rank Correlation). These results indicated that there was a good degree of correspondence between external morphological changes and tissue changes, and that coral gross morphological condition assessment may be used as a proxy for histopathological condition, and vice-versa.

Based on the above results, an adaptive, four-tiered, Stress Index was developed to describe and assess coral health status in the field during the

dredging activities of the Broward County Shore Protection Project, Segment III. This system is provisional and considers the type and severity of morphological and histopathological changes observed in the experimental corals above. For example, specimens with clear structural integrity, and no observable lesions, swelling, or mucus sheets over their tissues are rated to be in excellent condition (a score of 0). Specimens exhibiting slight to moderate polyp swelling and increased mucus production, as well as swelling of MSC, cell debris, and zooxanthellae degradation, can be rated to be in good condition or moderately stressed (score of 1). Specimens exhibiting apparent changes in coloration (e.g., intensification, patchy discoloration and/or bleaching), advanced swelling or tissue thinning, and cellular atrophy, such as increased granularity and cell debris, degeneration of the epidermal muco-ciliary system, and swelling of the calicoblastic epithelium, can be rated to be in fair condition or markedly stressed (score of 2). Finally, specimens exhibiting severe tissue swelling (*S. siderea*) or thinning (*M. cavernosa*), extensive color changes (i.e., dullness or fully bleached), advanced tissue atrophy, and focal to multi-focal necrosis, are suggestive of irreversible changes or death, can be rated to be in poor condition or severely stressed (score of 3). This provisional Stress Index is an experimental, semi-quantitative, non-linear tool, which requires extensive field calibration and validation during the pre-construction and construction phases of the Broward County Shore Protection Project, Segment III. The initial coral stress index threshold value that will be used in the field is 1.5 based on the above described four step scoring scale of zero (0) to three (3).

SEDIMENT MONITORING (SM) SITE LOCATIONS					
SITE ID CODE		STATE PLANE NAD 83 (NAD83 US Feet)		LAT / LONG WGS 84 (degrees)	
1	BOCASMC 1 (control)	962103	732465	N 26.2074	W 80.0395
2	BOCASMC 2 (control)	962462	732819	N 26.2080	W 80.0388
3	BOCASMC 3 (control)	964903	732747	N 26.2079	W 80.0344
4	BA1SM1	959997	723472	N 26.1926	W 80.0435
5	BA1SM2	961920	723720	N 26.1930	W 80.0399
6	BA1SM3	962003	721686	N 26.1897	W 80.0398
7	BA1SM4	961800	720117	N 26.1871	W 80.0402
8	BA1SM5	959585	719433	N 26.1860	W 80.0443
9	BA1SM6	959777	721192	N 26.1889	W 80.0439
10	BA2SM1	959313	712922	N 26.1752	W 80.0449
11	BA2SM2	961188	712835	N 26.1751	W 80.0414
12	BA2SM3	960580	707453	N 26.1662	W 80.0426
13	BA2SM4	960181	702522	N 26.1581	W 80.0434
14	BA2SM5	958775	702297	N 26.1577	W 80.0460
15	BA2SM6	959278	709519	N 26.1696	W 80.0450
16	BA3SM1	961223	709311	N 26.1692	W 80.0414
17	BA3SM2	962091	709172	N 26.1690	W 80.0398
18	BA3SM3	963011	708321	N 26.1676	W 80.0381
19	BA3SM4	962837	706724	N 26.1650	W 80.0385
20	BA3SM5	960927	705838	N 26.1635	W 80.0420
21	BA3SM6	960997	707540	N 26.1663	W 80.0418
22	BA4SM1	958271	694779	N 26.1453	W 80.0470
23	BA4SM2	959799	694797	N 26.1453	W 80.0442
24	BA4SM3	959834	693807	N 26.1437	W 80.0442
25	BA4SM4	958132	693772	N 26.1436	W 80.0473
26	BA6SM1	956634	679226	N 26.1196	W 80.0502
27	BA6SM2	958248	679069	N 26.1194	W 80.0472
28	BA6SM3	957901	678289	N 26.1181	W 80.0479
29	BA6SM4	956721	678149	N 26.1179	W 80.0501
30	FTL1SMC (control)	952761	664478	N 26.0953	W 80.0575
31	FTL2SMC (control)	957106	664889	N 26.0960	W 80.0495
32	FTL3SMC (control)	958813	664424	N 26.0952	W 80.0464
33	FTL5SMC (control)	952733	660460	N 26.0887	W 80.0576
34	FTL6SMC (control)	952461	661149	N 26.0899	W 80.0581
NOTE: BOCASMC2 is the same location as reef monitoring site BOCA1 on the second reef in 30 ft depth, at 26 20.8030N lat, 80 03.8830W long. FTL1, 2, 3, 5, & 6 SMC are at the same locations as reef monitoring sites FTL 1, 2, 3, 5, & 6.					

Table 1. Reef Edge Sediment Monitoring Treatment and Control Site Locations.

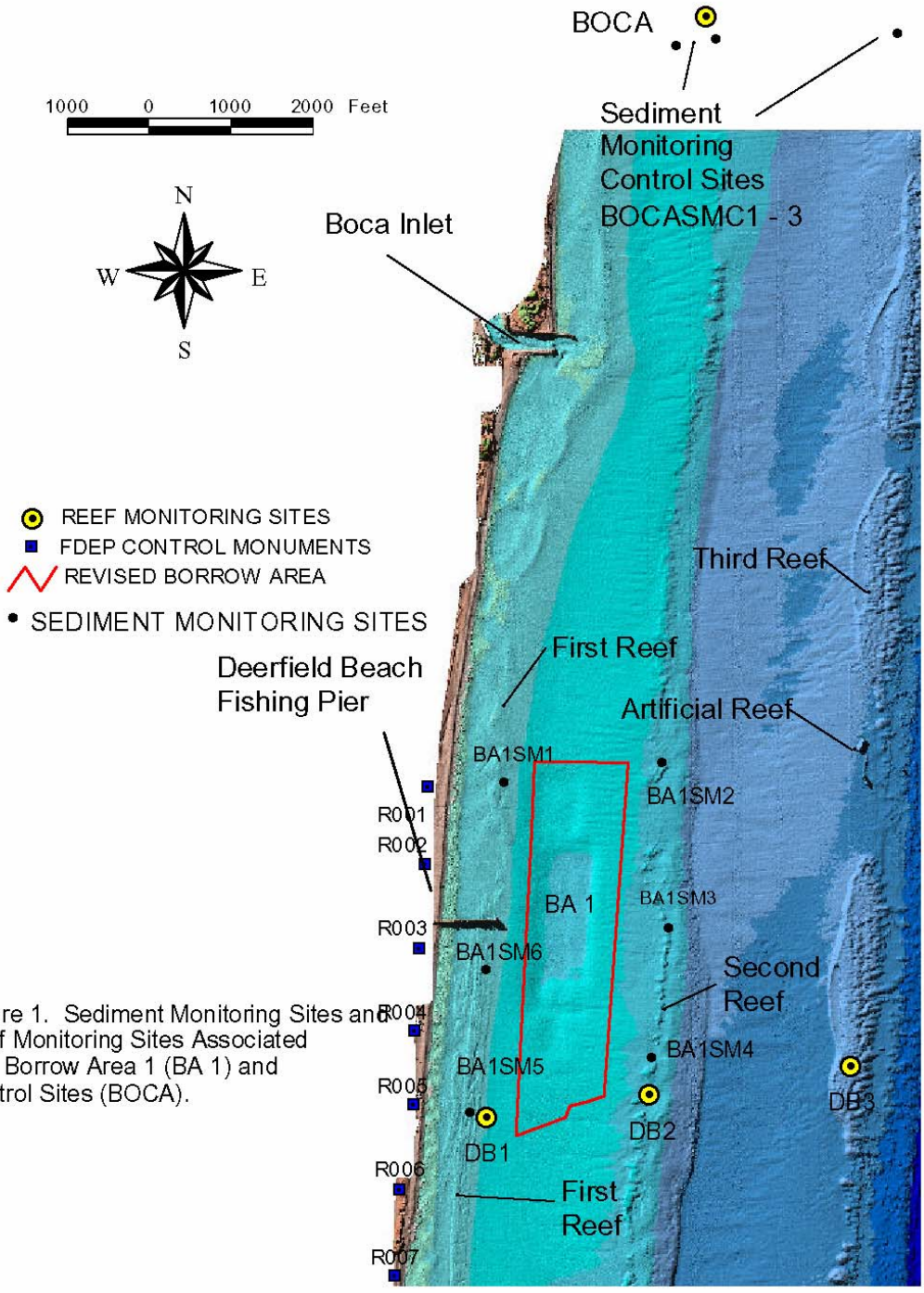


Figure 1. Sediment Monitoring Sites and Reef Monitoring Sites Associated with Borrow Area 1 (BA 1) and Control Sites (BOCA).

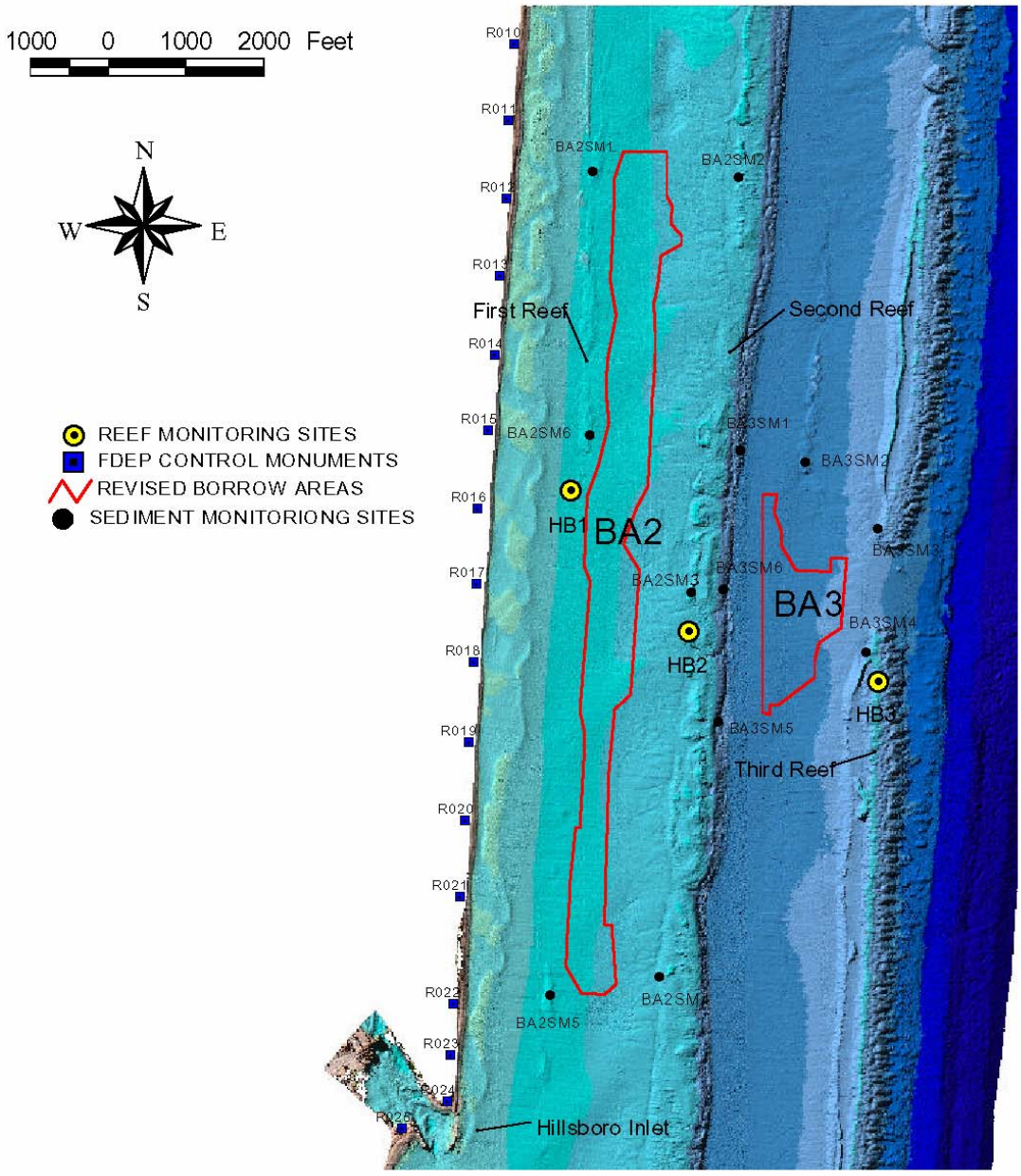


Figure 2. Sediment Monitoring Sites and Reef Monitoring Sites associated with Borrow Areas 2 and 3 (BA2 and BA3).

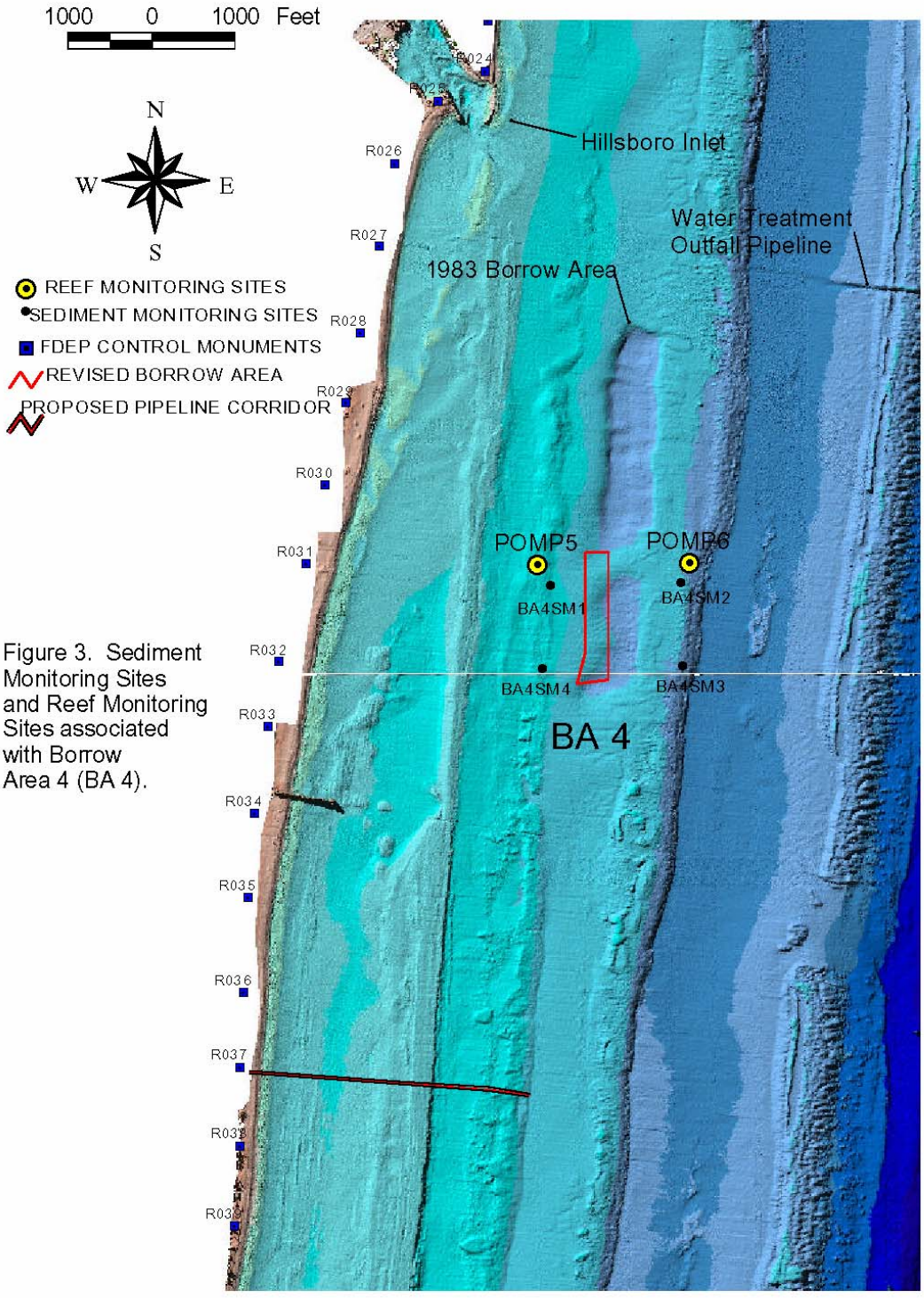


Figure 3. Sediment Monitoring Sites and Reef Monitoring Sites associated with Borrow Area 4 (BA 4).

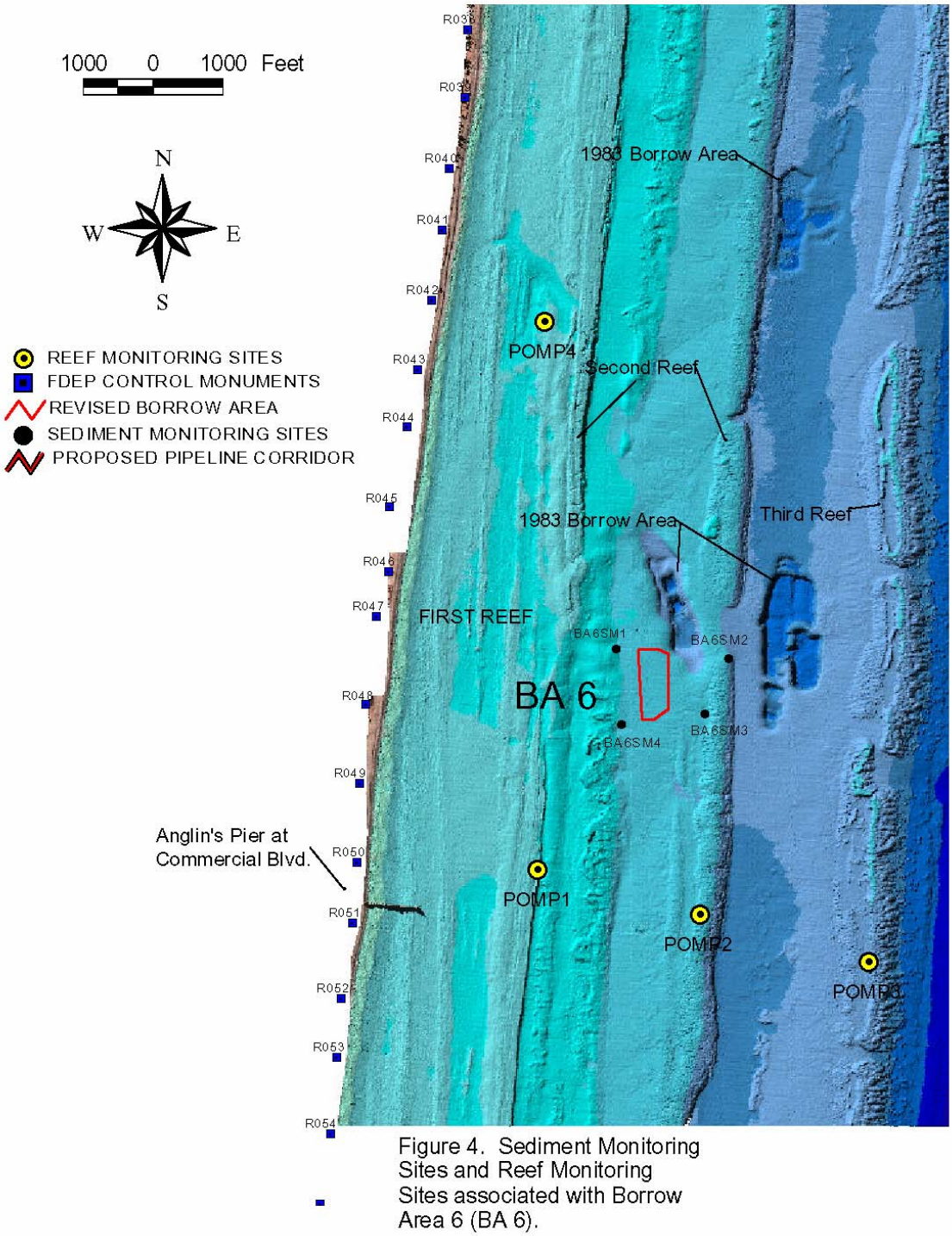


Figure 4. Sediment Monitoring Sites and Reef Monitoring Sites associated with Borrow Area 6 (BA 6).

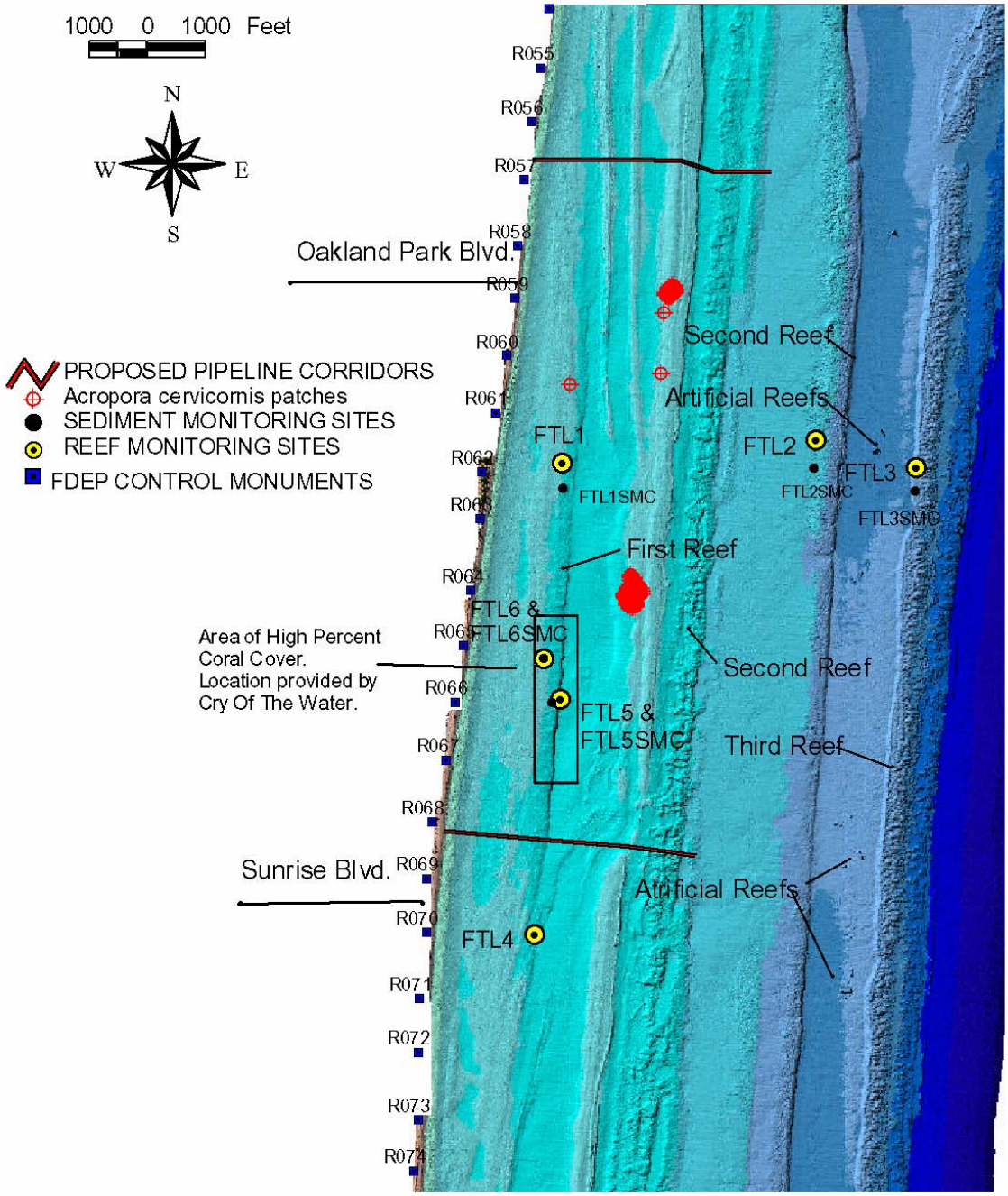


Figure 5. Sediment Monitoring Control Sites south of the Borrow Areas and Reef Monitoring Sites.

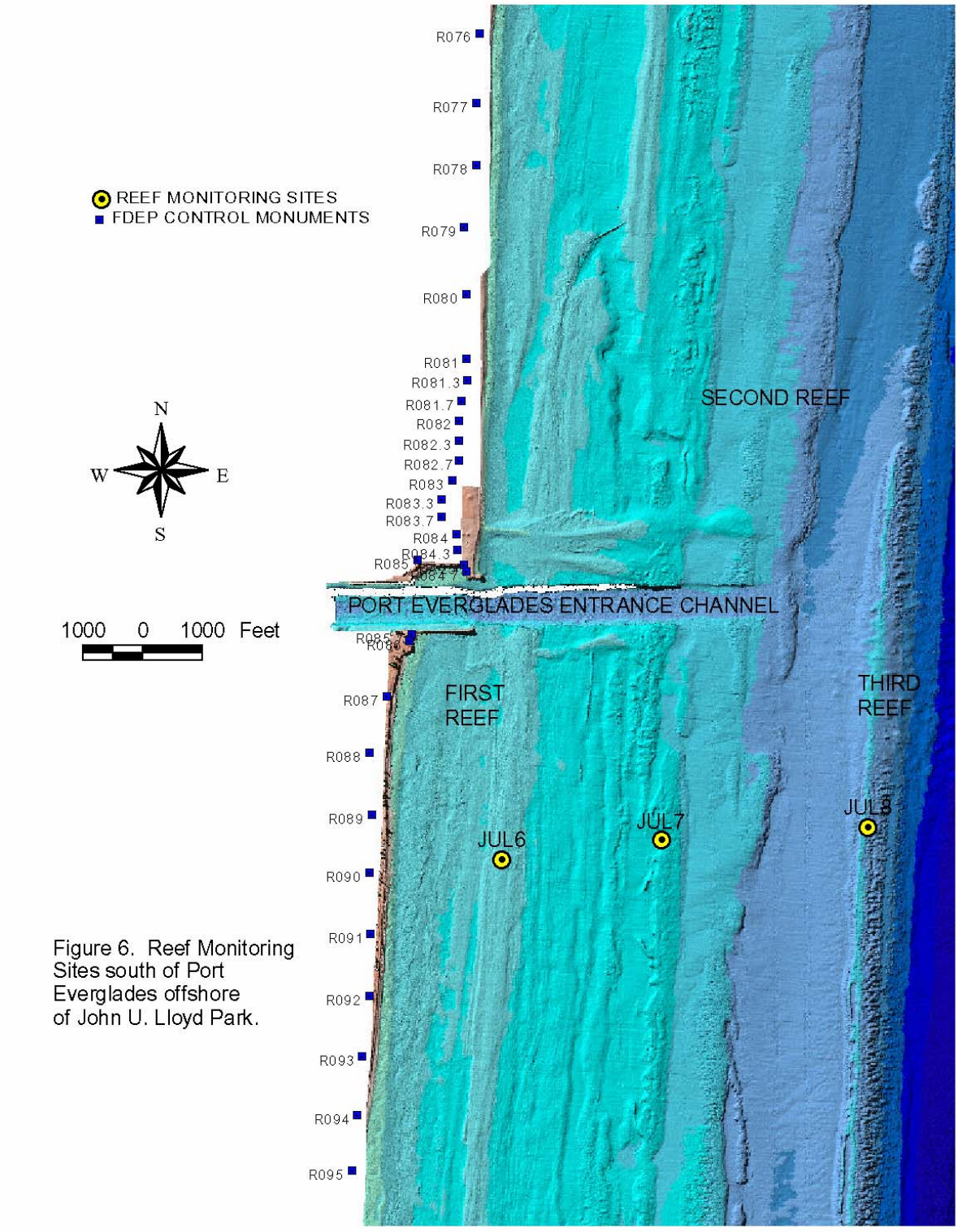


Figure 6. Reef Monitoring Sites south of Port Everglades offshore of John U. Lloyd Park.

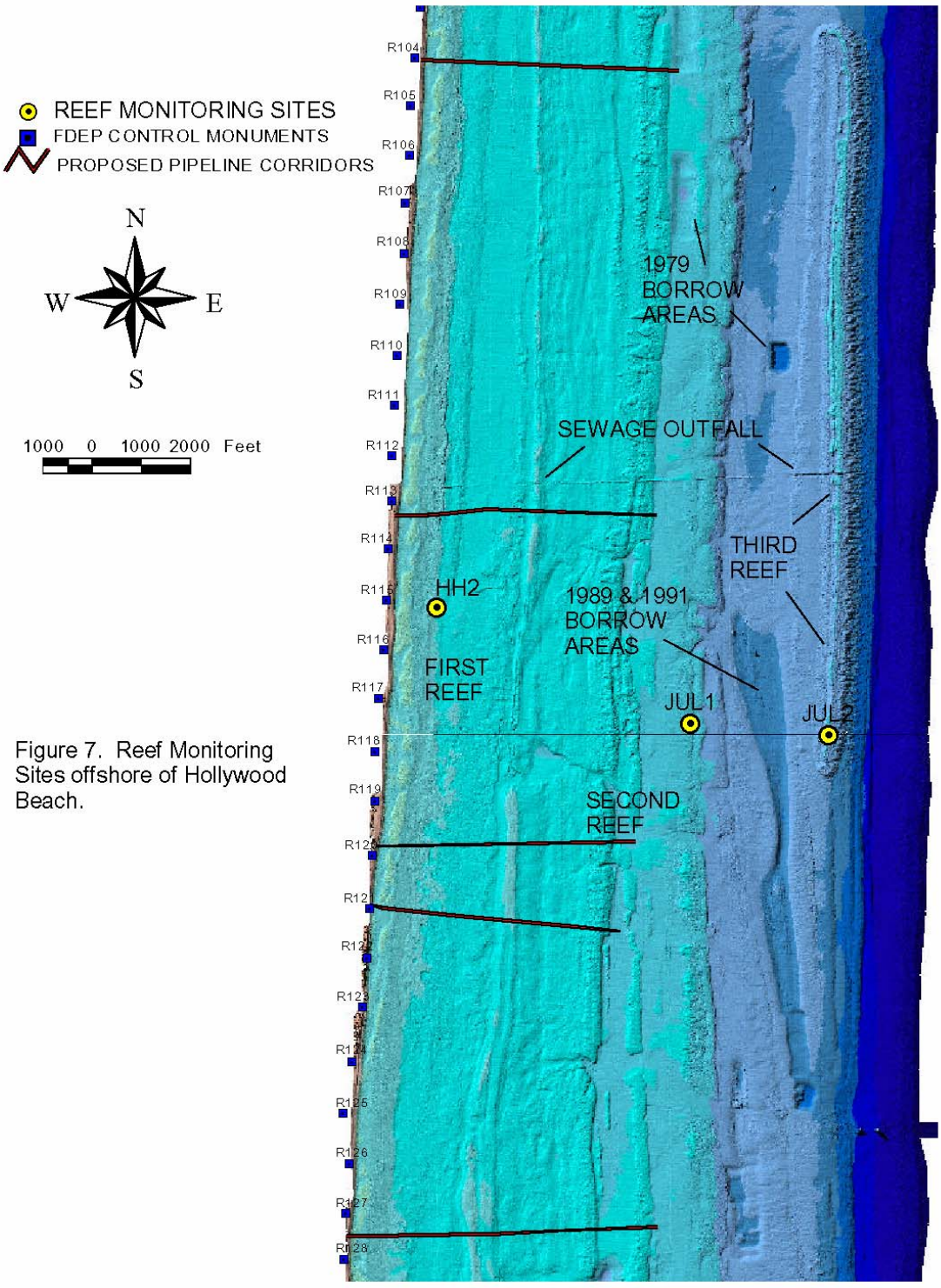


Figure 7. Reef Monitoring Sites offshore of Hollywood Beach.

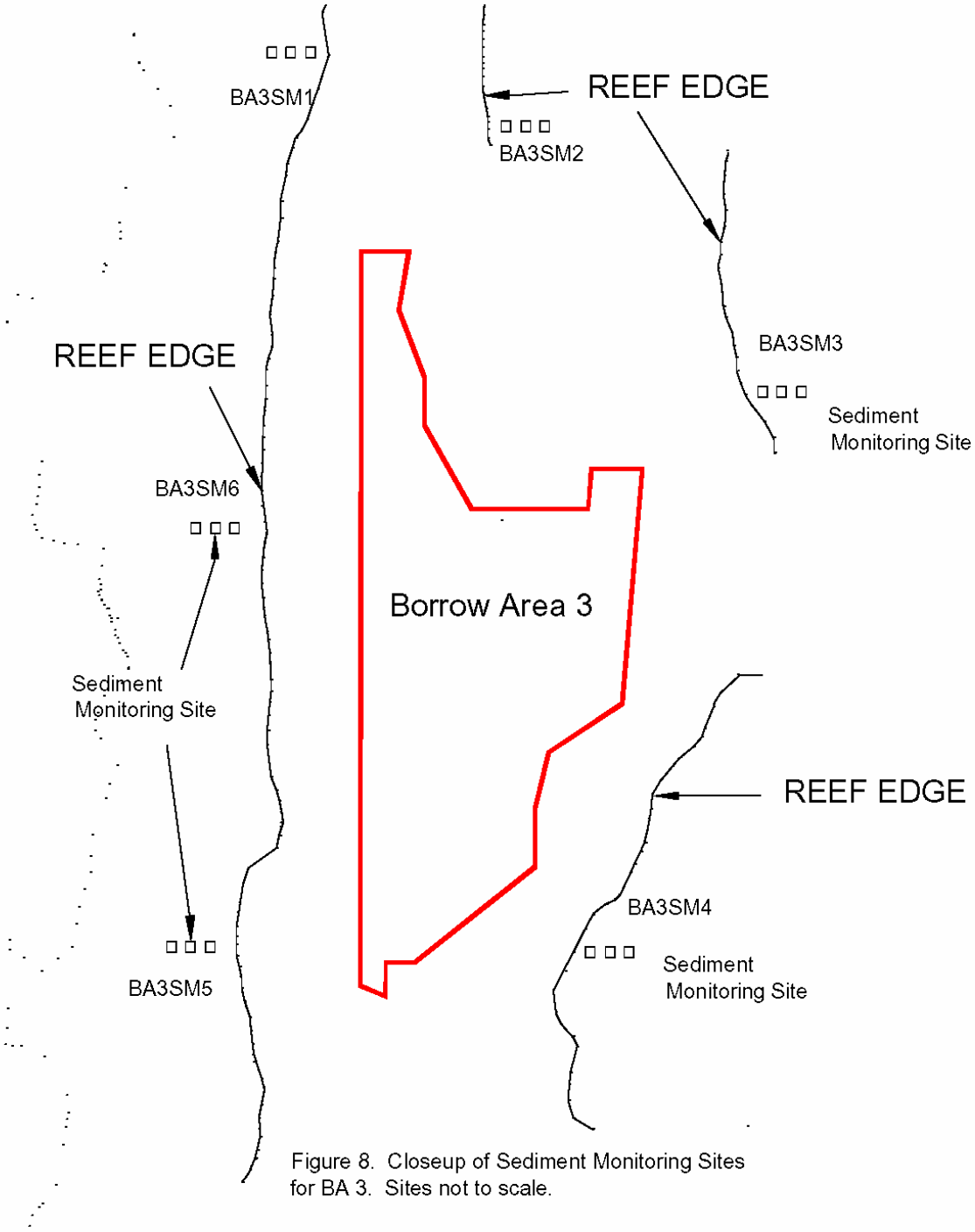


Figure 8. Closeup of Sediment Monitoring Sites for BA 3. Sites not to scale.

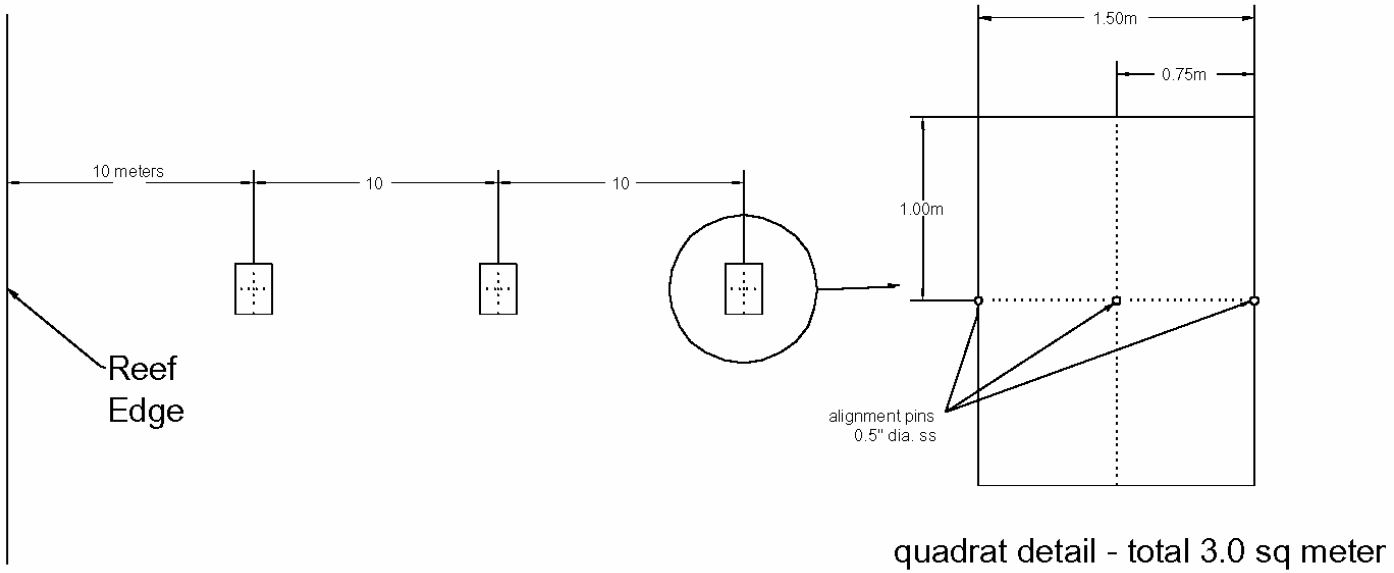


Figure 9. Typical Sediment Monitoring Site. Sediment trap ringstand and sediment collector plates will be located in proximity to quadrat that is ten meters from the reef edge.

Figure 10. Sediment fallout collector for measurement of accumulated depth (mm) of sediment. Two units will be placed at each 10 meter quadrat location (10 meters from reef edge) at all sediment monitoring sites. The first unit will be used for measuring weekly sediment depth and the second unit will be used to measure overall accumulated sediment depth. Pan is constructed of stainless steel with 0.75 inch high perimeter edge and will be attached to block with marine epoxy. Block will be attached to the reef substrate using Portland cement.

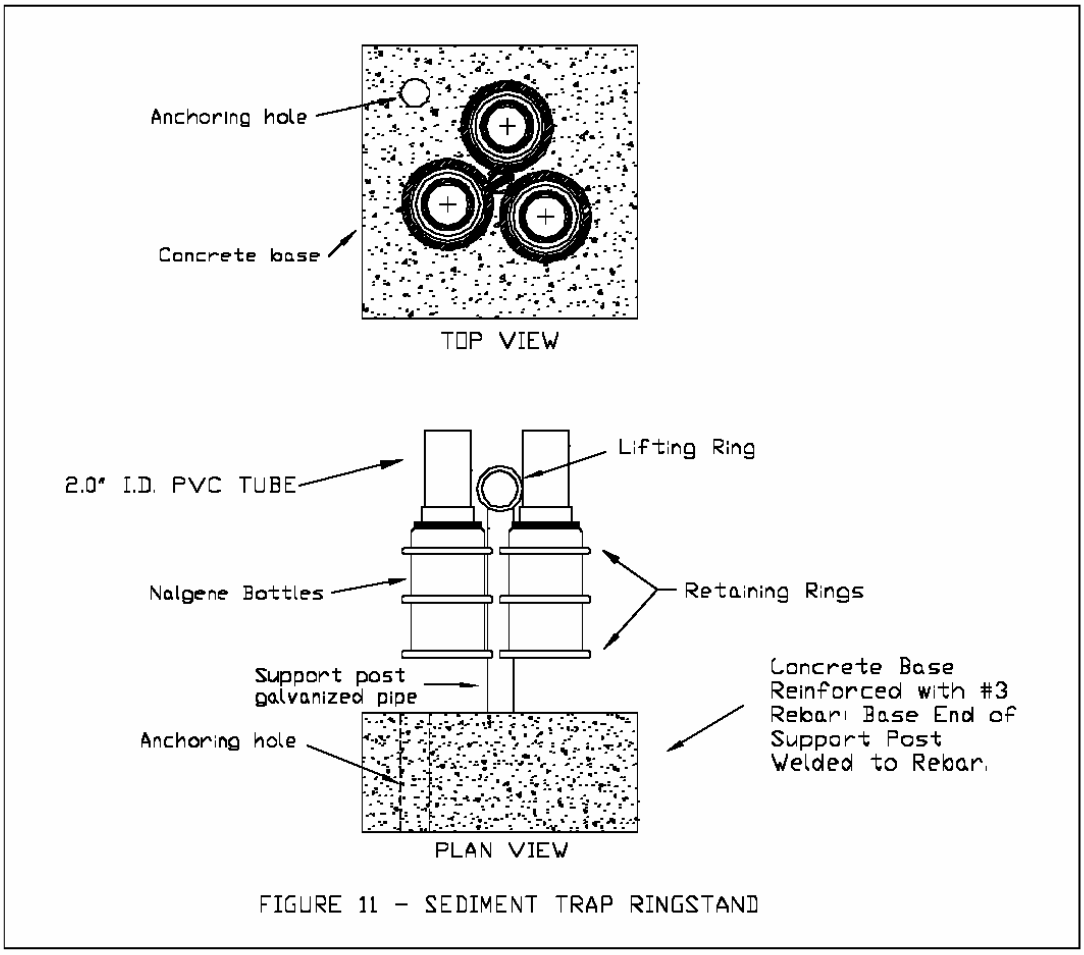


FIGURE 11 – SEDIMENT TRAP RINGSTAND

SEDIMENT MONITORING SITE DATA SHEET

SITE:	DATE:	DIVERS:

SEDIMENT DATA for Sediment Trays at 10 meter Quad

Measurement	Tray #1 (weekly)	Tray #2 (continuous)	BA6 tray #3 (daily)
1			
2			
3			
4			
5			
Average			
# of days			
Sed/day			

CORAL DATA (10, 20, & 30 meter Quads)

Colony #	Quad #	Species	Stress level (0-3, threshold level = 1.5)	Stress Notes
1				
2				
3				
4				
5				
6				
Average stress				

KEY: 10 meter quad is 10 meters from reef edge, 20 meter quad is 20 meters from reef edge. SS = *Siderastrea siderea*, SB = *Solenastrea bournoni*, MC = *Montastrea cavernosa* . Stress notes should include observations of mucus production, polyp swelling, changes in color.

NOTE: Coral tissue collection commences at sediment monitoring sites for the borrow area IF average Sed/day is below 1.5 mm and average stress value for any two (2) of the borrow area SM sites is above threshold level. If coral tissue collections are warranted note collection location referenced to transect and species collected.

NOTES

Figure 10b. Sediment monitoring site data entry sheet.

BC Shore Protection Project Sediment Monitoring Report Form

			Avg Sed Accumulation (mm/day)		Avg Coral Stress Index
Borrow Area	**SM Site No.**	**Date**	**Continuous**	**Weekly**	
1	1				
1	2				
1	3				
1	4				
1	5				
1	6				
			Avg Sed Accumulation (mm/day)		**Avg Coral Stress Index**
Borrow Area	**SM Site No.**	**Date**	**Continuous**	**Weekly**	
2	1				
2	2				
2	3				
2	4				
2	5				
2	6				
			Avg Sed Accumulation (mm/day)		**Avg Coral Stress Index**
Borrow Area	**SM Site No.**	**Date**	**Continuous**	**Weekly**	
3	1				
3	2				
3	3				
3	4				
3	5				
3	6				
			Avg Sed Accumulation (mm/day)		**Avg Coral Stress Index**
Borrow Area	**Continuous**	**Date**	**Continuous**	**Weekly**	
4	1				
4	2				
4	3				
4	4				

			Avg Sed Accumulation (mm/day)			Avg Coral Stress Index
Borrow Area	**Continuous**	**Date**	**Continuous**	**Weekly**	**Daily (1st month)**	
6	1					
6	2					
6	3					
6	4					

Conditions to turn off the usage of a Borrow Area:

1. If any two (2) of the weekly (Plate #1) collector plates at any individual Borrow Area has an average measure of 1.5 mm depth of sediment per day or greater.

OR

2. If visual observations of selected stony corals inside the SM site Quadrats show that the average stress index value for any two (2) of the borrow area SM sites exceed the laboratory determined threshold.

Figure 10c. Sediment Monitoring Report Form

2.0 PRE-CONSTRUCTION, CONSTRUCTION, AND POST-CONSTRUCTION IMPACT SURVEYS OF THE PIPELINE CORRIDORS

2.1 PRE-CONSTRUCTION PIPELINE CORRIDOR ALIGNMENT, ASSESSMENT, AND MONITORING

2.1.1 EPD will delineate pipeline alignment corridors that take into account the relative inflexibility of the submerged pipeline, and addresses the goal of avoiding and minimizing impacts to the hardbottom reef communities wherever possible. Pre-construction surveys have been conducted to document reef communities along the route corridors (Figure 7). CONSULTANT shall conduct inspections of the sand discharge pipeline corridors along the reef hardbottom areas traversed by the pipeline (Figure 7). There are five proposed pipeline corridors in Segment III, four primary corridors and one alternate. CONSULTANT will examine the reef habitat underneath each pipeline after the pipeline has been placed on the bottom and examine that same reef bottom habitat the day after the pipeline has been removed from that bottom location unless adverse weather conditions prohibit field activities (National Weather Service has issued either a “small craft should exercise caution” or “small craft advisory”). If field activities are delayed by weather, the CONSULTANT will complete the work as soon as weather conditions permit. (FDEP Permit No.: 0163435-001-JC; Specific Conditions 9.e. and 15)

The positioning system will be a Trimble AgGPS Global Positioning System (GPS) with Pro Beacon, or equivalent, interfaced to the HYPACK Hydrographic Data Collection and Processing program with correction from a U.S. Coast Guard Navigational Beacon. The locator automatically acquires and simultaneously tracks GPS satellites and precisely measures code phase and Doppler phase shifts and then computes time, latitude, longitude, height, and velocity once per second. The positioning data are tracked using the HYPACK, Inc. program, a state-of-the-art navigation and hydrographic surveying system. All data obtained is recorded on the computer's hard disk and copied to external memory at the end of each day.

A team of qualified COUNTY divers and/or their designees will be led by a biologist with a M. S. degree or higher (FDEP Permit No.: 0163435-001-JC; Specific Conditions 9.g.). The team will mark a route through the proposed corridor using a series of surface buoys. Video with State Plane coordinates (East Zone, NAD 83) and Date/Time overlay of the corridor will be taken by a diver before and after placement and will be acquired in a manner that allows for clear documentation of an area approximately 5.0 feet north and south of the optimal corridor. The location(s) where the pipeline or “collar” contacts hardbottom will be recorded using the positioning system described above. CONSULTANT shall count and identify to the lowest taxon reasonably achievable, all stony corals, octocorals, and fleshy sponge colonies visibly damaged or destroyed by the pipeline placement. CONSULTANT shall also

video-document the impact of the pipeline placement on the reef habitat in each deployment area. When the pipeline is removed the area of contact will be measured and photographed.

2.1.2 Reporting prior to pipeline placement will take the form of direct coordination between COUNTY divers and/or their qualified designees and those COUNTY officials directly responsible for siting of the pipelines. Following pipeline placement the CONSULTANT shall submit to the COUNTY a report of the findings for each pipeline corridor, including, but not limited to, species lists and video-documentation, within two weeks of field investigation of the area. Record handling will follow General Condition 14. and Specific Condition 9.e. (FDEP Permit No.: 0163435-001-JC).

2.2 CONSTRUCTION PHASE PIPELINE MONITORING

COUNTY will conduct bi-weekly inspections of the pipelines during construction to check for leaks and irregular conditions. (FDEP Permit No.: 0163435-001-JC; Specific Conditions 9.e. and 15, COE permit special condition #15).

A diver will swim the entire length of the pipeline from the point furthest offshore to the nearshore hardbottom edge. Every other inspection will be video taped. The video will be acquired in a manner that allows for clear documentation of an area approximately 5.0 feet north and south of the pipeline route. The camera will be set to fully automatic operation, maximum wide-angle, and “steadyshot”, recording at 30 frames each second. The diver will record the location, the nature, and extent of any leaks or irregular conditions using the positioning system described in method 2.1.1. The diver will immediately report the location(s) and description(s) of all leaks or irregular conditions to the on-scene project manager.

Record handling will follow General Condition 14. and Specific Condition 9.e. (FDEP Permit No.: 0163435-001-JC). Reporting frequency on method 2.2.2 will be two-fold. Weekly summaries will be prepared using Specific Condition 13 (FDEP Permit No.: 0163435-001-JC) as a template. Leaks or irregular conditions will be immediately reported to the highest-level EPD official on-scene.

3.0 LONG-TERM, COUNTY-WIDE REEF COMMUNITY HEALTH ASSESSMENT

3.1 A long-term study has been undertaken to monitor Broward County, Florida (southeast Florida) coral communities, reef fish assemblages and sedimentation rates in relation to possible effects from the Broward County Shore Protection Project. Coral communities and reef fish assemblages are monitored once per year during the months of September and October at a total of 25 stations distributed offshore of Broward County (Figures 1-7 above and Table 2 below). This annual monitoring effort characterizes and quantifies populations of scleractinian (stony) corals, octocorallian (gorgonian, soft) corals, porifera

(sponges) and reef fishes. In addition, sediment traps located at each station are sampled and analyzed every 60 days.

3.2 ANNUAL SITE VISITS.

Annual site visits shall be conducted in September or October of each year of the Project. During each site visit, CONSULTANT shall perform the following:

3.2.1 Coral Community Transects. At each of the Twenty-five (25) reef monitoring sites (Figures 1-7 above and Table 2 below) a permanent belt-quadrat transect has been established. Each transect consists of Twenty-one (21), eighteen (18) inch long, one-half (0.5) inch diameter, stainless steel pins fixed in the bottom with marine, two-part epoxy or Portland Cement, exactly one (1.0) meter apart (+/- 1.0 cm) in a straight line where ever possible. Transect analysis at each site will be consistent with methodology described by Dodge, et al. (1982). A minimum of Thirty (30) square meters of bottom will be analyzed at each site. After field data collection the following calculations and analysis will be conducted for each transect data set: Stony coral species density (colonies/m^2), diversity and evenness using Shannon-Weaver index calculations, Diversity and evenness for percent live polyp coverage, and density of octocorallia and porifera (colonies/m^2).

3.2.2 Fish Population Analysis. At each of the 25 reef monitoring sites, CONSULTANT shall conduct fish population assessments. Fish population assessments will be conducted as per methodology described in Bohnsack and Bannerot (1986) and

Bortone, et al, (1989). Two (2) Thirty (30) meter long transects for fish counts and one fifteen (15) meter diameter cylinder (for stationary counts) will be conducted. The Thirty (30) meter transects will be established by adding ten (10) meters to the existing coral transect lines (these are already Twenty (20) meters long). A second transect for fish census will be conducted from one end of the first line and perpendicular to the first line in a direction along the reef that will provide maximum topographical change. Populations of fishes will be counted one meter on either side of the transect line and two meters above the line. The center for the stationary counts will be established Seven and one-half (7.5) meters from the start point of the first line. Species counts will be to the lowest taxon that conditions allow and size (total length) estimates will be by class range (0-2, 2-5, 5-10, 10-20, 20-50, >50 cm).

3.2.3 Sediment Trap Analysis. CONSULTANT shall change out each ringstand (Figure 11 above) sediment trap at each of the twenty-five (25) reef monitoring sites every sixty (60) days during the term of the Agreement, for a minimum of six (6) change-outs per year. Ten (10) additional sediment trap ringstands will be installed at Sediment Monitoring Survey sites adjacent to the sand source borrow areas and monitored as per the methods in this section starting sixty-days prior to commencement of beach renourishment construction. Analysis of trap

contents will be conducted as per Standard Operating Procedures (SOPs) published and archived by Broward County (SOP No. ERO-019, and SOP No. ERO-037).

3.2.4 The first four years of annual monitoring results of coral transect analysis, fish count transect analysis and sediment trap analysis are available at the following web site locations:

http://www.broward.org/bri01717.pdf (year one report)
http://www.broward.org/bri01718.pdf (year two report)
http://www.broward.org/bri01719.pdf (year three report)
http://www.broward.org/bri01717.pdf (year four report)

SITE	REEF TRACT	DEPTH (ft)	LATITUDE (deg min)	LONGITUDE (deg min)	NORTHING (NAD83 US ft)	EASTING (NAD83 US ft)
HH2	First	19	26 00.6946 N	80 06.7572 W	610888	947605
JUL6	First	12	26 04.9120 N	80 06.2226 W	636457	950356
FTL4	First	20	26 08.2080 N	80 05.8440 W	656439	952289
FTL5	First	25	26 08.985 N	80 05.810 W	660460	952733
FTL6	First	25	26 08.872 N	80 05.758 W	661149	952461
FTL1	First	19	26 09.5343 N	80 05.7475 W	664478	952761
POMP4	First	20	26 12.7320 N	80 05.2010 W	683871	955613
POMP1	First	20	26 11.4356 N	80 05.2256 W	676016	955533
HB1	First	21	26 16.8357 N	80 04.5390 W	708758	959053
DB1	First	18	26 18.5869 N	80 04.3928 W	719373	959775
JUL1	Second	40	26 00.3014 N	80 05.8134 W	608541	952788
JUL7	Second	32	26 04.9635 N	80 05.7321 W	636788	953038
FTL2	Second	48	26 09.5971 N	80 04.9522 W	664889	957106
POMP5	Second	31	26 14.5660 N	80 04.7310 W	695000	958102
POMP2	Second	48	26 11.3289 N	80 04.8039 W	675386	957843
HB2	Second	35	26 16.5350 N	80 04.2620 W	706947	960579
DB2	Second	37	26 18.6280 N	80 04.0262 W	719637	961775
BOCA1	Second	30	26 20.8030 N	80 03.8830 W	732819	962462
JUL2	Third	52	26 00.2593 N	80 05.3010 W	608306	955595
JUL8	Third	50	26 04.9957 N	80 05.0990 W	637007	956500
FTL3	Third	60	26 09.5183 N	80 04.6406 W	664424	958813
POMP6	Second	52	26 14.5660 N	80 04.3980 W	695013	959921
POMP3	Third	51	26 11.2141 N	80 04.3650 W	674708	960247
HB3	Third	49	26 16.4255 N	80 03.8189 W	706301	963004
DB3	Third	55	26 18.6828 N	80 03.5764 W	719986	964229

Table 2. Coordinates and depths for each of the 25 reef monitoring sites.

4.0 PRE-CONSTRUCTION, CONSTRUCTION, AND LONG-TERM POST-CONSTRUCTION BIOLOGICAL SURVEYS OF THE NEARSHORE HARDBOTTOM

4.1 CONSTRUCTION PHASE SURVEYS OF THE NEARSHORE HARDBOTTOM TO MONITOR FOR SECONDARY IMPACTS

4.1.1 Intent

Survey the nearshore hardbottom to monitor for secondary impacts. Weekly change detection monitoring, conducted mid-construction, is designed to detect and arrest impacts before they become widespread. Project designs assume that habitat shoreward of the equilibrium toe of fill (ETOF) will be impacted, and habitat seaward of the ETOF may be indirectly impacted. (FDEP Permit No.: 0163435-001-JC Specific Condition 15a)

4.1.2 Methods

4.1.2.1 Benthic Ecological Assessment for Marginal Reefs (BEAMR)

Benthic communities will be evaluated using the Coastal Planning & Engineering, Inc. Benthic Environmental Assessment for Marginal Reef (BEAMR) method (CPE 2004). Each BEAMR sample will be taken from a prescribed area such as a quadrat. The southwest corner of the quadrat will align with the precise point of the sample location. BEAMR will be conducted at each specified transect using 12 replicate 1.0 m^2 quadrats (1.0 m x 1.0 m) every 2.5 meters, starting at 0.0 m. BEAMR datasheets have a standardized layout, and prompt biologists to enter data in all fields (Figure 12).

Project Name **Site Name / Transect Name**

Date **Data Collector**

Quad Label: Sample Name or #		List macroalgae Genus % List every coral colony ~and coral condition(s)	% cover or max size (cm)
Max Relief (cm)			
Max Sediment Depth (cm)			
Sessile Benthos…	**% Cover**		
Sediment- (circle all: sand shell mud)			
Macroalgae- Fleshy+Calcareous			
Turf- algae+cyanobacteria (circle all: g r b)			
Encrusting Red Algae			
Sponge			
Hydroid			
Octocoral			
Stony Coral			
Tunicate			
Bare Hard Substrate			
other-…			

Total Must = 100%

Standard Abbreviations: and abbreviation formats

Macroalgae: Pool to Genus = Genu or Genus: Avra, Bryopsis, Bryothamnion, Caul, Codi, Dasya, Dasycladus, Grac, Hali, Hypn, Sarg…

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, Annelid-sessile, Barnacle, Bryozoan, *Millepora* sp., Mollusca-sessile, Seagrass, Zoanthid.

Figure 12. Sample BEAMR data entry form. Each underwater datasheet has 4 quadrat entry forms on each side.

BEAMR samples three core characteristics in each quadrat; physical, abiotic and biotic percent cover, and coral density. Physical characteristics recorded are maximum relief in the quadrat (nearest cm) and maximum sediment depth (nearest cm).

Visual estimates of planar percent cover of all sessile benthos are pooled to 11 major functional groups. Functional groups are: sediment*, macroalgae, turf algae*, encrusting red algae, sponge, hydroid, octocoral, stony coral, tunicate, bare hard substrate, and other. "Other" is specified whenever needed and may include: seagrass, anemone, zoanthid, *Millepora* sp., sessile worm, barnacle, bryozoan, etc. 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 (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).

Each colony of octocoral and stony coral is identified and the maximum height or width is measured to the nearest cm. Octocoral individuals are identified to Genus. Stony coral individuals are identified to species whenever possible. The smallest size recorded is 1 cm, for individuals less than or equal to 1 cm. Abnormal conditions of each colony are recorded e.g., bleaching, disease, stress. BEAMR specifies stony corals and excludes fire corals (*Millepora* sp.) from this component of the benthic survey.

All transects in Table 4 with labels starting C will be sampled once each week, during construction.

4.1.2.2 Video Transects for PointCount Analysis

Video surveys will be conducted by a biologist using a 4 mm Sony TRV-900 video camera in an Ikelite housing. The camera will be set to fully automatic operation, maximum wide-angle, “steadyshot”, and “progressive scan”, recording 15 frames per second at 640 x 480 resolution. A survey tape will be stretched the length of each of the transects and used to guide the biologist-videographer as they swim the length of each video transect. Video of the seafloor along each transect will be taken at a height of 40 cm after Porter et al. (2002), and will progress no faster than 5.0 meters per minute. A convergent laser guidance system indicates the precise height of 40 cm from the benthos (Figure 13). The visible width of imagery taken from this height is 40 cm. The survey tape will be removed following the completion of each video transect.

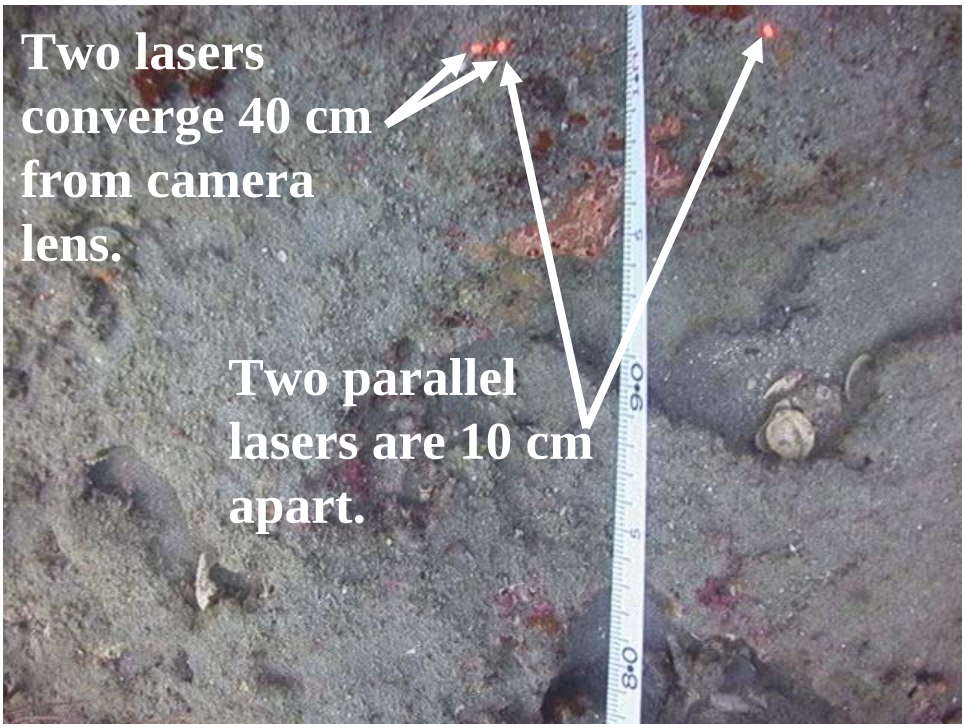


Figure 13. Laser guidance system in use on reef substrate.

All transects in Table 4 with labels starting C will be sampled once each week, during construction. See the timing matrix for scheduled monitoring events.

4.1.2.3 PointCount Image Analysis for Percent Cover

Video transect data (Method 4.1.2.2) will be analyzed using the software package PointCount for Coral Reefs© (Dustan et al. 1998). Processing video transects will include frame grabbing, assignment of random points to each image, and analysis of those points. Abutting frames will be selected from the video transect such that a nearly seamless mosaic of the transect is created. The number of frames needed to form a nearly seamless mosaic depends on the length of the transect and, to a lesser degree, on the actual height of the camera. The typical number of frames is 34 from every 10.0 transect meters. Each frame will be analyzed using the software package PointCount for Coral Reefs© (Dustan et al. 1998) or equivalent. The software places random points onto the image (10 points), and a qualified analyst identifies the benthos under each point. Identifications are made in the following categories: stony coral (to species when possible), macroalgae (to genus when possible), sponge, hydroid, zoanthid, octocoral, bryozoan, seagrass, large cyanobacteria tufts, substrate (including abiotic substrate, debris, turf algae, and unidentifiable features), and sand (only shifting sand, not visibly bound in a turf algae matrix). CPE uses a customized skin file (set of buttons and codes) that is compatible with all other versions of PointCount and allows more detailed data collection. A copy of the PointCount skin file (CPE_Florida.skn) will be included with every set of PointCount images.

All possible PointCount identifications are listed below. Species “complexes” follow definitions in Porter et al. 2002.

POSSIBLE POINTCOUNT IDENTIFICATIONS		
n/c non-counted	Sargassum	Madracis decactis
Coral skeleton	Stypopodium	Madracis mirabilis
Recently dead Halimeda	Turbinaria	Madracis pharensis
Rock	Udotea	Madracis sp.
Rubble	Ulva	Manicina areolata
Sand	Calcareous Brown	Meandrina meandrites
Sediment on hard substrate	Calcareous Green	Meandrina meandrites f. brasiliensis
Substrate	Calcareous Red	Meandrina meandrites f. danae
---	Cyanobacteria/Diatom tufts	Meandrina meandrites f. memorialis
Anemone	Encrusting Red	Millepora alcicornis
Barnacle	Fleshy Brown	Millepora complanata
Bivalves	Fleshy Green	Montastraea annularis COMPLEX
Bryozoan	Fleshy Red	Montastraea cavernosa
Hydroid	---	Montastraea annularis f. annularis
Octocorallia	Acropora cervicornis	Montastraea faveolata
Porifera	Acropora palmata	Montastraea franksi
Seagrass	Acropora prolifera	Mussa angulosa
Tunicate	Agaricia agaricites COMPLEX	Mussid (juvenile)
Worm-sessile	Agaricia agaricites f. carinata	Mussismilia brazilensiss
Zoanthidea	Agaricia agaricites f. danae	Mussismilia harttii
---	Agaricia agaricites f. humilis	Mussismilia hispida
Amphiroa	Agaricia cailleti	Mycetophyllia aliciae
Asparagopsis	Agaricia fragilis	Mycetophyllia danaana
Avrainvillea	Agaricia grahamae	Mycetophyllia ferox
Botryocladia	Agaricia lamarcki	Mycetophyllia lamarckiana
Bryothamnion	Agaricia tenuifolia	Oculina diffusa
Caulerpa	Agaricia undata	Oculina robusta
Codium	Astrangia poculata	Phyllangia americana
Dasya	Astrangia solitaria	Porites astreoides
Dasycladus	Cladocora arbuscula	Porites branneri
Dictyota	Cladocora debilis	Porites clavaria
Dictyurus	Cladocora sp.	Porites colonensis
Galaxaura	Colpophyllia natans	Porites divaricata
Gracilaria	Dendrogyra cylindrus	Porites furcata
Halimeda	Dichocoenia stellaris	Porites porites COMPLEX
Halymenia	Dichocoenia stokesii	Scleractinia unidentifiable
Hypnea	Diploria clivosa	Scolymia cubensis
Kallymenia	Diploria labyrinthiformis	Scolymia lacera
Laurencia	Diploria strigosa	Scolymia wellsi
Liagora	Eusmilia fastigiata	Siderastrea radians
Lobophora	Favia conferta	Siderastrea siderea
Neomeris	Favia fragum	Solenastrea bournoni
Padina	Isophyllastrea rigida	Solenastrea hyades
Penicillus	Isophyllia sinuosa	Stephanocoenia intersepta
Rhipocephalus	Leptoseris cucullata	Tubastraea coccinea

Table 3. All possible Point-Count identifications.

All transects in Table 4 with labels starting C will be sampled once each week, during construction. See Table 7 for scheduled monitoring events.

4.1.2.4 Coral Stress

Coral stress estimates will be conducted within a 1.0 m belt transect, with the southwestern corner of the belt transect aligned with 0.0 m on the transect line. Qualified stony coral colonies are *Montastrea cavernosa*, *Siderastrea siderea*, and *Solenastrea bournoni* greater than 2.0 centimeters. The location (to the nearest meter) and stress value of each qualified coral colony will be recorded.

All 5 transects in Table 4 starting C, and at all specified "temporary" transects will be sampled once each week (Table 7). "Temporary" transects will be selected for weekly monitoring at 8:00 am each Monday during construction. The criteria for the selecting locations of these weekly monitoring transects is; the six locations in Table 4 starting C, N, O, P, or T that are nearest to the discharge pipe at 8:00 am each Monday morning (the three transects approximately 1500 linear feet to the north and south of the discharge pipe). The western endpoint of these transects will coincide with the location on Table 4 and the eastern endpoint will be 92 m (300 ft) due east of the western endpoint. The eastern endpoint will be marked with DGPS, added to Table 4 and revisited on all subsequent visits to the transect. Once each week, during construction, the six newly selected "temporary" transects, and the six transects that were newly selected the previous week will be sampled. Within each week, sampling efforts will not be duplicated on any one transect, e.g., the minimum number of transects sampled each week is 6 and the maximum is 12.

4.1.2.5 Sediment Accumulation on Nearshore Transects

Sediment depth in the nearshore zone will be determined with repeated direct measurements, at regular intervals. A ruler, graduated in millimeters will be driven through the sediment until the ruler cannot be driven further. Sediment depth will be recorded to the nearest millimeter. Measurements greater than or equal to 300 mm will be recorded as 300 mm. Sediment accumulation on nearshore transects will be assessed at 1 meter intervals starting at 0 m and ending at 92 m

All 5 transects in Table 4 starting C, and at all specified "temporary" transects will be sampled once each week (Table 7). "Temporary" transect selection will follow the method detailed in 4.1.2.4.

4.1.4 Reporting

Periodic progress reports will be compiled and delivered weekly in electronic format to the County, FDEP and other designated parties. The environmental component of the report will summarize the weekly results of methods 4.1.2.4 and 4.1.2.5. Coral stress data from nearshore transects will not be calibrated, and cannot be used as a sole indicator of nearshore impacts. Summary comments and changes in average stress values over time may only be used as

qualitative descriptors. The whole of the periodic progress report will document the progress of construction and compliance with the permits and Contract, including but not limited to manpower, amount of work performed and by whom, equipment, problems encountered, method to correct problems, errors, omissions, deviations from Contract Documents, and weather conditions. Deliverables are one electronic copy of the weekly reports.

4.2 LONG-TERM POST-CONSTRUCTION SURVEYS OF THE NEARSHORE

4.2.1 Intent

Survey the nearshore hardbottom to monitor for secondary impacts from beach construction, and quantify those impacts, if detected. Project designs assume that habitat shoreward of the equilibrium toe of fill (ETOF) will be impacted, and habitat seaward of the ETOF may be indirectly impacted. (FDEP Permit No.: 0163435-001-JC Specific Condition 15a) (USACE Specific Condition 41)

4.2.2 Methods

4.2.2.1 Benthic Ecological Assessment for Marginal Reefs (BEAMR)

Benthic communities will be evaluated using the Coastal Planning & Engineering, Inc. Benthic Environmental Assessment for Marginal Reef (BEAMR) method as specified in 4.1.2.1. All transects in Table 4 with labels starting C, O, and P will be sampled. See matrix for timing (Table 7).

4.2.2.2 Video Transects for PointCount Analysis

Video transects will be conducted as detailed in 4.1.2.2. All transects in Table 4 with labels starting C, O, and P will be sampled. See matrix for timing (Table 7).

4.2.2.3 PointCount Image Analysis for Percent Cover

Video transect data collected in 4.2.2.2 will be analyzed using the software package PointCount for Coral Reefs© (Dustan et al. 1998) as detailed in 4.1.2.3. All transects in Table 4 with labels starting C, O, and P will be sampled. See matrix for timing (Table 7).

4.2.2.4 Coral species census and species-area curve

A stony coral species area curve will be constructed for specified transects. A diver will swim two (2) 1.0 m wide belt transects, centered on the transect line. The diver will use a framer, e.g., 1.0 m stick, 1.0 m^2 quadrat, etc., to ensure the area sampled is accurate. The diver will note location of the first specimen of every stony coral species (excluding *Millepora* spp.) in the belt transect areas. These data will be used to generate a species-area curve after Dustan (1985).

Positive species-level field identification is not possible for many scleractinia smaller than 1 cm. Because this survey must be non-consumptive, the scleractinia species list may not be comprehensive. All transects in Table 4 with labels starting C, O, and P will be sampled. See matrix for timing (Table 7).

4.2.2.5 Hardbottom Edge Mapping

Hardbottom margins will be mapped by recording the position of a diver swimming along the hardbottom-sand interface. The diver will tow a buoy with a DGPS antenna mounted on it, attached by cable to a positioning system. The positioning system will be a Trimble AgGPS Global Positioning System (GPS) with Pro Beacon interfaced to the HYPACK, Inc. processing program as detailed in section 2.1.1. The buoy will be on the shortest possible tether, such that the buoy is directly over the diver's head. The diver will follow each contour of the most prominent hardbottom-sand interface, e.g., ignoring isolated mobile rubble in the midst of sand. Hardbottom edge mapping will be conducted between Broward County monument R-86 and Dade County monument R-5. See matrix for timing (Table 7).

4.2.2.6 Large Monitoring Stations

Station layout will be 16 m^2 aligned with the cardinal compass directions. State DEP-described intent of monitoring these stations is to detect small changes in the large coral colonies. Station location will be set such that 12 corals, greater than 15 cm diameter, are within the station boundary. The location of each colony will be recorded relative to the station's coordinate plane. During each visit the colony will be located and a series of images and *in situ* data will be collected. Images will include: 1 overhead 40 cm above the substrate, 1 overhead framed so the colony just fits in the frame, 1 horizontal from the south framed so the colony just fits in the frame, and 1 horizontal from the north framed so the colony just fits in the frame. Overhead images will be oriented so the top of the image is the north edge, and all images will include a scale with the colony. *In situ* data will include: species identification, stress index #, % partial/total bleached, disease(s) identification and % affected by disease(s), % recently dead (bare skeleton with no epiflora), and % affected by Cliona. Each record of partial/total bleaching and disease(s) will be augmented by one close-up image, framed as near to the subject as auto-focus settings will allow. The large station locations are outlined in Table 5. All 8 of the stations will be sampled as specified in the matrix (Table 7).

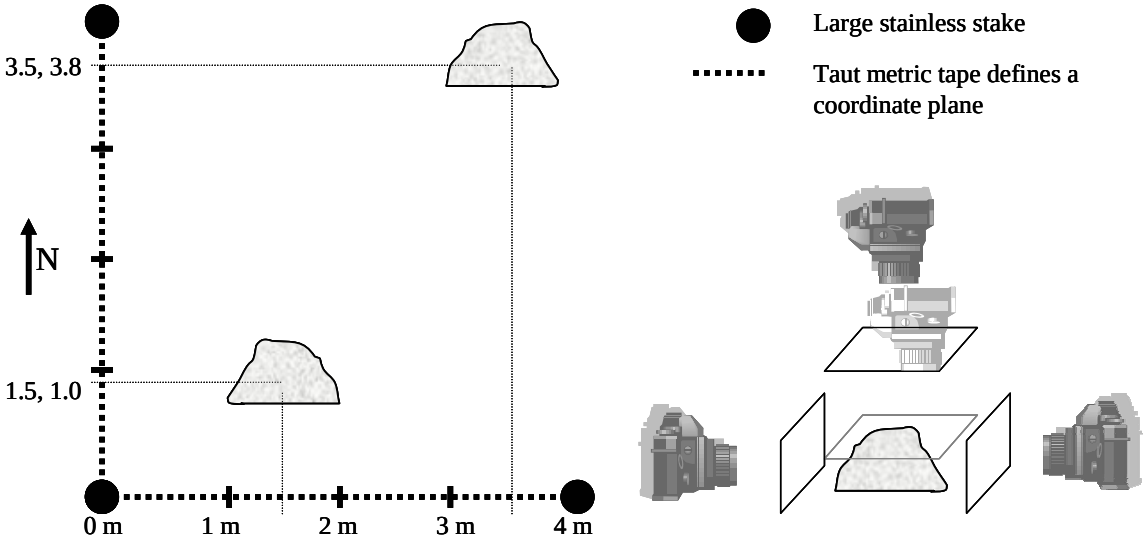


Figure 14. Sketch of large station orientation and coral imaging plan.

4.2.2.7 Biological Assessment of Fish Communities

4.2.2.7.1 Transect Counts

A 30 m line will be stretched out west to east, coinciding with the transect locations. The diver shall swim above the transect recording all fish within 1 m either side, and 1 m above the line (an imaginary 60 cubic meter hemi-tunnel). Species will be recorded as well as numbers and total length (by size class: <2, 2-5, 5-10, 10-20, 20-30, 30-50 and 50+ cm) as encountered. The diver will carry a 1 meter "T"-rod, with the size classes marked off, to aid in transect width and fish length estimation. Stretches of sand along the transect (absence of hard substrate) greater than 3 m will also be recorded. The transect takes approximately 10 minutes to complete but will not be time delimited.

4.2.2.7.2 Rover-diver Counts

Rover-diver counts will consist of the diver recording the species encountered during a 20-minute interval. The diver shall do a thorough search to record the maximum number of species. No abundance or size data will be recorded. Rover-diver counts will be accomplished in a 30 m square bounded by the transect line (Tables 4 and 6) to the south, and 30 m lines laid to the north of the eastern and western endpoints of the transect line.

4.2.3 Reporting

Data from each event will be compiled and incorporated into the GIS database for use in evaluating long-term project related impacts to nearshore epibenthic communities. These data shall include the raw data in Microsoft Excel format, graphic representations of the data, and still photographs. Statistical analysis of the data will be accomplished using parametric and non-parametric (ANOVA)

techniques as appropriate. Detection of changes in community composition along the transects over time will be done using a paired comparison or Tukey's Test for Multiple Comparisons. Multidimensional scaling (i.e. PRIMER-E software) will be used to describe community patterns and temporal changes. FDEP Permit No. 0163435-001-JC (Specific Condition 15a)

Annual reports will be cumulative in presentation of summary data, analyses, and discussion. Reports will be serial in presentation of all raw data, all raw imagery, all video, and field notes, i.e., those data will be presented once. Reports will be a collection of monitoring results from sections 1.0, 2.0., and 4.0. The 18-month post-construction report will satisfy the requirements of the Governor's Report (USACE Specific Condition 52). Annual reports will be submitted within 90 days of the final day of field data collection (Table 7).

Product Distribution:

- Broward County. 5 hardcopies, 10 digital copies and 2 copies of video data;
- FDEP, Tallahassee. 1 hardcopy, 1 digital copy, and 1 copy of video data;
- FDEP, West Palm Beach. 1 hardcopy, 1 digital copy, and 1 copy of video data;
- USACE, Palm Beach Gardens. 1 hardcopy, 1 digital copy, and 1 copy of video data
- USACE, Jacksonville; refer to specific condition 47;
- NMFS, Miami (2 COPIES); refer to specific condition 47. 1 hardcopy and 1 digital copy;
- USEPA, West Palm Beach; refer to USACE specific condition 47. 1 hardcopy and 1 digital copy.USFWS, Vero Beach. 1 hardcopy and 1 digital copy;
- FWC, Tallahassee. 1 hardcopy and 1 digital copy.
- OAI. 1 hardcopy and 1 digital copy.
- CPE. 2 hardcopies.

4.2.4 Locations

All transects will be installed in locations determined by the permit parameters. All transects will be marked with permanently installed stainless steel pins prior to the first occurrence of benthic data collection.

The details of each nearshore transect are presented in Table 4. Site selection followed a stratified-random protocol i.e., site locations were random within a narrowly defined, presumably homogenous area. Site selection criteria for natural hardbottom were as follows: north-south locations intended to achieve relatively even distribution through the
construction areas, and the western end of these transects was set at the nearest hardbottom east of the equilibrium tow of fill. Site selection criteria for

mitigation reefs were as follows: north-south locations intended to achieve relatively even distribution through each mitigation reef, as reef geometry allowed, and maintain a minimum of 30 m spacing, the east-west spacing was a minimum of 2.0 m from a mitigation reef edge and from any other transects.

The proposed locations of the large monitoring stations are presented in Table 5. These locations were selected because they had higher stony coral cover and stony coral diversity than was typical of nearshore habitat. Ten potential station locations are listed in Table 4 and eight are required. The two potential stations with the least coral cover and coral diversity will be eliminated. One or more stations may be relocated into the impact area, west of the ETOF, into areas of greatest coral cover and diversity.

Thirty additional fish assessment transects were selected from the set of 200 first sampled in 2001. The details of the additional fish monitoring transects are presented in Table 6.

Transect Label	Actual West Location: Easting	Actual West Location: Northing	Actual East Location: Easting	Actual East Location: Northing	Actual West Location: Latitude DD.dddd	Actual West Location: Longitude DD.dddd	Actual East Location: Latitude DD.dddd	Actual East Location: Longitude DD.dddd	Actual Length (m)	Rugosity (m)	Depth West (ft)	Depth East (ft)	Pin Arrangement (if other than 0,1,5,10,15,20,25,29,30m)
A101c	948229.23	624585.05	948332.77	624592.95	26.04924633	-80.1104366	26.04926612	-80.1101211	30	44.2	15	15	0,1,5,11.3,14.9,20,26,29,30
A101d	948259.53	624454.74	948349.15	624473.90	26.04888728	-80.110347	26.04893831	-80.1100737	30	40.8	15	15	0,1,5,10,12.6,23,27,29,30
A101e	948266.62	624325.69	948357.44	624323.39	26.04853213	-80.1103281	26.04852409	-80.1100516	30	38.2	15	16	0,1,8,2,10,15,20,26,29,30
A101f	948281.76	624204.05	948375.76	624225.19	26.04819721	-80.1102845	26.0482536	-80.1099978	30	42.6	15	15	0,1,6.7,10,15,20.7,26,29.5,30
A102b	948302.88	624072.46	948397.30	624078.94	26.04783481	-80.110223	26.04785086	-80.1099353	30	45.4	13	15	0,0.6,6,10.2,15,20,25,29.1,30
A102c	948288.61	623943.66	948382.09	623958.76	26.04748074	-80.1102691	26.04752053	-80.1099841	30	39.8	15	16	0,1,7.5,11.2,16,21,26.5,28.8,30
A102d	948276.18	623800.19	948375.55	623811.10	26.04708629	-80.1103099	26.04711444	-80.1100071	30	43.8	15	16	0,1,5.9,10.2,16.5,20.2,25,29,31
A102e	948253.58	623685.29	948349.11	623712.08	26.04677062	-80.1103811	26.04684253	-80.1100897	31	45.94	15	16	0,1,4.6,9.7,18,21.2,25.1,30,31
A102g	948221.02	623547.57	948316.88	623567.30	26.04639236	-80.1104832	26.04644484	-80.1101908	30.1	48.1	17	17	0,1,5,10,16.1,21,24.9,28.4,30.1
A102h	948315.79	623402.02	948413.24	623424.40	26.04599017	-80.1101976	26.04604991	-80.1099003	30	41.8	18	18	0,1,5.2,9.6,15.5,20,25.2,29,30
A102i	948209.29	623408.19	948308.27	623406.58	26.04600914	-80.1105218	26.04600286	-80.1102204	30	49.5	18	19	0,3.3,5,10,16,20,25,29,30
A103c	948111.31	622590.45	948210.43	622617.51	26.04376136	-80.1108371	26.04383395	-80.1105347	29.2	38.2	16	18	0,1,5,10,15,19.8,24.5,29,29.2
A103d	948116.24	622577.62	948207.75	622600.80	26.04372597	-80.1108224	26.04378803	-80.1105432	30	41.5	16	17	0,1,5,10,15.6,20,25.2,29,30
A123c	946866.46	602075.76	946961.08	602090.69	25.98734806	-80.1150514	25.98738737	-80.1147631	29.8	44.5	13	13	0,1,5,10,15,20,25,29,29.8
A123d	946855.85	601962.87	946955.52	601967.61	25.9870377	-80.1150861	25.98704888	-80.1147826	30	41.9	15	15	0,1,5.7,10,13,20,25,29,30
A123e	946850.61	601881.81	946946.54	601895.25	25.98681479	-80.1151037	25.98684998	-80.1148114	30	47.7	15	15	0,0.7,5.9,9,14.8,20.5,25,29.3,30
A123f	946843.76	601755.61	946939.17	601769.89	25.98646774	-80.1151271	25.98650525	-80.1148364	31	39.9	13	15	0,0.9,5,9.5,15,20,25,30,31
A124c	946745.71	600872.51	946844.40	600896.36	25.98404012	-80.1154438	25.98410389	-80.1151429	31.5	46	15	15	0,1,5.3,10,15,20,24.9,29,31.5
A125b	946962.58	600270.87	947059.51	600278.03	25.98238094	-80.114796	25.98239883	-80.1145009	29.7	41.4	13	13	0,1,5,10.4,15.6,20.6,25,29,29.7
A125c	946861.60	600251.20	946957.63	600264.99	25.98232871	-80.1151038	25.98236486	-80.1148112	30	45.5	14	14	0,1,5,10,15,20,25,29,30
A125d	946725.09	600249.47	946821.10	600264.46	25.98232649	-80.1155194	25.98236594	-80.1152268	30	40.3	14	14	0,1,4.8,9.6,16.6,20.1,25,29,29.8
A125f	946926.35	599958.64	947021.02	599967.51	25.98152266	-80.1149128	25.9815453	-80.1146244	30.3	41.45	15	15	0,0.9,5,10,14.7,20,25,29,30.3
A125g	946835.97	599963.99	946932.84	599978.12	25.98153906	-80.1151877	25.98157613	-80.1148926	30	43.7	14	14	0,0.7,7,9.8,15,20.7,25.2,29,30
A125h	946715.45	599955.17	946811.95	599974.72	25.98151704	-80.1155548	25.98156902	-80.1152606	30	38.2	14	14	0,1,5.5,10.1,15,20,26.7,29.2,30
A125i	946988.88	599782.01	947088.74	599791.61	25.98103557	-80.1147261	25.98106012	-80.1144219	30.5	45	15	15	0,1,6,9.6,15,19.8,24.6,28.6,30.5
A125j	946899.27	599785.54	946993.60	599790.19	25.98104695	-80.1149987	25.98105799	-80.1147115	30	37.9	15	15	0,0.8,5.6,10,15,20,23,29,30
A125k	946709.10	599776.21	946804.57	599785.98	25.98102483	-80.1155778	25.98104993	-80.115287	28	39.1	15	15	0,0.9,5,10.6,13.4,20.1,24.4,27.6,28

Table 4. Nearshore transect locations.

Transect Label	Actual West Location: Easting	Actual West Location: Northing	Actual East Location: Easting	Actual East Location: Northing	Actual West Location: Latitude DD.dddd	Actual West Location: Longitude DD.dddd	Actual East Location: Latitude DD.dddd	Actual East Location: Longitude DD.dddd	Actual Length (m)	Rugosity (m)	Depth West (ft)	Depth East (ft)	Pin Arrangement (if other than 0,1,5,10,15,20,25,29,30m)
C033a	955744.95	693066.28	955842.17	693053.31	26.23749286	-80.0860816	26.23745529	-80.0857853	30.2	32.67	11	10	0,1,5,10.1,14.9,20.3,25.3,29.3,30.2
C046a	954094.77	680299.54	954192.66	680304.4	26.20240429	-80.0913882	26.20241577	-80.0910896	30	33.82	10	10	0,1,4.9,9.4,15,19.7,24,29,30
C074a	951110.26	652340.81	951208.57	652341.61	26.12554799	-80.1010792	26.12554832	-80.1007796	30	33	15	14	0,1,5.1,10.1,15.2,20.1,25,29,30
P088a	949045.77	638237.99	949142.36	638254.95	26.08679033	-80.1076652	26.08683517	-80.1073706	29.8	31.8	8	9	0.2,1,5.2,10.1,15,20.2,24.9,29.1,30
P090a	948669.72	636223.74	948767.51	636233.05	26.08125621	-80.1088528	26.08127998	-80.1085547	29.9	32.3	5	5	0,1,4.7,10.1,15,19.8,25.2,28.9,29.9
C096a	948432.96	630285.13	948535.98	630282.39	26.0649235	-80.1096977	26.06491403	-80.1093839	30	31.7	9	9	0,1,5,10,15.1,19.5,25.1,29.1,30
C098a	948438.63	628232.91	948535.74	628223.63	26.05927772	-80.1097231	26.05925036	-80.1094275	30	31.8	9	9	0,1.1,5.1,10,15.1,20,25.1,29.2,30
N099a	948392.69	627270.39	948490.79	627283.83	26.05663067	-80.109883	26.05666581	-80.1095839	30.2	31.2	8	8	0,1,4.8,9.8,15.2,19.8,25,28,30.2
N099b	948244.43	626767.43	948342.36	626779.38	26.05524981	-80.110345	26.05528084	-80.1100465	30	31.9	6	5	0,1,5,9.8,15,20,25.1,29.2,30
P100a	948359.92	626316.26	948451.97	626339.54	26.05400646	-80.1100026	26.05406878	-80.1097218	30	31.25	10	9	0.2,1.2,5.2,10,14.9,20.1,25.1,29.2,29.8
P100b	948264.52	625588.67	948358.21	625596.82	26.05200664	-80.1103083	26.05202731	-80.1100228	30	31.2	8	8	0,1.1,5,10,15,20,25,29,30
P101a	948149.77	625189.96	948244.13	625206.42	26.05091194	-80.1106661	26.05095545	-80.1103783	30	31.12	10	10	0,1,5,10,15,20,25,29,30
N104a	948080.8	622233.87	948171.87	622243.04	26.04278098	-80.1109375	26.0428045	-80.1106599	30	31.11	13	13	0,1,5,10,15,20,25,28.2,29,30
N104b	947988.15	621620.64	948083.41	621637	26.0410957	-80.1112323	26.04113893	-80.1109419	30	30.8	18	18	0,1,5,10,15,20,25,29,30
N105b	947913.09	620607.59	948007.72	620621.07	26.03831019	-80.1114819	26.0383455	-80.1111935	30	30.8	9	9	0,1,5,10,15,20,25,29,30
N106a	947817.83	620111.91	947916.08	620123.89	26.03694835	-80.1117823	26.03697946	-80.1114828	30	31.1	7	7	0,1,5,10,15,20,25,29,30
P108a	947749.26	618149.68	947846.2	618173.6	26.03155149	-80.1120317	26.03161548	-80.111736	30	31.4	8	7	0,1,5,9.6,14.9,19.8,24.8,29,30
N110a	947641.87	616054.56	947737.86	616067.91	26.02578977	-80.1124021	26.0258247	-80.1121095	30	33.75	9	9	0,1,5,10,15,19.9,25,29,30
P113a	947429.09	613093.14	947526.63	613110.19	26.01764679	-80.1131112	26.01769188	-80.1128139	30	30.6	9	8	0,1,5,10,15,20,25,29,30
P116a	947395.58	610043.44	947495.49	610053.17	26.00925759	-80.1132763	26.0092825	-80.1129719	31	30.5	10	10	0,1,5,10,15,20,25,29,31
P119a	947312.83	606983.49	947410.81	606976.3	26.00084111	-80.1135914	26.0008195	-80.1132933	30	31.02	9	9	0.2,1.1,5,10,15,20,25,29,30
P120a	947126.24	605852.65	947224.45	605856.53	25.9977336	-80.1141828	25.99774245	-80.1138837	29.8	30.85	10	8	0,0.8,4.8,9.8,14.8,19.8,24.8,28.8,29.8
N120b	947127.22	605301.28	947226.04	605302.88	25.99621674	-80.1141912	25.9962193	-80.1138903	29.8	32.2	13	12	0,1.1,5,9.6,15,20,25,29,29.8
N121b	947032.86	604294.97	947133.1	604306.56	25.9934501	-80.1144992	25.99348012	-80.1141938	30.1	33.5	12	12	0,1,5,10,14.9,20,25,29.7,30.1
N122a	946968.34	603802.79	947013.36	603811.78	25.9920973	-80.1147057	25.99212119	-80.1145685	30	31.4	14	13	0,1,5,10,15,20,25,29,30
P123a	946880.44	602714.35	946979.25	602721.32	25.98910459	-80.1149957	25.98912193	-80.1146948	30	31.2	15	17	0,1,5,10,15,20,25,29,30
O125a	947232.38	600676.13	947336.36	600671.67	25.9834908	-80.1139665	25.98347659	-80.1136501	30	31.4	21	21	0,0.9,5,10.6,15.1,20.1,25,29,30
N126b	946756.96	599050.85	946852.72	599030.49	25.97902844	-80.115447	25.97897064	-80.115156	30	31.8	18	18	0,1,5,10,14.8,20.5,25,29,30
N127a	946598.03	598591.72	946687.36	598617.76	25.9777683	-80.1159402	25.97783828	-80.1156678	27	27.8	16	18	0,1,5,10,15.6,24,25,26.6,27

Table 4 (cont'd). Nearshore transect locations.

Transect Label	Actual West Location: Easting	Actual West Location: Northing	Actual East Location: Easting	Actual East Location: Northing	Actual West Location: Latitude DD.dddd	Actual West Location: Longitude DD.dddd	Actual East Location: Latitude DD.dddd	Actual East Location: Longitude DD.dddd	Actual Length (m)	Rugosity (m)	Depth West (ft)	Depth East (ft)	Pin Arrangement (if other than 0,1,5,10,15,20,25,29,30m)
T086a	949833.2	640118.08			26.0919476	-80.105227				NA			0,1,5,10
T086b	949387.87	639699.85			26.09080546	-80.1065925				NA			0,1,5,10
T087a	948949.17	639270.97			26.08963388	-80.107938				NA			0,1,5,10
T087b	948875.62	638777.36			26.08827735	-80.1081724				NA			0,1,5,10
T088b	948830.24	637742.85			26.08543226	-80.1083322				NA			0,1,5,10
T089a	948756.32	637281.5			26.08416448	-80.108567				NA			0,1,5,10
T089b	948716.42	636738.13			26.08267042	-80.1086999				NA			0,1,5,10
T090b	948648.09	635758.37			26.07997638	-80.1089284				NA			0,1,5,10
T091a	948565.89	635232.66			26.0785317	-80.1091898				NA			0,1,5,10
T091b	948601.28	634737.13			26.07716783	-80.1090923				NA			0,1,5,10
T092a	948593.89	634178.15			26.07563021	-80.1091264				NA			0,1,5,10
T098b										NA			SKIPPED too close to pier
T101b	948384.05	624667.14			26.04946926	-80.1099634				NA			0,1,5,10
T102a	948455.66	624130.27			26.04799097	-80.1097565				NA			0,1,5,10
T102f	948464.96	623637.62			26.04663551	-80.1097384				NA			0,1,5,10
T103a	948280.49	623106.96			26.04517912	-80.1103112				NA			0,1,5,10
T103b	948318.53	622609.36			26.0438095	-80.1102057				NA			0,1,5,10
T105a	947900.77	621113.99			26.03970354	-80.1115089				NA			0,1,5,10
T106b	947774.48	619625.38			26.0356107	-80.1119244				NA			0,1,5,10
T107a	947805.19	619144.97			26.03428851	-80.1118408				NA			0,1,4,10
T107b	948348.19	618634.1			26.03287292	-80.1101979				NA			0,1,5,12
T108b	947807.3	617646.42			26.03016592	-80.1118654				NA			0,1,5,10
T109	947777.7	617169.7			26.02885501	-80.1119654				NA			0,1,5,10
T109b	947716.89	616540.87			26.02712622	-80.1121636				NA			0,1,5,10
T110b	947682.41	615556.95			26.02442007	-80.112289				NA			0,1,5,10
T111a	947633.54	615101.34			26.02316759	-80.1124472				NA			0,1,5,10
T111b	947495	614449.42			26.02137673	-80.1128825				NA			0,1,5,10

Table 4 (cont'd). Nearshore transect locations.

Transect Label	Actual West Location: Easting	Actual West Location: Northing	Actual East Location: Easting	Actual East Location: Northing	Actual West Location: Latitude DD.dddd	Actual West Location: Longitude DD.dddd	Actual East Location: Latitude DD.dddd	Actual East Location: Longitude DD.dddd	Actual Length (m)	Rugosity (m)	Depth West (ft)	Depth East (ft)	Pin Arrangement (if other than 0,1,5,10,15,20,25,29,30m)
T112a	947418.76	613998.84			26.02013859	-80.113124				NA			0,1,5,10
T112b	947386.19	613527.77			26.01884327	-80.1132329				NA			0,1,5,10
T113b	947436.68	612584.78			26.01624814	-80.1130986				NA			0,1,5,10
T114a	947375.8	612154.32			26.01506506	-80.1132929				NA			0,1,5,10
T114b	947420.28	611483.04			26.01321752	-80.1131713				NA			0,1,5,10
T115a	947437.07	611100.22			26.01216406	-80.1131281				NA			0,1,5,10
T115b	947356.56	610557.11			26.01067145	-80.1133845				NA			0,1,5,10
T116b	947450.41	609563.17			26.00793533	-80.1131193				NA			0,1,5,10
T117a	947493.9	609083.94			26.00661614	-80.1129968				NA			0,1,5,10
T117b	947501.11	608546.15			26.00513653	-80.112986				NA			0,1,5,10
T118a	947384.25	608007.94			26.00365807	-80.1133528				NA	15		0,1,5,10
T118b	947299.6	607496.18			26.00225178	-80.1136211				NA	17		0,1,5,10
T119b	947327.22	606436.52			25.9993361	-80.1135589				NA	17		0,1,5,10
T121a	947134.17	604803.23			25.99484646	-80.1141803				NA	17		0,1,5,10
T122b	946913.52	603250.35			25.99057853	-80.114884				NA	14		0,1,5,10
T123b										NA			no sand edge, all HB thru art. reef & ETOF
T124a	946969.12	601640.62			25.98614906	-80.1147479				NA	20		0,1,5,10
T124b	946914.14	601177.69			25.98487655	-80.1149248				NA	20		0,1,5,10
T125e	947101.98	600092.29			25.98188706	-80.1143754				NA	20		0,1,5,10
T126a	946813.43	599560.72			25.98043006	-80.1152646				NA	18		0,1,3,8
T127b	946544.38	598069.19			25.9763318	-80.1161142				NA	15		0,1,5,10
T128a	946579.55	597621.33			25.97509906	-80.1160164				NA	16		0,1,2,6,11

Table 4 (cont'd). Nearshore transect locations.

Transect Label	Proposed Location	Actual Location	Depth (ft)	Pin Arrangement	Rugosity Contoured Transect Length (m)	Rugosity - Index	Point Count Code	Date Installed (dd-Mon-yy)	Time Installed
L100c	Offshore of R-100.5								
L100d	Offshore of R-100.5								
L104c	Offshore of R-104 located 1000 to 1500 feet east of the ETOF								
L119c	Offshore of R-119 at the hardbottom edge								
L120c	Offshore of R-120 600 feet east of the ETOF								
L120d	Offshore of R-120 Greater than 600 feet east of the ETOF								
L121c	Offshore of R-121 800 feet east of the ETOF								
L121d	Offshore of R-121 Greater than 800 feet east of the ETOF								
L123g	Offshore of R-123 at the 2001 site (137 feet east of the ETOF)								
L123h	Offshore of R-123 Greater than 137 feet east of the ETOF								
	As discussed during a meeting with Cheryl and Vlad in June 2003, they are interested in monitoring stations at the following locations. We will have to take a look at the 2001 GIS to determine the best spots before we formalize the presentation in the Nearshore Monitoring Plan.								

Table 5. Large monitoring stations. Approximate locations - Actual locations TBD.

Label	Lat (n) DD MM.mmm WGS84	Long (w) DD MM.mmm WGS84	Adjust Long (m)	Depth (ft):	Rugosity (m):	Sand >3m (m):
87.5	26 05.305	80 06.483	Eastern Point	10	31.8	
88.5	26 05.144	80 06.494		5	34	
91.5	26 04.634	80 06.509		8	34.2	4.4
92.5	26 04.465	80 06.524		BB	8	35.3
93.5	26 04.318	80 06.533		11	31.7	
94.5	26 04.139	80 06.561	Eastern Point	15	34.3	
95.5	26 03.984	80 06.501		9	33.8	
96.5	26 03.806	80 06.562		10	31.8	6
97.5	26 03.655	80 06.541		11	32.8	
105	26 02.355	80 06.662		11	30.7	
108.5	26 01.800	80 06.712	Eastern Point	14	34.2	7m sand patch had 2m dia 'patch' reef in it.
109	26 01.734	80 06.695	Eastern Point		31.8	
109.5	26 01.633	80 06.711	Eastern Point	12	33.9	
110.5	26 01.419	80 06.734		15	32.1	
111.5	26 01.291	80 06.759		8	33.1	
112.5	26 01.136	80 06.764		10	36.2	
113.5	26 00.974	80 06.774		15	31.6	
114.5	26 00.798	80 06.770		19	32.7	3.2
115.5	26 00.644	80 06.788		12	31.5	3.5
116.5	26 00.485	80 06.748		17	31	12
117.5	26 00.310	80 06.762		15	33	
118	26 00.228	80 06.766		16	32.5	
118.5	26 00.141	80 06.792		11	32.1	
119.5	25 59.951	80 06.811		13	30.9	4
122.5	25 59.443	80 06.875		22	32.1	
127.5	25 58.571	80 06.913		20	31.3	
D1.5	25 58.435	80 06.946		17	30.9	0
D2.5	25 58.265	80 06.938		20	31.2	11
D3.5	25 58.094	80 06.946		18	34.1	
D4.5	25 57.895	80 06.850		18	31.6	

Table 6. Additional Nearshore fish monitoring transects.

4.2.5 Data Management and QA/QC

BEAMR QAQC will occur in several stages. Qualified biologists are trained in the BEAMR Standard Operating Procedure (CPE, 2004). The standard BEAMR datasheet will be used in the field and this datasheet prompts biologists to complete all fields. CPE developed an Access-based BEAMR data entry tool that is similar in appearance to the BEAMR datasheet. This data entry form has built-in QA features such as standardized spellings, number format validation, and automatic summation of functional group percent cover (must be 100%). A

standard QA protocol will be applied once all data are entered. The electronic data will be checked against the original datasheets.

Video for PointCount QAQC will occur in two stages. Biologists are trained in the proper methodology, set-up, and maintenance of the camera and lasers, both are crucial to high quality video data. When sea-state is less than ideal, the raw video will be reviewed by a biologist qualified in PointCount. This person will determine whether the video data are adequate for PointCount analysis.

PointCount QAQC will occur in three stages. All analysts must pass an initial qualification by counting a single file that is relatively high in macrofauna cover. All initial qualification data, past and present, are converted into a Bray-Curtis similarity matrix. The minimum inter-observer similarity for functional groups is 80%, though 90% or better is typically achieved. All analysts make a similar re-qualification on one randomly selected natural hardbottom transect, for each semiannual dataset. Ten percent (10%) of all transects will be counted by two qualified observers. A similarity analysis will be applied to these transects, and critical differences will be addressed and disseminated to all qualified PointCount staff. The union of all qualified QAQC transects will be entered into the database. The Access-based PointCount data management plan was inherited, with minor changes, from the US Environmental Protection Agency Coral Reef/Hardbottom Monitoring Project (Dustan et al., 1998).

A single Access database is in development to manage all biological data collected in the county. This database eases QAQC operations, data management, portability to GIS, and provides relatively secure data storage.

5.0 LONG-TERM MITIGATION MONITORING PROGRAM

The details of each nearshore transect are presented in Table 4. Site selection followed a stratified-random protocol i.e., site locations were random within a narrowly defined, presumably homogenous area. Site selection criteria for natural hardbottom were as follows: north-south locations intended to achieve relatively even distribution through the construction areas, and the western end of these transects was set at the nearest hardbottom east of the equilibrium tow of fill. Site selection criteria for mitigation reefs were as follows: north-south locations intended to achieve relatively even distribution through each mitigation reef, as reef geometry allowed, and maintain a minimum of 30 m spacing, the east-west spacing was a minimum of 2.0 m from a mitigation reef edge and from any other transects.

Thirty additional fish assessment transects were selected from the set of 200 first sampled in 2001. The details of the additional fish monitoring transects are presented in Table 6.

5.1 MONITORING OF TRANSPLANTED CORALS

After transplanting colonies to the mitigation reefs CONSULTANT shall tag a subset of the colonies (a minimum of 25% of the transplanted shall be tagged) and shall record the condition, health, and growth of the subset by taking and analyzing digital images of each of the tagged corals. Using this data, the CONSULTANT shall evaluate the general success of the coral transplant program on the mitigation reefs. Monitoring of the transplanted coral colonies shall take place once immediately after transplantation, once six (6) months after transplantation, once one year after transplantation, and every six (6) months for two (2) years after transplantation to the Mitigation Artificial Reef for a total of five (5) post-transplantation monitor events. Coral transplant monitoring reports shall be submitted to COUNTY within ninety (90) days of completion of monitoring field work.

5.2 MONITORING OF EPIBENTHOS: INCLUDING CORAL RECRUITMENT, FISH, AND ALGAL RECRUITMENT

5.2.1 Intent

Under FDEP Permit No. 0163435-001-JC (Specific Condition 15.c), the Broward County EPD requires monitoring of epibenthic colonization upon the mitigation reefs. By documenting epifaunal succession on the artificial reefs, the replacement habitat value of the artificial reefs compared to natural nearshore hardbottom can be determined. In addition, it provides a quantitative approach to mitigation for unavoidable and unexpected project-related impacts.

Analyses of all data will contribute to a functional habitat assessment of the mitigation reefs and assess the overall replacement habitat value for impacted nearshore habitat. Replacement habitat value assessments will compare sessile benthic flora, sessile benthic fauna, and fish assemblages on the mitigation reefs with those on the adjacent natural hardbottom, seaward of the equilibrium toe of fill (ETOF).

Unless otherwise stated, the field sampling activities will take place within three (3) weeks of the first day of the month specified (weather permitting). This window is necessary because field data collection requires 2-3 weeks of in-water time.

5.2.2 Methods

5.2.2.1 Benthic Ecological Assessment for Marginal Reefs (BEAMR)

Benthic communities will be evaluated using the Coastal Planning & Engineering, Inc. Benthic Environmental Assessment for Marginal Reef (BEAMR) method as detailed in 4.1.2.1. All transects in Table 4 with labels starting A, N, P, C096a, and C098a will be sampled with BEAMR conducted at each specified transect using 12 replicate 1.0 m^2 quadrats (1.0 m x 1.0 m)* every 2.5 meters, starting at 0.0 m. See Table 7 for scheduled monitoring events.

*The 6-month post-construction sampling event used 0.25 m^2 quadrats (0.5 m x 0.5 m). The sampling device was then increased to 1.0 m^2 quadrats (1.0 m x 1.0 m). This increase synchronizes the areas sampled in the Mitigation and Construction monitoring datasets (12.0 m^2 $transect^{-1}$). This change will add value to the Mitigation environmental dataset.

5.2.2.2 Video Transects for PointCount Analysis

Video surveys will be conducted as detailed in 4.1.2.2. All transects in Table 4 with labels starting A, N, P, C096a, and C098a will be videoed for PointCount along a west to east transect axis. See Table 7 for scheduled monitoring events.

5.2.2.3 PointCount Image Analysis

Video transect data collected in 5.2.2.2 will be analyzed using the software package PointCount for Coral Reefs© (Dustan et al. 1998) as detailed in 4.1.2.3. All transects in Table 4 with labels starting A, N, P, C096a, and C098a will be sampled. See Table 7 for scheduled monitoring events.

5.2.2.4 Gross Rugosity

A diver will stretch a survey tape from the west end to several meters beyond the east end of the transect, securing the tape only to the westernmost pin. The diver will press the tape into the bottom, hand over hand, such that the tape towards the west does not move and excess tape is pulled from the east end of the transect. The gross rugosity, i.e., contoured length of the transect, will be recorded where the tape intercepts the easternmost pin. The contoured length of the transect must be equal to, or greater than, the straight-line length of the transect. All transects in Table 1 with labels starting A, N, P, C096a, and C098a will be sampled for gross rugosity. See Table 7 for scheduled monitoring events.

5.2.2.5 Non-consumptive Macroalgae Species Census

A non-consumptive census of macroalgae species will be conducted at selected transects. A diver will swim two (2), 1.0 m wide belt transects, centered on the

transect line. The diver will use a framer, e.g., 1.0 m stick, 1.0 m^2 quadrat, etc., to ensure the area sampled is accurate. The diver will note location of the first specimen of every macroalgae species in the belt transect areas. These data may be used to generate a species-area curve after Dustan (1985). Positive species-level field identification is not possible for all macroalgae. Because this survey must be non-consumptive, the macroalgae species list may not be comprehensive. A non-consumptive macroalgae species census will be conducted only at transects P090a, P123a, A102d, and A102i. See Table 7 for scheduled monitoring events.

5.2.2.6 Biological Assessment of Fish Communities

Biological assessment of fish communities will be conducted at all transects in Table 1 with labels starting A, N, P, C096a, and C098a, and at the 30 supplemental permanent fish monitoring transects specified in Table 3. See Table 7 for scheduled monitoring events.

5.2.2.6.1 Transect Counts

A 30 m line will be stretched out west to east, coinciding with the transect locations. The diver shall swim above the transect recording all fish within 1 m either side, and 1 m above the line (an imaginary 60 cubic meter tunnel). Species will be recorded as well as numbers and total length (by size class: <2, 2-5, 5-10, 10-20, 20-30, 30-50 and 50+ cm) as encountered. The diver will carry a 1 meter “T”-rod, with the size classes marked off, to aid in transect width and fish length estimation. Stretches of sand along the transect (absence of hard substrate) greater than 3 m will also be recorded. The transect takes approximately 10 minutes to complete but will not be time delimited.

5.2.2.6.2 Rover-diver Counts

Rover-diver counts will consist of the diver recording the species encountered during a 20-minute interval. The diver is encouraged to look wherever they please in an attempt to record the maximum number of species. No abundance or size data will be recorded. Rover-diver counts will be accomplished in a 30 m square bounded by the transect line (Tables 1 and 3) to the south, and 30 m lines laid to the north of the eastern and western endpoints of the transect line.

5.2.3 Reporting Requirements

Analyses of all data will contribute to a functional habitat assessment of the mitigation reefs and assess the overall replacement habitat value for impacted nearshore habitat. Replacement habitat value assessment will compare sessile benthic flora, sessile benthic fauna, and fish assemblages on the mitigation reefs (Table 4with labels starting A) with those on the adjacent natural hardbottom (Table 4 with labels starting N, P, C096a, and C098a).

All data collected, and all relevant analyses conducted will be included in annual monitoring reports and submitted in conjunction with the fish monitoring, and coral transplantation reports. Reports will analyze and discuss current conditions compared to: the 2001 pre-construction baseline survey (where applicable), and all previous surveys conducted. Annual reports will be cumulative in presentation of summary data, analyses, and discussion. Reports will be serial in presentation of all raw data, all raw imagery, all video, and field notes, i.e., those data will be presented once. The 48-month post-construction report will present the final functional habitat assessment of the mitigation reefs. Annual reports will be submitted within 90 days of the final day of field data collection.

Product Distribution:

- Broward County. 5 hardcopies, 10 digital copies and 2 copies of video data;
- FDEP, Tallahassee. 1 hardcopy, 1 digital copy, and 1 copy of video data;
- FDEP, West Palm Beach. 1 hardcopy, 1 digital copy, and 1 copy of video data;
- USACE, Palm Beach Gardens. 1 hardcopy, 1 digital copy, and 1 copy of video data
- USACE, Jacksonville; refer to USACE specific condition 47;
- NMFS, Miami (2 COPIES); refer to USACE specific condition 47. 1 hardcopy and 1 digital copy
- USEPA, West Palm Beach; refer to USACE specific condition 47. 1 hardcopy and 1 digital copy
- USFWS, Vero Beach. 1 hardcopy and 1 digital copy;
- FWC, Tallahassee. 1 hardcopy and 1 digital copy;
- OAI. 1 hardcopy and 1 digital copy;
- CPE. 2 hardcopies.

6.0 PRE-CONSTRUCTION, CONSTRUCTION PHASE, AND POST-CONSTRUCTION SEA TURTLE MONITORING PROGRAM

6.1 JUVENILE GREEN SEA TURTLE SURVEYS

6.1.1 Intent

Juvenile sea turtles, particularly green sea turtles (*Chelonia mydas* L.) return to coastal regions 30 – 70 cm (curved carapace length) individuals, approximately 2-3 years old. They are particularly abundant along the nearshore reef habitats of southeastern Florida, where they gradually undergo a dietary shift from omnivory to herbivory. Until recently, there were no systematic or quantitative studies available to determine turtle abundance along any of the South Florida reef habitats. In response to the Broward County Shore Protection Project, Broward County EPD has commissioned sub-contractors, under FDEP Permit

No. 0163435-001-JC (Specific Condition 15.d.xvi), to document the abundance of juvenile sea turtles along the nearshore reef habitats of Broward County. These in-water monitoring surveys will help establish positional data records of juvenile greens within nearshore developmental habitats, before and after this beach construction project.

6.1.2 Methods

The nearshore reef habitat of Segment II (18.3 km; from Hillsboro Inlet to Port Everglades) and Segment III (13.3 km; from Port Everglades to Broward County/Miami Dade County Line) will be surveyed for juvenile sea turtle populations. Annual surveys will take place during the months of May, June, or July from 2003 through 2006 (Table 7).

The abundance and distribution of juvenile green turtles in Broward County's nearshore developmental habitats will be estimated utilizing the 'Shark Fishing' survey technique (Makowski *et al.*, in press). The survey will be completed using two in-water observers towed approximately 8 m behind a slowly moving (1.5-2.0 knots) boat. The in-water observers will visually scan the area from directly below and to the left (port observer), and directly below and to the right (starboard observer), as far as water clarity will allow (typically, $\leq$ 6 m to each side). When a juvenile turtle is sighted, in-water observers will motion to the boat operator, who will record the sighting on a lap-top computer that is simultaneously linked to GPS satellites with a Trimble beacon. HYPACK® MAX software, PC-based Windows software for planning, conducting, editing and publishing hydrographic surveys, will store turtle positional data, as well as the date and time of the observation. Other data (weather conditions, underwater visibility) will be added later, from field observation notes. The operator will also record the location of any turtles that surface to breathe near the boat. Survey transects will be performed once in a northern direction and once in a southern direction, and always on different days.

All turtle sightings will be plotted on nearshore laser airborne depth sounder (LADS) contour maps, using ArcView versions 3.3 and 8.3 Geographic Information System (GIS) software.

6.1.3 Reporting

An annual census report will be submitted to the Broward County EPD 90 days after completion of each surveying event. In addition, a geographic information system (GIS) database of juvenile green turtle sightings will be annually updated and submitted with each report. Surveys for 2003 and 2004 have been completed and submitted in partial compliance with permit conditions (FDEP Permit No. 0163435-001-JC, Section 15.d.xvi).

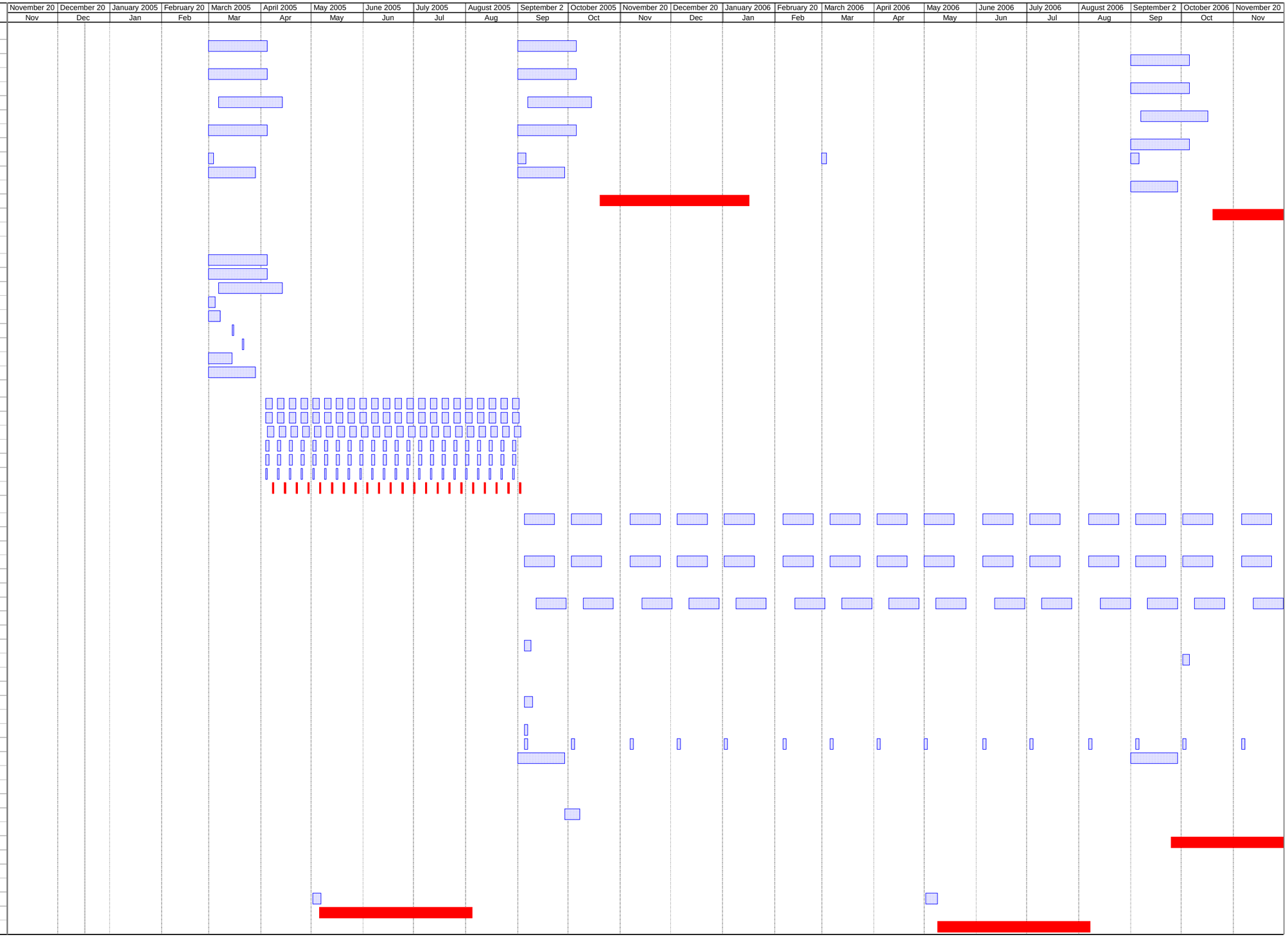
6.2 Macroalgal Resource Biomass

Quality and quantity of juvenile green sea turtle foraging habitat is better assessed by genus-level percent cover of 672 m^2 than as suggested in (FDEP Permit No. 0163435-001-JC Specific Condition 15.d.xvii). Data from sections 4.1.2.1, 4.2.2.1, and 5.2.2.1 will be used in lieu of biomass data.

7.0 TIMING

Table 7. Timing matrix depicted on the following three large-format pages.

ID	Task Name
1	**MITIGATION**
2	**BEAMR (method 5.2.2.1)**
5	**BEAMR (5.2.2.1)**
8	**Video PointCount (method 5.2.2.2)**
11	**Video PointCount (5.2.2.2)**
14	**PointCount (method 5.2.2.3)**
17	**PointCount (5.2.2.3)**
20	**Gross Rugosity (method 5.2.2.4)**
23	**Gross Rugosity (5.2.2.4)**
26	**Macroalgae sp Census (method 5.2.2.5)**
33	**BA of Fish Comm. (method 5.2.2.6)**
36	**BA of Fish Comm. (5.2.2.6)**
39	**Annual Report (5.2.3) 24 month Post Const**
40	**Annual Report (5.2.3) 36 month Post Const**
41	**Annual Report (5.2.3) 48 month Post Const**
42	**PRE-CONSTRUCTION**
43	BEAMR (method 4.1.2.1) pre-const
44	Video PointCount (method 4.1.2.2) pre-const
45	PointCount (method 4.1.2.3) pre-const
46	Coral Species Census (method 4.2.2.4) pre-const
47	Hardbottom Edge Mapping (method 4.2.2.5) pre-const
48	Pipeline Corridor Assessment (method 2.1.1) pre-const
49	Pipeline Swim pre-const (method 6.2.2) pre-const
50	Large Monitoring Stations (method 4.2.2.6) pre-const
51	BA of Fish Comm (method 2.2.2.7) pre-const
52	**MID-CONSTRUCTION**
53	BEAMR (method 4.1.2.1) mid-const
76	Video PointCount (method 4.1.2.2) mid-const
99	PointCount (method 4.1.2.3) mid-const
122	Coral Stress (method 4.1.2.4) mid-const
145	Sed Accumulation (method 4.1.2.5) mid-const
168	Pipeline Swim (6.2.2) mid-const
191	**Weekly Report (method 4.1.4) mid-const**
214	**POST-CONSTRUCTION**
215	**BEAMR (4.1.2.1) post**
235	BEAMR (4.1.2.1) post
238	BEAMR (4.1.2.1) post
239	**Video for PointCount (method 4.1.2.2) post**
259	Video for PointCount (4.1.2.2) post
262	Video for PointCount (4.1.2.2) post
263	**PointCount (method 4.1.2.2) post**
283	PointCount (4.1.2.2) post
286	PointCount (4.1.2.2)
287	**Coral sp Census/ sp-area curve (method 4.2.2.4)**
288	Coral sp Census/sp-area curve (4.2.2.4) post
292	Coral sp Census/sp-area curve (4.2.2.4) post
293	Coral sp Census/sp-area curve (4.2.2.4) post
294	**Hardbottom Edge Mapping (method 4.2.2.5) post**
295	Hardbottom Edge Mapping (4.2.2.5) post
296	Pipeline Corridor Assessment (method 6.2.2) post
297	**Large Monitoring Stations (method 4.2.2.6) post**
317	**BA of Fish Comm (method 4.2.2.7) post**
320	BA of Fish Comm (4.2.2.7) post
321	**BA of Fish Comm (4.2.2.7) post**
324	**Gross Rugosity (method 5.2.2.4) post**
325	**Post-Construction Report (4.2.3)**
326	**Governor's Report (method 4.2.3)**
327	**Post-Construction Annual Report (2006) (4.2.3)**
328	**Post-Construction Annual Report (2007) (4.2.3)**
329	**Post-Construction Annual Report (2008) (4.2.3)**
330	**Post-Construction Annual Report (2010) (4.2.3)**
331	**Sea Turtle Survey (methods 6.1.2)**
334	**Annual Report 2005**
335	**Annual Report 2006**



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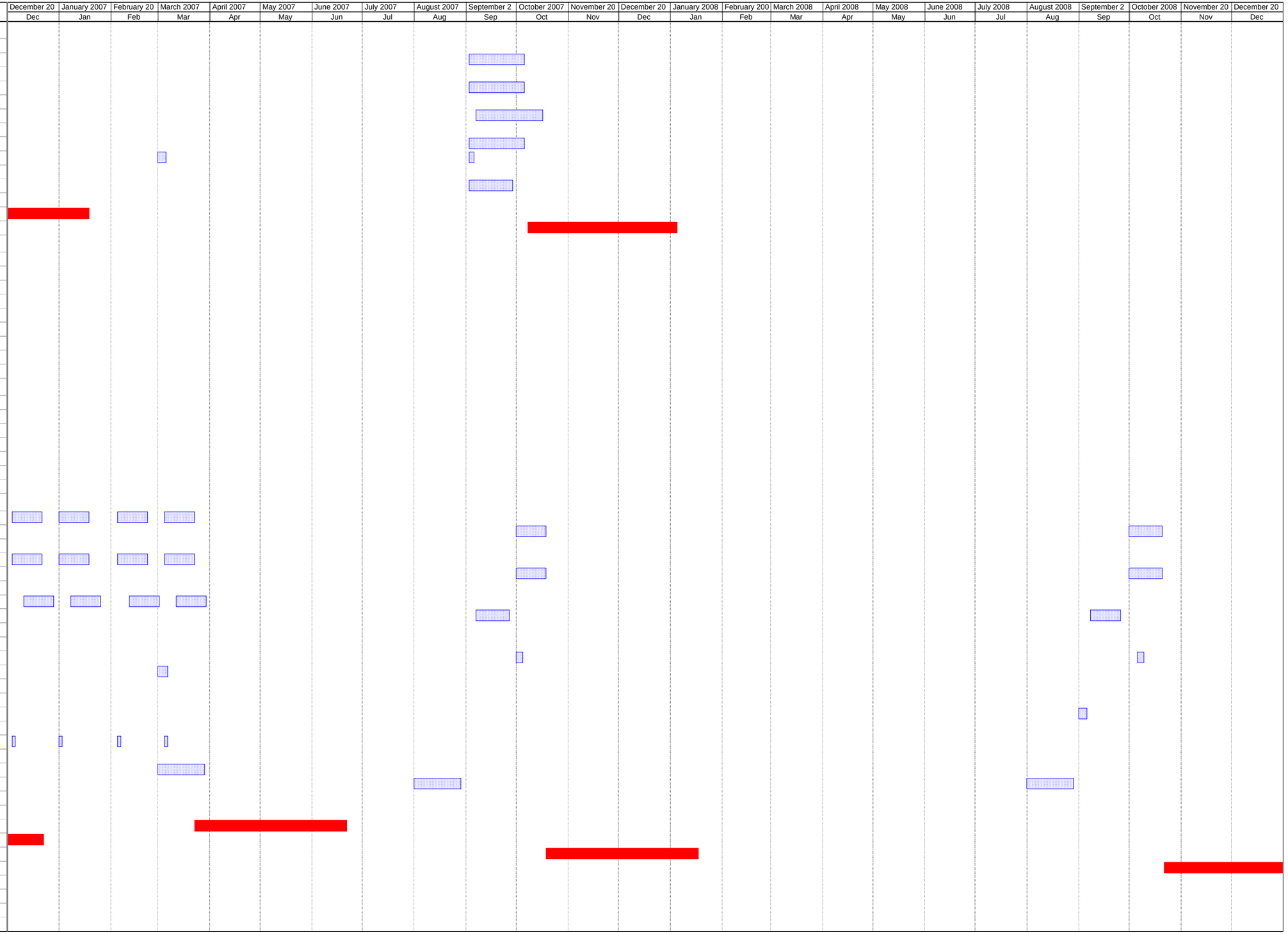
Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Table 7

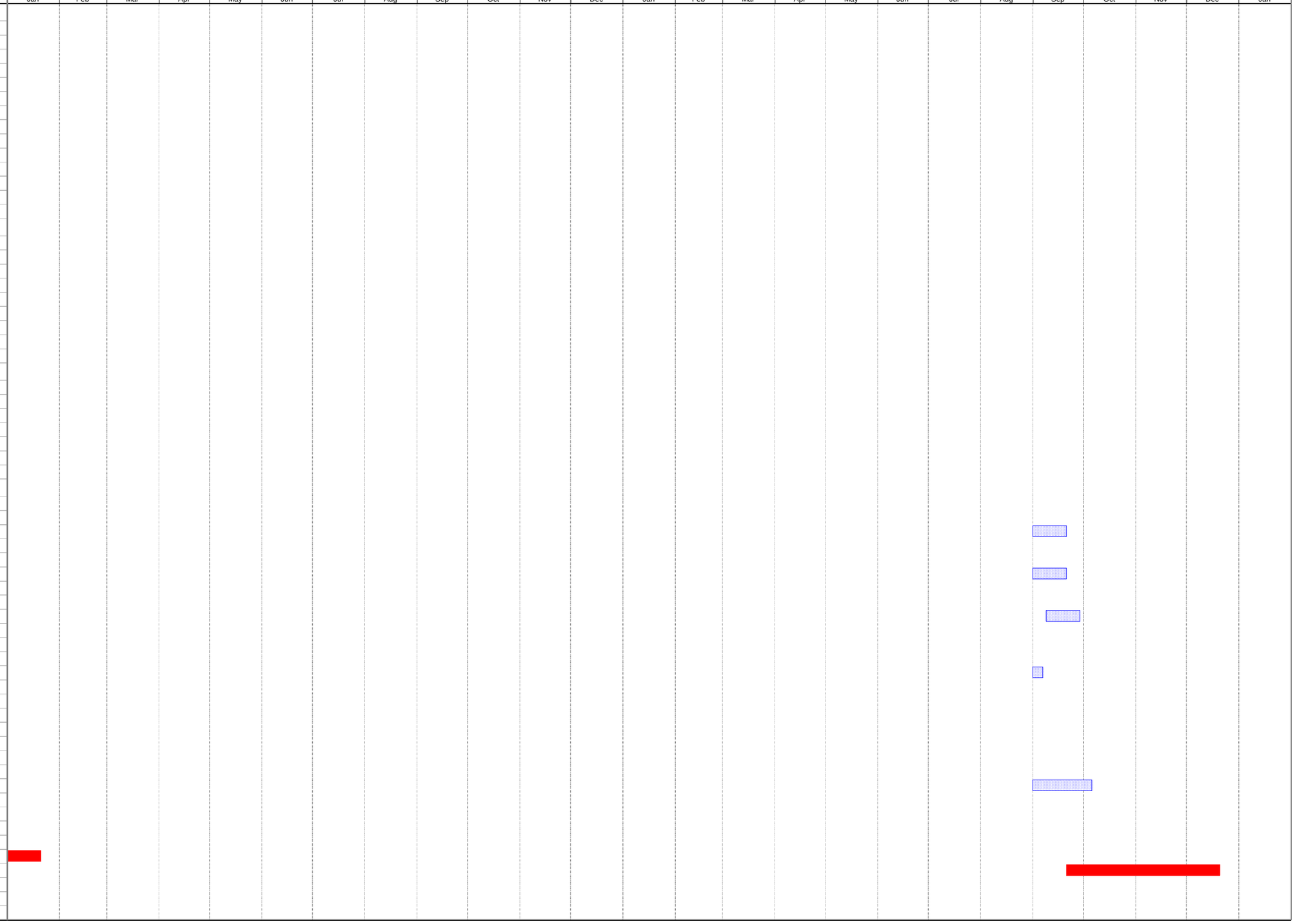
ID	Task Name
1	**MITIGATION**
2	**BEAMR (method 5.2.2.1)**
5	**BEAMR (5.2.2.1)**
8	**Video PointCount (method 5.2.2.2)**
11	**Video PointCount (5.2.2.2)**
14	**PointCount (method 5.2.2.3)**
17	**PointCount (5.2.2.3)**
20	**Gross Rugosity (method 5.2.2.4)**
23	**Gross Rugosity (5.2.2.4)**
26	**Macroalgae sp Census (method 5.2.2.5)**
33	**BA of Fish Comm. (method 5.2.2.6)**
36	**BA of Fish Comm. (5.2.2.6)**
39	**Annual Report (5.2.3) 24 month Post Const**
40	**Annual Report (5.2.3) 36 month Post Const**
41	**Annual Report (5.2.3) 48 month Post Const**
42	**PRE-CONSTRUCTION**
43	BEAMR (method 4.1.2.1) pre-const
44	Video PointCount (method 4.1.2.2) pre-const
45	PointCount (method 4.1.2.3) pre-const
46	Coral Species Census (method 4.2.2.4) pre-const
47	Hardbottom Edge Mapping (method 4.2.2.5) pre-const
48	Pipeline Corridor Assessment (method 2.1.1) pre-const
49	Pipeline Swim pre-const (method 6.2.2) pre-const
50	Large Monitoring Stations (method 4.2.2.6) pre-const
51	BA of Fish Comm (method 2.2.2.7) pre-const
52	**MID-CONSTRUCTION**
53	BEAMR (method 4.1.2.1) mid-const
76	Video PointCount (method 4.1.2.2) mid-const
99	PointCount (method 4.1.2.3) mid-const
122	Coral Stress (method 4.1.2.4) mid-const
145	Sed Accumulation (method 4.1.2.5) mid-const
168	Pipeline Swim (6.2.2) mid-const
191	**Weekly Report (method 4.1.4) mid-const**
214	**POST-CONSTRUCTION**
215	**BEAMR (4.1.2.1) post**
235	BEAMR (4.1.2.1) post
238	BEAMR (4.1.2.1) post
239	**Video for PointCount (method 4.1.2.2) post**
259	Video for PointCount (4.1.2.2) post
262	Video for PointCount (4.1.2.2) post
263	**PointCount (method 4.1.2.2) post**
283	PointCount (4.1.2.2) post
286	PointCount (4.1.2.2)
287	**Coral sp Census/ sp-area curve (method 4.2.2.4)**
288	Coral sp Census/sp-area curve (4.2.2.4) post
292	Coral sp Census/sp-area curve (4.2.2.4) post
293	Coral sp Census/sp-area curve (4.2.2.4) post
294	**Hardbottom Edge Mapping (method 4.2.2.5) post**
295	Hardbottom Edge Mapping (4.2.2.5) post
296	Pipeline Corridor Assessment (method 6.2.2) post
297	**Large Monitoring Stations (method 4.2.2.6) post**
317	**BA of Fish Comm (method 4.2.2.7) post**
320	BA of Fish Comm (4.2.2.7) post
321	**BA of Fish Comm (4.2.2.7) post**
324	**Gross Rugosity (method 5.2.2.4) post**
325	**Post-Construction Report (4.2.3)**
326	**Governor's Report (method 4.2.3)**
327	**Post-Construction Annual Report (2006) (4.2.3)**
328	**Post-Construction Annual Report (2007) (4.2.3)**
329	**Post-Construction Annual Report (2008) (4.2.3)**
330	**Post-Construction Annual Report (2010) (4.2.3)**
331	**Sea Turtle Survey (methods 6.1.2)**
334	**Annual Report 2005**
335	**Annual Report 2006**



Project: Rev 121704 Broward Environm
Date: Fri 12/17/04

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

ID	Task Name
1	**MITIGATION**
2	**BEAMR (method 5.2.2.1)**
5	**BEAMR (5.2.2.1)**
8	**Video PointCount (method 5.2.2.2)**
11	**Video PointCount (5.2.2.2)**
14	**PointCount (method 5.2.2.3)**
17	**PointCount (5.2.2.3)**
20	**Gross Rugosity (method 5.2.2.4)**
23	**Gross Rugosity (5.2.2.4)**
26	**Macroalgae sp Census (method 5.2.2.5)**
33	**BA of Fish Comm. (method 5.2.2.6)**
36	**BA of Fish Comm. (5.2.2.6)**
39	**Annual Report (5.2.3) 24 month Post Const**
40	**Annual Report (5.2.3) 36 month Post Const**
41	**Annual Report (5.2.3) 48 month Post Const**
42	**PRE-CONSTRUCTION**
43	BEAMR (method 4.1.2.1) pre-const
44	Video PointCount (method 4.1.2.2) pre-const
45	PointCount (method 4.1.2.3) pre-const
46	Coral Species Census (method 4.2.2.4) pre-const
47	Hardbottom Edge Mapping (method 4.2.2.5) pre-const
48	Pipeline Corridor Assessment (method 2.1.1) pre-const
49	Pipeline Swim pre-const (method 6.2.2) pre-const
50	Large Monitoring Stations (method 4.2.2.6) pre-const
51	BA of Fish Comm (method 2.2.2.7) pre-const
52	**MID-CONSTRUCTION**
53	BEAMR (method 4.1.2.1) mid-const
76	Video PointCount (method 4.1.2.2) mid-const
99	PointCount (method 4.1.2.3) mid-const
122	Coral Stress (method 4.1.2.4) mid-const
145	Sed Accumulation (method 4.1.2.5) mid-const
168	Pipeline Swim (6.2.2) mid-const
191	**Weekly Report (method 4.1.4) mid-const**
214	**POST-CONSTRUCTION**
215	**BEAMR (4.1.2.1) post**
235	BEAMR (4.1.2.1) post
238	BEAMR (4.1.2.1) post
239	**Video for PointCount (method 4.1.2.2) post**
259	Video for PointCount (4.1.2.2) post
262	Video for PointCount (4.1.2.2) post
263	**PointCount (method 4.1.2.2) post**
283	PointCount (4.1.2.2) post
286	PointCount (4.1.2.2)
287	**Coral sp Census/ sp-area curve (method 4.2.2.4)**
288	Coral sp Census/sp-area curve (4.2.2.4) post
292	Coral sp Census/sp-area curve (4.2.2.4) post
293	Coral sp Census/sp-area curve (4.2.2.4) post
294	**Hardbottom Edge Mapping (method 4.2.2.5) post**
295	Hardbottom Edge Mapping (4.2.2.5) post
296	Pipeline Corridor Assessment (method 6.2.2) post
297	**Large Monitoring Stations (method 4.2.2.6) post**
317	**BA of Fish Comm (method 4.2.2.7) post**
320	BA of Fish Comm (4.2.2.7) post
321	**BA of Fish Comm (4.2.2.7) post**
324	**Gross Rugosity (method 5.2.2.4) post**
325	**Post-Construction Report (4.2.3)**
326	**Governor's Report (method 4.2.3)**
327	**Post-Construction Annual Report (2006) (4.2.3)**
328	**Post-Construction Annual Report (2007) (4.2.3)**
329	**Post-Construction Annual Report (2008) (4.2.3)**
330	**Post-Construction Annual Report (2010) (4.2.3)**
331	**Sea Turtle Survey (methods 6.1.2)**
334	**Annual Report 2005**
335	**Annual Report 2006**



Project: Rev 121704 Broward Environm
Date: Fri 12/17/04

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Table 7

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