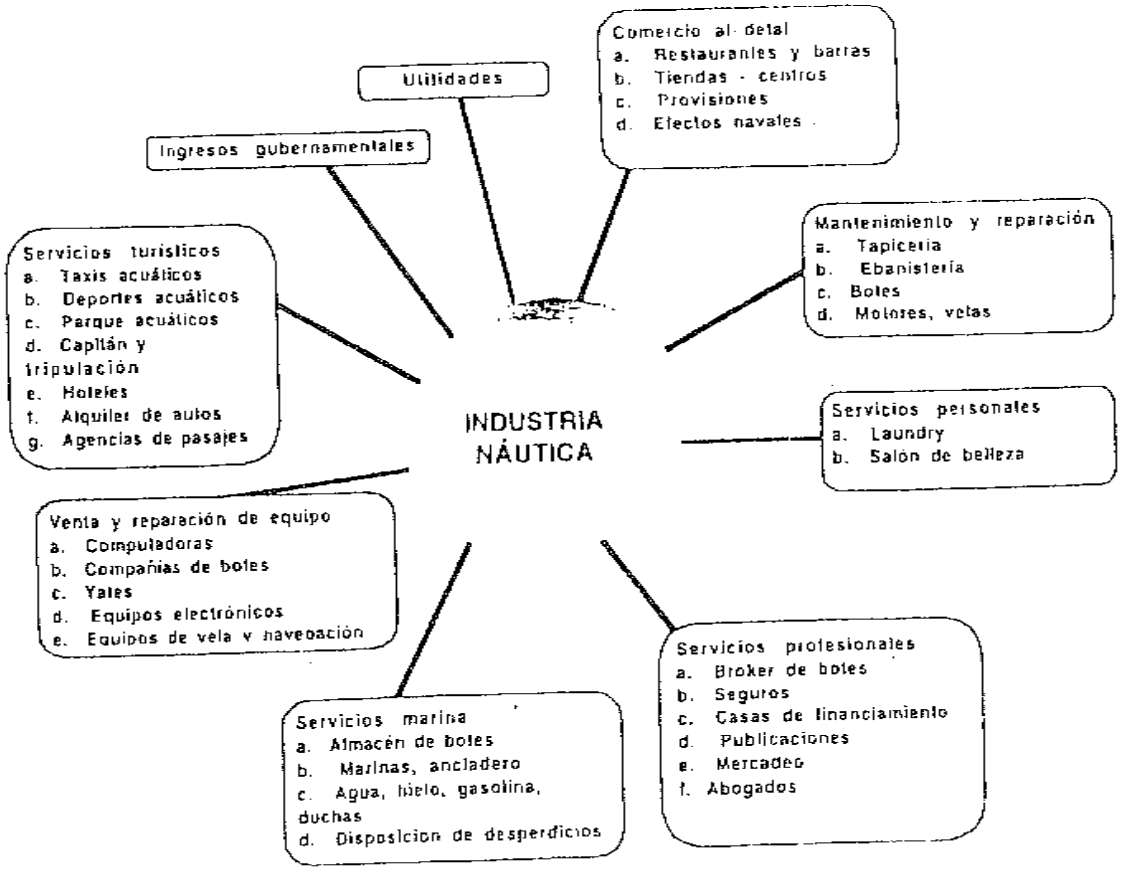
La Creación de Riqueza en la Industria de Botes y Actividades Marinas

La sinergia entre riquezas naturales y creatividad humana produce el estado de abundancia económica

La creación de Riquezas de la Industria de Botes



Marinas en Puerto Rico

Nombre	Municipio	Espacios		Total
		Muelle	"Drystack"	
Aguadilla Yacht Club	Aguadilla	100	0	100
Arecibo Yacht Club	Arecibo	85	0	85
Boca Cangrejos Yacht Club	Carolina	150	0	150
Club Deportivo del Oeste	Joyudas	60	30	90
Club Naútico de Boquerón	Cabo Rojo	111	0	111
Club Naútico de Ponce	Ponce	160	37	197
Club Naútico de San Juan	San Juan	96	0	96
Club Naútico Pozuelo	Guayama	42	0	42
Isleta Marina	Fajardo	306	0	306
Karolette Charter	Humacao	33	0	33
Marina Harborside	Humacao	170	280	450
Marina de Palmas	Humacao	17	70	87
Marina de Salinas	Salinas	101	0	101
Marina del Conquitador	Fajardo	21	0	21
Marina Puerto del Rey	Fajardo	750	500	1,250
Puerto Chico Marina	Fajardo	280	370	650
San Juan Bay Marina	San Juan	125	48	173
San Juan Center Marina	San Juan	120	0	120
Sea Lovers Marina	Fajardo	150	0	150
Villa Marina Yacht Harbour	Fajardo	250	400	650
		3,127	1,735	4,862

Fuente: Estudios Técnicos, Inc.

Nota: No incluye la totalidad de Marinas en Puerto Rico. Falta el Náutico de la Parguera, El Varadero de Parguera, Culebra y villas de pescadores y otras pequeñas marinas en diversos puntos de la Isla

Marina Puerto Real

Impacto Económico de las Marinas

- De acuerdo con el Country Business Pattern, en 1996, 26 marinas emplearon 302 personas y pagaron una nómina de $4,261,000, para un ingreso promedio total de $14,109.

- La industria genera 1.81 empleos indirectos y 4.45 empleos inducidos por cada empleo directo que existe.

  - Sobre esta base tenemos un total de 545 empleos indirectos y 1,344 empleos inducidos.

Categorías de Empresas dentro de la industria

1. Accesorios y efectos marinos; tienda
2. Alquiler de embarcaciones
3. Buceo; tienda/escuela/excursiones
4. Corredor de yates
5. Distribuidor de productos marinos
6. Ebanista marino
7. Electricista marino
8. Embarcaciones y accesorios; tienda
9. Fabricante de embarcaciones
10. Fabricante de efectos marinos
11. Financiamiento de embarcaciones
12. Inspector marino
13. Mantenimiento; servicio
14. Marina; (incluyendo varaderos)
15. Mecánico marino
16. Reparación; pintura/fibra vidrio
17. Salvamento marino
18. Seguro de embarcaciones
19. Surfing/windsurfing; tienda
20. Varadero
21. Otros

Integración de Marina Puerto Real a la Comunidad

- Propulsor del desarrollo económico
- Defensor del ambiente y la ecología
- Agente contribuyente a mejorar la calidad de vida
  - creación de empleos
  - Socio en el área social y educativa

Apéndice 8: Comunidades Bénticas

MARINE RESOURCES ASSESSMENT: MARINA PUERTO REAL, FAJARDO, PUERTO RICO

PRELIMINARY REPORT NO.1: FIELD STUDIES OF JULY 24, 2002

PREPARED FOR:

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PEPARED BY:

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GARDEN HILLS PLAZA MSC 326
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GUAYNABO, P.R. 00966-2700

AUGUST 24, 2002

EXECUTIVE SUMMARY

In July 24, 2002, Vicente & Associates, Inc., conducted a site inspection in the site proposed for the development of Marina Puerto Real, which would be located within the coastal zone of Fajardo, Puerto Rico. The purpose of this inspection was to initiate a study of the marine resources, which could become impacted by the proposed marina. Three (3) underwater transects were conducted: one near shore transect (within the proposed marina site); and two offshore transects (close but outside the marina construction site). Additional underwater diving-transects within the proposed marina site was not possible due to the unsafe water quality conditions and navigational interferences encountered while conducting the near shore transect. Instead of conducting additional near shore underwater transects in July 24, 2002, five (5) non-diving locations were inspected near shore.

Based on the study as described below, Vicente & Associates, Inc., concludes that protected habitats such as coral reef ecosystems and seagrass beds do not occur near shore the proposed marina site; seagrass beds and corals do occur offshore close to the project limits, and that grazing grounds of endangered or threatened species were not found in this study. Further studies will be conducted both: within the proposed marina site, and, within adjacent areas, which could become indirectly impacted by the project.

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PART I

MARINE RESOURCES ASSESSMENT: MARINA PUERTO REAL, FAJARDO, PUERTO RICO

1. BACKGROUND

The proposed project consists of the construction of a marina (Marina Puerto Real), which would be located at the Maternillo Sector, Puerto Real Ward, Fajardo, east coast of Puerto Rico (**FIGURE 1**).

The proposed MARINA (marina Puerto Real) will fall within the proposed study area enclosed within the following points: **point 1** (Lat. 18-20.001N Long. 65 37.761W; **point 2** (Lat. 18-20.268N Long.65 37.576W; **point 3** (Lat. 18-20.143N Long.65 37.327W; and, **point 4** (Lat. 18-19.729N Long.65 37.635W).

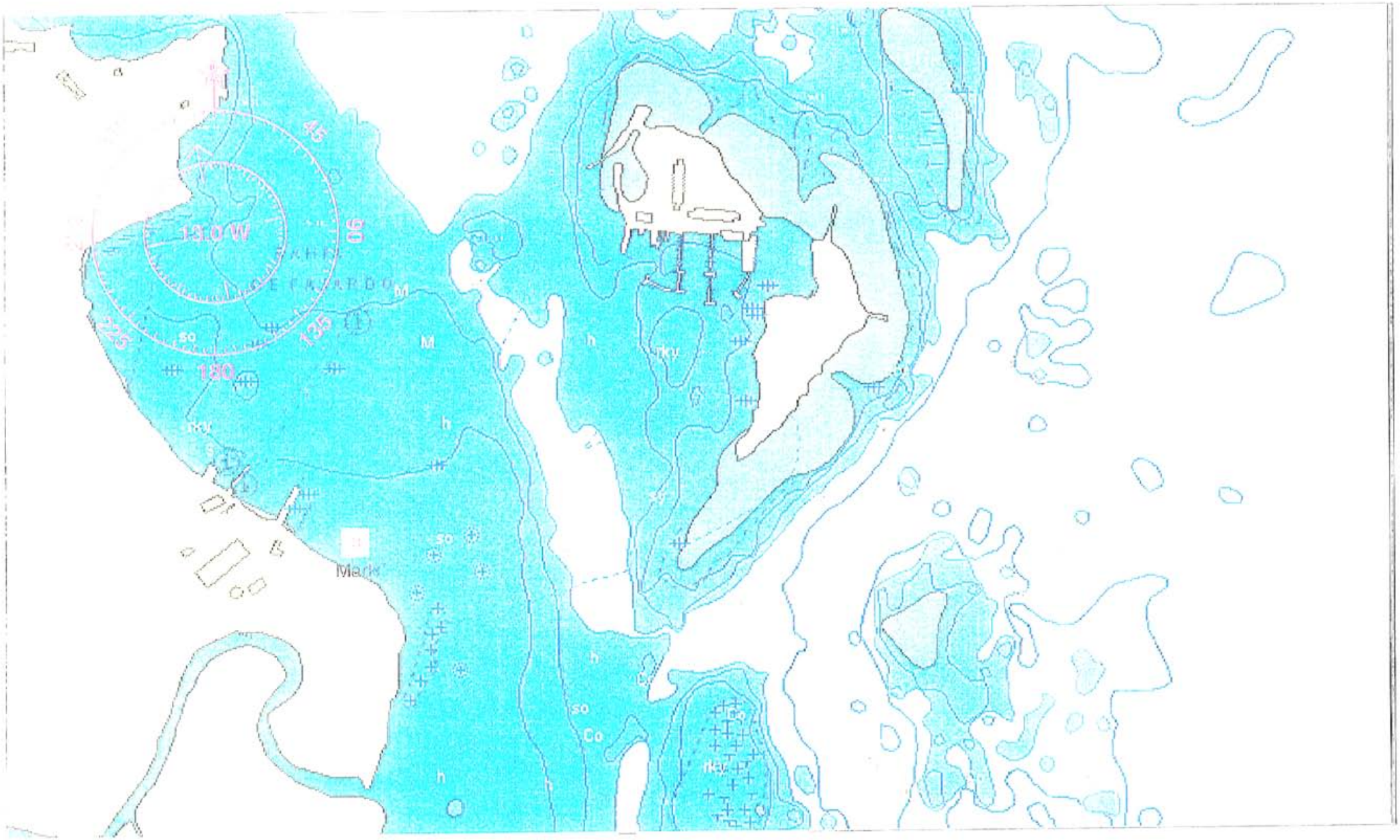
The marina consists of the following principal components:

1. Construction of 193 concrete slips for vessels between 60 and 80-ft in length,
2. Dredging of 91,313 cubic meters
3. Utilization of 155,250m2 of submerged lands
4. Construction of a platform with Finger Lifts and Travel Lifts,
5. Installation of floating docks,
6. Construction of two (2) breakwaters, a clubhouse, and a parking lot, and,
7. Other structures described in COE-1998-04900 (IP-DD), JP 1999-24-0710-JGU, ZMT-99-070.

The figure below shows the proposed components of the marina as well as the overall magnitude of the proposed project.

FIGURE 1	Project location. The proposed project, which consists of the construction of a marina (Marina Puerto Real) would be located at the Maternillo Sector, Puerto Real Ward, Fajardo, and east coast of Puerto Rico. This figure is derived from NOAA, Chart#U25663.

VIRGIN PASSAGE AND SONDA DE VIEQUES. WEST INDIES. - 1 : 43,945
(Passport World Charts - vector format) Chart #U25650 - Depth Units:



PART 2

MARINE RESOURCES ASSESSMENT: MARINA PUERTO REAL, FAJARDO, PUERTO RICO

METHODOLOGY: SEAGRASS, CORAL REEFS, MUD BOTTOM AND WATER QUALITY

The principal marine benthic resources expected to occur within the study site are seagrass beds, coral reefs, and mud bottoms. Seagrass beds and coral reefs (or coral reef habitats) could be found in the shallow areas while mud bottoms are expected to be found in the deeper areas below the photic zone. Mud bottoms may also be inhabited by photo-eurytopic seagrasses such as *Halophila* spp.

Coral reefs are of global ecological and economical importance and are protected. Hard corals for example, which are the main constituents of the framework of coral reefs, are included in the APPENDIX II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1995).

Corals are also now protected under the Magnuson-Stevens Fishery Management and Conservation Act. For example coral reefs are classified as Essential Fish Habitats and are also regulated in the Fishery Management Plan for Corals and Reef Associated Plants and Invertebrates of Puerto Rico and the United States Virgin Islands. Coral reefs are also protected by the 1973 Clean Water Act through Section 404 (the (b) 1 Guidelines), which qualify coral reefs as "special aquatic sites". In addition the 1998 EXECUTIVE ORDER 13089 for coral reef protection establishes a national (U.S.) policy for the protection of corals and dependent systems.

The Commonwealth of Puerto Rico established a state policy for the protection of corals (i.e. Law for the Protection, Conservation, and Management of Coral Reefs in Puerto Rico" (Ley Número 247 del 15 de julio de 1999). Similarly, seagrass beds, which are often classified as coral reef associated habitats, are protected as well. Besides stabilizing bottom sediments and improving water quality, seagrass beds are nursery and feeding grounds of reef fishes and are foraging grounds of green sea turtles *Chelonia mydas* and of the West Indian manatee *Trichechus manatus*. These two species are protected by the U.S. Endangered Species Act, by the *Ley de Vida Silvestre* of Puerto Rico and by international conventions and organizations (e.g. CITES, IUCN).

Three transects, and five point inspections (their locations are shown in FIGURE 2) were conducted. The point inspections, all in very shallow water, were conducted by wading, due to the very poor water quality conditions found near shore. The location of each of the five (5) point inspections were registered with the V&A/GPS#2, which is a 12 channel global positioning instrument with an EPE of 10-20-ft. At each inspection point, notes on the depth, substrate, and of the flora and fauna were taken *in situ*.

The transects consisted of implementing the 20m-U/W video-transect technique as outlined below. The locations and extents of the three transects are shown in FIGURE 2. One of the transects (ST. 126-134) is an inshore transect. The other two transects (ST. 130-131, and ST.132-136) are located offshore but close to the proposed project location. The beginning and end points of each transect were also registered with a GPS 48, 12 channel global positioning instrument. Marking the beginning and end points of the transects will help in the monitoring process, which is a process often required by the agencies.

The 20m U/W video-transect method

The underwater digital-video transect method has proven to be an efficient tool in understanding benthic composition and processes which occur in the ocean floor for at least two reasons. First, this form of field survey method is non-destructive since no extractive samples are required. Second, the pictures captured by the digital camera are of a high resolution, which allows the expert to identify macroscopic benthic species to a genus and species level.

Furthermore, the U/W video-transects have become implemented by the Environmental Protection Agency (EPA) in monitoring the reefs of the Florida Keys National Marine Sanctuary (see Wheaton et al., 1999, Petterson, 1999) and has been utilized worldwide in benthic surveys by experts around the world. (Quibilan et al, 1999; Vicente and Mahoravo, 1999).

FIGURE 2	The location of the three transects performed (ST. 126-134) and the five point near shore inspections (ST. 137, ST. 138, ST. 139, ST. 140, ST. 141) conducted in July 24, 2002 by V&A, Inc.


ST. 125 - 134
ST. 137
ST. 138
ST. 139
ST. 140
ST. 141
ST. 130-135
ST 132-135
Punta Fajardo
001
003

The 20-m transect line method uses a 20m nylon line as a basic sampling unit to determine the composition and distribution of benthic communities encountered within a given transect. This methodology is described, with slight variations in other benthic studies required by federal agencies in situations where benthic communities are of concern (see Vicente & Associates 2000a; 2000b). As previously mentioned, the methodology is based on video image, analysis, and on in *situ* annotations.

Each 20-m segment is delineated by a 1/4 inch yellow nylon transect line which has been marked at 5m intervals with red flagging tape secured with a tie wrap. Each 5-m interval is further subdivided into 1-m segment with a permanent paint.

The transect line is stretched and fixed at both ends with lead weights and with surveyor stakes in order to ensure that the line remains straight during the video and in situ documentation phase.

One end of the transect is first fixed to the bottom while the other end of the transect is pulled along the desired direction (east in this case) by an assistant diver. The transect line is pulled until it becomes straight and until it becomes properly aligned in the desired direction.

Once the 20m transect line has been placed and stabilized over the ocean floor, the expert verifies the depth and the alignment of the transect line using a computerized U/W console unit. The information is passed *in situ* by using Nalgene Poly-Paper sheets attached to a slate board and by using an under water writing pen. At the beginning and end of each 20m segment, the PI annotates the substrate type, the depth, and the dominant taxa found in the immediate vicinity of the initial transect point. Notes on any significant event (green turtle grazing ground, manatee grazing ground) found between the two end points of the transects are also noted. The underwater formats used to annotate in situ observations are shown below.

A digital Sonny PC-100 and a PC-110 camcorder camera are used for filming each 20-m segment from the beginning to the end of the transect line.

The camcorder camera is first placed inside a specially designed underwater housing unit, which electronically or mechanically controls all the principal functions of the camera system. The underwater housing is made of a fully anodized marine grade aluminum casting.

The lens used for filming has a view angle of 90º with full macro and zoom capability. The lens also has a focus distance from 0 to infinity. Prior to filming each transect, and all U/W equipment filming control units are tested and a short strip of the tape is shot to inspect if the system was functioning adequately.

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Each 20-m video-transect includes images of the sea floor (substrate, corals, sponges, vegetation, dominant taxa) approximately one meter to each side of the transect line (in low visibility environments, the camera is placed closer to the line, and therefore, the bottom area film, may be less than 1m to each side of the line). Each 20m segment covers a general area of 40m2. Panoramic footage within a transect is sometimes taken for general characterization purposes. The transect line is filmed during each 20-m transect and appears in the center of the video-transect for reference purposes.

Species of special importance such as conchs, corals, gorgonians, sponges and seagrasses, are recorded when necessary with close-up shots for details. Some species are recorded verbally by speaking into the U/W microphone system of the camera.

In addition to filming each 20-m ($40m^{-2}$) transect, the principal investigator (PI) and one of the assistant diver conducts a census of two benthic commercial taxa: conchs (*Strombus* spp.) and spiny lobsters (*Panulirus* spp.). The PI and the assistant diver count and identify all conchs and lobsters one meter to each side of the transect line for a total sampling area of $40m^{-2}$ per 20m segment.

The video-transect tapes and *in situ* annotations are returned to the laboratory for analysis. Representative video-frames of each transect are frozen on a SONY 4MB Memory Stick. The images are integrated into the final report by using a SONY Memory Stick Reader/Writer MSAC-US1. Specimens, only when necessary were taken to the laboratory for taxonomic determination.

All macro-benthic species intercepted by the transect are identified and counted. Both, *in situ* annotations and information derived from the video-transects are broken down into a table format for interpretation and for the analysis.

MARINA PUERTO REAL BENTHIC STUDIES

SEAGRASSES

UNDERWATER FORMAT

Date: _____

Location: _____ Segment: _____

FROM: WPT ____ EPE: ____ TO: WPT ____ EPE: ____

Meter	Substrate	Depth (ft)	Bearing (°)	Dominant Taxa	NOTES
0					
20					
0-20	NOTES: Include observations on endangered/threatened species and *Strombus spp.* Population density (No./40m2) and outstanding information.				% SEAGRASS COVER = #CORALS INTERCEPTED = #GORGONIANS INTERCEPTED =
40					
20-40	NOTES:				% SEAGRASS COVER = #CORALS INTERCEPTED = #GORGONIANS INTERCEPTED =
60					
40-60	NOTES:				% SEAGRASS COVER = #CORALS INTERCEPTED = #GORGONIANS INTERCEPTED =
80					
60-80	NOTES:				% SEAGRASS COVER = #CORALS INTERCEPTED = #GORGONIANS INTERCEPTED =
100					
80-100	NOTES:				% SEAGRASS COVER = #CORALS INTERCEPTED = #GORGONIANS INTERCEPTED =

MARINA PUERTO REAL BENTHIC STUDIES

CORAL REEFS

UNDERWATER FORMAT

Date: _____
Location: _____ Segment: _____
FROM: WPT ____ EPE: ____ TO: WPT ____ EPE: ____

Meter	Substrate	Depth (ft)	Bearing (°)	Dominant Taxa	NOTES
0					
20					
0-20	NOTES: Include observations on percent coral cover, endangered/threatened species, reef fish, and topography.				#CORALS INTERCEPTED = #GORGONIANS INTERCEPTED = # SPONGES INTERCEPTED =
40					
20-40	NOTES:				#CORALS INTERCEPTED = #GORGONIANS INTERCEPTED = # SPONGES INTERCEPTED =
60					
40-60	NOTES:				#CORALS INTERCEPTED = #GORGONIANS INTERCEPTED = # SPONGES INTERCEPTED =
80					
60-80	NOTES:				#CORALS INTERCEPTED = #GORGONIANS INTERCEPTED = # SPONGES INTERCEPTED =
100					
80-100	NOTES:				#CORALS INTERCEPTED = #GORGONIANS INTERCEPTED = # SPONGES INTERCEPTED =

Positioning the transects.

The locations of the beginning and end points of a transect are registered using a global positioning system instrument (GPS 48XL). With this instrument it was found that, the estimated horizontal position error (EPE) ranges between 10-ft to 20-ft at the project site (satellite signal reception varies from one locality to another). This relatively low EPE is now possible due to the removal of the SA code, which became effective in May 1, 2000.

Waypoints are pre-established when necessary for locating the beginning and end points of each transect and for orientation in the field. All pertinent location data (latitudes, longitudes, waypoint numbers) is then transferred from the GPS instrument to geo-referenced electronic maps (United States Geological Survey 7.5-minute Topographic Quadrangles) by using a GPS-PRO digital mapping software program. Updated electronic NOAA charts are also utilized to mark the position of the stations using the Visual Series Nobeltec software.

Taxonomy of the flora and fauna intercepted during the 20-m transects.

Species composition and their relative distribution within a given station reflect habitat quality conditions and habitat functions among other factors. Therefore, proper taxonomic determinations are crucial in environmental assessments studies, such as the one conducted.

All taxonomic determinations in this study are made *in situ* only by specialized taxonomists and from high quality digitized video images. External morphological criteria are the primary basis for classification. When necessary, close-up (up to 1 cm of distance between lens and subject) footage which captures fine external morphological features (e.g. conules, septae) is taken for species confirmation in the laboratory. The general criteria utilized for identifying the benthic taxa expected to be found in this study are described below.

CORALS and GORGONIANS. Corals and gorgonians are identified to the lowest taxa possible by using the following criteria: shape patterns (e.g. branching, encrusting, pillar, brain), corallite characteristics (embedded, protruded, porous, septa, callice), habitat (e.g. relative depth, light conditions, exposed, cryptic), color (including fluorescence), and others (e.g. behavior, symbionts). Most coral species are identified to a species level by the principal investigator (PI) and when necessary coral taxonomic references (Colin, 1978; Human, 1993; Cairns, 1982; Almy and Carrión-Torres, 1963; George and George, 1979; Bouchon, 1990) will be consulted.

SEAGRASSES. Experts utilize leaf characteristics to identify most of the 49 species of seagrasses. Sometimes additional plant components need to be inspected (e.g. reproductive bodies, rhizomes, roots). The species found in Puerto Rico and in the West Indian Region in general are well known and are described in Vicente (1992). Some references used were Phillips (1992) and Hartog (1975) among others (Littler and Littler, 2000).

SPONGES. Sponges are identified using several criteria including shape (e.g. vase-shape, encrusting, dendritic etc); color of the ectosome and of the mesohyl, consistency (e.g. spongy, solid, crumbly), texture (velvety, slimy), exudates, stellate patterns, and habitat. Sponges were almost all identified to a species level using the author's field taxonomic experience.

When necessary, the following taxonomic references will be utilized: (Alcolado, 1986; Hechtel, 1965; Human, 1992; Laubenfels, 1936; Pang, 1973; Rutzler, 1981; Soest 1978, 1980, 1984, 1988; unpublished, Vicente, 1982; Wiedenmeyer, 1977; Zea and van Zoest, 1986; Zea, 1987).

ALGAE. Algae are classified into the following categories proposed in the Coral Reef Monitoring Manual for the Caribbean and Western Atlantic (see Rogers et al., 1994).

These categories are FLESHY ALGAE, CALCAREOUS ALGAE, CRUSTOSE CORALLINE, ARTICULATED CORALLINE RED, and TURF ALGAE (= thin algal mat). The category FLESHY ALGAE will be utilized in this study as a synonym of the MACROALGAE category.

FLESHY ALGAE. Fleshy red algae include species, which are large, branching, and are not calcified. Minor calcifications, such as those found in *Liagora* spp. are not considered significant and therefore, this genus is kept under the fleshy alga category.

The following taxa are included under this category in this study: red algae (Rhodophyta) such as *Acanthophora spicifera, Dictyurus occidentalis, Bryothamnion triquetum, Amansia multifida, Gracilaria dominguensis,* and brown algae (Phaeophyta) such as *Dictyota* spp. and green algae (Chlorophyta) such as *Caulerpa* spp.

CALCAREOUS ALGAE. Calcareous algae include red (RHODOPHYTA), calcareous, segmented algae such as the genera *Amphiroa, Galaxaura, Jania* and *Corallina*. These algae also are referred to as "articulated coralline red algae".

This category also includes green algae (CHLOROPHYTA) such as the various common tropical species under the genus *Halimeda* (e.g. *Halimeda opuntia, Halimeda incrassata, Halimeda monile* and *Halimeda discoidea*). Dead fragments of *Halimeda* result in the formation of calcareous sand.

CRUSTOSE CORALLINE ALGAE. This category includes red algal species, which form smooth pavements over dead coral bottoms, and includes genera such as *Peyssonnelia, Sporolithon,* and *Mesophyllum, Cruoriella*. These genera may invade cryptic or illuminated habitats.

TURF ALGAE. This taxon includes a variety of species, which do not develop much tissue above the substrate. In coral reef habitats, these species normally include rhodophytes such as *Coelothrix irregularis, Gelidium pusillum, Ceramium,* and *Polysiphonia.*

Turf algae (thin algal mats) have become the principal benthic component of many reefs since *Diadema antillarum* populations became ecologically extinct throughout the Caribbean Region between 1983-87.

References which will be consulted to verify species of marine plants are Littler et al., (1989), Woelkerling (1976) and Dawson, (1956).

Other lesser abundant benthic species are identified by using the following references: Colin, (1978); George and George, (1979); Human (1992) among others (e.g. Tucker and Morris, 1995; Warmke and Abbot, 1962).

REEF FISH. Reef fish are identified when required using the following references listed in the reference section Robins et al., (1986); Fischer, (1978); Human, (1992); Idaz and Greenberg, (1986).

PART 3

MARINE RESOURCES ASSESSMENT: MARINA PUERTO REAL, FAJARDO, PUERTO RICO

RESULTS

The general descriptions of all stations (the three transects Sta. 126-134, Sta. 130-135, Sta. 132-136 and the five shore-point inspections PT 137-PT 141) studied by Vicente & Associates, Inc. in July 24, 2002, in, and near the proposed Marina Puerto Real site, Fajardo, and east coast of Puerto Rico, are given in TABLE 1. Pooling all stations together, the depth ranged between +1ft in point 126 of STATION 126-134, to a maximum depth of 23-ft in STATION 132-136. Dominant macrophytes, as will be explained in further detail, include fleshy red algae, fouling green algal species near shore, reef algae and seagrasses offshore.

TRANSECT ANALYSES.

STATION 126-134

The location of station 126-134 is shown in FIGURE 2. This station represents some of the near shore benthic habitats, which would be impacted by the dredging activities of the project.

The transect conducted in this station intercepted some coastal vegetation (beach vegetation), macrophytic debris, sand and mud. Ripple marks were observed in the bottom. No attached macrophytes such as seagrasses and macroalgae were found attached to the unconsolidated substrate.

No corals, neither hard (Cnidaria:Scleractinia) nor soft (Cnidaria:Octocorallia) were found in this station. Fouling species such as sea lettuce (*Ulva* sp.), and barnacles (*Balanus* spp.) were found attached to artificial structures. The water quality in this station was found to be very poor.

There were no species of commercial importance, such as conchs (*Strombus* spp.) and lobsters (*Panulirus* spp.) found within the transect domain.

The poor visibility, the significant sediment resuspension, and the reddish color of the water (probably due to tannic or other substances from the Fajardo River) probably create unfavorable conditions for the recruitment and growth of seagrasses and corals in this station (see TABLE 2 and FIGURE 3).

TABLE 1	The general descriptions of all stations (the three transects Sta. 126-134, Sta. 130-135, Sta. 132-136 and the five shore-point inspections PT 137-PT 141) studied by Vicente & Associates, Inc. in July 24, 2002 in, and near the proposed Marina Puerto Real site, Fajardo, east coast of Puerto Rico.

STATION	WPT (GPS2)	LATITUDE	LONGITUDE	DEPTH	DOM.TAXA
TR 126-134 *BLACK SAND-MUD* *P.REAL*	From: 126	18º 20.001	65º 37.761	+1ft	Sparse coastal vegetation: *Thespesia populnea.*
	To: 134	18º 20.050	65º 37.734	5-ft	NO ATTACHED MACROPHYTES
TR 130-135 *BROWN MUD* P.REAL	From: 130	18º 20.100	65º 37.445	20-ft	INFAUNA
	To: 135	18º 20.141	65º 37.405	22-ft	INFAUNA
TR 132-136 *MUD-RUBBLE* P. REAL	From: 132	18º 20.021	65º 37.337	23-ft	INFAUNA at point 132.
	To: 136	18º 20.015	65º 37.215	1-ft	*Penicillus capitatus* at point 136. Seagrasses intercepted between the two points.
PT 137 *BLACK SAND* P.REAL	137	18º 19.991	65º 37.730	2-ft	Rhodophytes *Gracilaria dominguensis*
PT 138 *ANOXIC MUD* P.REAL	138	18º 19.968	65º 37.687	1.5-ft	NO MACROPHYTES
PT 139 *FILL/SAND* P.REAL	139	18º 19.953	65º 37.658	1.0-ft apx	Chlorophyta. *Ligia exotica*
PT 140 *FILL/SAND* P.REAL	140	18º 19.928	65º 37.619	0-2ft	Chlorophyta and Rhodophyta. *Acanthophora spicifera*
PT 141 *FILL/SAND* P.REAL	141	18º 19.915	65º 37.576	0-3ft	Rhodophyta *Acanthophora spicifera*

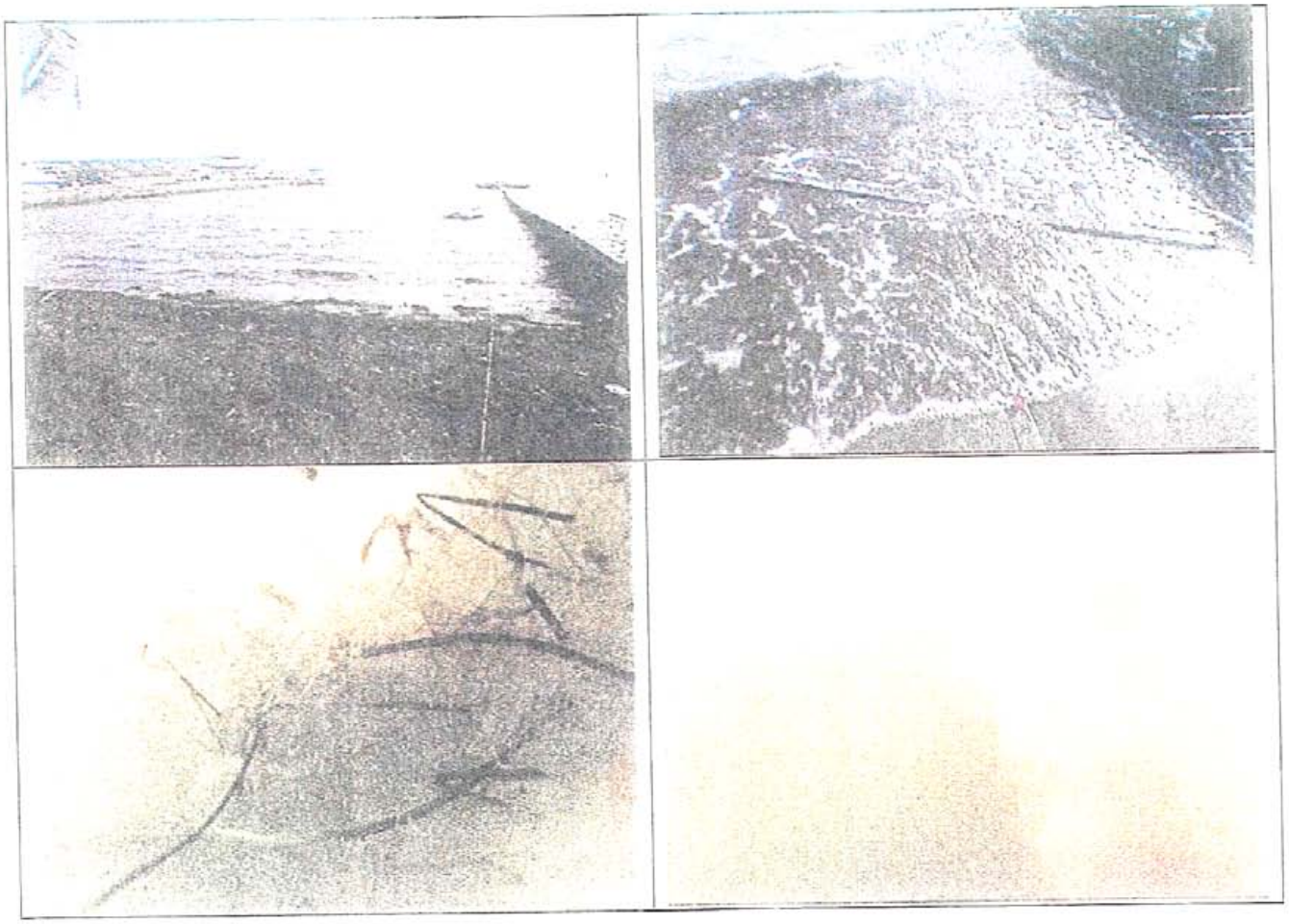
TABLE 2	Extension, substrate type, depth, direction and the dominant taxa intercepted or sited while conducting the 100m transect at STATION: 126-134

Date: July 24, 2002
Location: FAJARDO STATION: 126-134
FROM: WPT: 126 EPE: 10-20-FT TO: WPT: 134 EPE: 10-20-FT

Meter	Substrate	Depth (ft)	Bearing (°)	Dominant Taxa	NOTES
0	Dark sand.	+1	40º	NONE	Some upland vegetation: *Thespesia populnea* (Maho), *Cocos nucifera* (the Malaya coconut variety), other.
20	Black sand.	3	40º	NONE	*Ulva fasciata* or *Enteromorpha intestinalis*: pollution indicators on artificial structures.
0-20	Sandy bottom. Very poor visibility. No seagrass, no concha, no corals.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
40	Black sand, mud.	5	40º	NONE	NO NOTES: VERY POOR VISIBILITY.
20-40	NOTES: sand, mud. *Callinectes* sp. Bit diver.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
60	Black sand, mud.	5	40º	NONE	NO NOTES: VERY POOR VISIBILITY.
40-60	NOTES: notes not taken.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
80	Mud	5	40º	NONE	NO NOTES: VERY POOR VISIBILITY.
60-80	NOTES: notes not taken.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
100	Mud, fine sand	5	40º	NONE	NO NOTES: VERY POOR VISIBILITY.
80-100	NOTES: Mud, fine sand. TRANSECT ABORTED: BOAT TRAFFIC, UNSAFE CONDITIONS IMPEDED CONTINUANCE OF TRANSECT OFFSHORE.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0

FIGURE 3	Representative benthic habitat types intercepted by the 100m transect performed in Station 126-134, in July 24, 2002, within the proposed dredged zone of the Marina Puerto Real Project, Fajardo, Puerto Rico.

BENTHIC STUDIES: PUERTO REAL
STATION: TR 126-134
JULY 24, 2002



STATION 130-135

The location of this station is shown in FIGURE 2. This station represents some of the offshore benthic habitats occurring beyond, and northeast of the project site.

The transect conducted in this station intercepted a mud bottom. The mud appears to be covered by cyanobacteria. There was no dominant flora or epifauna. Occasional, half-buried green algae (i.e. *Caulerpa prolifera*) were seen next to the transect line. No corals, neither hard (Cnidaria:Scleractinia) nor soft (Cnidaria:Octocorallia) were intercepted by the transect. No seagrasses were intercepted by this 100m transect. There were no species of commercial importance, such as conchs (*Strombus* spp.) and lobsters (*Panulirus* spp.) found within the transect domain.

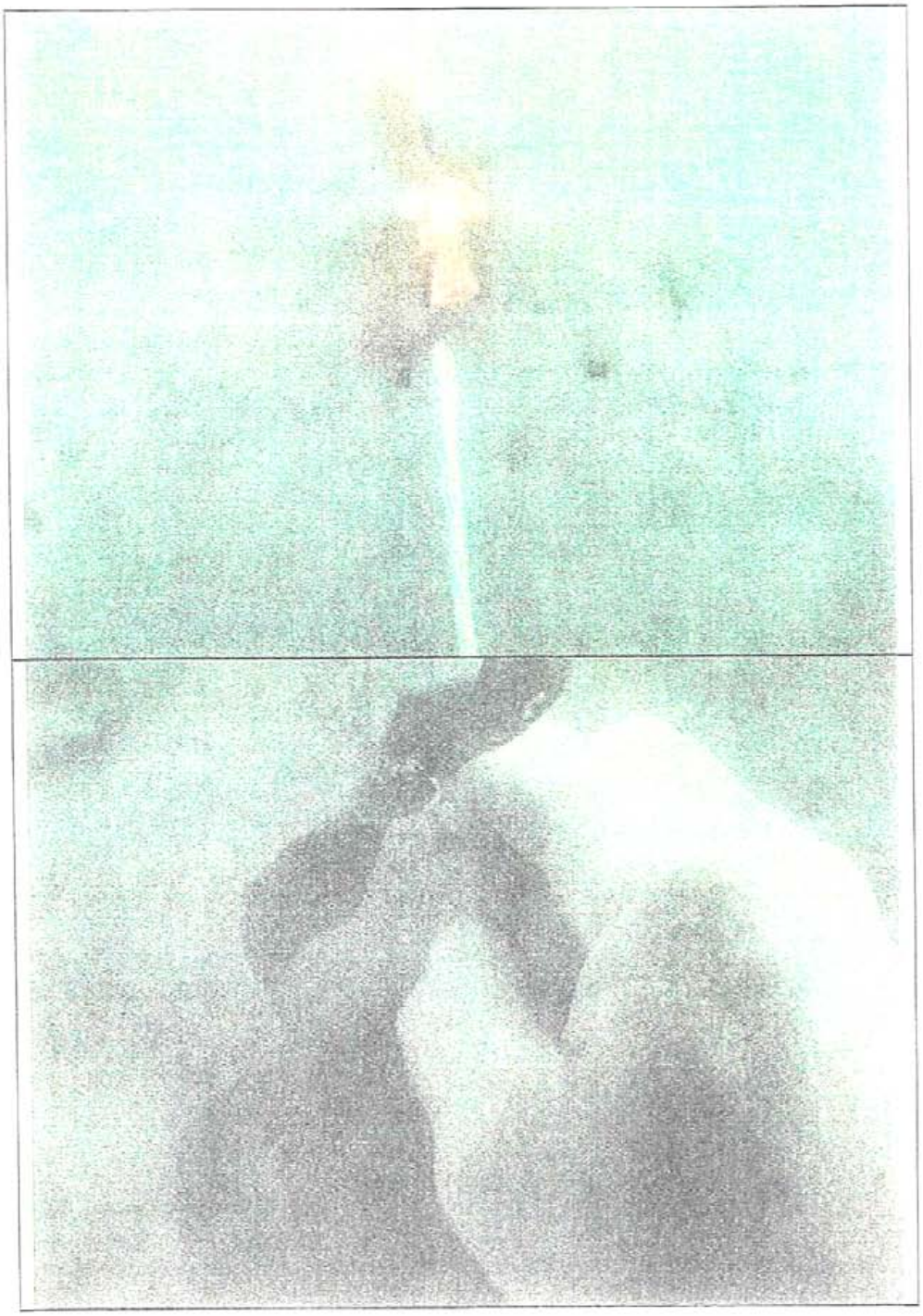
The water has a dark green color in this station suggesting eutrophication, caused perhaps, by nutrient inputs from Rio Fajardo. A (see TABLE 3 and FIGURE 4).

TABLE 3	Extension, substrate type, depth, direction and the dominant taxa intercepted or seen while conducting the transect at STATION: 130-135.

Date: July 24, 2002
Location: FAJARDO STATION: 130-135
FROM: WPT: 130 EPE: 10-20-FT TO: WPT: 135 EPE: 10-20-FT

Meter	Substrate	Depth (ft)	Bearing (°)	Dominant Taxa	NOTES
0	Brown mud	20	48º	NONE / infauna	Infauna borrows. *Telesto riseii* on foreign object.
20	Brown mud	22	48º	NONE / infauna	INFAUNA.
0-20	Mud.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
40	Brown mud	22	48º	NONE / infauna	NO NOTES: VERY POOR VISIBILITY.
20-40	Mud, infauna.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
60	Brown mud	22	48º	NONE / infauna	No conchs. No *Halophila* (expected).
40-60	Mud, infauna. Cyanophytic film over portions of mud.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
80	Brown mud	22	48º	NONE / infauna	No conchs. No *Halophila* (expected).
60-80	Mud, infauna. Cyanophytic film over portions of mud.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
100	Brown mud	22	48º	NONE / infauna	No conchs. No *Halophila* (expected).
80-100	Mud, no *Halophila spp.* Barren bottom.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0

FIGURE 4	Representative benthic habitat types intercepted by the 100m transect performed in Station 130-135, in July 24, 2002, northeast and beyond the proposed Marina Puerto Real Project, Fajardo, Puerto Rico.



STATION 132-136

The location of Station 132-136 is shown in FIGURE 2. This station represents some of the offshore benthic habitats occurring beyond, and east of the project site. The transect conducted in this station intercepted mud bottom communities, seagrass beds, and reef-rubble habitats found southwest of Arrecife Mata Caballos (see TABLE 4 and FIGURE 5). Two hard corals (*Cnidaria: Scleractinia*) were intercepted by the transect line. Some gorgonians, such as *Gorgonia ventalina*, were found in the vicinity of the transect line as it crossed the seagrass bed. Isolated sponges such as *Aplysina fulva* were found near, but not intercepted by the transect line. These systems are outside the project site but occur in the vicinity of the northeast breakwater structure.

There were no species of commercial importance, such as conchs (*Strombus* spp.) and lobsters (*Panulirus* spp.) found within the transect domain. There was no evidence of green turtle (*Chelonia mydas*) or manatee (*Trichechus manatus*) grazing sites within the seagrass beds intercepted in this station.

The water has a deep green color in this station suggesting eutrophication, caused perhaps, by nutrient inputs by Rio Fajardo.

TABLE 4	Extension, substrate type, depth, direction and the dominant taxa intercepted or seen while conducting the transect at STATION: 132-136.

Date: July 24, 2002
Location: FAJARDO STATION: 132-136
FROM: WPT: 132 EPE: 10-20-FT TO: WPT: 136 EPE: 10-20-FT

Meter	Substrate	Depth (ft)	Bearing (°)	Dominant Taxa	NOTES
0	Mud.	23	103º	NONE	Infauna borrows.
20	Mud.	23	103º	NONE	Cyanophyta.
0-20	Mud, no conchs, no seagrass. Some cyanophytes. *Caulerpa verticillata* (Chlorophyta).				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
40	Mud.	22	103º	NONE	No seagrass. No conch. Elongated *Halimeda incrassata.*
20-40	NOTES: Mud, *Caulerpa prolifera, Udotea flabellum* (Chlorophyta).				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
60	Mud.	19	103º	*Caulerpa prolifera*	No seagrass. No conch. Thallophytes increasing in abundance.
40-60	NOTES: NO CONCHS (*S. pugilis* expected). *Halimeda incrassata, Caulerpa serrulata.*				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
80	Mud. Calcareous sand.	18	103º	Rhodophyta.	Bottom sandier, less mud.
60-80	NOTES: NO CONCHS. Isolated turions of *Thalassia testudinum. Udotea flabellum* more abundant.				% SEAGRASS COVER = 0 #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
100	Mud. Calcareous sand.	13	103º	NONE	No conch. No sea urchins.
80-100	*Thalassia* bed begins at 14-ft of depth.				% SEAGRASS COVER = + SV #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0

TABLE 4	(CONTINUED) Extension, substrate type, depth, direction and the dominant taxa intercepted or seen while conducting the transect at STATION: 132-136.

Date: July 24, 2002
Location: FAJARDO STATION: 132-136
FROM: WPT: 132 EPE: 10-20-FT TO: WPT: 136 EPE: 10-20-FT

Meter	Substrate	Depth (ft)	Bearing (°)	Dominant Taxa	NOTES
100	Mud. Calcareous sand.	13	103º	NONE	No seagrass. No conch. No sea urchins.
120	Mud.	11	110º	*Thalassia / Syringodium*	No conchs.
100-120	*Thalassia testudinum* and *Syringodium filiforme*. One isolated coral head (*Solenastrea bournoni*, preliminary id.)				% SEAGRASS COVER = + SV #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
140	Mud. Calcareous fragments.	9	110º	*Thalassia / Syringodium*	No conchs
120-140	*Thalassia testudinum* and *Syringodium filiforme*. Isolated coral heads (*Solenastrea bournoni*, preliminary id.)				% SEAGRASS COVER = + SV #CORALS INTERCEPTED = 1 #GORGONIANS INTERCEPTED = 0
160	Mud.	8	110º-90º	*Thalassia / Syringodium*	No conchs.
140-160	*Thalassia testudinum* and *Syringodium filiforme*. Isolated coral head (*Solenastrea bournoni*, preliminary id.). *Erythropodium caribbaeorum, Niphates erecta.*				% SEAGRASS COVER = + SV #CORALS INTERCEPTED = 1 #GORGONIANS INTERCEPTED = 0
180	Calcareous sand.	4	110º-90º	*Thalassia / Syringodium*	No conchs. Dead *Porites porites*.

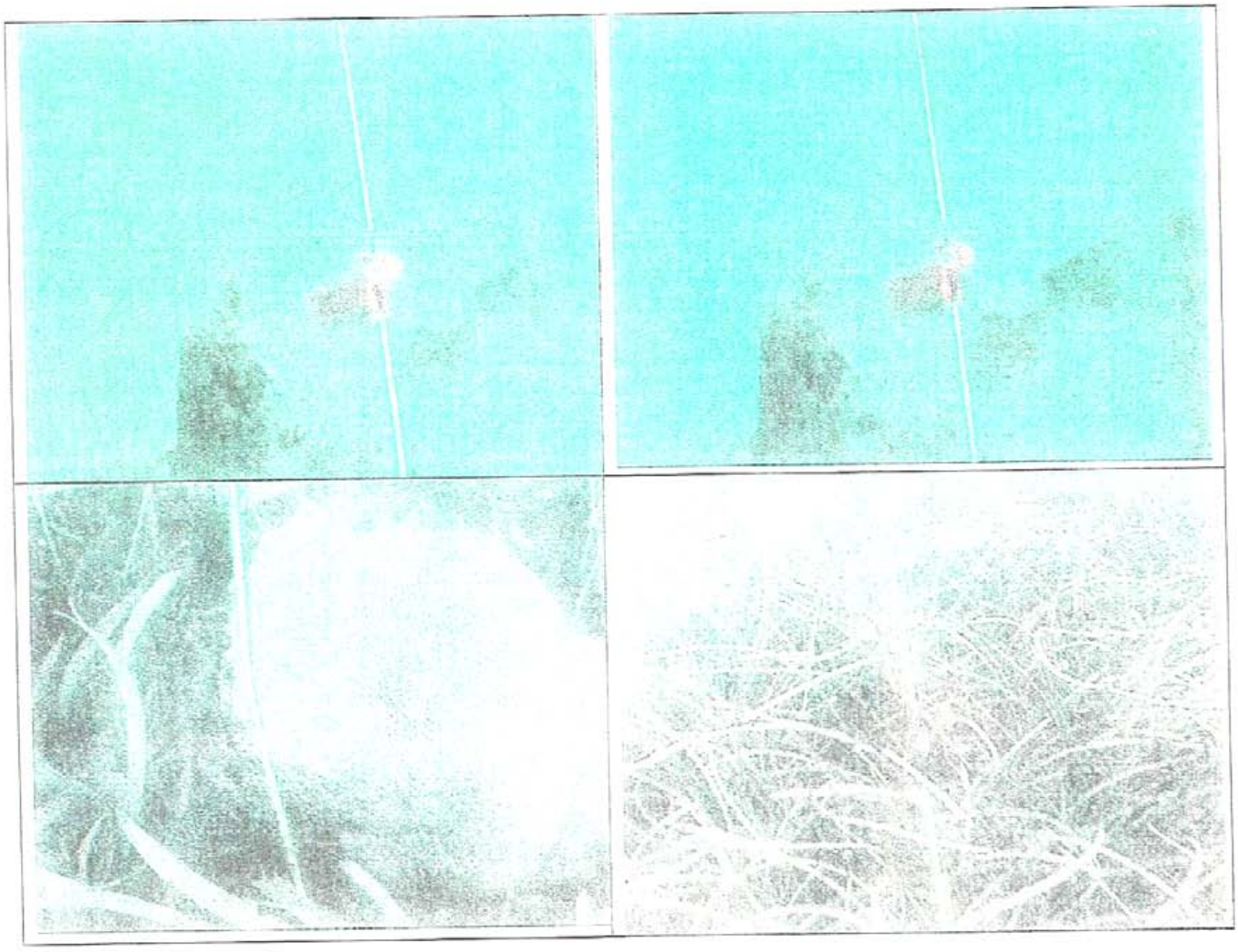
TABLE 4	(CONTINUED) Extension, substrate type, depth, direction and the dominant taxa intercepted or seen while conducting the transect at STATION: 132-136.

Date: July 24, 2002
Location: FAJARDO STATION: 132-136
FROM: WPT: 132 EPE: 10-20-FT TO: WPT: 136 EPE: 10-20-FT

160-180	*Thalassia testudinum* and *Syringodium filiforme*.				% SEAGRASS COVER = + SV #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
200	Calcareous mud.	3	100²	*Syringodium*	*Syringodium filiforme* very thick.
180-200	Mostly *Syringodium filiforme*. No conchs in any transect.				% SEAGRASS COVER = + SV #CORALS INTERCEPTED = 0 #GORGONIANS INTERCEPTED = 0
220	*Porites* rubble	1	100²	NONE	*Penicillus capitatus*
200-220	Seagrasses become sparser. *Porites* rubble dominant substrate.				

FIGURE 5	Representative benthic habitat types intercepted by the 220m transect performed in Station 132-136, in July 24, 2002, east of, and beyond the proposed Marina Puerto Real Project, Fajardo, Puerto Rico.

BENTHIC STUDIES: PUERTO REAL
STATION: TR 132-136
JULY 24, 2002



SHORE POINT INSPECTIONS

The results of the five point-shore inspections (Station 137, Station 138, Station 139, Station 140, Station 141) conducted in July 24, 2002 by V&A, Inc. are summarized in TABLE 5.

In summary, the inspections conducted by V&A, Inc., in these near shore stations, indicate, that there are no traditional ecologically important habitats found near shore of the project site. For example, seagrass bed ecosystems and coral reefs were not encountered.

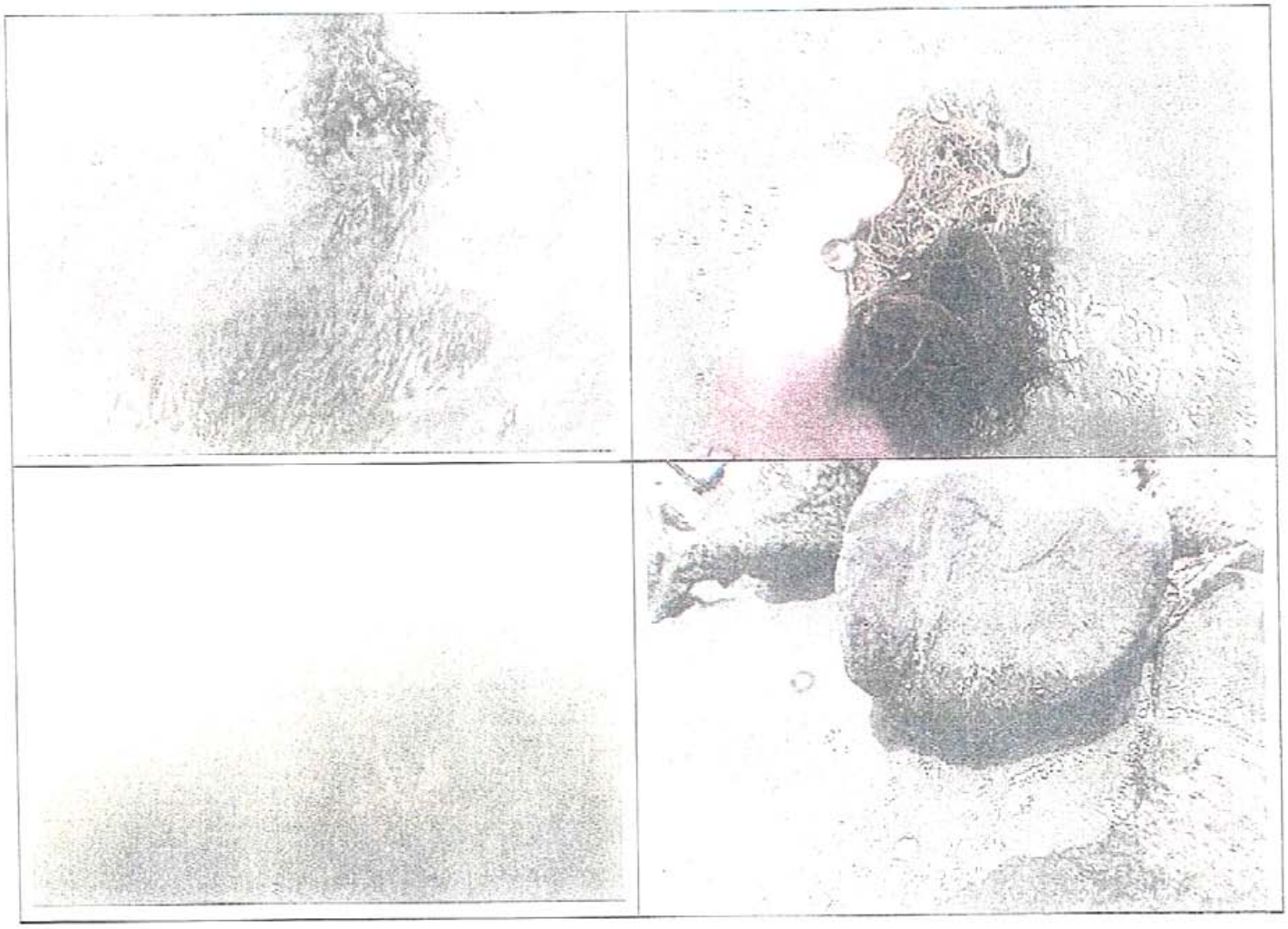
Representative photographs of the shore and near shore conditions of the site are shown in FIGURE 6.

TABLE 5	The results of the observations on the five point-shore inspections (Station 137, Station 138, Station 139, Station 140, Station 141) conducted in July 24, 2002 by V&A, Inc.

STATION	WPT (GPS2)	DEPTH	SUBSTRATE	DOM.TAXA	NOTES
PT 137 *BLACK SAND* P.REAL	137	2-ft	Black sand, probably with magnetite.	Rhodophytes *Gracilaria dominguensis Hypnea musciformis.*	No corals, no seagrasses nor species of special importance.
PT 138 *ANOXIC MUD* P.REAL	138	1.5-ft	Anoxic sticky mud, fill material.	NO MACROPHYTES	No corals, no seagrasses nor species of special importance.
PT 139 *FILL/SAND* P.REAL	139	1.0-ft apx	Fill material on shore.	Chlorophyta on intertidal rocks. *Ligia exotica*	No corals, no seagrasses nor species of special importance.
PT 140 *FILL/SAND* P.REAL	140	0-2ft	Fill material. Black sand.	Chlorophyta and Rhodophyta. *Acanthophora spicifera*	No corals, no seagrasses nor species of special importance.
PT 141 *FILL/SAND* P.REAL	141	0-3ft	Hard bottom and loose sediments.	Rhodophyta *Acanthophora spicifera. Gracilaria* spp.	No corals, no seagrasses nor species of special importance.

FIGURE 6	Representative shore benthic habitat types and shore conditions found in the five point-shore inspections (ST. 137, ST. 138, ST. 139, ST. 140, ST. 141). Seagrasses, hard corals and soft corals were not found within these stations.

POINT INSPECTION ANALYSES
BENTHIC STUDIES: PUERTO REAL
STATIONS: PT 137-138-139-140-141
JULIO 24, 2002



PART 4

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