APPENDIX G

DRAFT MITIGATION PLAN

St. Lucie County

South County Beach & Dune Restoration Project
Draft Mitigation Plan

October 14, 2010

COASTAL TECH
COASTAL TECHNOLOGY CORPORATION

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Nearshore hardbottom, St. Lucie County, Florida (CSA 2010a)
Sea oats, Vero Beach, Florida (Coastal Tech 2009)
South Beach, St. Lucie County, Florida (Coastal Tech 2007)

1.0 INTRODUCTION

The south St. Lucie County Beach and Dune Restoration Project (Project), FDEP File Number 0154626-001-JC, proposes to restore beach and dune between DEP reference monuments R-87.7 to R-90.3 and R-98 southward to the St. Lucie/Martin County line (Figure 1) in order to: a) offset sediment deficit, b) restore and maintain the recreational beach, c) restore and maintain habitat for marine turtle nesting, marine life and shorebirds, and d) provide storm damage protection for property and infrastructure. As currently designed, the Project may directly impact existing dune vegetation seaward of the dune crest, and nearshore hardbottom within the predicted footprint of the Project.

This draft plan outlines the mitigation measures that St. Lucie County proposes to conduct pre- and post-construction in order to offset loss of ecological functions due to potential Project impacts.

2.0 DUNE VEGETATION MITIGATION

The Project may place fill over vegetation located within the upper beach/pioneer zone of the dune system, but there is no intent to place beach fill landward of the dune crest (the line of permanent woody vegetation). The upper beach/pioneer zone typically contains halophytic species that also tolerate xeric conditions; many of these species have high growth rates and also spread rapidly as they grow, and some species are stimulated to grow faster as they become buried in sand (Smithsonian Marine Station website). Typical species found in the upper beach/pioneer zone include railroad vine (*Ipomoea pes-caprae*), seashore paspalum (*Paspalum distichum*), sea purslane (*Sesuvium portulacastrum*), and sea oats (*Uniola paniculata*). Pioneer species trap wind-blown sand, resulting in sand accumulation and eventual establishment of a dune system.

Due to the severe impact of the 2004 hurricane season, namely Frances and Jeanne, a dune restoration/revegetation project was implemented in southern St. Lucie County. The dune system from R-87.7 to 90.3 and from R-98 to the St. Lucie/Martin County line was revegetated with sea oats and other coastal native dune species. That revegetation project extent corresponds to much of the proposed Project's southern segment and has demonstrated successful establishment and proliferation of species proposed to be planted for this project.

2.1 Proposed Mitigation – Dune Vegetation

Subsequent to Project construction, St. Lucie County will plant the restored dune with a mix of native coastal dune pioneer plants, which may include sea oats (*U. paniculata*), beach sunflower (*Helianthus debilis*), railroad vine (*I. pes-caprae*), and dune panic grass (*Panicum amarum*), depending upon nursery availability at the time of planting. A total of ~293,000 planting units will be installed 18 inches on center in staggered rows on the dune crest (Figures 2 and 3). Table 1 identifies the distribution of proposed species to be planted.

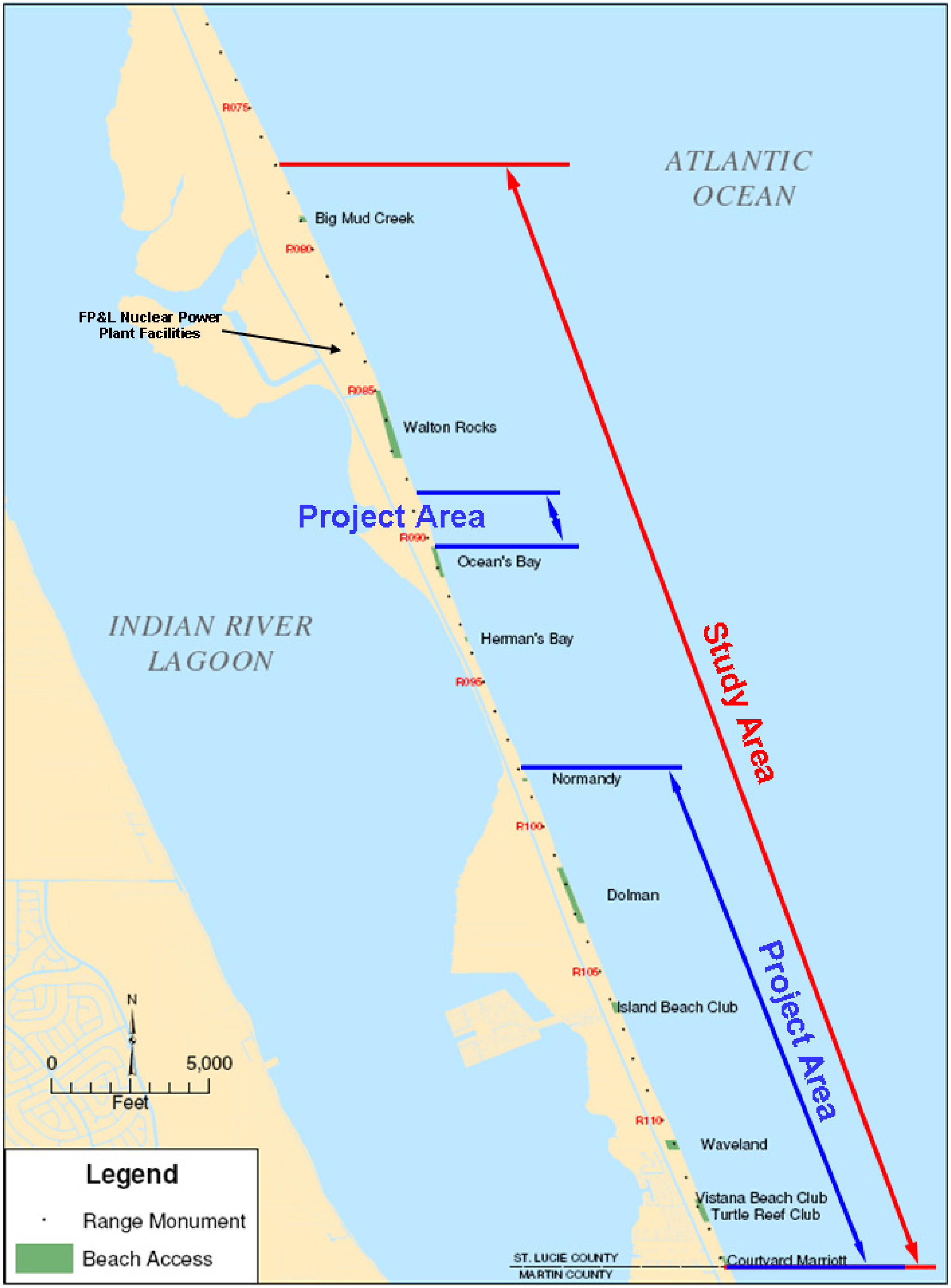

Figure 1: South St. Lucie County Project Area (in blue): DEP reference monuments R-87.7 to R-90.3 and R-98 to the St. Lucie/Martin County line.

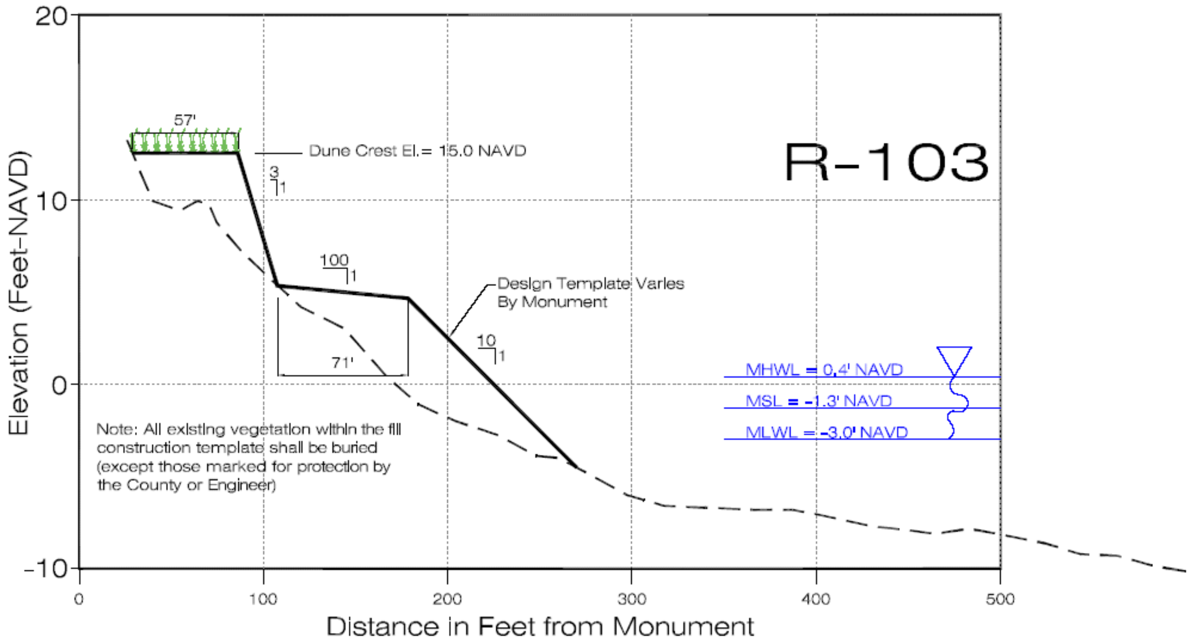

Figure 2: Proposed dune vegetation planting example profile at R-103.

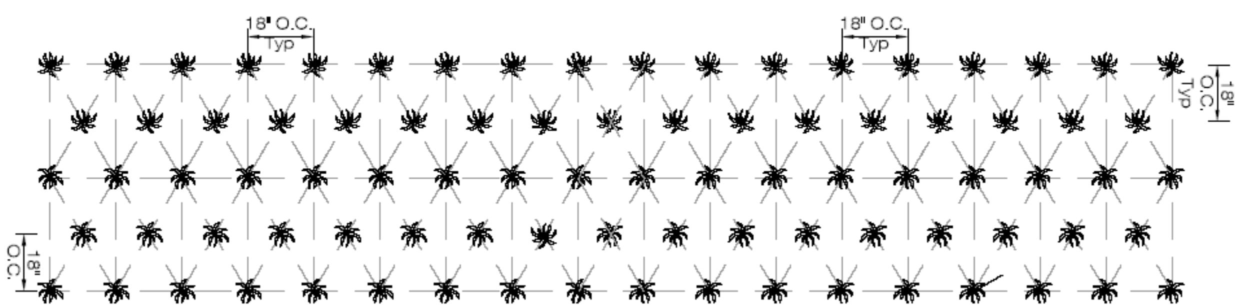

Figure 3: Typical dune planting layout.

Table 1: Proposed dune planting distribution.

Common Name	Scientific Name	% Distribution	Approximate Quantity	Size
Sea Oats	*Uniola paniculata*	80	291,000	Liner
Dune Panic Grass	*Panicum amarum*	13	47,320	Liner
Railroad Vine	*Ipomoea pes-caprae*	4	14,560	Liner
Dune Sunflower	*Helianthus debilis*	3	10,920	Liner
	TOTAL	100	293,000	

All planting units shall:

- contain at least two (2) viable emergent stems per liner,
- be between 8 inches and 16 inches tall (or length in the case of railroad vine) as measured from the top of root ball to the apical meristem (top of stem), and
- be installed at a minimum depth of 6 inches below surrounding grade as measured from top of root ball to sand surface (Figure 4).

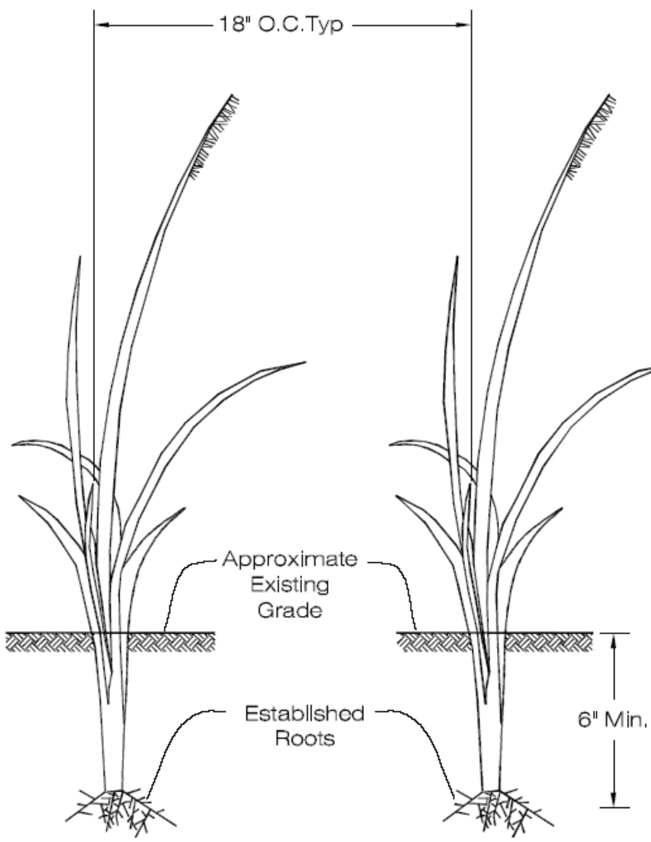

Figure 4: Typical planting detail.

2.2 Dune Planting Monitoring and Maintenance

Within 30 days after planting is completed, the dune vegetation shall be monitored using any standard method for assessing total areal plant cover; the simple *Flat Vegetative Cover Test Method* is recommended. Several representative photo-reference points will be established and photographs will be taken to depict the completed planting activities. The number, size, and location of all species planted, as well as the planting dates and any variation to the planting plan (Figures 2-4 and Table 1), will be noted.

One year after planting completion, the planted area will be monitored using methodology consistent with the immediate post-construction monitoring event. The number, size, and location of all species planted, and any necessary re-plantings will be noted. If it is determined that any of the planted species are not proliferating, other appropriate coastal dune pioneer species may serve as replacements, after approval from the Department. If mortality of plants occurs due to human encroachment, temporary fencing will be erected and maintained until the success criteria (section 2.4) are met.

2.3 Reporting

The post construction and one year monitoring reports shall be submitted within 60 days of each monitoring event. Reports shall detail the data collected during monitoring and percent survivorship shall be identified in the one year post construction monitoring report.

2.4 Dune Planting Success Criteria

At the end of the one year post construction monitoring period, starting from the time the last plant was installed (or replaced at any time after the initial planting), if 80% or more of the plants that were initially planted survive, then continued monitoring and maintenance of the dune area is not required. Mortality as a result from loss of dune structure (e.g., slumping due to escarpment formation) will be noted and will not be included in the required planting survivorship. If 80% survival has not been achieved at the end of the first year after installation, then replanting and monitoring shall continue until 80% survivorship of native dune plants is achieved in the planting area and maintained for one full year.

3.0 NEARSHORE HARDBOTTOM MITIGATION

2009 monitoring efforts describe three hardbottom community types within the Project area, and based upon that pre-construction baseline monitoring of nearshore hardbottom adjacent to the Project (CSA 2010a), it appears that two hardbottom community types may be impacted by the Project beach fill. Results from cross-shore monitoring transects and nearshore hardbottom edge mapping efforts within the footprint of the Project indicate that the substrate types within the Project footprint consist of a matrix of hardbottom (HB), partially-exposed hardbottom (PEHB), and sand (Table 5 within CSA 2010a).

3.1 Ecological Functions of Potentially Impacted Community Types

Ecological functions of nearshore hardbottom communities within the Project area vary depending upon the dominant floral and faunal species observed and the community structure. Hardbottom Community One (CSA 2010a), located within the footprint of the Project's north segment (R-87.7 to R-90.3), is often discontinuous and patchy along the landward edge of hardbottom, approximately 11 to 48m (36 to 157 feet) from the mean high water line (MHWL). Hardbottom Community One consists of low- to medium-relief hardbottom with a significant wormrock (*Phragmatopoma lapidosa*) component (approximately 10% coverage along monitoring transects) relatively close to shore, and supports biota such as hydroids, encrusting sponges, macroalgae, and turf algae. The physical characteristics of this community type facilitate the establishment and proliferation of *P. lapidosa*, while also supporting a large percent cover of robust, canopy-forming red algae. This community type provides shelter and nutrient source to many invertebrate, fish, and turtle species. Additionally, wormrock is reef-building and contributes to the biological diversity of the nearshore environment. Figure 5 provides visuals of this community type.

Hardbottom Community Two is characterized by low-relief consolidated coquina rock ledges approximately 26 to 42m (85 to 138 feet) from MHWL. The ledge is well-defined, undercut with exposed consolidated coquina rock ledge with little or no epibiotic cover (CSA 2010a). This community did <u>not</u> have the wormrock component or robust macroalgae evident in Hardbottom Community One and appears to be constantly subjected to the dynamics of the nearshore environment: sand movement, scouring, and alternating burial/exposure. Because of the ephemeral nature of this community type, in addition to the general absence of extensive biotic coverage, ecological functions likely include temporary shelter for motile invertebrates and fish. Figure 7 depicts this community type and Figures 8 through 13 exhibit the expanses of HB, PEHB, and sand along cross-shore monitoring transects within the limits of this community type, as field-verified by CSA (2010a).

A third hardbottom community type was characterized by CSA (2010a), but this third community type was located further offshore than the other two communities, and will likely not be impacted by the Project predicted ETOF and 150m mixing zone. Hardbottom Community Three was characterized by discontinuous large, flat boulders along the length of the medium—relief ledge system in deeper, more offshore areas south of R-109.2. This community type consists of a more diverse faunal community when compared to the other two hardbottom community types.

The remainder of the south segment of the Project area footprint is dominated by expanses of sand. CSA (2010a) noted that "three large shore-parallel sand gaps were observed within the survey area that lacked nearshore hardbottom structures or featured very small patches of exposed hard substrate. Shore-parallel sand gaps recorded along the survey area (R-94 to R-99, R-107 to R-109, and R-112 to R-2) totaled approximately 3,700m (12,000ft) in length and consisted primarily of fine, unconsolidated sand substrate."

Characterization of the nearshore hardbottom used to estimate direct impacts within and adjacent to the proposed Project area for the purposes of the JCP application was conducted via the use of

August 1, 2008 aerial photography. In 2008, CSA conducted an analysis and ground-truthing of the aerial photography which interpreted the extent of nearshore hardbottom within and adjacent to the proposed Project area and generated an ESRI shape file. The 2008 aerial interpretation hardbottom maps were the baseline for which the application of the Dean Equilibrium Profile methodology was used to identify approximately 1.08 acres of hardbottom impact (including pipeline corridors) as described in the updated Design Document.

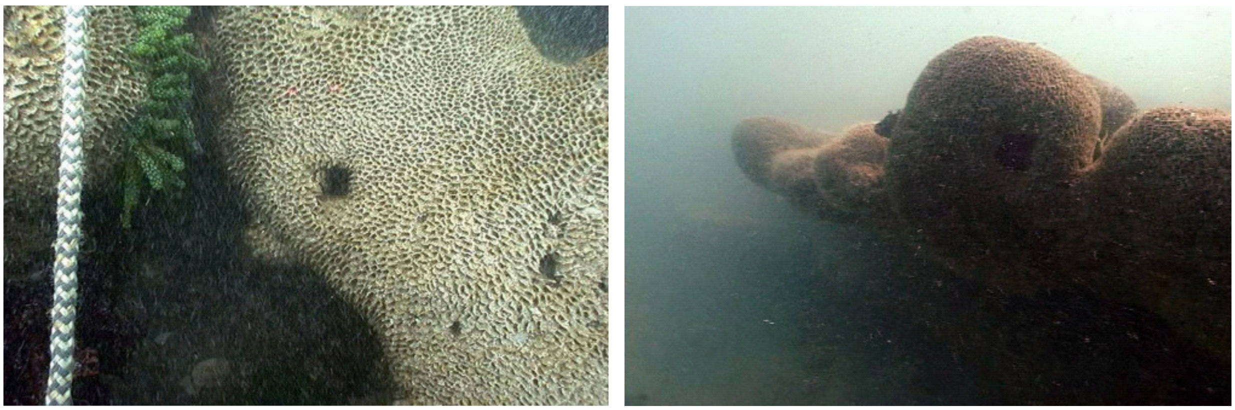

Figure 5: Representative images from CSA (2010a) of Hardbottom Community One, which consists of low- to medium-relief hardbottom with a wormrock component.

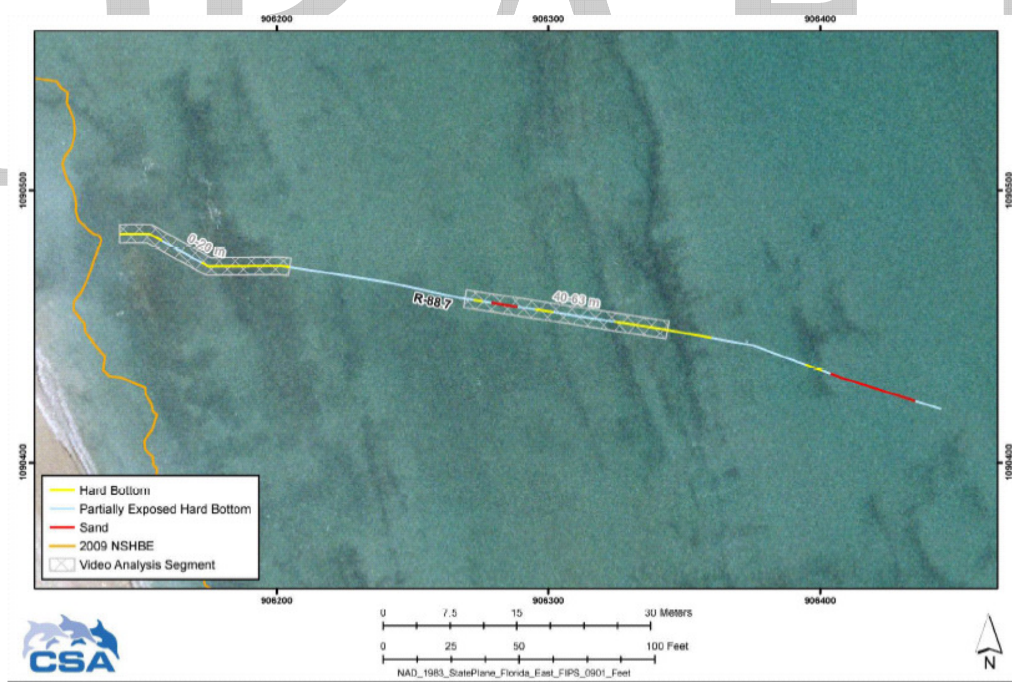

Figure 6: Pre-construction monitoring transect at R-88.7 (CSA 2010a), which is representative of hardbottom extent of Community One in the Project north segment (R-87.7 to R-90.3).

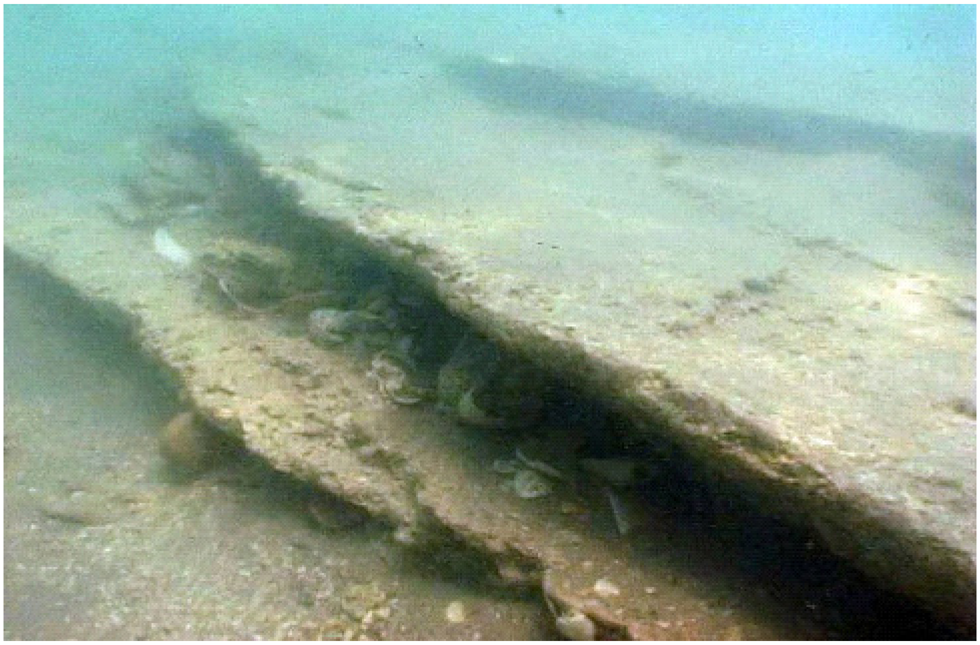

Figure 7: Representative photo (CSA 2010a) of Hardbottom Community Two, characterized by consolidated coquina rock ledge with little epibiotic growth.

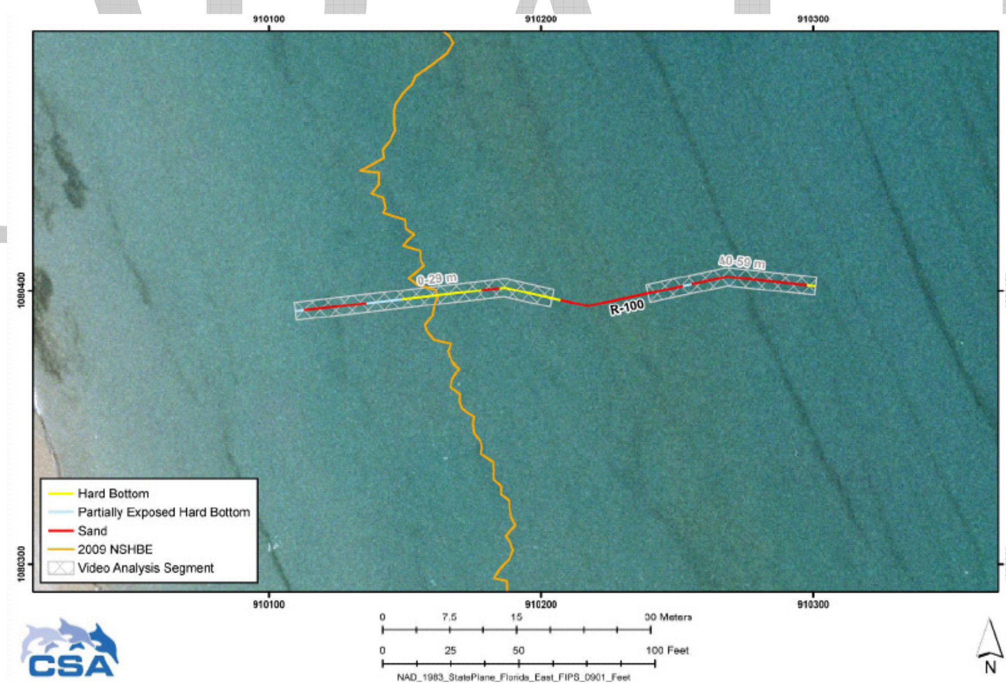

Figure 8: Pre-construction monitoring transect at R-100 (CSA 2010a), which is representative of hardbottom extent of Community Two in the Project south segment (R-98 to St. Lucie/Martin County line).

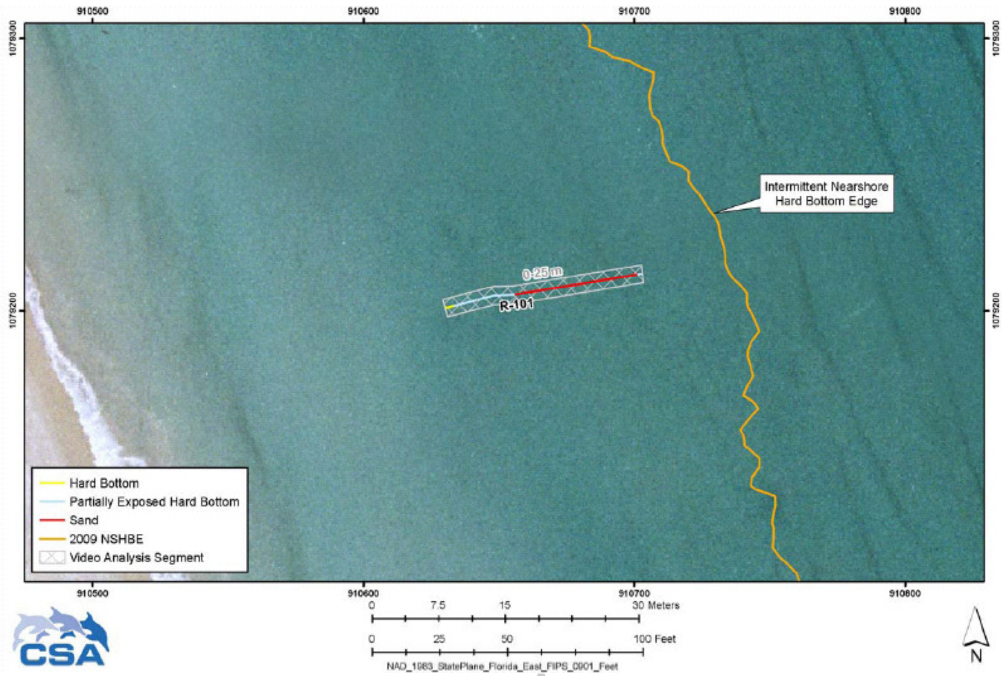

Figure 9: Pre-construction monitoring transect at R-101 (CSA 2010a), which is representative of hardbottom extent of Community Two in the Project south segment (R-98 to St. Lucie/Martin County line).

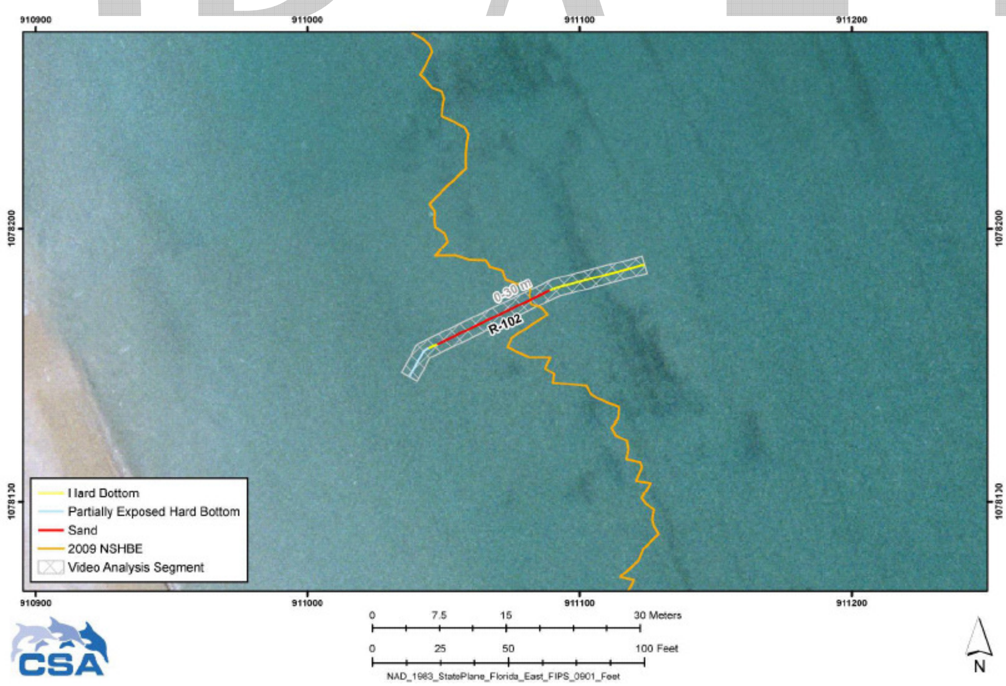

Figure 10: Pre-construction monitoring transect at R-102 (CSA 2010a), which is representative of hardbottom extent of Community Two in the Project south segment (R-98 to St. Lucie/Martin County line).

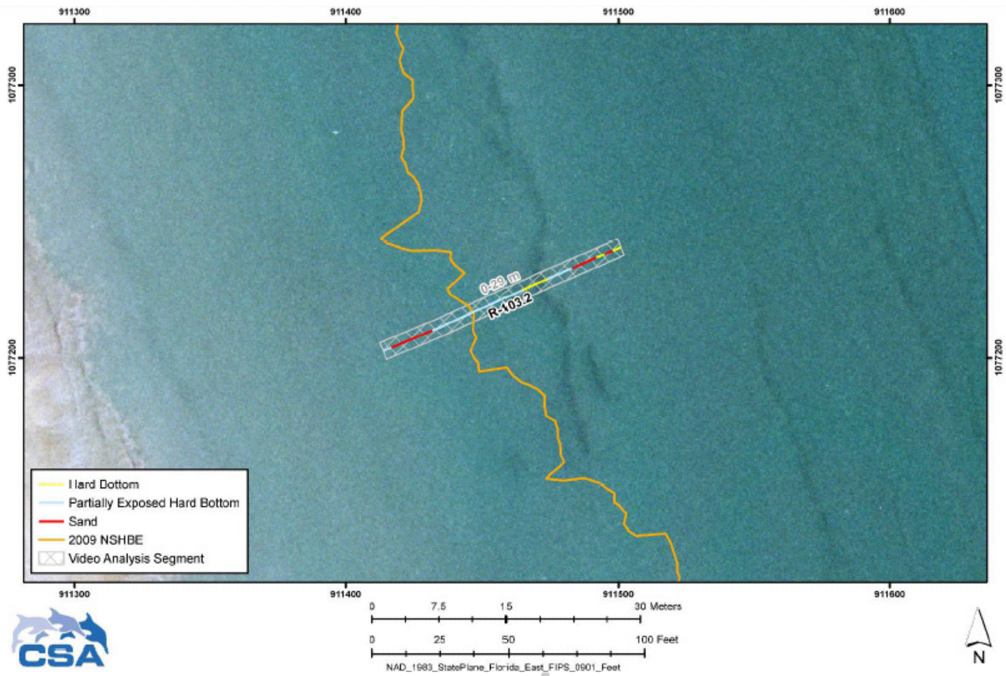

Figure 11: Pre-construction monitoring transect at R-103.2 (CSA 2010a), which is representative of hardbottom extent of Community Two in the Project south segment (R-98 to St. Lucie/Martin County line).

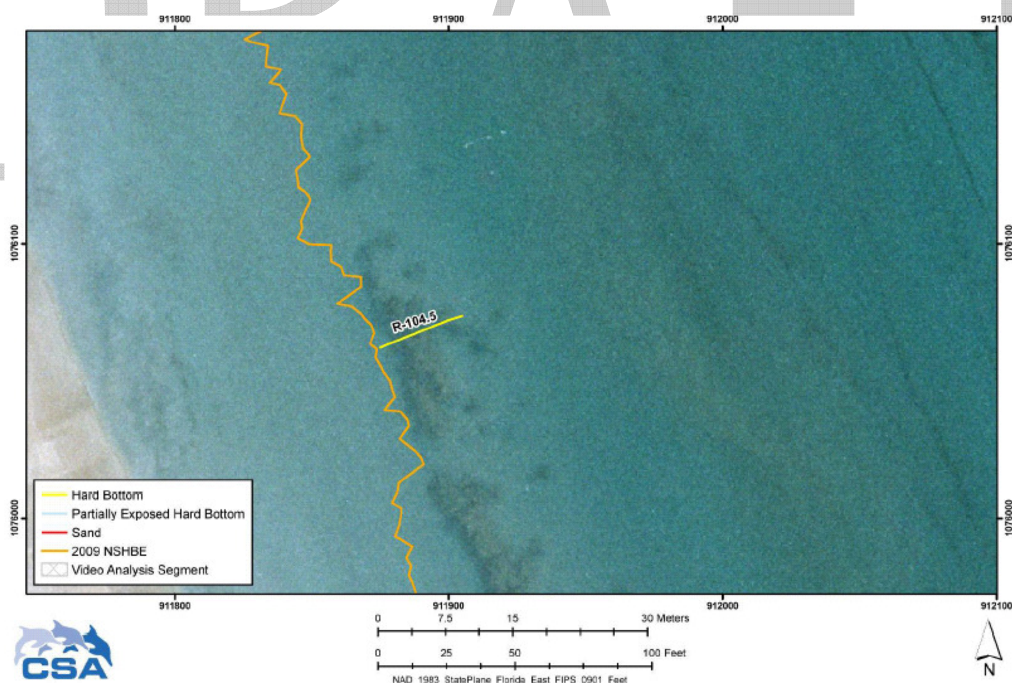

Figure 12: Pre-construction monitoring transect at R-104.5 (CSA 2010a), which is representative of hardbottom extent of Community Two in the Project south segment (R-98 to St. Lucie/Martin County line).

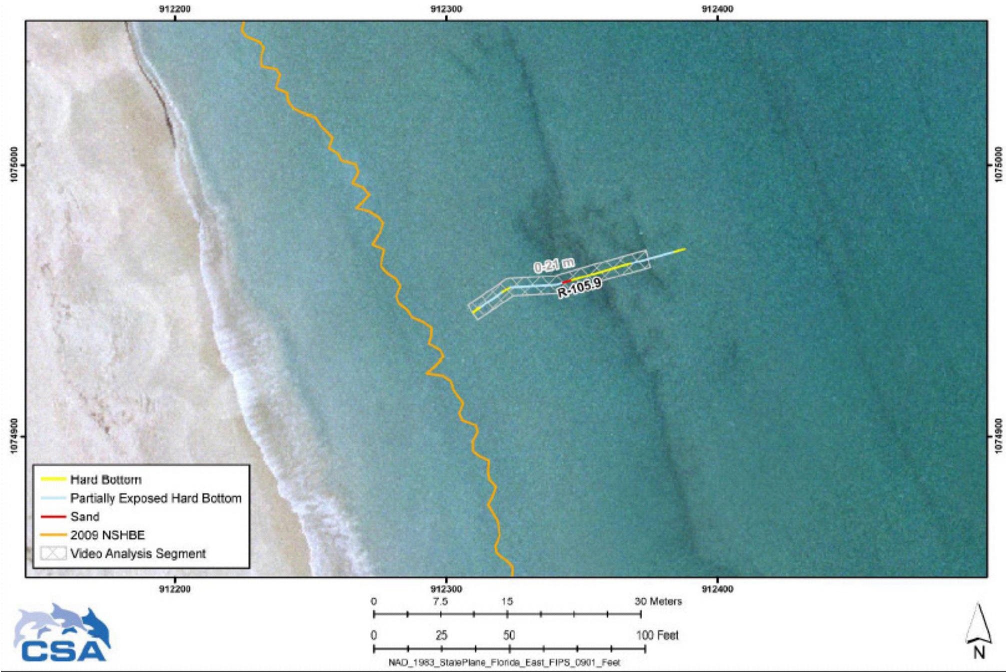

Figure 13: Pre-construction monitoring transect at R-105.9 (CSA 2010a), which is representative of hardbottom extent of Community Two in the Project south segment (R-98 to St. Lucie/Martin County line).

Due to concerns expressed by FDEP staff regarding Coastal Tech's original hardbottom impact acreage (1.08 acres) estimates identified within the updated Design Document (revised July 6, 2010), FDEP developed a methodology to estimate the maximum potential hardbottom impacts using the existing data - i.e., 2008 aerial interpretation and 2009 field work. FDEP concerns are related to the ephemeral nature of the existing hardbottom which is not represented in the 2008 aerial-interpreted-hardbottom-map or 2009 field work results. Coastal Tech provided the 2008 aerials with the following superimposed: CSA's 2008 aerial-interpreted-hardbottom-map, the 2009 diver-surveyed landward edge of hardbottom (LEHB), and the 2009 transect data. For the purposes of the NEPA process, FDEP identified the following steps to delineate the maximum nearshore hardbottom impacted by the proposed Project. FDEP drew onto the 2008 aerials FDEP interpretation of the LEHB as a line throughout the Project area conservatively connecting gaps (where no hardbottom was found in 2008 or 2009 – including over 7000'± at the southern end of the Project) between the more landward of either (a) the 2009 diver-surveyed LEHB, or (b) the landward extent of hardbottom reflected in the 2009 cross-shore video transects. The predicted ETOF to be used is that predicted by the Dean equilibrium profile methodology. The 2009 cross-shore video transects conducted by CSA, indicate, on average, that about one-third of each transect length is HB or PEHB. Based upon this "one-third estimate", one-third of the area between the LEHB and the predicted ETOF is estimated as the maximum potential hardbottom impact estimate – equal to 7.94 acres, including 0.97 acres of Hardbottom Community One (low- to medium-relief with approximate 10% wormrock component) and 6.97 acres of Hardbottom Community Two (low-relief coquina ledges with little or no biotic cover). It was agreed with FDEP that this acreage would be cited in the DEIS as the estimated maximum hardbottom impact acreage. Impacts to patchy hardbottom and PEHB are also included in the total maximum potential hardbottom impact estimate.

Additional field work and aerial imagery interpretation are slated to be conducted in 2010. Field verification via line-intercept transects will be used to interpret 2010 aerial imagery and generate hardbottom maps in the form of an ESRI shape file; these maps shall be used to refine the likely Project nearshore hardbottom impacts and to further define the proposed specific mitigation for the Project.

CSA (2010a) noted that hardbottom extent, as interpreted from 2008 aerial photographs, may have been more extensive than was present during field survey efforts in 2009. There was insufficient exposed hardbottom for mapping purposes within the sand gaps (as described on page 6), and these results, combined with the monitoring results of transect R-104.5 in 2008 and 2009 (hardbottom present in 2008, completely buried in 2009), indicate that the southern portion of the Project experiences considerable changes in terms of burial and exposure of hardbottom. The evident changes in exposed hardbottom may correspond to the effects of the Pierce Shoal welding to the shoreline and southward migration of sand from this shoal as reflected in Figure 14. This shoal may have been instrumental in accretion of the beach from 1972 to 2006 within the southern segment of this project (R-104 to R-109), and the sand accumulation witnessed in the nearshore areas is likely associated with natural coastal processes associated with the Pierce Shoal and its proximity to the Project shoreline.

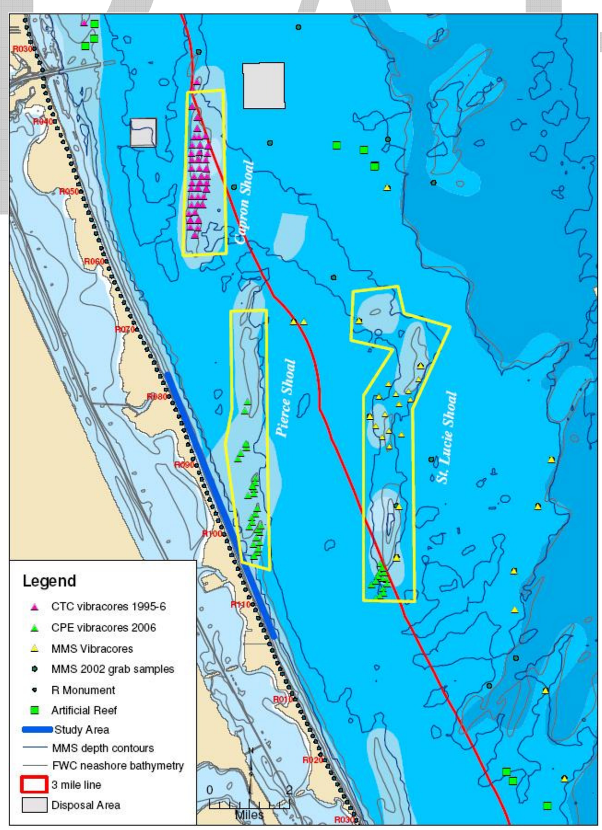

Figure 14: Project area and adjacent features, including the nearshore Pierce Shoal.

The six (6) proposed pipeline corridors were diver-surveyed in 2009 (R-89.5, R-100, R-101, R-104, R-108, and R-114) and resulted in the elimination of one proposed corridor at R-101 due to a 62m extent of hardbottom in the nearshore region of that proposed pipeline corridor. The northernmost pipeline corridor (approximately at R-89.5) contains variable presence of hardbottom and partially-exposed hardbottom, but no practicable alternative (i.e., other route that would result in lesser impact) appears to be feasible for the north Project segment. The remaining four (4) proposed pipeline corridors (R-100, R-104, R-108, R-114) consist almost completely of sand and shell hash, with some interspersed small expanses of hardbottom or partially-exposed hardbottom. This small expanse provided little biotic cover and may be an area of ephemeral hardbottom exposure (CSA 2010a), or an area experiencing accretion effects from the migration of Pierce Shoal. The use of pipeline collars or similar type of stand-off device is proposed and is expected to minimize potential impacts to hardbottom resources along the pipeline corridor. Potential impacts to nearshore hardbottom from pipeline corridors (if an offshore borrow area is used) are included in the estimates for Hardbottom Communities One and Two, will be further evaluated during post-construction biological monitoring, and any unanticipated impacts can be addressed via the Contingency Mitigation Plan (Appendix B).

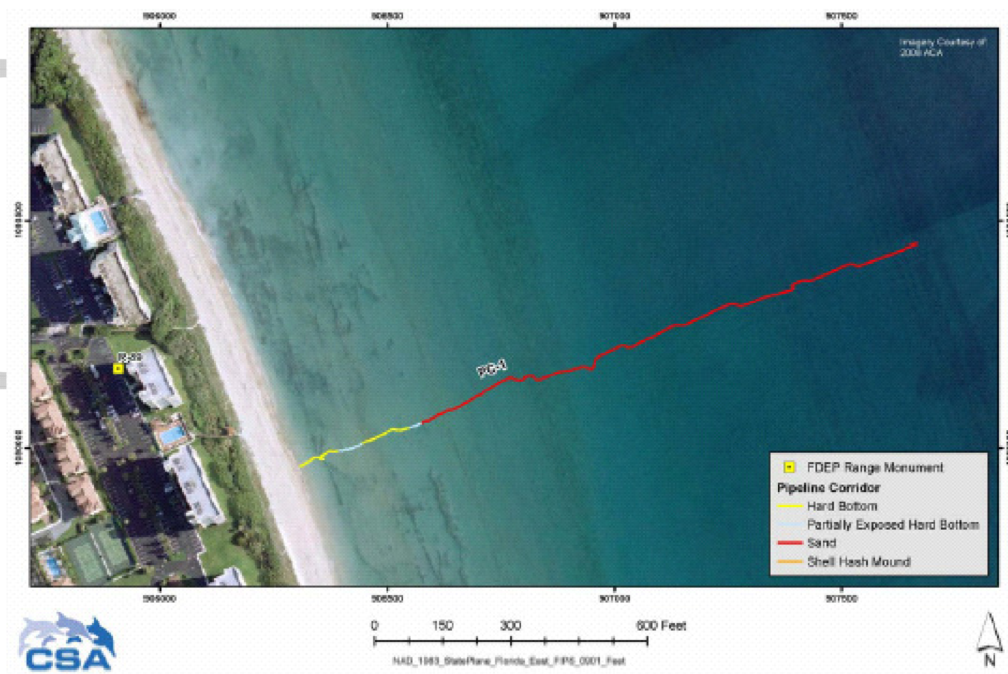

Figure 15: Pre-construction monitoring transect at proposed pipeline corridor near R-89.9 (CSA 2010a).

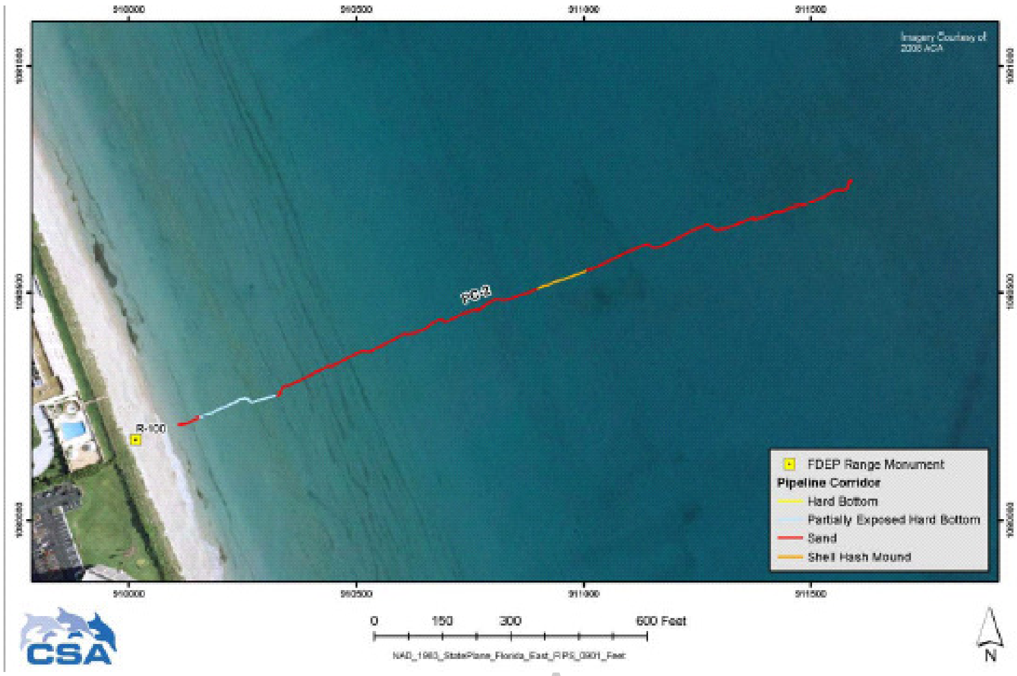

Figure 16: Pre-construction monitoring transect at now-eliminated pipeline corridor near R-100 (CSA 2010a).

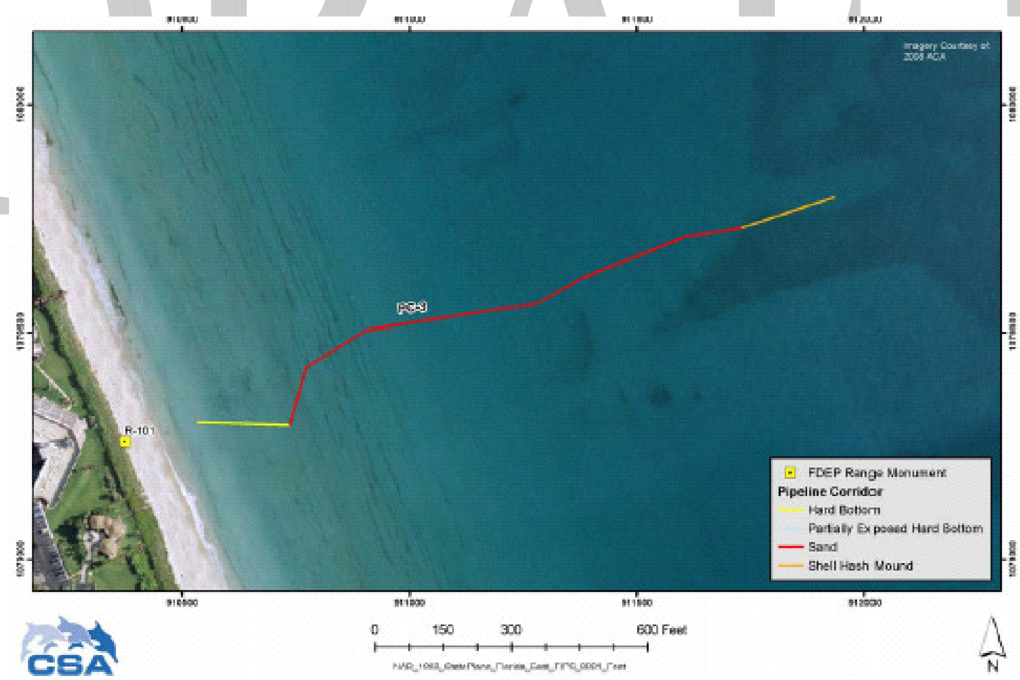

Figure 17: Pre-construction monitoring transect at proposed pipeline corridor near R-101 (CSA 2010a).

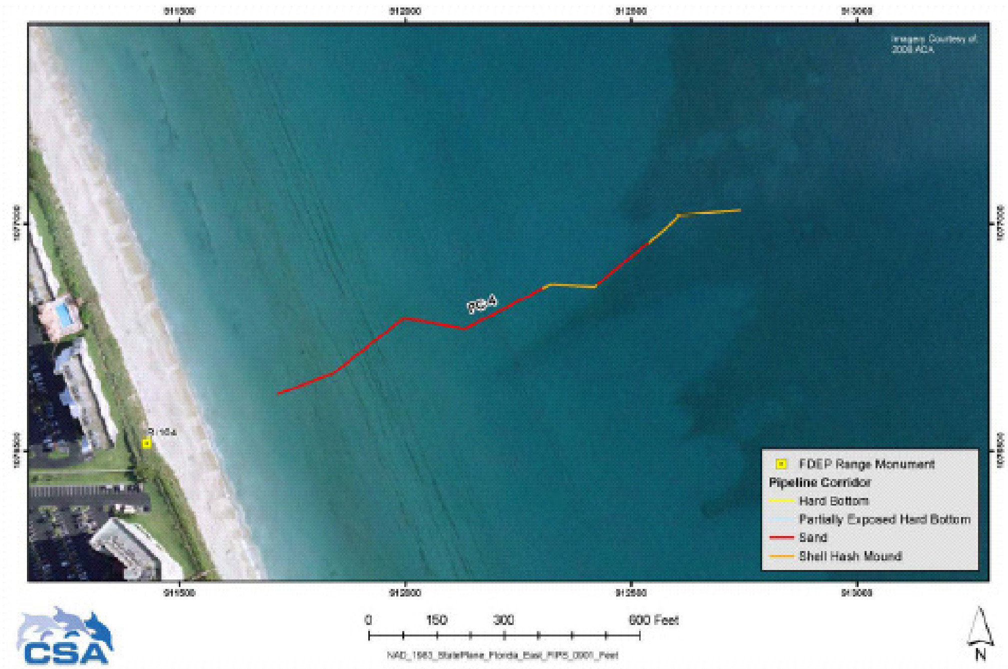

Figure 18: Pre-construction monitoring transect at proposed pipeline corridor near R-104 (CSA 2010a).

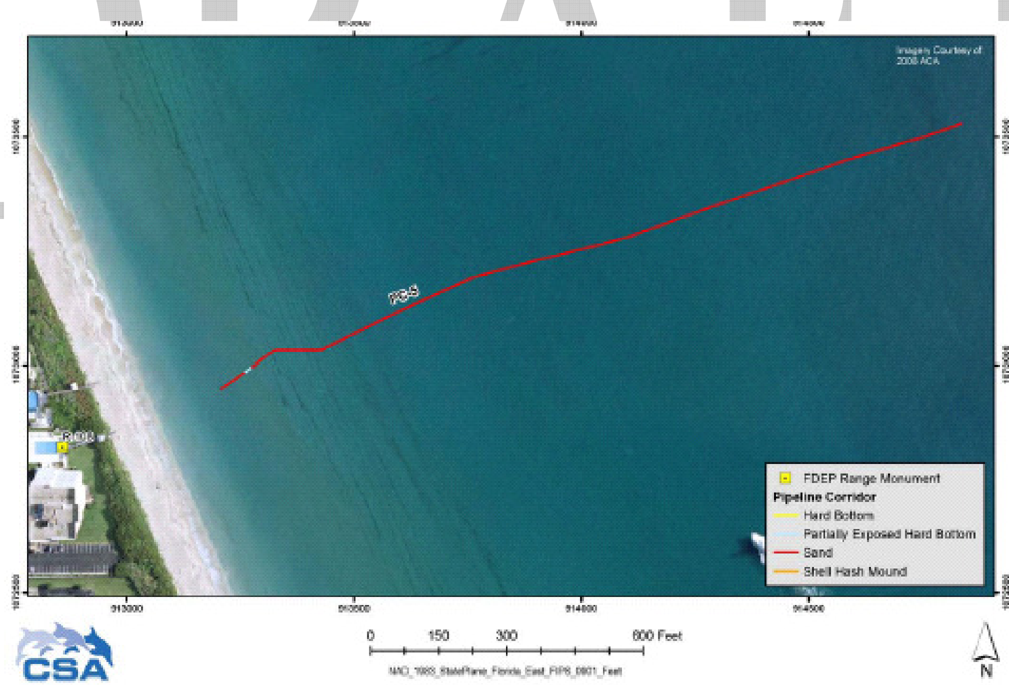

Figure 19: Pre-construction monitoring transect at proposed pipeline corridor near R-108 (CSA 2010a).

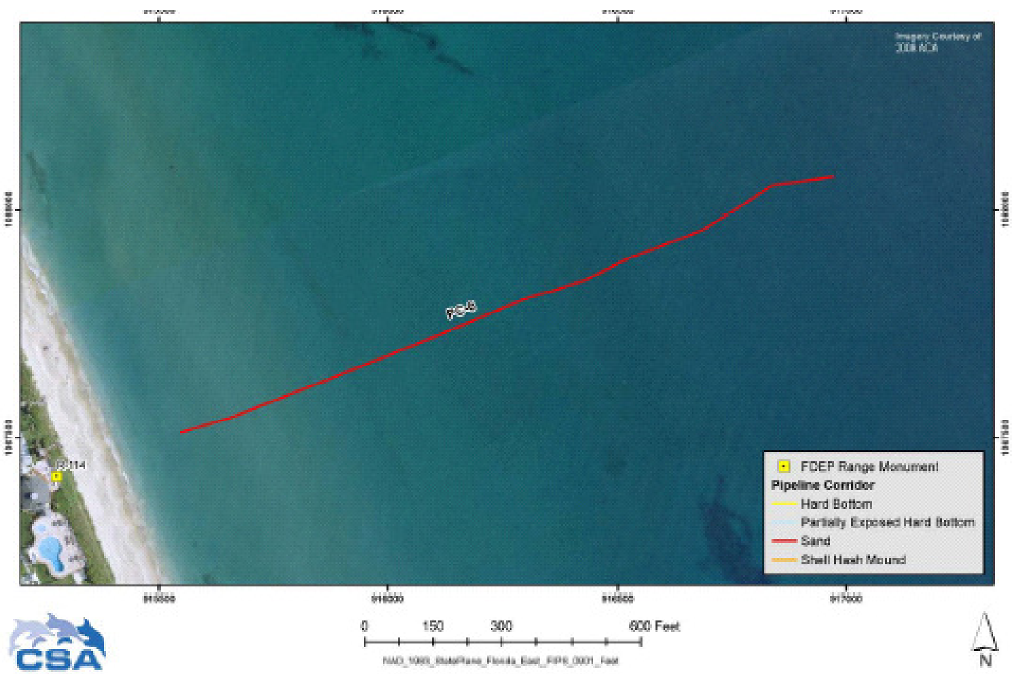

Figure 20: Pre-construction monitoring transect at proposed pipeline corridor near R-114 (CSA 2010a).

3.2 Proposed Mitigation – Nearshore Hardbottom

To offset lost ecological functions from the burial of hardbottom and pipeline corridor impacts from the Project, the County proposes to construct artificial reef(s) in comparable locations to the impact sites to the most practicable extent possible. The County currently has an existing and successful artificial reef program in place (http://www.stlucieco.gov/public_works/reefs.htm), which has resulted in installation of artificial reefs offshore several areas throughout the county. Appendix A contains the most recently available monitoring report (2008), which details the year 2 monitoring of several constructed artificial reefs and identifies that the artificial reefs are "functioning similar to natural reefs" (page 29).

Using the estimated maximum potential hardbottom impacts as described in section 3.1, a UMAM analysis was conducted (Appendix C). After assessing the ecological functions of the two hardbottom communities, as described by CSA (2010a), EAI (2009), and CSA (2010b), as well as the expected ecological functions provided by mitigation based on artificial reef monitoring reports, it was determined that a maximum of approximately 1.19 acres of mitigation reef constructed to mimic Hardbottom Community One and a maximum of approximately 5.03 acres of mitigation reef constructed to mimic Hardbottom Community Two will adequately offset lost ecological functions due to the Project. Because artificial reefs are among the most common type of mitigation that offsets loss of ecological functions due to hardbottom impacts, the time lag was determined to be short (3 years to replace lost ecological functions for Hardbottom Community One; 2 years to replace lost ecological functions for Hardbottom Community Two) and risk to be low- to moderate (1.5 on a scale of 1 to 3) for both proposed community types.

Therefore a potential maximum total of 6.22 acres of mitigation reef(s) will be constructed prior to initial fill construction (currently scheduled for November 2011) and consist of low- to medium-relief to mimic the structure of the impacted hardbottom community types, described in section 3.1. Several potential locations for artificial reef(s) have been identified, based on the following criteria: 1) ability to maintain 15m (50 ft) buffer between constructed reef and surrounding hardbottom, not directly located on existing hardbottom, and expected appropriate veneer of sand over rock substrate; 2) proximity (approximately one-quarter mile) to county park(s) to facilitate public use; 3) approximate water depths between 3.7 and 4.6m (12 and 15 feet); and 4) priority given to location between the two impact sites to facilitate recruitment from the two community types, as well as house fleeing motile fauna during Project construction. Figures 21 and 22 depict the proposed locations of the mitigation reef(s), which will be further refined via jet probing, bathymetric survey, and site-specific stability analysis of the target areas, expected during fall 2010 or spring 2011. Preference will be given to "Site Number 3" (Figure 23) as it meets all of the above criteria, and secondarily to "Site Number 4".

Detailed artificial reef construction plans will be submitted to the Department at least 30 days prior to construction. The final mitigation reef(s) location(s) will be chosen by methodologies such as bathymetric surveys (to determine appropriate depths), jet probing of substrate (to ensure stability), and will maintain at least a 15-meter (50-foot) buffer from existing hardbottom communities including sand-covered hardbottom with emergent epibiota. Typically, artificial reefs are located on approximately 24 inches of sand veneer covering hard substrate to minimize significant sinking of the reef materials; the sand veneer depth requirements will be further refined in collaboration with agency staff.

The mitigation reef(s) is proposed to be located in depths similar to the impacted areas, though due to the nebulous logistics in constructing artificial structures in depths less than 4m (CSA 2009) as well as the public safety hazard and reduced probability of success in very nearshore regions, the mitigation reef(s) may be constructed in depths exceeding those at impacted areas. As identified within the Department-commissioned literature synthesis of hardbottom habitat ecological functions (CSA 2009, page 8-11), "Because of the stability and logistic issues stated above, it is apparent that NHB [nearshore hardbottom] cannot be mitigated for in like-kind fashion, given present technology and budgets." Given all these limitations in constructing acceptable like-kind mitigation, the County intends to remain flexible in developing strategies for success.

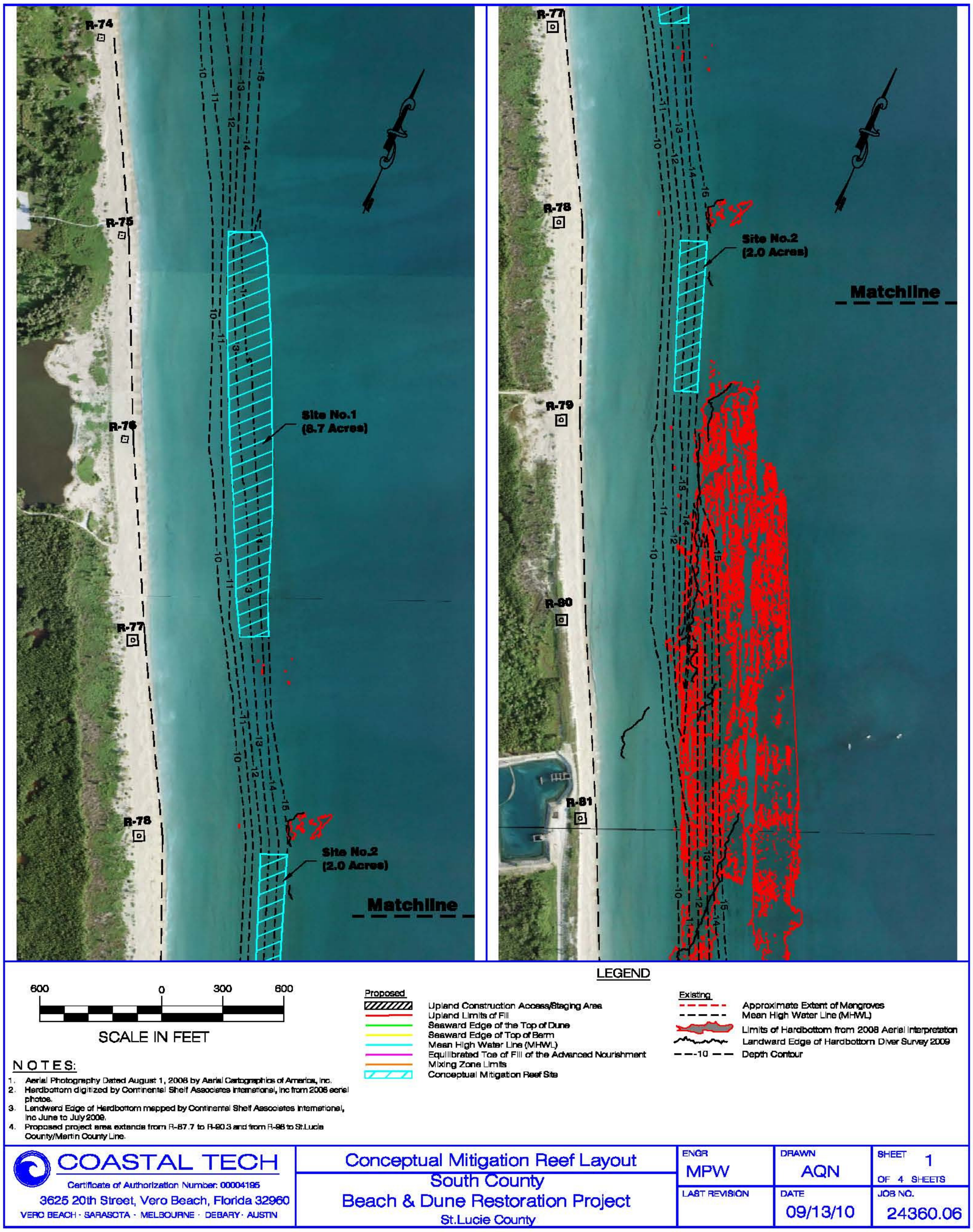

Figure 21: Potential mitigation reef locations, relative to the Project location.

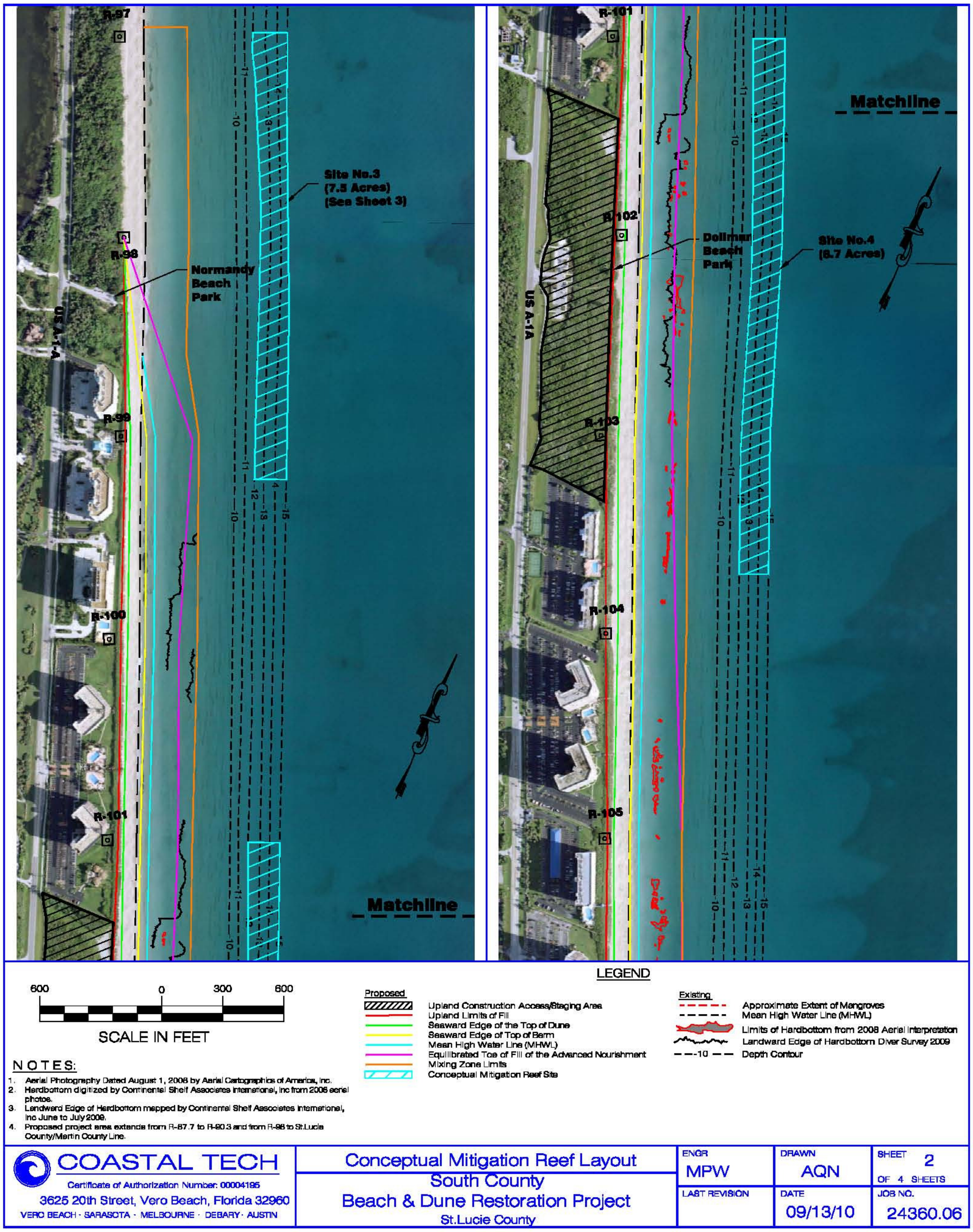

Figure 22: Potential mitigation reef locations, relative to the Project location.

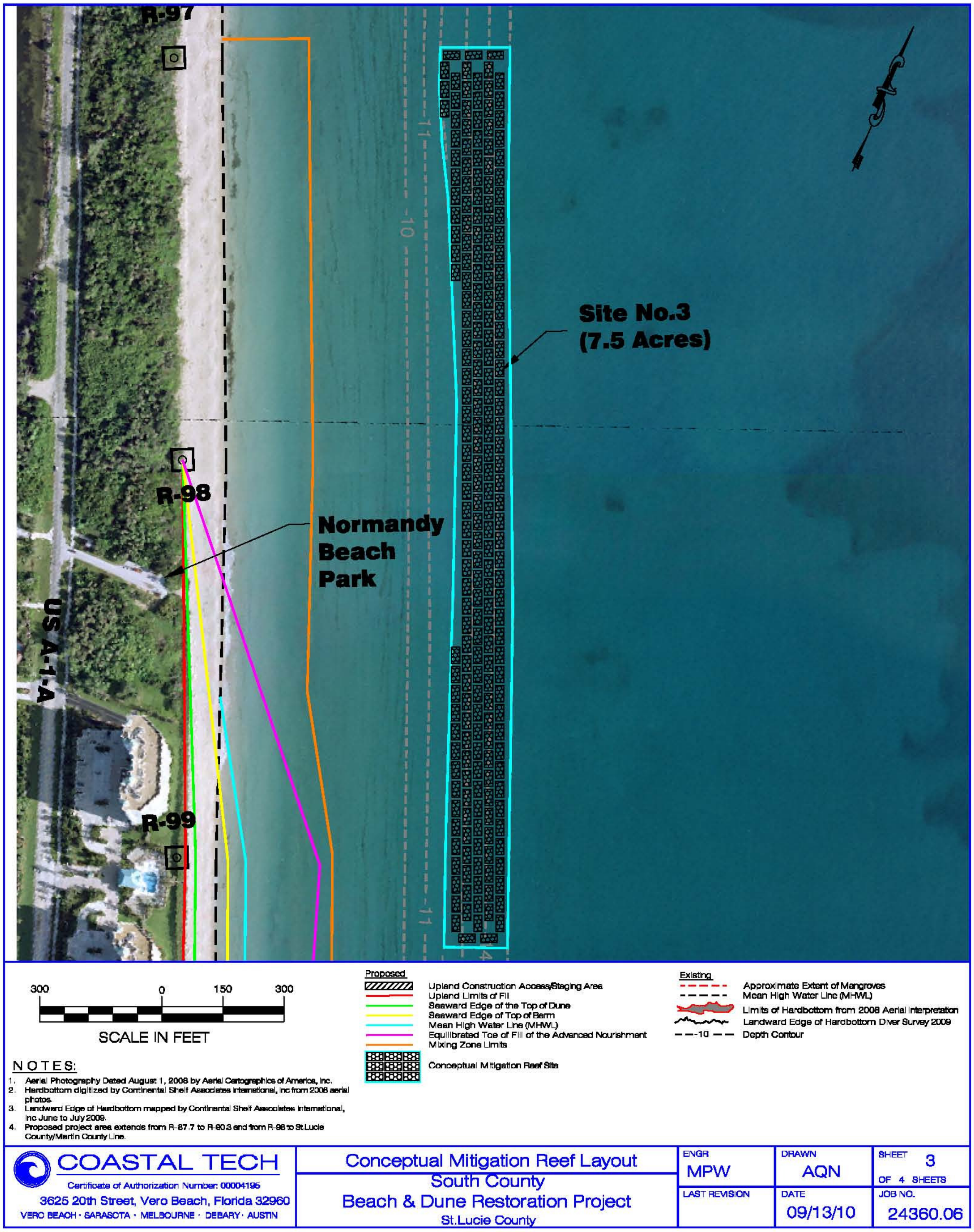

Figure 23: Preferred mitigation reef location, relative to the Project location.

As mentioned, the mitigation reef(s) will have low- to medium-relief (comparable to the proposed impacted hardbottom communities as documented in CSA 2010a) and after construction will have the U.S. Coast Guard-required clearance for navigation above the top surface referenced to Mean Low Water. In order to mitigate for ecological function losses due to the impacts to Hardbottom Community One, which has a wormrock component (approximately 10% coverage along monitoring transects), the mitigation reef(s) constructed to offset those community-type losses will attempt to incorporate strategies that account for behavioral preferences of settling invertebrates, such as *P. lapidosa* (CSA 2009). These strategies may include potential relocation of wormrock boulders located within the impact site, if feasible. Different materials, including but not limited to limestone and concrete, may be utilized to encourage colonization by reef invertebrates. A Letter of Consent will be issued by the FDEP to allow for mitigation reef construction on state lands. We expect that a Letter of Permission will be issued by the USACE.

Figure 24 is a conceptual rendering of the proposed mitigation reef structure, which will be further refined following jet probing and bathymetric surveys, expected in fall 2010.

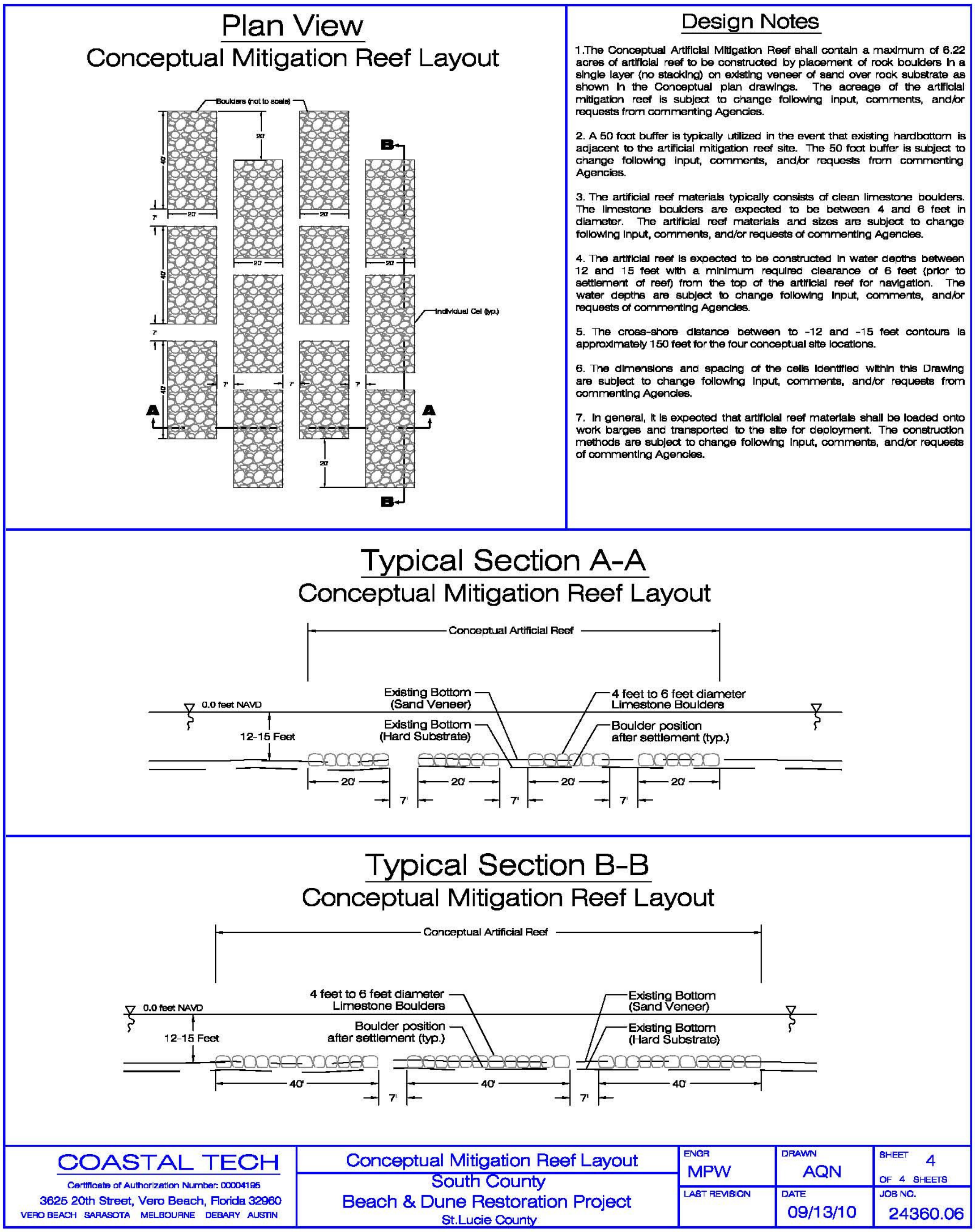

Figure 24: Conceptual mitigation reef layout.

3.3 Mitigation Reef(s) Monitoring

The mitigation reef(s) will be monitored using methodologies consistent with those identified within the County's Biological Monitoring Plan (CTC 2010). Monitoring of mitigation reef(s) will occur immediately post-construction and annually for at least 3 years post-construction. A minimum of eight (8) shore-perpendicular monitoring transects will be established so that all relief types are represented. *In situ* quadrats will be sampled during each monitoring event, either four (4) $0.5m^2$ quadrats or eight (8) $0.25m^2$ quadrats per transect, and video labeled with coordinate information will be collected along each transect.

3.4 Reporting

All data deliverables shall be provided within 90 days after completion of each mitigation reef(s) monitoring survey and will include the following data on CD:

- all digital video transects and frame-grabbed images from all transects
- PointCount files and associated data (i.e. PTS files, MGR files, cd.dat files)
- Excel spreadsheets of PointCount data (raw data and summary files)
- Excel spreadsheets of *in situ* quadrat data.
- Spatial GIS shapefiles of transects.

A report summarizing the monitoring (permanent transects, quadrats) and analyses will be prepared. The report shall include appropriate graphics/tables, statistical analysis of the collected data, and assessment of ecological functions provided by the mitigation as compared to those provided at the impact site. The report shall be provided within 90 days after completion of the survey in both hard copy and digital format.

3.5 Success Criteria

Evaluation of the artificial reef(s) success as mitigation will occur via the results of the annual biological monitoring (CTC 2010), which will quantify and characterize Project-related impacts, and the results of the mitigation reef(s) monitoring. A UMAM analysis, pursuant to Chapter 62-345, Florida Administrative Code, will be performed using the collected quantitative and qualitative data from both the biological monitoring and mitigation reef(s) monitoring. If UMAM scoring indicates that ecological functions have been effectively offset, the mitigation reef(s) will be deemed a success. UMAM factors include acreages of both impact and mitigation sites, as well as scoring of ecological functions lost or provided at the impact and mitigation sites, respectively.

Because of the close proximity to shore of the proposed impact site, it may be difficult to construct a reef or reef system where the areal extent persists over time. The proposed impact site consists of a dynamic area where ephemeral hardbottom is continually buried and exposed, and very little epibiotic cover is present. Therefore, measurement of areal coverage over several monitoring events will provide better assessment of burial/exposure patterns, rather than a single monitoring event.

CSA (2009, page 8-12) notes: "If like-kind mitigation is desired, then managers and permit applicants will have to accept that material will be lost (buried) under the sand. To some extent, this mimics the natural situation. Given the expense of constructing reefs, it is unsettling to place one in very shallow water only to have it disappear beneath a moving sand bar. However, during other seasons the reef material will likely uncover. Potentially more problematic would be public safety issues in very shallow waters as well as potential movement of reef materials onto the beach with time."

If UMAM analysis indicates that ecological functions have not been offset, a secondary assessment will be performed in which success will be determined. The secondary assessment criteria may include:

1) Average areal extent over at least 2 years post-construction, using aerial interpretation and physical monitoring data in addition to the biological monitoring results, is not statistically different from the lost average areal extent of the ephemeral hardbottom at the impact site(s) from at least 2 years of pre-construction data;
2) The percent coverage of dominant epibiota and substrate types will not be statistically different from those at the impact site, using Bray-Curtis Similarity Index or other similar statistical analysis; and/or
3) The species list at the mitigation reef(s) shall contain at least 80% of the benthic species (alternatively: conspecifics or species of equivalent ecological niche) recorded at the impact site, to ensure that comparable ecological functions are provided by the mitigation.

If after three (3) annual monitoring events, it is determined that the installed mitigation reef(s) do not adequately offset lost ecological functions, via UMAM or the secondary assessment method, the Department will be consulted and the Contingency Mitigation Plan (Appendix B) will be implemented.

3.6 Long-Term and Adaptive Management

Long-term management, to occur after performance standards have been met, will be the responsibility of the St. Lucie County Erosion District (SLCED). Long-term management techniques may include regular monitoring events, diver/snorkeler surveys, or other low-cost/high-efficiency mechanisms.

Over time, unforeseen changes may occur. St. Lucie County will oversee the adaptive management strategies, in addition to the long-term management as described above. Adaptive management techniques may occur during the requisite monitoring period (i.e., first 3 years), as well as once the mitigation performance standards have been met. For example, if during the required mitigation monitoring period, it is discovered that recruitment of benthic invertebrates or macroalgae is not occurring, techniques such as transplantation may be implemented. In this scenario, the SLCED will evaluate their existing budget (including FDEP cost sharing funds) for this project to determine availability of funds to implement remedial actions. Dramatic changes as a result of a hurricane or other storm events or sea level rise which result in burial of the mitigation reef by sand are acts of nature and are expected to also occur in the nearshore region where hardbottom exists. In this scenario, the SLCED will "do nothing". Damage due to use by the general public can be remedied by providing educational materials regarding snorkeling/diving/fishing protocol on the reef. Currently, the County's Coastal Resource Supervisor works with the Marine Sea Grant Program to maintain links on the County's web site with information on the location and proper use of artificial reefs by the public. In addition, the County's Coastal Resource Supervisor routinely speaks to recreational and public interest groups regarding the County's artificial reef program, the recreational opportunities, and environmental enhancement provided by the artificial reefs.

4.0 REFERENCES

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