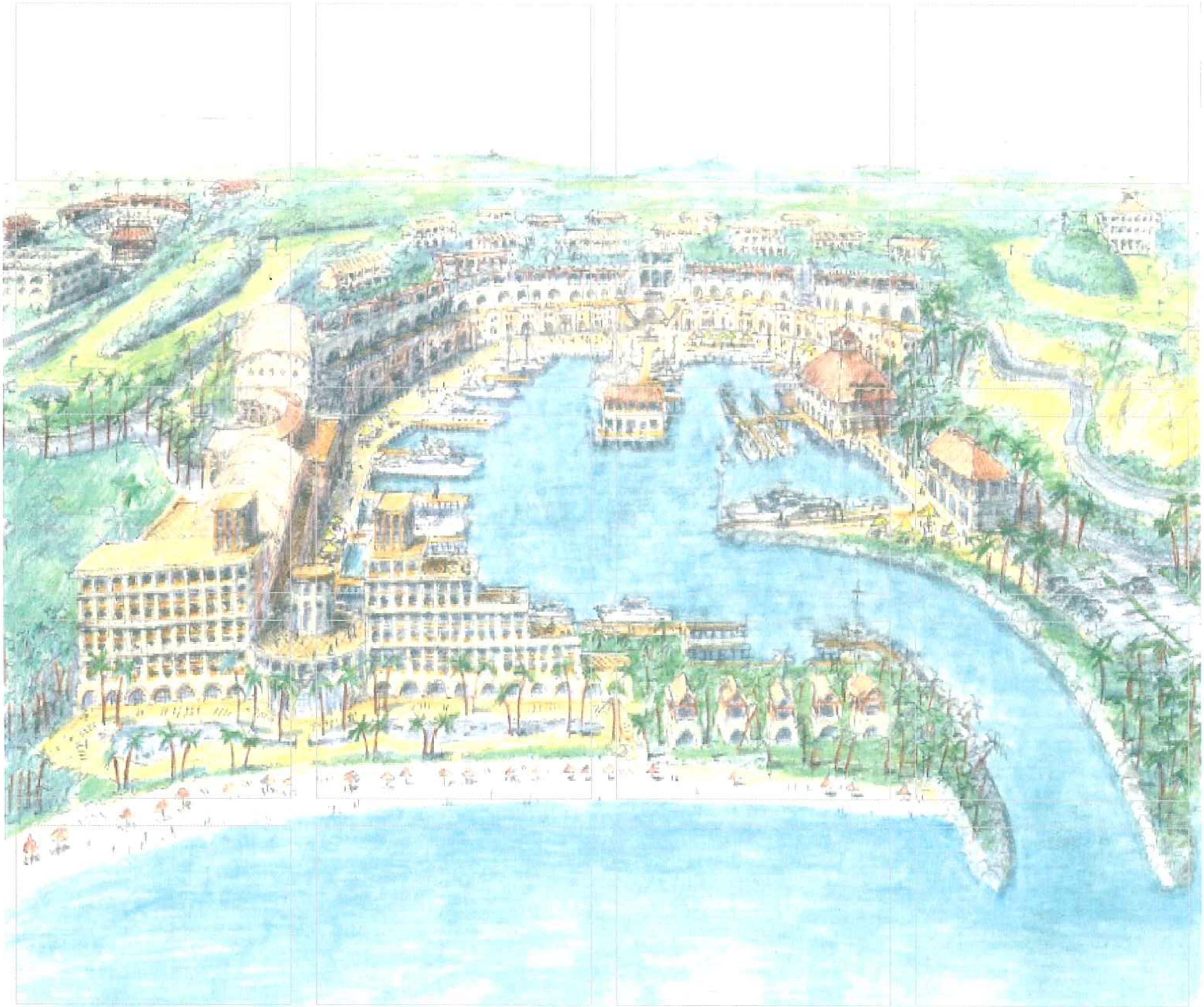

Final Report

Environmental Impact Assessment

Presented to:

The New South Ocean Development
New Providence Island, The Bahamas.

July 2007

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FINAL REPORT

New South Ocean Development Resort

Environmental Impact Assessment

Prepared for:

The New South Ocean Development Company, Ltd.
New Providence Island, Bahamas

July, 2007

ERM Project: 0060464

Environmental Resources Management
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ACRONYMS AND ABBREVIATIONS

ac	Acre(s)
AMMC	Antiquities, Monuments & Museums Corporation
ASTM	American Standard Testing Methods
ATM	Applied Technology and Management, Inc.
BaTelCo	The Bahamas Telecommunications Corporation
BDP	The Bahamas Biological Diversity Plan
BEC	The Bahamas Electricity Corporation
BEST	Bahamas Environment, Science and Technology Commission
BGC	Bahamas General Communications
BGS	below ground surface
BLCS	Bahamas Living Conditions Survey
BMP	Best Management Practices
BNT	Bahamas National Trust
BREEF	The Bahamas Reef Environmental Education Foundation
C	Celsius
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DEHS	Department of Environmental Health Services
DO	dissolved oxygen
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	US Environmental Protection Agency
ESA	Environmental Studies Associates
F	Fahrenheit
FHWA	Federal Highway Administration
ft	Feet (foot)
FTA	Federal Transportation Administration's

Gal	Gallon
GDP	Gross Domestic Product
GEMSS	Generalized Environmental Modeling System for Surface waters
gpd	Gallons per day
GSI	Groundwater Services, Inc.
in	Inches
km	Kilometers
lbs	Pounds
LOS	Level of Service
m	Meter(s)
MCL	Maximum Contaminant Levels
mg/L	milligrams per liter
mgd	million gallons per day
mi	Mile(s)
MLW	mean low water
mm	Millimeters
mm/year	millimeters per year
MPA	Marine Protected Area
mph	miles per hour
NAC	noise abatement criteria
NBSAP	The Bahamas National Biodiversity Strategy and Action Plan
NCWRI	National Creeks and Wetlands Restoration Initiative
NSA	Noise Sensitive Area
NSOD	New South Ocean Development
PET	potential evapotranspiration
ppm	parts per million
RBCA	Risk Based Corrective Action
ReefBalls	artificial reefs
RO	Reverse Osmosis

SPCC	Spill Control and Countermeasure Plan
SVOCs	semi-volatile organic compounds
SWIL	Smith Warner International Limited
TDS	Total Dissolved Solids
TE	Tourism Economics
TSS	total suspended solids
VOCs	Volatile Organic Compounds
WSC	The Bahamas Water and Sewer Corporation

1 EXECUTIVE SUMMARY

1.1 DESCRIPTION OF PROPOSED PROJECT AND ALTERNATIVES

The New South Ocean Development Company proposes to construct a world-class oceanfront destination resort called the New South Ocean Development (NSOD, Project or Resort) on 377.711 acres (as of July 2, 2007) of land in the southwestern portion of New Providence Island in the Commonwealth of the Bahamas (The Bahamas). The project is located approximately four miles south of the Nassau International Airport and 13 miles southwest of Nassau.

The goal of the project is to create a world-class, hospitality-driven, ocean front destination resort that will complement other residential developments in southwestern New Providence such as Lyford Cay, Old Fort Bay, and the proposed Albany development, and will support the economic transformation of southwestern New Providence. The project will represent an investment of approximately $867 million.

The NSOD will involve the redevelopment of the former South Ocean Golf & Beach Resort, which has been closed since July 2004. The NSOD conceptual master plan prepared by architect Michael Graves and EDSA, a land planning and landscape architecture firm, envisions two hotels (a five-star and a four-star), a casino, marina designed for mega-yachts, golf course, racquet club, hotel condominium units, amphitheater, recording studios, various commercial and support facilities, and roads.

Under the no action alternative, the property on which the NSOD is proposed would remain unchanged and its buildings would remain vacant. The social and economic benefits of the project, including employment; increased tourism; financial benefits to The Bahamas from taxes, project spending and increased tourism revenues; and active use of the property would not be realized. Over time, the property would experience continued degradation.

Other alternative sites, land uses, sizes, and designs were considered for the NSOD site. All alternatives were evaluated in the context of meeting the proposed project purpose of creating a world-class destination oceanfront resort, which would offer beaches, boating, golf, tennis, and other amenities, while enhancing The Bahamas' tourism economy and improving the socio-economic conditions of New Providence. Alternatives that did not satisfy the project purpose were not considered reasonable and eliminated from further evaluation.

No alternative sites that met the project purpose or had less environmental impacts were available. Two primary alternatives were considered for the marina:

- Offshore marina – This alternative involves a traditional offshore marina that would be accessed via a pier from shore.
- Inland marina – This alternative involves excavating uplands and creating an inland marina.

An offshore marina would have a greater environmental impact on marine resources than the proposed inland marina because it would require deepening the near-shore areas and altering existing habitats, including seagrass beds and corals. The inland marina would have greater environmental impact on terrestrial resources; however, the marina is proposed in an area that has already been significantly disturbed and provides little valuable habitat. Therefore, the inland marina was determined to be the environmentally preferred alternative.

Alternative beach designs were also considered. The proposed Headland Control Stabilized Beach is designed to create a beach in static equilibrium, which would not depend on external sources of sand.

1.2 DEFINITION OF THE AREA OF INFLUENCE

The project is anticipated to have significant economic effects locally and for the country of The Bahamas. The project will also help New Providence meet a rapidly growing demand for hotel rooms and facilitate development in the southwestern part of the island. In terms of environmental impacts, the project will affect certain environmental resources. Upland on-site influences include land clearing associated with marina development and dredging of the marina basin and entrance channel. Marine influence areas include benthic (bottom-dwelling) communities affected by the dredging. However, the impacts will be confined to the immediate project area and measures have been proposed to mitigate any potential adverse effects.

1.3 ENVIRONMENTAL IMPACTS

Water Quality

Construction activities, land clearing, and marine dredging may result in temporary erosion and sedimentation. On land, construction activities may aggravate erosion and impact plants and animals in the construction areas. Sediment control measures will be applied to protect the areas surrounding the construction site, both on land and in the water. Moderate impacts are expected and will be controlled and mitigated with standard construction control measures (Best Management Practices). When the marina is opened to the sea and filled with water, initial turbidity in the marina will be high as loose sediments are suspended. This plume of high turbidity will exit the marina and dissipate in the sea over a relatively short period of time.

The entrance channel to the marina may also experience irregular sedimentation and erosion. With the proposed inlet structure, it is unlikely that there will be any significant migration of sand from the eastern side of the eastern jetty into the entrance channel during normal conditions. Episodic events may also cause sand from the west to migrate towards the portion of the entrance channel that runs parallel to the beach. This type of movement is part of the beach's natural defense mechanism against the onslaught of storm waves. In order to reduce the likelihood that this sand causes siltation in the entrance channel, an artificial reef will be placed parallel to the shore in between the coast and the channel. The exact layout and configuration of the artificial reef, which will be built out of ReefBalls, will be determined and optimized through hydrodynamic modeling.

According to oceanographic and sediment transport investigations, sediment movement is predominantly from east to west under normal conditions. Seasonal and episodic events are possible, however, that cause occasional transport towards the west. Neither the gross sediment transport through the site, nor the net sediment accumulation at the site, appears to be significant. This is evidenced by the lack of sand accumulated along virtually the entire coastline from the project site on to the west, and particularly along the eastern side of the easternmost jetty that protects the entrance to Stuart Cove's. From this one can conclude that the structures necessary to create the beaches (headlands, artificial reefs, and terminal groins) will not have a significant impact on the sediment supply to areas downstream of the site (as there is little or none to begin with). It also is the main motivation for selecting a beach system design (Headland Control) that does not depend on sediment supply from upstream in order to maintain its equilibrium configuration.

Air Quality

The nature of the emissions associated with this project is temporary or sporadic. During the construction phase, fugitive dust will be generated as a consequence of earth movement. These emissions will be controlled using water tank trucks or sprinklers. Trucks and heavy vehicle loads will be covered at all time and the roads will be kept clean in existing residential areas. During the operation phase, combustion sources such as boilers, emergency generators, and fire pumps will be the main sources of emissions. Emergency generators and fire pumps are temporary sources used only in case of emergency. Boilers for this type of project are usually small; therefore, their operation does not pose an adverse environmental impact.

Noise

Construction activities will occur in multiple phases throughout the construction period. Construction noise typically occurs intermittently and varies depending upon the nature or phase of construction (e.g., demolition/land clearing, grading, and excavation). Construction activities such as site preparation; truck hauling of material; pouring of concrete; use of power tools; and earthmovers, material handlers, and portable generators will generate noise, which could reach high levels for brief periods. Although noise ranges are generally similar for all construction phases, the grading phase tends to involve the most equipment. Construction noise will be temporary and will occur during daylight hours when occasional loud noises are more tolerable. Extended disruption of normal activities is not anticipated. Provisions will be included in the plans and specifications requiring the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and maintenance of muffler systems.

The major noise sources associated with project operations are expected to include the marina boats/yachts idling (stationary source) and increased vehicular traffic (mobile source). Noise levels from these exterior sources are expected to dominate noise levels from interior sources or enclosed buildings like the amphitheater, recording studio, television studio, casino, racquet club, etc. None of these operations are expected to generate significant noise impacts.

Terrestrial Ecosystems

The NSOD site is already heavily disturbed. Approximately 54 percent of the site consists of man-made (e.g., golf course) or disturbed habitats. Much of the remaining natural habitat is fragmented into relatively small, less valuable areas. The largest intact habitat is the relatively undisturbed Broadleaf Coppice forest located in the west central portion of the site and surrounded by the golf course on three sides and the South West Bay Road on the other side. Even here exotic species have invaded the fringes of the forest. There are no parks or preserves present on-site or in the general area, but there are two natural solution cavities called "blue holes," which are protected under Bahamian law. There are also several protected species that occur on the site, including four tree species (Mahogany, Horseflesh, Tree of Life, and Yellow Pine); the Bahamian boa constrictor; and two birds (Bahamian Woodstar and American Kestrel) known to use the site.

Construction of the proposed project will impact much of the remaining natural habitat on the site, with approximately 10 percent of the site remaining in natural habitat or naturally-occurring vegetative communities. Six naturally occurring terrestrial habitat types found in The Bahamas have been identified on site. These include: Broadleaf Coppice; Mixed Evergreen/Broadleaf Coppice; Coastal Sand Strand; Sandy Beach, Coastal Rock; and Aquatic Emergent Vegetation. The two blue holes are located along the golf course and will not be further affected by the proposed project construction. The exact location of the protected tree species will be identified in the field and these individual trees will be protected to the greatest extent possible. Trees that cannot be avoided will be relocated to the greatest extent possible. Any boa constrictors encountered during construction will be safely captured and relocated to an off-site protected area. No direct impacts to the two protected bird species are anticipated; the birds will likely relocate to suitable nearby habitat during construction, although there will be a net loss of on-site habitat for these species.

Operation of the NSOD is not anticipated to have any additional impacts on the remaining natural areas. The developer will implement measures to protect these remaining natural areas, such as removal of exotic species.

Marine Ecosystems

The marine environment offshore of the proposed NSOD Resort consists primarily of hardbottom habitat with coral (approximately 55 percent) sand bottom with scattered coral (approximately 32 percent), Sargassum flats and

Seagrass beds (approximately 7 percent), and hard bottom with macroalgae (approximately 4 percent). Patch reefs and seagrass beds are present, but collectively represent approximately 2 percent of the habitat.

Potential impacts of the proposed project on the marine environment include physical effects of habitat disturbance and injury and/or mortality of marine flora and fauna through collisions with construction equipment or entrainment in dredges; reduced fitness or survivorship of marine flora or fauna due to localized changes in water quality; and increases in potentially harmful human activity or boat traffic.

The most substantive effect of the proposed project on marine habitat will be associated with construction of the proposed access channel from the marina inlet seaward to a depth of approximately 15 feet. The effects of this construction, however, will be localized within a small area. The proposed channel will affect approximately 10 acres of benthic habitat, primarily sandy bottom with scattered macroalgae and coral immediately offshore of the project site. None of the proposed project facilities will occur within Macroalgae Beds, Seagrass Beds, Sargassum Flats, Hardbottom with Coral, or Patch Reefs. Therefore, the proposed project will have no direct effect on these habitat types.

The use of artificial reefs is planned to reduce scour at the foot of coastal structures, reduce siltation of the access channel for the marina, and reduce turbidity at the beaches, tourist attraction, and habitat restoration. The areas where the dredging will take place will be surveyed for live coral communities, which will be rescued and transplanted onto the artificial reef units, further reducing the impact of the dredging operations. It is anticipated that these reefs will rapidly be populated with fish and will, along with the transplanted corals, form part of a thriving reef ecosystem.

There are no protected marine reserves in the project area, although the Bahamas National Trust is considering the designation of a protected marine environment off the southwest coast of New Providence Island to the south of the proposed project. This general area is known to include patch reefs and hardbottom habitat, which support populations of stony corals, soft corals, and other soft-bottom, hardbottom, and reef invertebrates and fishes. Aside from their inherent ecological value, these living resources attract and support commercially significant recreational diving (snorkel and scuba) activities. The construction of the proposed access channel will not affect this potential marine reserve.

There are a number of endangered marine turtles, mammals (e.g., whales and manatee), and invertebrates (e.g., various species of coral). There is no evidence or recent records of marine turtles nesting in the project area. This is most likely due to the lack of a sandy beach to build nests on, so there is a distinct possibility that once the planned beaches are created, turtles may begin nesting at the site. Should this be the case, any nesting sites will be monitored and protected. Marine mammals should be able to easily avoid the clamshell dredge during dredging of the access channel. Although detailed taxonomic surveys of corals were not undertaken as part of this assessment, the proposed alignment of the access channel is confined to predominantly sandy bottom habitat and should have no effect on any endangered corals. Any corals that lay in the planned dredge path will be rescued for transplantation and propagation onto the proposed artificial reefs.

Socioeconomics

The development of the proposed project will have a beneficial impact on the area in which it is located. Overall, development on the NSOD property will clean up parts of the property that have been neglected since the former South Ocean Golf & Beach Club closed. Although some new, more intense land uses are proposed to be developed within the property, these uses are consistent with the resort character of the former facility and area zoning. Discussions with representatives of the Ministry of Tourism indicate that there is a desire to bring new development to the southwestern portion of New Providence Island and the proposed NSOD Resort is consistent with that goal.

Both construction and operation of NSOD will provide opportunities for employment that will benefit local residents on the southwestern side of New Providence. The project will also have a positive impact on New Providence unemployment in general. Therefore, the NSOD project will have a beneficial impact on the Bahamian economy, resulting in additional project-related and non-project-related economic growth in the project vicinity.

Solid and Hazardous Waste

It is expected that the highest volumes of solid waste will be generated during the construction phase of the proposed project, specifically during the dredging of the marina, the demolition of existing structures, and land clearing activities. There is also a potential that approximately two tons per day of domestic waste could be generated during the operational phase.

The potential adverse impacts to be generated by these activities will be minimized by establishing environmentally sound management practices. Pollution prevention, waste minimization practices, and eco-efficiency are alternatives that will be evaluated and implemented throughout the construction and operational phases of the project. The implementation of these alternatives could represent a reduction of up to 100 percent in construction debris and of up to 73 percent in domestic waste that otherwise would need to be disposed of in a landfill.

For the disposition of all wastes, the developer will follow all environmental regulations established by the Department of Environmental Health Services (DEHS) and other regulatory agencies, and will request approvals and/or permits as applicable.

Cultural Resources

Studies conducted for this EIA suggest that there may be unidentified historical and archaeological resources within some of the undeveloped portions of the NSOD project site. Also, the limits and precise locations of all features and deposits associated with a known historical plantation site have not been defined. Additional archaeological investigations within portions of the NSOD property are underway to evaluate the potential effects to all historical and archaeological resources in areas identified as having a high sensitivity. Given the modifications associated with development activities proposed in areas identified as having limited sensitivity, it is likely that any archaeological deposits in these portions of the property have already been severely disturbed. Thus, construction activities in the areas identified as limited sensitivity will not affect any archaeological/historical resources that possess or are likely to possess significant information about the history and development of The Bahamas.

1.4 AGENCY CONSULTATION AND PUBLIC INVOLVEMENT

As part of the EIA Process, consultations were undertaken with the BEST Commission, The Bahamas National Trust, and the Departments of Fisheries, Tourism, Works, and Physical Planning as well as the Antiquities, Monuments & Museums Corporation. These agencies were consulted in order to understand their viewpoints regarding the project as well as to understand potential impacts related to these agencies' areas of interest and expertise.

A public meeting was held on February 7, 2007 at the Radisson Cable Beach Casino and Golf Resort to present and discuss the studies associated with the EIA. Members of the project Team were present to answer questions specific to the environmental baseline studies being conducted. Public comments were received through the question and answer period of the meeting. The meeting was well attended, with 75 people signing in. The overall tone of the meeting was positive and constructive. The major concerns raised concerning the proposed project were the realignment of the South West Bay Road (e.g., where would it go, how inconvenient would it be) and public access to the beach.

Further public consultation will be as directed by the Government.

1.5 ENVIRONMENTAL MANAGEMENT PLAN

To operate the NSOD project in a sustainable manner that considers environmental factors at all levels, and to mitigate the effects of potential impacts, an Environmental Management Plan (EMP) will be developed and implemented. This plan will address:

- Specific construction guidelines, phasing and mitigation measures;
- Monitoring programs;
- Emergency response measures; and
- Post-construction operational guidelines.

As part of the EMP, an Environmental Management System (EMS) will be developed to insure compliance with the EMP. Environmental, health, and safety audits will be conducted annually to insure compliance with all applicable Bahamian laws and regulations, operating permits, Best Management Practices (BMPs), and the project's Sustainable Development Program. The implementation of corrective actions for any and all deficiencies will be tracked.

1.6 CONCLUSIONS REGARDING ENVIRONMENTAL ACCEPTABILITY OF THE PROJECT

This section of the EIA discusses the overall environmental acceptability of the proposed NSOD Resort. Environmental acceptability is evaluated in two ways:

- The extent to which the proposed project will comply with applicable environmental standards and requirements; and
- A comparison of the unavoidable negative environmental impacts with the net project benefits.

1.6.1 *Compliance with Applicable Environmental Standards and Requirements*

The current Bahamian Building and Land Development Code does not outline a definitive permit application and land development approval process. The proposed project will comply with all applicable Bahamian environmental standards and requirements, relevant legislation, and legal and regulatory statutes. NSOD will work with the BEST Commission and designated agencies during the EIA process to meet these requirements, and comply with the commitments agreed to in the project's Environmental Management Plan during project development and operations.

1.6.2 *Cumulative Impacts*

Cumulative impacts are the environmental, social, or other impacts from the proposed Project, added to the incremental impact of similar projects in the same or nearby locations. While the impact from each individual project may be minor, the additive impacts from multiple projects could be major. The spatial extent of the other projects considered includes other major development projects on the southwestern tip of New Providence Island, including: Albany, the container port, Clifton Heritage Park, and a Marine Protected Area. Developments in southwest New Providence Island that were reasonably expected to occur before, during, or shortly after completion of the proposed Project, and that were large enough to potentially produce regional impacts (such as noticeably increased traffic), were included as cumulative impacts.

The most notable potential cumulative impacts could be associated with transportation services, coastal processes such as sediment drift, and the ground water/freshwater (hydrogeology) resource. Section 7.2 discusses these potential cumulative impacts and suggested mitigation measures.

1.6.3 *Comparison of Unavoidable Negative Environmental Impacts to Project Benefits*

The NSOD project has taken many measures to avoid and minimize environmental impacts through careful design and environmentally sensitive construction and resort operation. Further, Section 6.2 identifies an extensive set of mitigation measures to further reduce the net impact of the project. Nevertheless, the project will result in some unavoidable negative impacts. These impacts include:

- Loss of approximately 160 acres of natural terrestrial habitat, which will also result in a net loss of habitat available for fauna on New Providence Island;
- Loss of some protected trees, which are either too large to transplant or do not survive relocation;
- Increased demand for electricity, which will require the importation of more oil and the emission of more air pollution;
- Increased demand for freshwater, which will require increased desalination or the import of freshwater to New Providence;
- Generation of solid waste, which will use limited sanitary landfill volume;
- Increased potential for accidental spills and use of fertilizers and pesticides, which will cumulatively impact water quality; and
- Increased vehicular traffic, which will result in increased mobile source air emissions.

These unavoidable negative impacts are offset by several significant project benefits. Many of these benefits are social and economic, and include:

- Approximately 2,235 jobs generated from the project, of which 1,358 jobs (61%) would be in operations and 877 (39%) in construction. These jobs will produce $1.2 billion in wages, $81.7 million (7%) and $1.1 billion (93%) of which would be direct impacts from the construction and operations phases, respectively;
- Significant contributions to the local economy through visitor spending;
- Significant contributions to the government of The Bahamas through various tax payments;
- Contribution to achieving government's vision for southwest New Providence;
- Increased quality of life for residents of New Providence as a result of increased employment opportunities, recreational opportunities, and infrastructure improvements; and
- A newly created reef ecosystem that will provide shelter for fish and corals, as well as provide an attraction for visiting tourists.

Although it is difficult to compare beneficial and adverse effects on different resources, overall the social and economic benefits are quite significant and consistent with the government's plans for New Providence, while the environmental impacts will not affect overall biodiversity or significantly affect water or air quality. The effects of the project on water demand, electrical generation, and solid waste generation are issues common to all development on a small island such as New Providence. Therefore, we conclude that the benefits of the proposed project significantly exceed the project's environmental impacts. The developer should fully implement the Environmental Management Plan and track its performance through an Environmental Management System to ensure that the environmental impacts are avoided, minimized, and mitigated to the full extent possible.

2 DESCRIPTION OF PROPOSED PROJECT AND ALTERNATIVES

2.1 DESCRIPTION OF PROPOSED PROJECT

The New South Ocean Development Company proposes to construct a world-class oceanfront destination resort called the New South Ocean Development (NSOD or Project) on approximately 377.711 acres of land in the southwestern portion of New Providence Island in The Bahamas. (Refer to Appendix A.1 for the Site Location Aerial Photograph and Appendix A.2 for the New Providence Island Location Image.) The project is located approximately four miles south of the Nassau International Airport and 13 miles southwest of Nassau with the proposed Albany development to the east and the proposed Clifton Heritage Park to the west.

2.1.1 *Project Vision*

The goal of the project is to create a world-class hospitality-driven resort destination, which will complement the residential developments in southwestern New Providence such as Lyford Cay, Old Fort Bay, and the proposed Albany development, and will support the economic transformation of southwestern New Providence. The project will improve the transportation network, provide employment opportunities, and increase property values for residents in local communities such as Adelaide and Coral Harbor. The project will represent an investment of approximately $867 million.

2.1.2 *Current Status*

The NSOD will involve the redevelopment of the former South Ocean Golf & Beach Resort, which has been closed since July 2004. The South Ocean Golf & Beach Resort is currently boarded up and in deteriorating condition. The former resort included approximately 220 hotel rooms in several buildings on both sides of South West Bay Road. The resort had approximately 3,000 linear feet of ocean frontage, but much of the beach has eroded over the past several years and mostly limestone rock outcrops remain.

As its name suggests, the former resort also included an 18-hole golf course and clubhouse, which were both closed about two years ago shortly after the hotel stopped operating. Two tennis courts also remain on the property. South Ocean Road, which provided access to the hotel on the inland side of South West Bay Road, still provides access to the residential neighborhood of

South Ocean Village. A non-functioning traffic signal exists at the intersection of South West Bay Road and South Ocean Road.

The proposed site also includes Stuart Cove's Dive Bahamas, which is a private world-renowned diving charter business recognized as one of the Caribbean's leading dive centers. It was recently recognized as the Top Dive Operator in The Bahamas by Rodale's Scuba Diving Magazine. As part of the project, Stuart Cove's will be relocated to the proposed marina (see additional details below in Section 2.1.3). This partnership with Stuart Cove's Dive Bahamas will offer visitors and residents of NSOD a wide range of water sport opportunities and immediate access to some of the best diving in the Caribbean.

2.1.3 *Project Components*

The NSOD conceptual master plan prepared by architect Michael Graves and EDSA, a land planning and landscape architecture firm envisions two hotels (a five-star and a four star), a casino, marina, golf course, racquet club, condominium hotel units, residential units, various commercial and support facilities, and roads. Table 2.1 summarizes the program for each component of the resort. Appendix B graphically presents the conceptual master plan. Each of these master plan components are described below.

Table 2.1 Resort Program Summary

Component	Number of Rooms/Units	Building Footprint	Approximate Acreages
Five-star Hotel	100 rooms	162,883 ft^2	26.0
Four-star Hotel / Casino/ Condos	650 rooms 100 units	443,337 ft^2	38.8
Marina	N/A		16.0
Residential - Large Lots	40 units	185,000 ft^2	30.0
- Fractional Villas	48 units	44,560 ft^2	11.09
- Mid-sized Estates	33 units	46,200 ft^2	26.5
- Timeshares	180 units	42,000 ft^2	11.0
Golf Course and Clubhouse	N/A	20,000 ft^2	149.02
Commercial and Support Facilities	N/A	268,125 ft^2	22.7
Racquet Club	N/A	98,000 ft^2	8.0
Primary Roadways	N/A		21.0
Employee Housing Parcel and Parking Deck	N/A	400,000 ft^2	2.6
Future Outdoor Entertainment Venue	N/A	N/A	15.0
Totals	750 rooms 401 units		377.71

Five-Star Hotel

A 100 suite super-luxury five-star beachfront hotel is planned where the former South Ocean oceanfront hotel and Stuart Cove's dive shop are currently located. The low-rise hotel will include a cluster of pool frontage and ocean frontage buildings. A central focal point will be a long reflecting pool leading from the lobby towards the beach. The hotel will also offer pools, restaurants, bars, a small salle privee gaming venue, business center, and retail shops. Associated with the hotel will be a spa including both treatment and massage pavilions.

The beach along the closed South Ocean oceanfront hotel has been eroded during recent storms and little sand remains. Sand from the excavation of the marina channel is proposed to be pumped onshore to restore the beach. An offshore artificial reef is proposed to stabilize the sand, resulting in a beach which is in static equilibrium: once created it will not depend on external sources of sand (such as natural transport from upstream or the east) or artificial nourishment by NSOD to maintain its shape. The headland control system will include terminal groins at either side of the beach with the ends angled according to the predominant wave direction in order to create a headland effect. In addition, a central headland and offshore artificial reefs will be constructed for protection against scour and incoming wave energy.

Marina

Marina facilities at NSOD will include both a marina basin and an entrance channel. The marina basin will be excavated from the upland landward of the southwest shoreline of the South Ocean property. The marina footprint provides for a basin of approximately 16 acres. The marina basin is expected to be lined with concrete bulkheads and suitable mooring facilities. The marina will provide approximately 118 berths for vessels between 38 and 125 feet in length, with additional side-berths for larger vessels up to 200 feet in length. The final marina configuration, including total berths and slip mix, will be determined during the detailed design phase. The design depth for the marina will vary between -12 to -15 feet at mean low water (MLW).

The marina basin entrance is located immediately west of the existing Royal Beach State condominiums at a topographic low point to minimize excavation. The entrance and access channel will both be approximately 150 feet wide and 15 feet deep at MLW. The proposed channel alignment runs roughly perpendicular to the shoreline for approximately 150 feet, then curves west and parallels the shoreline for approximately 1,500 to 2,000 feet until it reaches the 15 feet MLW contour. This alignment was selected in order to minimize impacts on sensitive benthic habitats such as patch coral and seagrasses. Rock jetties will extend from the shoreline on either side of the channel to reduce wave action and minimize sedimentation. Channel markers (both lighted and unlighted) will help delineate the channel to prevent groundings. In order to avoid sedimentation from the beach in front of the four-star hotel, an artificial reef constructed of ReefBalls will be placed between the beach and the portion of the channel that runs parallel to it.

As indicated above, Stuart Cove's Dive Bahamas Shop has agreed to relocate from its current location to the proposed marina. It will be housed in a new structure adjacent to the marina.

Four-Star Hotel/Casino/Conference Center/Condominium Hotel Units/Retail

The hotel, casino, conference center, condominium hotel units, and retail shops will all be linked by a pedestrian promenade that encircles the marina.

A 650-room, multi-story, four-star oceanfront hotel is proposed on the west side of the resort between the marina and the ocean. The four-star hotel will offer restaurants and bars, a beach, spa, pools, and retail shops as well as a casino, conference center, and marina-oriented retail shops. Sand from the excavation of the marina channel is proposed to be pumped on-shore to create a beach in an area that is mostly rock outcrops. A headland control system will be utilized to create a beach in static equilibrium. This is necessitated by the fact that there is little or no sediment supply arriving at the site from upstream (the east). The planned beach configuration, which will be controlled by the groin that runs parallel to the western side of the marina entrance channel, will be further protected from wave action by the planned artificial reef. A terminal groin on the west end of the property will act as a downstream headland.

The former South Ocean Golf & Beach Resort had a casino license, the rights to which have been acquired by the NSOD Company. The NSOD casino will be adjacent to the four-star hotel and will overlook the marina. It will provide over 40,000 square feet (ft^2) of gaming rooms complete with a restaurant and bar.

Adjacent to the casino and also overlooking the marina will be a conference center. The conference center will provide up to 27,000 ft^2 of meeting space.

The north side of the marina will be lined with approximately 100 hotel condominium units as well as a pool, deck, bar and cafe, and approximately 75,000 ft^2 of pedestrian-level, marina-front retail shops. Appendix C provides an artist's rendering of the marina complex.

Golf Course

The NSOD Resort will offer an 18-hole Greg Norman-designed golf course that is flexible enough to be enjoyed by novice golfers yet challenging for advanced players. The course encompasses 149.020 acres approximately in the center of the site and offers elevation changes, natural influences, and many diverse water views, including freshwater lakes, two blue holes, and the ocean. The front nine holes on the eastern half of the site are routed through gently rolling landscapes, while the back nine wind through native Bahamian forest that features mature ficus and gumbo limbo trees. A renovated 20,000 square foot clubhouse and related maintenance facilities are also planned.

The South Ocean golf course currently exists on the property as a remnant of the South Ocean Golf & Beach Resort. The golf course was closed approximately two years ago, but is currently being redesigned and renovated. The renovation includes lengthening the course, widening the fairways and landing areas, locating bunker complexes to make the course more challenging, installing a new irrigation system, and reseeding.

The only proposed modification to the golf course for the NSOD Resort development is to provide vehicular access from the country club access road to South Ocean Road via a short tunnel under the course.

Other Residential/Hotel Units

In addition to the condominium hotel units mentioned above, the resort will also offer a range of other residential living options, including:

- Large estate lots with approximately 40 estates (0.75 acre lots), most with frontage on the golf course;
- Mid-size estate lots with approximately 33 privately gated residential home lots adjacent to the golf course (0.50 acre lots);
- An 11 acre vacation ownership parcel associated with and adjacent to the casino resort, for development of approximately 180 time share or other vacation ownership units in a multi-story complex; and
- An 11 acre fractional ownership villa project overlooking the golf course and the ocean, containing 48 fractional villas in a multi-story complex.

Racquet Club

The racquet and tennis club will be located in the northwestern portion of the site and will consist of a 98,000 ft^2 clubhouse and 16 tennis courts.

Various Commercial and Support Facilities

Approximately 15 acres of land will be reserved for future development of a major outdoor entertainment venue and other commercial and entertainment facilities and/or attractions, which could include a 2,500-seat enclosed amphitheater; a two-story, 51,000 gross ft^2 television studio; and a 51,000 gross ft^2 recording studio.

The project will also include a two acre employee housing parcel including approximately 50 units of employee housing and a 400,000 ft^2 (approximately 1,200-space), multi-story parking structure for the marina complex (i.e., four-star hotel, casino, and conference center); and various other site utility and support buildings.

Roads

The proposed project will require approximately 21.0 acres of primary roadways to provide vehicular access to the various resort components. The primary access to the NSOD Resort will be from South Ocean Boulevard at a new traffic circle. Access will also be provided from South West Bay Road.

Development of the resort will require the re-alignment of South West Bay Road as it weaves around the five-star hotel and marina complexes. Public access will be maintained to the out parcels within the resort. Ultimately, a loop road is proposed to extend from the planned commercial port to the west of the site in Clifton along the power lines that form the northwest boundary of the NSOD to South Ocean Boulevard, which will redirect truck and much public traffic around the NSOD Resort.

2.1.4 *Construction Schedule and Phasing*

The specific project construction schedule and phasing have not yet been finalized, but the renovations to the golf course are nearly complete and the course may be open by the last quarter of 2007 as a "pay for play" facility.

The initial phase of Project development will focus on constructing the necessary infrastructure to support the resort (e.g., water, sewer, roads, and electricity). The exact timing for the construction of the remainder of the resort will be dependent on market conditions, but the marina complex (e.g., marinas, multi-story hotel, and condominium) and five-star hotel will be built early in the development process.

2.2 Description of Alternatives

2.2.1 *The "No-Action" Alternative*

Under the no-action alternative, the property on which the NSOD is proposed would remain unchanged and its buildings would remain vacant. The social and economic benefits of the project, including employment; increased tourist opportunities; financial benefits to The Bahamas from taxes, project spending and increased tourism revenues; and active use of the property would not be realized. Over time, the property would experience continued degradation.

2.2.2 *Other Alternatives Considered*

Other alternative sites, land uses, sizes, and designs were considered for the NSOD site as described below. All alternatives were evaluated in the context of meeting the proposed project purpose of creating a world-class destination oceanfront resort that offers beaches, boating, golf, tennis, and other amenities, while enhancing The Bahamas' tourism economy and improving the socio-economic conditions of the island. Alternatives that did not satisfy the project purpose were not considered reasonable and eliminated from further evaluation.

Alternative Sites

No alternative sites were identified for the proposed NSOD Resort that met the project purpose, were available, and would have similar or less environmental impacts. First, in order to meet the project purpose, a large contiguous oceanfront tract of at least 350 acres in southwestern New Providence was required. Second, this property would have to be available for sale at a reasonable price. Third, the proposed site already has an existing golf course. No other sites were available that already had a signature golf course. Construction of a new golf course, which requires approximately 180 acres of land - much of which would need to be cleared and re-graded - would involve much greater environmental impacts than taking advantage of a site with an existing golf course. Therefore, no other site was identified as a reasonable alternative worthy of further consideration.

Alternative Land Uses

The proposed NSOD site encompasses the former South Ocean Golf & Beach Resort and retains a casino license. The site is currently zoned for touristic, residential, and open space (e.g., golf) uses. Further, the government of The Bahamas has expressed an interest in developing southwestern New Providence for tourism development (Ministry of Tourism, 2007).

Several other prospective developers have looked at the NSOD property since the South Ocean Golf & Beach Resort closed and all have focused on redevelopment of the site as a resort. These prospective developers evaluated various combinations of the following resort components: hotel, golf course and golf academy, spa, casino, marina, conference center, and various types and scales of residential development. No other alternative land uses were considered economically viable or appropriate for the site.

For the reasons described above, alternative land uses not related to or supporting tourism development were not considered reasonable for this site and eliminated from further consideration.

Alternative Sizes

Most of the resorts on New Providence are located on the north shore of the island (e.g., Nassau, Paradise Island, Cable Beach). In order to construct an economically viable project, the NSOD will need to be sufficiently large with high-quality attractions to attract tourists to southwestern New Providence. The prior resort's smaller size and two-star designation proved uneconomic and unsustainable. Therefore, a smaller resort was not considered reasonable and was eliminated from further evaluation.

The potential for a larger resort was also considered, but the site is bounded by a brewery to the west, power line right-of-way to the north, the proposed Albany development to the east, and the ocean to the south. Therefore, the site could not be readily expanded. The current site could be developed more intensely to achieve the same purpose, but this was rejected as being incompatible with the surrounding community and landscape.

Alternative Designs

Alternative designs were considered for the proposed NSOD Resort. The golf course already exists and any alternative designs or locations for the course would result in additional unnecessary environmental impacts. The hotels need to be along the ocean and no viable alternative designs/locations were identified. The only component of the resort for which a viable design alternative was identified was for the marina.

Marina Design Alternatives

Four alternatives were considered for the marina:

- Off-site Locations - Preliminary environmental and marketing assessments of the South Ocean property indicated that it was an appropriate site for a marina facility to service the surrounding development and that consideration of alternative off-site locations was not warranted. The proposed marina site is situated in the lee of the prevailing winds, has reasonable access to deep water, and does not appear to possess any overriding physical or environmental constraints to construction. Consequently, siting the marina at an off-site location as a result of on-site constraints was not necessary. In addition, the market analyses identified the desirability of a marina facility as part of the overall South Ocean concept.
- Offshore Marina – An offshore marina (see Appendix C) would be accessed via a pier from shore. It would have a greater environmental impact on marine resources than the proposed inland marina because it would require deepening the near-shore areas, altering existing habitats, including seagrass beds and corals. Approximately 16 acres of valuable shallow-water marine habitat would be directly affected, including hardbottom with coral, Sargassum flats, patch reefs, and seagrass beds. In addition, this alternative would have a greater impact on nearshore sediment transport, could increase beach erosion in the vicinity, and would be more prone to hurricane damage in such an exposed location.
- Expand Stuart Cove's Basin - Stuart Cove operates a dive charter operation from a relatively small, but existing, marina basin located just east of the proposed entrance channel. Under this alternative, the existing basin would be expanded. However, this alternative was eliminated because it conflicted with upland land uses for the project, including the existing golf course, planned resort facility, and the current property boundary. This alternative would also require extensive excavation landward of the shoreline, so it does not offer any economic benefits over the proposed location.
- Inland Marina – This alternative involved creating an inland marina. The inland marina would involve excavating uplands and connecting the new

basin to seawater. It would have greater environmental impact on terrestrial resources; however, the marina is proposed in an area that has already been significantly disturbed and provides little valuable habitat.

Therefore, the inland marina was determined to be the environmentally preferred alternative.

Beach Design Alternatives

Three alternatives were considered for the beach design:

- Groin Stabilized Beaches - this alternative involves using the traditional groins to stabilize the sand placed on the beaches by reducing long shore sediment transport. A groin is a shore-perpendicular structure that extends from the coast into the surf zone (and sometimes beyond). It is usually constructed from stone, although cement and other materials can and have been used.
- Detached Breakwater Stabilized Beach – this alternative involves using detached breakwaters to minimize the loss of sand placed at the beaches by reducing incoming wave energy.
- Headland Control Stabilized Beaches – this alternative involves using artificial headlands to create beaches in static equilibrium, keeping the new sand in place and eliminating the dependence of beach stability on external sand sources (See Appendix B).

Despite numerous publications indicating their lack of success, the use of groins to reduce long-shore sediment transport at shorelines is still common practice in coastal engineering. In reality, the effect of a groin field is to *increase* long-shore sediment transport, rather than reduce it, due to the currents created along the down-drift side of the structures by storms waves. It has therefore been determined that the use of groins to stabilize sand placed on the beaches would hasten the loss of this sand to a downstream (to the west) location. Further, the lack of sediment supply from upstream (to the east) would not allow the lost sand to be replaced, resulting in the disappearance of the newly created beaches, likely after the first storm to impact the area.

The use of offshore or detached breakwaters to impede the drift of sand from beaches has received a great amount of attention in the past few decades. These structures act virtually the same as seawalls constructed offshore, in terms of the short-crested wave field that is set up on their seaward side, due to the interaction between the incoming waves and those reflected off the structure itself. This wave field prevents the precipitation, and thus accumulation, of sand, and encourages scour and subsidence of the structure. Furthermore, as storm waves penetrate the narrow gap in between the structures, the return flow creates a strong current that removes sand from the shoreline facing the gap, leading to sand loss, beach erosion, and the eventual need to seek remedial measures. In addition, this solution results in an aesthetic that is not compatible with the goals of the proposed project.

Headland control for beach stabilization represents a "new" approach that has been developed over the last three decades and has evolved from observations "of how Nature itself has sculptured the shorelines of the world" (Silvester, 1997). Beaches termed to be in "static equilibrium" are beaches that have maintained their shape for decades, or even hundreds of years, without the benefit of an external sand supply. It has been found that these beaches have a particular shape and orientation with respect to the incoming wave energy, and the placement of headlands that anchor the sandy beaches. These beaches are self-protecting: they form offshore sandbars to reduce incoming wave energy during storms, and more importantly, are self-repairing. After the passage of a storm, the sandbar is dismantled and the sand of which it was made is returned to its point of origin by the post-storm waves. These beaches have the additional benefit of having long exposed stretches of sand, providing the aesthetic required for the proposed project.

The first two alternatives considered for the beach design were found to lead to loss of the placed sand, and thus are not acceptable for the purposes of this project. As the goal is to create a sustainable beach (i.e., a beach that will retain its configuration once created), the third design strategy, Headland Control, has been selected as the most environmentally advantageous. The stability of the beaches will be further increased by the use of artificial reefs (ReefBalls) to reduce scour at the foot of the headlands, as well as reduce the possibility of sand loss to the marina entrance channel. This will, of course, have the added environmental benefit of creating a new reef ecosystem at the site.

3 AGENCY CONSULTATION AND PUBLIC INVOLVEMENT

3.1 AGENCY CONSULTATION ACTIVITIES AND RESULTS, INCLUDING REQUIRED PERMITS

As part of the Environmental Impact Assessment (EIA) Process, consultations were undertaken with the Bahamas Environment, Science and Technology Commission (BEST), the Bahamas National Trust, the departments of Fisheries, Tourism, Works, Environmental Health Services, and Physical Planning as well as the Antiquities, Monuments & Museums Corporation and The Bahamas National Trust. These agencies were consulted in order to understand their viewpoints regarding the project as well as to understand potential impacts related to these agencies' areas of interest and expertise.

Bahamas Environment, Science and Technology Commission (BEST)

An introductory meeting with BEST representatives, Mr. Sean Cunningham, Mr. Deon Stuart, and Mrs. Stacey Moultrie, was attended on Tuesday, January 16, 2007. The purpose of the meeting was to discuss the process of preparing EIAs in the Bahamas. BEST representatives indicated that their endorsement was necessary to officially start up the technical studies and EIA development. The process included evaluation and approval of the Curriculum Vitae of the personnel that would conduct the studies and the EIA, site visit coordination and issuance of an official letter including the requirements to be included in the EIA.

Bahamas National Trust

Eric Carey, Executive Director, and Lynn Gape, Deputy Director, of The Bahamas National Trust (BNT) were consulted on January 25, 2007 regarding plans to develop an ecological attraction called the Primeval Forest northeast of the project site. The BNT's plans for developing the Primeval Forest, which features trees that are roughly 200 years old and limestone caves, are still in progress. According to the BNT, the success of the Primeval Forest as a tourist attraction will depend on the future development of the southwestern part of the island, as there are few visitors to The Bahamas who currently visit this part of the island.

Department of Works

Howard Barret, Chief Civil Engineer, Sharon Griffiths, Sr. Engineer Civil Design and Robert Garvey, Civil Engineer of Department of Works were consulted on January 24, 2007 regarding the changes to roads in the vicinity of the project. See Section 5.3.5 on Traffic Impacts for further discussion of potential changes to roads within the project area.

There are no officially approved plans for road changes as of February 14, 2007, but the Department of Works is aware of a variety of potential changes to the roads in southwestern New Providence to accommodate several developments in the area, including the proposed Albany Resort and Southwest container port.

Department of Physical Planning

Michael Major, Director of the Department of Physical Planning, was consulted on January 24, 2007 regarding land use policies and zoning in the vicinity of the project area. The project site is already zoned for tourism and residential uses, as was the former South Ocean Golf & Beach Resort. The Department indicated that the planned uses are generally consistent with existing zoning and land use in the area. The Department of Physical Planning will likely need to review the project before granting revised zoning (if necessary) and building permits. See Section 4.3.1 for further discussion of land use issues related to the proposed project.

Antiquities, Monuments & Museums Corporation

Keith Tinker, Director, as well as Michael Pateman, Archaeologist, of the Antiquities, Monuments & Museums Corporation (AMMC) were consulted on January 24 regarding current and future tourism plans for the Clifton Heritage Park as well as on January 30, 2007 with regards to the archaeological sites on the NSOD property.

The Clifton Heritage Park, which is located west of the NSOD site, will feature historical sites dating from the Lucayans, a pre-Columbian people, through the colonial period. The AMMC intends to develop the site as a historical as well as ecological tourist attraction. See Section 4.3.9 on Tourist and Recreational Areas for further information on potential features of the Clifton Heritage Park.

As per the Antiquities, Monuments and Museums Act, the AMMC has jurisdiction over sites that are of historical significance to The Bahamas. There are several plantation era structures/features and locales where Lucayan sites may be present on the NSOD site that are of interest to the AMMC. See Sections 4.3.7 and 5.3.2 for further discussion of these resources/potential resources, and the AMMC's role and recommendations with regard to them.

Department of Environmental Health Services

Henry Moxey, Project Director, and Natasha Morris, Assistant Engineer, of the Department of Environmental Health Services (DEHS) Project Execution Unit, were consulted on January 25, 2007 regarding the existing hazardous and non-hazardous waste disposal facilities at New Providence and on the future plans for waste management. Mr. Moxey provided information on the renovated landfill and the new facilities for hazardous waste storage, consolidation and identification. Mr. Moxey also provided information on the future plans of the government for attracting investors for installing recycling facilities in the Island, along with the establishment of recycling programs.

The current Bahamian Building and Land Development Code does not outline a definitive permit application and land development approval process. The proposed project will comply with all applicable Bahamian environmental standards and requirements, relevant legislation, and legal and regulatory statutes. NSOD will work with the BEST Commission and designated agencies during the EIA process to meet these requirements, and comply with the commitments agreed to in the project's Environmental Management Plan during project development and operations.

Department of Fisheries

Michael Brainan, Director, and Edison Deleveaux, Deputy Director of the Department of Fisheries were consulted on January 25, 2007 regarding information and insight into commercial, recreational/sport and subsistence fishing practices in the vicinity of the project area.

Landings data were requested. These data only provide information regarding where finfish (scalefish) and shellfish are received by a dealer or market. The landings data received are elaborated in Section 4.3.3 which discuses the economy.

Based on their experience, the Department of Fisheries does not believe there are any commercial fishermen operating in the vicinity of the project area, and indicated that commercial fishing is concentrated on the north side of the island. While there may be some recreational fishing being undertaken by Bahamians in nearby villages such as Adelaide, and tourists undertaking sport fishing, this would most likely occur at the Tongue of the Ocean, which is several miles away from the NSOD project's shoreline. Further discussion of the potential for commercial or recreational fishing can be found in Section 4.3.3 discussing the economy and in Section 5.2.2 discussing Aquatic Resources.

Areas of potential concern identified by the Department of Fisheries included the resort activities' impact on the water filled sinkholes or "blue holes", situated on the NSOD property as well as the potential for oil spills from the marina.

Department of Tourism

David Johnson, Deputy Director General, and Sheila Cox, General Manager of Ecotourism of the Department of Tourism were consulted on January 31, 2007 regarding information and insight into the Department's overall plans and views of development in New Providence as a whole and in relation to development in the southwestern side of New Providence.

The Tourism Department views southwestern New Providence as the "final frontier" for development on the island. The Department sees Albany and the proposed NSOD project as complementary to the residential communities in Lyford Cay and Old Fort Bay; furthermore, development in this area would help New Providence meet the rapidly growing demand for hotel rooms in the area. Hotels in Cable Beach are being redeveloped to meet this demand; these developers are expending approximately US $2.4 billion to build over 2,000 rooms. The third phase of the Paradise Island mega-resort, Atlantis, will also be underway in the following years to meet this growing demand.

The Department of Tourism representatives noted that the previous resort on the project site, the South Ocean Golf & Beach Resort, was known for its excellent golf course and its popularity among Bahamians seeking to hold community events such as church meetings. Being somewhat removed from the rest of New Providence, the South Ocean area was seen as having a similar quiet character as the Out Islands (Family Islands).

The Department's only area of concern is the potential shortage of labor for construction and operation given the number of proposed concurrent development projects.

3.2 *Public Involvement Activities and Results*

An informal public meeting was held on February 7, 2007 at the Radisson Cable Beach Casino and Golf Resort to present and discuss the studies associated with the EIA. Members of the ERM Project Team were present to answer questions specific to the environmental baseline studies being conducted. Public comments were received through the question and answer period of the meeting. The meeting was well attended with 75 people registering. The overall tone of the meeting was very positive and constructive. Many people stated that they welcomed and would support the development of a high-quality resort on the property. Many attendees expressed their appreciation for the opportunity to meet since they were aware of the new developer, but had no idea of what was happening.

The concerns raised about the project were the realignment of the South West Bay Road (e.g., where it would go, how inconvenient it might be) and public access to the beach. Most of the attendees expressed an interest in having a second community meeting when the master plan was ready for public review. Many offered assistance to work with the developer in helping to develop the plan to ensure community support (e.g., save some of the large fig trees on the west side of the golf course and important pine trees on the site, preserve wooded buffers along South Ocean Blvd.).

Further public consultation will be as directed by the Government.

4 BASELINE DESCRIPTION OF AFFECTED ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate and Meteorology

According to the *State of the Environment Report* (BEST, 2005), the climate of The Bahamas is sub-tropical with fairly high temperatures but only moderate rainfall. The average annual rainfall varies from about 34 inches to about 58 inches. Mean daily temperatures fluctuate between 60°F and 90°F although maximum and minimum temperatures fluctuate over a much wider range from 41°F to 96°F. The months of May to October are considered the summer months in The Bahamas, when mean daily temperatures exceed 77°F. These months are typically the wetter months. The winter months of December to March are much cooler and drier. Daylight interval varies from 10 hours 35 minutes in late December to almost 14 hours in late June. The average is at least seven hours of bright sunshine per day, year round.

Mean wind speeds do not vary significantly on a monthly basis. The highest winds are observed during the winter months, with averages of 8 to 9 miles per hour. Winds at the site prevail from the easterly quadrants (northeast to southeast), which places the project site primarily in the lee of the prevailing winds.

Based on available wind and wave data, winds that produce significant waves in the directions that directly impact the shoreline at South Ocean occur less than 10 percent of the time, and large waves occur only infrequently. However, large waves that may occur as a result of hurricanes and other storms have the potential to affect this area.

Average monthly wind speeds ranged from an average of 6.2 mph in September to 8.9 mph in March. Again, because Nassau Airport is located on the north side of the island, northerly weather may be overrepresented in these data, and since the South Ocean site is in the lee of New Providence Island, it is more vulnerable to southerly or southeasterly weather patterns. The prevailing winds at the site generally occur from the easterly trade winds. In the fall and winter, the wind may shift to east-northeast, while during the summer, the southeasterly winds prevail. However, westerly winds also occur in the summer.

4.1.2 *Hurricane Frequency and Storm Surge*

Figure 4.1 presents tropical storm and hurricane tracks that have passed either directly over or nearby New Providence Island in the past (NOAA, 2007), indicating the potential for any location on the island to be affected by a storm. From 1871 through the end of the 2006 hurricane season, 45 tropical storms or hurricanes passed within 60 miles of Nassau (www.hurricanecity.com, March 9, 2007) for a return frequency of once every 3.02 years. New Providence can expect to be directly hit by a hurricane approximately once every 11 to 12 years. The last major storm to hit Nassau was Hurricane Frances in early September 2004, which had 105 mph winds and a six-foot storm surge.

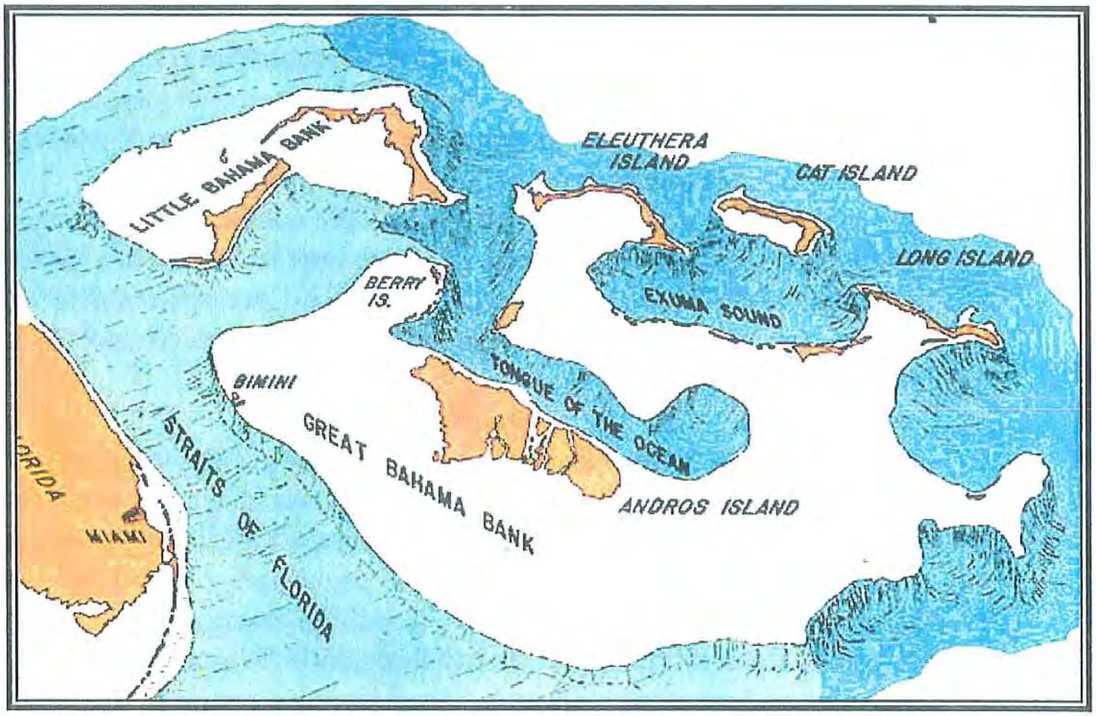
Available storm data were reviewed, including *The Storm Surge Atlas for the Northern and Central Bahamas* (Rolle, 1990) and other regional studies on storm surge levels for New Providence. Based on these studies, it is estimated that storm surge levels of approximately seven and nine feet above mean sea level for Category 3 and 5 hurricanes, respectively, have the potential to affect the island's southwest side. Waterfront development, including all marina structures, should be designed accordingly, with consideration given to risk and damage repair for the various structure types.

4.1.3 *Topography*

The Bahamas Archipelago lies in the Atlantic Ocean, extending more than 650 miles from the eastern coast of Florida to the southeastern corner of Cuba. The islands are the exposure surface of two ocean banks, Grand Bahama Bank and Little Bahama Bank (Figure 4.1). The Bahamas are characterized for having generally low relief. The highest point is Mt. Alvernia rising to a peak elevation of about 206 ft on Cat Island. New Providence has ridges rising to about 100 ft with a summit height of 127 ft above MSL (BEST, 2005). The NSOD project is located at the southwest corner of New Providence Island. The local topography is dominated mainly by low rounded hills, observed as monticules on the golf course and within scattered groupings of pine trees. Flat areas are located mainly on the eastern part of the property. The majority of the NSOD property has an approximate average elevation of 32.8 ft above mean sea level (BEST, 2005).

New Providence Island is located on Great Bahama Bank along the eastern edge of the "Tongue of the Ocean" trough.

Figure 4.1 The Two Bahamas Banks



4.1.4 Geology

Surface rock in the area is composed of oolitic limestone of marine and eolian origin. Dolomitized limestone is found along the coastal portion of the project site. Caliche, or poorly cemented limestone, is observed in some of the exposure horizons of the rounded hills, in the shorelines, and in low flat areas (Figure 4.2). There is a very thin or absent soil layer.

The oolitic limestone was exposed to a period of high energy in the past. This facilitated the development of the karst topography observed on the project site at present. Dissolution features can be found by identifying depression areas in the terrain. Some of these depressions only mark low flat areas, while in other parts of the property they are characterized by an extensive system of small caves, solution channels or conduits, vertical shafts or roof-collapsed sinkholes or dolines, and two irregular steep-sided water-filled natural solution cavities called "blue holes."

The conduits and sinkholes occur in fractures and fissures along preferential faulting planes. Field measurements showed a preferential faulting plane between 60°and 80° NE ([1]). Sinkholes that showed this preferential orientation were documented in the area north of the proposed marina.

They were also observed in the tree lines west of the large pond on the east side of the golf course, and in the northern area of the site (Figure 4.2).

In areas of exposed hills, layer stratification was observed. These layers showed a preferential orientation of 55° NE ([1]), parallel to those observed in the sinkhole areas. Between those layers and in rock fractures small dissolution cavities were observed.

4.1.5 *Hydrogeology*

Fresh ground water occurs in the area of the proposed project in the form of thin lenses floating on top of denser sea water. Due to its proximity to the ocean, the aquifer is estimated to be shallow with a water table fluctuating between three and five feet below ground surface (BGS) near the shoreline and in the low areas and several feet deeper in the northern area where higher surface elevations exist[1]. The water level is affected by tidal fluctuations that make it difficult to estimate a local ground water table. Previous work conducted on a site to the east (the Albany project), adjacent to the proposed project area, showed variable results when trying to determine an average water table[2].

A preliminary hydrogeologic assessment of the site concludes that hydrologic data for the area is scarce and general (ATM, 2007). As part of the study, field testing for Total Dissolved Solids (TDS) was conducted in the "blue holes" and in the irrigation wells at the site. With this testing it was determined that saline water (i.e., water with a concentration of 1,500 parts per million [ppm] of TDS or more) predominates in the western part of the site, but some fresh water lenses can be found in the eastern area. Fresh ground water was found within the proposed marina basin footprint, an area in close proximity to the shoreline. Brackish ground water was found in both the blue holes within the golf course, one of which is located over 2,000 feet north of the shoreline (i.e., "north blue hole"). Estimated TDS concentrations tended to increase with depth in both the "north" blue hole and the irrigation wells that were monitored. However, none of the irrigation wells had total depths sufficient to determine the thickness of the fresh ground water lenses at the site (ATM, 2007).

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[1] Interview with NPDCo. Personnel: Mrs. Paulette Pinder, February 5-6, 2007.

[2] Hydrology of the Albany House Development Site and Surrounding Lands, New Providence Island, Bahamas; Final Report, July 2005.

4.1.6 *Oceanography and Coastal Environment*

The proposed project will consist of a marina, an entrance channel, jetties, and the adjacent beach areas as shown in Figure 4.3.

The oceanographic and coastal information presented here was developed from the following sources:

- Smith Warner International Limited (SWIL), October 2005, Coastal Environmental Impact Assessment / Conceptual Design, Albany Development, New Providence, The Bahamas;
- Applied Technology & Management (ATM), May 11, 2006, Final Summary Report, Environmental Reconnaissance South Ocean Property, New Providence, Bahamas;
- Applied Technology & Management (ATM), March, 2007, South Ocean Development, Environmental Impact Assessment, New Providence, The Bahamas; and
- ERM's on-site reconnaissance and literature review.

The project is located along a sandy shelf called Southwest Bay. East of the property along the southern shoreline of New Providence Island, an expansive sandy shelf exists, averaging 10 feet deep or less to the east of the property. This shelf diminishes directly offshore (south and west) of the property, retaining a relatively shallow depth and sandy bottom out to approximately 0.80 nautical mile. A natural submerged canyon called the Tongue of the Ocean, where water depths quickly drop to hundreds of fathoms, is further offshore and west of the property.

A detailed bathymetric survey of the waters south of the site indicated that the bottom slopes gently over sand bars with occasional patch reefs (ATM, 2007). Close to shore, many sandbars allowed wading depths of two to four feet to a distance of almost 200 feet from shore on the east side of the property. The shallow shelf to the south of the project site continues to gently slope away from shore. The sandy shoreline and nearshore bottom along the project site extends out to approximately six feet in depth, then the bottom type transitions to limestone rock with varying coverage of sand.

The tides at New Providence Island are semidiurnal (two occurrences of high and low each day) with a mean range of approximately 2.5 to 3.0 feet. The mean spring tide range is approximately 3.5 to 4.0 feet. These are typical of The Bahamas and present no special challenges or considerations to the development other than utilizing a low water reference for minimum navigation clearance.

The South Ocean shoreline can be divided into sections east and west of the existing Stuart Cove's entrance channel. The shoreline east of Stuart Cove's is characterized by minimal sandy beaches with sand deposits and hardbottom with coral in the nearshore. Significant scarp formations are present consistently along the undeveloped shoreline. A seawall is present to the seaward side of the abandoned structures; there is no beach at mean high water. The shoreline west of Stuart Cove's is characterized by ironshore with intertidal coastal rock and sandy deposits in the nearshore.

The beach face slope is generally steeper than 10H:1V, and the offshore slope is approximately 100H:1V. The steep cross-shore slope is due to ironshore and scarp formations, and the shallow offshore slope is due to the fine-grained sand material found along the South Ocean shoreline. The shoreline is generally stable due to the coastal rock along much of the project site and the sand deposits seaward of the sandy beach areas.

The prevailing wave conditions near the proposed NSOD project site are primarily a function of the prevailing wind direction and magnitude. Higher energy wave conditions are usually associated with episodic weather events such as tropical storms, hurricanes, and frontal systems with elevated wind conditions. Meteorological records that would contain data detailing specific heavy weather events and their wind and wave conditions are not available. The prevailing winds are from the east and are influenced by the trade winds. Generally, the trade winds vary seasonally from the northeast to southeast directions.

The proposed project area is protected from long-period storm swells by New Providence Island to the north and east and Andros Island to the west. The shallow Exuma Bank to the south and southeast also affords limited protection from long-period storm swells. In general, long-period storm swells cannot reach the project area. Fetch limited wind-waves; however, can affect the proposed project area from the southwest to the southeast.

To approximate wave heights for different exposure directions to the proposed project site, an open water fetch wave forecasting program in the (USACE, 1992) was used to evaluate the potential wind-wave climate, following recommendations of the Coastal Engineering Manual (USACE, 2001). The prevailing wind directions from the south and southeast were applied, as well as the smaller fetch southwest direction. The maximum yearly wind speeds from the south direction from 1985 to 2003 range from 9.4 to 15.3 mph, while monthly mean wind speeds are on the order of 4.4 mph. Using a sustained 8.9 mph wind and a 14.8 ft depth, the prevailing wave conditions are calculated to be 1 to 2 ft waves from the southeast. The southeast fetch distance is over 19.9 miles; however, the shallow depths limit wind-wave growth. Prevailing wave heights calculated from southwest wind conditions are also 1 to 2 ft because of a smaller fetch distance (approximately 14.9 mi), but much deeper water. Winds from the south are not as common; however, the fetch is over 49 mi and wind-generated waves between 3 and 4 ft can be expected with constant 9 mph winds. Typical wave periods range from 5 to 8 seconds, with a maximum fetch-limited period of approximately 12 seconds (Islands by Design, 2004).

The South Ocean shoreline is more susceptible to a storm system approaching from the south with the center of rotation to the west. This event would take advantage of the maximum available fetch. Under these conditions, short- period, depth-limited waves (approximately 6.5 ft high) could be expected in the nearshore. Waves offshore would likely reach approximately 9.8 ft.

Recent offshore current measurements (SWIL, 2005) showed current velocities up to 10 cm/sec during neap tides, while spring tide current velocities were up to 20 cm/sec near South Ocean Beach.

At South Ocean Beach, the availability of sand for transport is limited. The thickness of the sand layer is 0.2 ft to 1.0 ft in the first 20 ft of water depth (SWIL, 2005). Recent evaluations showed that the average sediment transport rate is only 1,550 m^3/yr and that most sediment movement occurs within 200 ft of the shoreline during non-extreme events (SWIL, 2005). Extreme events, however, move much more sand (if it is available) over a larger area. The marina, entry channel, and access trench will likely require occasional maintenance dredging.

4.1.7 *Water Quality*

4.1.7.1 *Ground Water Quality and Quantity*

The freshwater resources of The Bahamas occur as three-dimensional lens-shaped bodies, overlying brackish and saline waters at depth (Figure 4.4). The amount of rainfall; orientation of the island; and the subsurface geology control the shape, size and thickness of the freshwater bodies. Due to the shallow depth of the freshwater lenses, they are vulnerable to contamination and evaporation. All available freshwater in The Bahamas comes from rainfall that hits the islands, since there are no regional aquifers. In excess of 90 percent of the freshwater lenses are within five feet of the surface (WSC, 2007).

Figure 4.2 Map of the Local Geology

ERM

Figure 4.2 Map of Local Geology

Not to Scale

Figure 4.3 Offshore Bathymetry and Elevation Contours

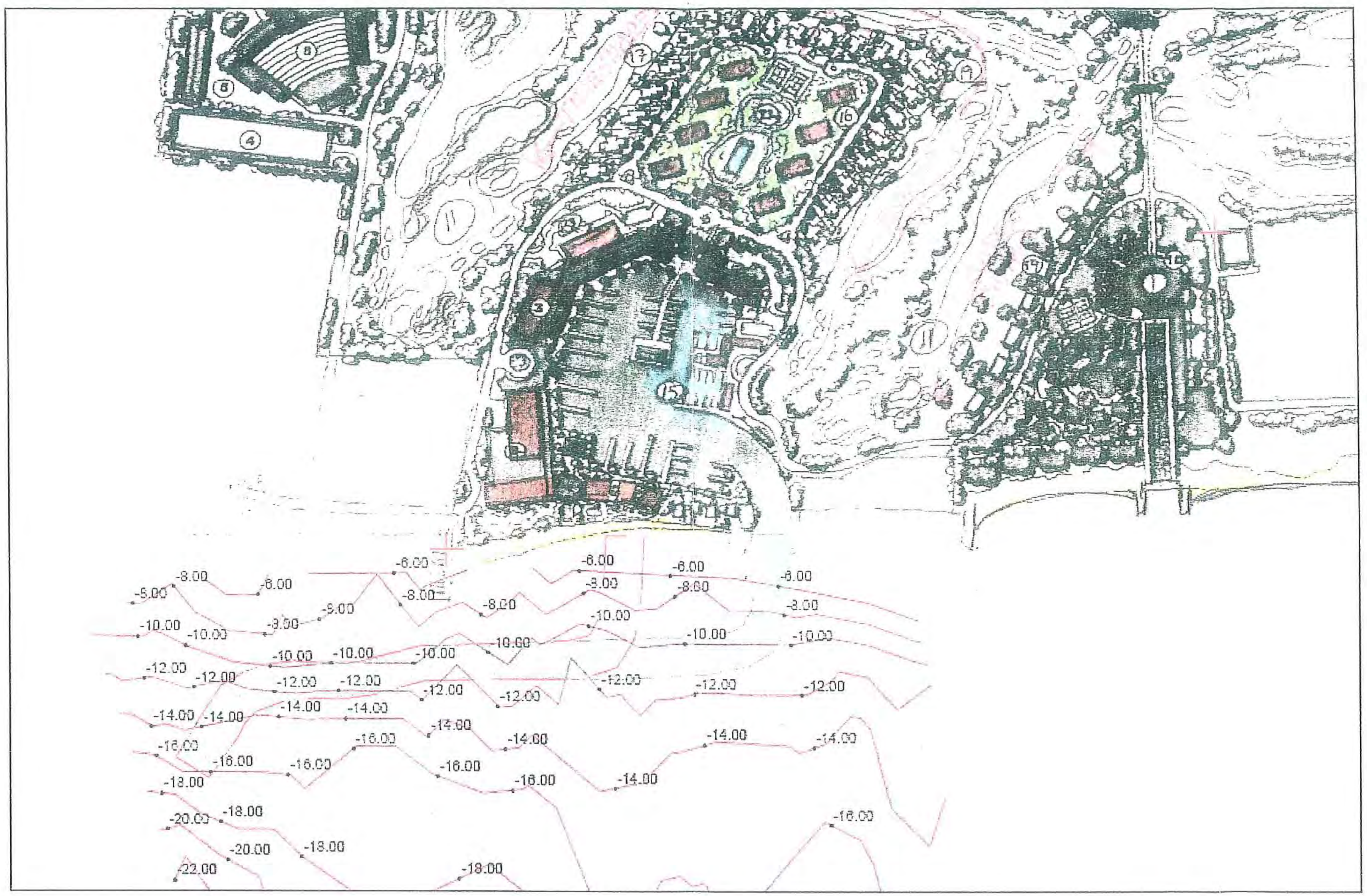

Figure 4.3 Offshore Bathymetry and Elevation Contours

Scale: 1:20,000

Figure 4.4 Diagram of a Typical Freshwater Lens

Diagram of a Freshwater Lens in an Oceanic Island
(Like The Bahamas)

Beginning in the 1960s, a series of monitoring wells were installed on New Providence Island to determine the thickness of the freshwater lens (Little et al., 1977). Hydrogeologic investigations conducted in the early 1970s showed that the freshwater lens underlay approximately 17,500 acres, or approximately 34 percent of the island area (Cant and Weech, 1986). The geometry of the freshwater lens on New Providence Island is primarily determined by the local geology relief and the presence of tidal surface water bodies on the island. For the purposes of this discussion, freshwater is defined by The Bahamas Water and Sewerage Corporation (WSC) as water containing a chloride concentration of 400 milligrams per liter (mg/L) or less. In order to meet the water requirements of a growing population on the island of New Providence, the water lenses have been used beyond their sustainable or safe yields. This has caused a mixing of fresh and brackish lenses and retreat of the freshwater interface inland vertically, resulting in a steady rise in the salinity of the water supplied from wells around the edges of the lens.

The construction of tidal channels, man-made lakes, and the withdrawal of freshwater via shallow trenches and pits has either eliminated freshwater or reduced the thickness of the lens in many areas of the island.

Two of the main factors contributing to the extent of the freshwater lens are rainfall and evapotranspiration (see Figure 4.4).

4.1.7.2 *Rainfall*

There are at least two rainfall gauges maintained on New Providence Island: one at the water treatment plant in the water fields and one at Nassau International Airport. There is a long-term record from the gauge located at the international airport and a shorter term record from the gauge maintained at the water treatment plant and water field facility. A compilation of rainfall data is given in Table 4.1. An analysis done by Turrell and Associates shows that the highest annual rainfall for the period of record was 76.33 inches; the lowest was 36.37 inches. The average rainfall for the period 1961 -2003 is 54.34 inches. An analysis of the 1-in-10-year drought for New Providence Island can be calculated by averaging the four driest years of record in the 44-year period or by the average of the driest year in each 10-year period of the record. These methods yield 1-in-10-year drought rainfalls of 39.03 inches and 39.73 inches per year respectively. Another important analysis of the rainfall data is for the average rainfall in a five-year dry period. The period of 1961-1965 showed an average rainfall of only 42.57 inches/year, which is nearly 12 inches below the long-term average.

4.1.7.3 *Evapotranspiration*

The potential evapotranspiration (PET) of The Bahamas region was calculated by Sealy (1985). In the southeastern Bahamas the calculated PET was 59 to 63 inches/year. In the northern Bahamas the calculated PET ranged between 51 to 55 inches /year. Cant and Weech (1986) estimated the actual evapotranspiration to be about 43.69 inches/year. Whitaker and Smart (1997) and Cant and Weech (1986) suggest that the planning value that should be used for recharge is 25 percent of the annual rainfall. An analysis by Hall Tech (2005a) showed that recharge rates, defined as rainfall minus evapotranspiration, range between 8 and 12 inches per year, which yields a range of 15 to 22 percent of the mean annual rainfall. If the average annual rainfall value for the airport record is used and a 25 percent rate of recharge is assumed, the average annual recharge rate would be 13.58 inches/year.

Table 4.1 Rainfall Data from Nassau International Airport, 1961-2003

Year	Rainfall (in.)	Year	Rainfall (in)
1961	36.37	1982	45.99
1962	45.84	1983	63.42
1963	43.80	1984	59.34
1964	44.81	1985	61.26
1965	42.01	1986	41.44
1966	74.24	1987	66.55
1967	47.67	1988	61.42
1968	71.48	1989	52.97
1969	51.70	1990	54.82
1970	49.85	1991	64.89
1971	45.87	1992	43.54
1972	48.57	1993	53.63
1973	64.43	1994	43.80
1974	37.34	1995	76.33
1975	53.06	1996	58.84
1976	56.14	1997	64.69
1977	41.66	1998	46.82
1978	53.25	1999	50.68
1979	67.95	2000	54.32
1980	73.93	2001	73.58
1981	43.92	2002	60.42
		2003	43.17
High = 76.33 inches			
Low = 36.37 inches			
Average (43-year) = 54.34 inches		1-in-10 year drought = 39.03 inches	

4.1.7.4 *Ground Water Testing*

A Phase I and Limited Phase II Environmental Site Assessment was conducted in 2006 by Environmental Studies Associates (ESA) and the results are summarized below.

Testing

Ground water was encountered in the borings of MW-1, MW-2, and MW-3 at a depth of approximately 16 feet below grade. Ground water was observed in the boring of MW-4 at a depth of approximately 10 feet below grade and from the boring of well MW-5 at a depth of approximately four feet below grade. All five borings were converted to monitoring wells by solid-stem augers approximately eight feet into the saturated zone (refer to Figure 4.5).

Sampling and Analysis

Laboratory analyses determined the results of volatile organic compounds (VOCs), semi-VOCs (SVOCs), and organo-phosphorous pesticides as below the detection limit for all the ground water samples. Concentrations of nitrate nitrogen and nitrite nitrogen were reported in the water samples collected from PW-1, MW-2, and MW-4. Low concentrations of inorganic parameters were reported in the water samples collected from wells MW-1, MW-2, and MW-3. A summary of the inorganic analytical results are contained in Table 4.2.

Table 4.2 *Project Ground Water Sample Analysis Summary*

Sample Name	Sample Date	Barium (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)
MW-1	10/22/06	0.039	NA	NA
MW-2	10/23/06	NA	11.4	0.31
MW-4	10/23/06	NA	7.64	0.21
PW-1	10/25/06	NA	8.91	0.5
EPA Maximum Contaminant Level		2	10	1

Notes:
NA – Not Analyzed
EPA – United States Environmental Protection Agency

Results

ESA identified a few sites where spillage of apparently small quantities of gasoline, diesel fuel, oil, agrichemicals, or transformer fluid occurred. Field sampling found almost no ground water contamination. ESA compared the ground water analytical results to US Environmental Protection Agency

3 *Figure 4.5 Monitoring Well Locations*

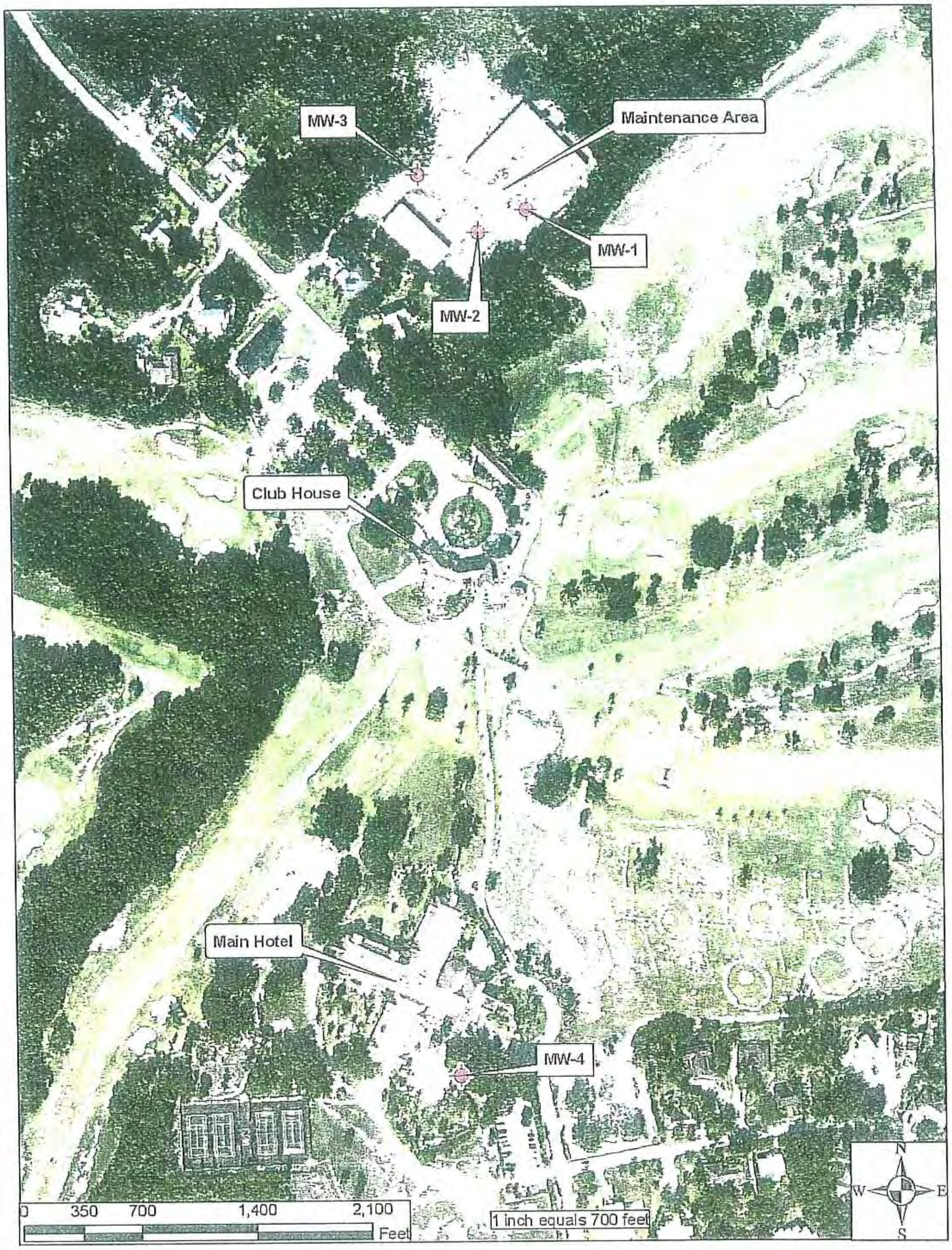

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Figure 4.5 Monitoring Well Locations

(EPA) Maximum Contaminant Levels (MCL). All of the tested parameters are below the MCL standard except for the concentration of nitrate nitrogen reported in the ground water sample collected from well MW-2. The MCL for nitrate nitrogen is 10 mg/L. The laboratory reported a nitrate nitrogen concentration of 11.4 mg/L in the water sample collected from well MW-2. Exceedance of the MCL for nitrates is only a concern if the ground water is proposed as a drinking water source.

4.1.7.5 *Surface Water Quality*

There are six ponds on the proposed project site. Four ponds are man-made and serve as water hazards for the golf course. Two ponds are natural solution cavities called "blue holes." Table 4.3 lists the ponds on the site and Figure 4.6 shows their locations.

A large, sub-elliptical blue hole with near-vertical, limerock walls is located at the southern extreme of the existing golf course just east of the putting green of the 15th hole. The distance to the water surface at this feature was estimated to be approximately 30 feet below land surface, and the long-axis diameter was approximately 125 feet. The blue hole at OW-3 showed signs of algal growth most likely due to fertilizer runoff from golf course management.

The blue hole at OW-6 appeared to be clean, clear, and properly functioning. No wildlife or wildlife activity was visible in either of the holes, although blue holes are known to support an active biological community. This smaller feature is irregular in shape, with a long-axis diameter of approximately 30 feet, and distance to water surface of approximately ten feet.

There appears to be some tidal influence in both of these water bodies: The blue holes' tidal schedule is roughly three hours behind the tidal schedule of the ocean. Observations of these features over several days in January 2007 clearly documented a hydrologic connection with the nearby sea, as a clear tidal fluctuation of the water surface elevation was apparent in both blue holes. The fluctuation was marked by staining of the lime rock and, in the case of the smaller blue hole, the formation of stalactites. The northernmost blue hole (OW-6) displayed a tidal fluctuation of approximately two to three feet, while the southernmost blue hole (OW-3) demonstrated an apparent tidal fluctuation of approximately four feet.

The ATM report (2006) listed and briefly described six surface water bodies that were present on the South Ocean Beach Resort. Four of these features are man-made and are described in the next subsection of this report. The other two features are the blue holes referenced above. In their report, ATM designated the blue holes as feature OW-3 and OW-6. Feature OW-3 is the blue hole near the putting green of the 15th hole.

Table 4.3 Water Bodies On-Site

Waterbody	Comments/Description	Ecological Value
OW 1	Lined with concrete	Low
OW 2	Unlined, various aquatic life (i.e. waterfowl, turtles)	Moderate
OW 3	Natural (blue hole) salinity suggests subsurface connection	Moderate
OW 4	Lined with concrete	Low
OW 5	Unlined, some shore vegetation and pond life	Moderate
OW 6	Natural (blue hole), water appears clean and clear	High

Source: ATM, 2006

Characteristic of karst topography, there are no rivers, streams, or creeks on-site. The nearest off-site surface water is the Atlantic Ocean abutting the southern property line

Figure 4.6 Open Water On-Site

ERM

Figure 4.6 Open Water on Site

4.1.8 Air Quality

The Bahamas State of the Environment Report documents very low greenhouse gases and combustion emissions for The Bahamas as compared to other countries (BEST, 2005). The report shows 1,792 thousand tons per year of greenhouse gases; two thousand tons per year of sulfur dioxide; two thousand tons per year of nitrogen oxide; 51 thousand tons per year of carbon monoxide; and seven thousand tons per year of non-methane volatile organic compounds. Baseline ambient air quality for The Bahamas is therefore considered good. According to the report, the ambient air concentration of small particulate matter ranges from 11 to 15 micrograms per cubic meter, well below the ambient air limit value (40 micrograms per cubic meter) contained in The Bahamas Pollution Control and Waste Management Regulations.

Bahamas Electricity Corporation and a brewery are located west of the NSOD property. Except for the power plant and the brewery, there are not many sources of anthropogenic emissions near or with influence on the NSOD property. With trade winds prevailing from the east most of the year, minimal environmental impacts are expected from these sources. Non-anthropogenic emissions that would occasionally impact the ambient air quality of The Bahamas consist of airborne dust from the Sahara and volcano ash.

4.1.9 Noise

Noise is defined as any unwanted sound. Certain activities inherently produce sound levels or sound characteristics that have the potential to create noise. The sound generated by proposed or existing facilities may become noise due to land use surrounding the facility, if these lands contain residential, commercial, institutional, or recreational uses and the sound is perceived as noise by the users of the adjacent lands.

4.1.9.1 General Noise Metrics

Due to the wide range in sound levels, sound is expressed in decibels (dB), a unit of measure based on a logarithmic scale. A 10 dB increase in noise level corresponds to a 100 percent increase, or doubling, in perceived loudness. As a general rule, a five dB change is necessary for noise increases to be noticeable to humans (EPA, 1974). Sound measurement is further refined by using an A-weighted decibel scale to emphasize the range of sound frequencies that are most audible to the human ear (e.g., between 1,000 and

8,000 cycles per second). Therefore, unless otherwise noted, all decibel measurements presented in this noise study are A-weighted (dBA).

The instantaneous A-weighted sound level in any residential community over any sampling period varies as sporadic noise events occur. Such events might be passing vehicles, aircraft or rail events, bird noises, tree leaf rustle, etc. To condense this varying data to a more usable form, standard measurement metrics are defined. The obvious ones are the minimum (min), maximum (max), and average levels that occur over the interval. The max and min are the highest and lowest measured level during the sampling period. The average designated L_{eq} is the equivalent steady sound level that has the same acoustic energy as the actual time varying signal. It can be thought of as the true energy average, and is not simply the arithmetic average over the period.

Percentile levels or exceedance levels, designated L_1, L_{10}, L_{50}, L_{90}, and L_{99}, are the statistically derived units over the sampling period. They are the levels exceeded for 1, 10, 50, 90, and 99 percent of the sampling time. Of these, L_{eq} and L_{90} are the most useful for evaluating community noise. L_{90} is the sound level exceeded during 90 percent of the measurement interval and filters out sporadic, short-duration noise events, thereby capturing the quiet lulls between such events. It is this consistently present "background" level that forms a conservative basis for evaluating the audibility of a new source.

4.1.9.2 *Existing Conditions*

The NSOD project site is a suburban residential area with generally average ambient noise levels. Land use in the vicinity of the site is mixed. North and east of the site are residences and undeveloped land. To the south, the site fronts residential properties, a commercial building (Stuart Cove's dive shop) and the Atlantic Ocean. To the far west are industrial properties consisting of the brewery and The Bahamas Electric Company power plant. A multi-family residential property abuts the eastern property line of the marina. Table 4.4 presents typical sound levels (L_{90}) found throughout the U.S. under calm and still wind conditions.

Table 4.4 Typical Noise Level, dBA, Exceeded 90 percent of the Time, L_{90}

Description	Typical Range	Average
Very Quiet Rural or Remote Area	26 to 30 inclusive	28
Very Quiet Suburban or Rural Area	31 to 35 inclusive	33
Quiet Suburban Residential	36 to 40 inclusive	38
Normal Suburban Residential	41 to 45 inclusive	43
Urban Residential	46 to 50 inclusive	48
Noisy Urban Residential	51 to 55 inclusive	53
Very Noisy Urban Residential	56 to 60 Inclusive	58

Source: (Average 38-58 dBA) EPA Community Noise Study, 1971

Based on the sound levels in Table 4.4, the minimum ambient levels for the proposed project site should range between 36 and 45 dBA depending on the proximity of major roads.

To document the existing noise environment, ambient-noise surveys were conducted at various locations within the project site. Measurement was conducted over a 24-hour period at four measuring points as follows:

- Point # 1 – Main Entrance to NSOD Site on South West Road (Residential);
- Point # 2 - Along South West Road across from Stuart Cove's dive shop (Commercial);
- Point # 3 – Near gateway at north entrance to the golf course along South Ocean Road (Residential); and
- Point # 4 – Near guard shack north of old golf clubhouse (Residential).

Table 4.5 presents the background L_{eq} and L_{90} for each Noise Sensitive Area (NSA). As indicated above, L_{eq} and L_{90} are the most useful noise metrics for evaluating community noise. Table 4.6 presents the dominant noise sources and meteorological conditions during noise measurements at the nearest NSAs. Detailed information on the measurement methodology, map location of measurement points, type of instruments used, and dosimeter log sheets showing measurement results for all noise metrics can be found in Environmental Reconnaissance, South Ocean Property (ATM, 2006).

Table 4.5 Measured Background Noise Data at NSAs

NSA	L_{eq} (hourly)	L_{90}
1	62.2	35.5
2	61.4	40.0
3	53.1	35.5
4	56.7	39.5

Table 4.6 Dominant Noise Sources and Meteorological Conditions during Noise Measurements

Measurement Points	Description & Distance to Nearest NSA	Land Use	Meteorological Conditions	Dominant Sources of Noise
1	Microphone placed approximately 20 ft from South West Bay Road at the entry to NSOD; 80 ft(24.38m) from nearest residence on South West Bay Road.	Residential	Partly cloudy, light breeze, with temperatures ranging from 70 to 80 °F	Car and truck traffic from South West Road; jet and propeller aircraft (infrequent); construction equipment for golf course (approximately 500 ft away); birds; and motorized golf carts (infrequent).
2	Microphone placed approximately 10 ft from South West Bay Road; approximately 50 ft from the nearest commercial building at Stuart Cove's dive shop on South West Bay Road.	Commercial	Partly cloudy, light breeze, with temperatures ranging from 70 to 80 °F	Car and truck traffic from South West Road; construction vehicles for golf course (approximately 750 ft away from measurement point); idling buses (50 ft away from measurement point), jet and propeller aircraft (infrequent); dive boats; and birds.
3	Microphone placed near gateway feature at north entrance to golf course, approximately 2,000 ft north of the old golf clubhouse, and approximately 300 ft from the nearest off-site residential building (across South Ocean Blvd).	Residential	Partly cloudy, light breeze, with temperatures ranging from 70 to 80 °F	Car and truck traffic from South Ocean Blvd; jet and propeller aircraft (infrequent); and birds.
4	Microphone placed near construction laydown area, approximately 350 ft northwest of the old golf clubhouse; 100 ft from the nearest residence (on-site).	Residential	Partly cloudy, light breeze, with temperatures ranging from 70 to 80 °F	Construction equipment for golf course (immediate proximity); jet and propeller aircraft (infrequent); and birds.

4.1.9.3 *Noise Criteria*

There are no specific noise regulations in The Bahamas. In lieu of specific regulations, a 5 dB change is necessary for noise increases to be noticeable to humans (EPA, 1974). Therefore, if the projected noise levels (i.e., project noise plus background noise) from *stationary sources* associated with the proposed project do not exceed the background levels by more than 5 dBA the noise source would not be perceptible or noticeable to humans.

Noise impacts from roadway traffic (i.e., *mobile sources*) are determined based on the Federal Highway Administration (FHWA) noise abatement procedures. The hourly L_{eq} (i.e., L_{eq}[h]) is the preferred noise metric for the FHWA. Table 4.7 presents the FHWA noise abatement criteria (NAC) based on land use activity category.

Table 4.7 Federal Highway Noise Abatement Criteria

Land Use Activity Category	Leq (h) (dBA)	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities, not included in Categories A or B above.
D	--	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, schools, churches, libraries, hospitals, and auditoriums.

Source: FHWA (1995)

Based on the FHWA NAC, developed land in the project area is considered to fall under Category B land use activity. Undeveloped land north of the project area falls under Category D (i.e., no criteria).

A traffic noise impact would occur when either of the following conditions exists:

- The projected traffic noise levels approach or exceed the NAC shown in Table 4.7; or

- The projected traffic noise levels substantially exceed the existing noise levels in an area.

There is no mandated definition for what constitutes a substantial increase over existing noise levels in an area. Most U.S. state highway agencies use a 10 to 15 dBA increase in noise levels to define a "substantial increase" in existing noise levels (FHWA, 1995). For the purpose of this noise assessment, a 10 dBA increase in noise level was conservatively used to define "substantial increase."

4.1.10 *Waste Management*

The Environmental Health Services Act of 1987 and the Health Rules provide the regulatory framework for solid waste management in The Bahamas and establish overall responsibility in the Ministry of Health and Environment. The DEHS, assists in carrying out the requirements of the Act and is responsible for the collection and disposal of solid waste in New Providence (DEHS, 1998).

Bahamians and visitors together generate more than 264,000 tons of municipal solid waste annually, with New Providence Island contributing about 77 percent and Grand Bahamas 17 percent of this total, leaving only about 6 percent, or 15,800 tons annually, generated on the other Family Islands (DEHS, 1998).

About 180,000 tons/year of municipal waste are collected by the DEHS and private commercial carriers. The Waste Management Division of the DEHS is responsible for the collection of approximately 50,000 pounds of waste generated by residences and small businesses. Commercial waste, consisting of about 130,000 tons of waste per year, is undertaken by both private collectors and by the DEHS (DEHS, 1998).

To date, recycling efforts in New Providence are limited, consisting of glass bottles with return deposits, scrap metal, and a minimum of cardboard and paper. Future plans regarding recycling efforts include the establishment of a plant to convert used cooking oil into biodiesel and a facility to recover petroleum-derived used oil for the manufacturing of asphalt.

There are two main non-hazardous and hazardous waste management facilities in the island of New Providence. These facilities consist of the new Harrold Road landfill and the New Providence hazardous waste storage facility.

The new Harrold Road landfill, which consists of a bio-reactive sanitary landfill covering 135 acres, opened in 2000 with an expected life span of 20 years. This landfill is located adjacent and to the north of the former Harrold Road landfill. It has a total landfill volume of 7.9 million cubic yards, including cover material. About 4.5 million tons of refuse will be deposited over its 20-year design period. The new landfill is provided with a 60-millimeter high density polyethylene liner with a double layer installed under leachate collection trenches. The leachate collection system drains by gravity to a sump located on the east side of the landfill. A 100-foot-wide strip between the buffer zone and the landfill cells accommodates perimeter drainage, access and cover material stockpiling. According to the DEHS, this landfill is adequate for the disposal of domestic waste and other special wastes such as asbestos and used petroleum oil.

The recently opened New Providence hazardous waste storage facility is located adjacent to the Harold Road landfill site. The facility consists of eight bays dedicated to the storage of hazardous waste and one bay dedicated to the staging and processing of materials. The main purpose of the facility is to provide hazardous waste with adequate classification, identification, and packaging prior to its shipment off-shore.

4.2 NATURAL ENVIRONMENT

This section describes the existing terrestrial and aquatic ecosystems associated with the proposed NSOD project. The terrestrial and aquatic habitats known to occur on-site and offshore are described in greater detail below in Sections 4.2.1 and 4.2.2 of this report. Additionally, Section 4.2.3 provides a discussion of Protected Habitats/Species in the area of the proposed NSOD project.

4.2.1 *Terrestrial and Landside Aquatic Ecosystems*

In addition to the previously developed portions of the site, including the golf course, resort, and support structures, six naturally-occurring, terrestrial habitats or vegetation communities have been identified on-site. These include: Broadleaf Coppice; Mixed Evergreen/Broadleaf Coppice; Coastal Sand Strand; Sandy Beach, Coastal Rock; and Aquatic Emergent Vegetation. These areas are depicted in Figure 4.7, which delineates developed and undeveloped habitat overlain on an aerial photograph of the proposed development.

In January 2007, ERM conducted a reconnaissance of the undisturbed Broadleaf Coppice to confirm, characterize, and delineate habitat; to identify the vegetative species associated with the observed habitats; and to corroborate the results of a biological baseline completed at the project site by ATM in 2006. Table 4.8 lists the floral species recorded during site survey work completed in 2006 and early 2007. The distribution of each taxon is recorded by habitat type present at the site. The list of species is not intended to represent a full inventory of all species present; rather, it lists those taxa observed during the course of biological fieldwork at the project site.

Figure 4.7 Terrestrial Habitat Map

ERM Environmental Resources Management

TERRESTRIAL AND LANDSIDE AQUATIC ECOSYSTEMS

NEW SOUTH BEACH OCEAN RESORT ENVIRONMENTAL IMPACT ASSESSMENT

NEW PROVIDENCE ISLAND, THE BAHAMAS

FIGURE 4.7

Table 4.8 Terrestrial Flora Species

	Habitat Code:	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Common Name	Species	Broadleaf Coppice-Undistrubed	Broadleaf Coppice-Disturbed	Mixed Evergreen/Broadleaf Coppice-Undisturbed	Mixed Evergreen/Broadleaf Coppice-Disturbed	Cleared Coppice	Sand Strand-Undisturbed	Sand Strand-Disturbed	Coastal Rock	Sandy Beach	Developed-Golf Course	Developed-Structures/Support Facilities	Landside Aquatic Features-Natural Blue Holes	Landside Aquatic Features-Man-made	Aquatic Emergent Vegetation
Naturally Occurring Taxa															
Sea Purslane	*Sesuvium portulacastrum*								X	X					
Beach Morning Glory	*Ipomea pes-caprae*				X					X					
Moon Vine	*Ipomea macrantha*									X					
Coconut Palm	*Cocos nucifera*	X	X		X	X	X	X		X	X	X			
Sea Grape	*Coccoloba uvifera*		X	X	X		X	X		X					
Gumbo Limbo	*Bursera simruba*	X	X	X	X		X				X				
Bamboo Grass	*Lasiacis divaricata*	X													
Inkberry	*Scaevola plumieri*						X								
Acacia	*Acacia macracantha*	X	X	X	X		X								
Buttonwood	*Conocarpus erectus*						X								
Cabbage Palm	*Sabal palmetto*	X	X	X	X		X	X			X				
Indian Almond	*Terminalia catappa*	X	X	X	X		X								
Calabash	*Crescentia cujete*				X										
Tree of Life	*Lignum vitae*	X	X								X				
Poisonwood	*Metopium toxiferum*	X		X	X						X				
Wild Tamarind	*Lysiloma latisiliquum*	X	X	X	X										
Love Vine	*Cuscuta* sp.	X	X	X	X		X								
Air Plant	*Tilandsia* sp.	X		X											
Wild Madeira	*Alvaradoa amorphoides*	X	X								X				
Mahogany	*Swietenia mahogoni*	X	X								X				
Horseflesh	*Lysiloma sabicu*	X	X	X	X						X				
Saltwort	*Batis maritima*								X	X					
Sandspur	*Cenchrus* sp.						X			X					
Pigeon Plum	*Coccoloba diversifolia*	X	X	X	X										
Bastard Pigeon Plum	*Coccoloba swartzii*	X	X	X	X										
Boar Pigeon Plum	*Coccoloba krugii*	X	X	X	X										

Common Name	Species	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Habitat Code:		Broadleaf Coppice-Undistrubed	Broadleaf Coppice-Disturbed	Mixed Evergreen/Broadleaf Coppice-Undisturbed	Mixed Evergreen/Broadleaf Coppice-Disturbed	Cleared Coppice	Sand Strand-Undisturbed	Sand Strand-Disturbed	Coastal Rock	Sandy Beach	Developed-Golf Course	Developed-Structures/Support Facilities	Landside Aquatic Features-Natural Blue Holes	Landside Aquatic Features-Man-made	Aquatic Emergent Vegetation
Bracken Fern	*Pteridium aquilinium*	X	X	X	X										
Willow Bustic	*Bumelia salicifolia*	X		X	X										
Cinnecord	*Acacia choriophylla*	X		X	X										
Sapodilla	*Manilkara zapota*	X									X				
Jacaranda*	*Jacaranda caerulea*	X													
Wild Guava	*Tetrazygia bicolor*	X													
Silver Top Palm	*Coccothrinax argentata*	X			X						X				
Bearded Fig	*Ficus citrifolia*	X													
Strangler Fig	*Ficus aurea*	X									X				
Unidentified Acacia	*Acacia* sp.	X	X	X	X		X								
Yellow Pine	*Pinus caribaea*	X	X	X	X		X								
Chicken Toe	*Tabebuia bahamensis*	X													
Wild Mamee	*Clusia rosea*	X													
Satinleaf	*Chrysophylum oliviforme*	X	X	X	X										
Pork and Doughboy	*Acacia acuifera*	X													
Cattail	*Typha domingensis*												X	X	X
Invasive Exotic Taxa**															
Australian Pine	*Casuarina spp.*		X	X	X		X			X					
Brazilian Pepper	*Schinus terebinthifolia*		X		X		X								
Jumbey (Jumbay)	*Leucaena leucocephala*	X	X	X	X		X								
African Tulip	*Spathodea campanulata*	X		X							X				
Purple Morning Glory	*Ipomea purpurea*				X										
Exotic Taxa															
Royal Poinciana	*Delonix regia*	X			X						X	X			
Banyan	*Ficus* spp.	X									X				
Screw Pine	*Pandanus utilis*						X								
Rubber Tree	*Ficus elastica*	X									X				

Habitat Code:		A	B	C	D	E	F	G	H	I	J	K	L	M	N
Common Name	Species	Broadleaf Coppice-Undistrubed	Broadleaf Coppice-Disturbed	Mixed Evergreen/Broadleaf Coppice-Undisturbed	Mixed Evergreen/Broadleaf Coppice-Disturbed	Cleared Coppice	Sand Strand-Undisturbed	Sand Strand-Disturbed	Coastal Rock	Sandy Beach	Developed-Golf Course	Developed-Structures/Support Facilities	Landside Aquatic Features-Natural Blue Holes	Landside Aquatic Features-Man-made	Aquatic Emergent Vegetation
Horticultural Taxa															
Banana	*Musa* sp.					X									
Papaya	*Carica papaya*		X			X									
Orange	*Sinensis* sp.					X									
Mango	*Mangifera indica*					X									
Guava	*Psidium* sp.					X									
Sugar Cane	*Saccharum* sp.					X									
Avocado	*Persea americana*					X									

*Some authors, (Patterson,2002) consider Jacaranda to be a native species, while others (Cutts, 2004) consider the species to have originated in Argentina. Kingsbury (1988) lists the species as *Jacaranda mimosifolia* and states that it originated in Brazil.

**BEST Commission, The National Invasive Species Strategy For The Bahamas, March 2003

4.2.1.1 *Broadleaf Coppice*

Survey work on the NSOD site documented that the great majority of the vegetated portions of the property was mature broadleaf forest, herein referred to as Broadleaf Coppice. Two subcategories were recognized: Broadleaf Coppice – Undisturbed and Broadleaf Coppice Disturbed.

<u>Broadleaf </u>Coppice – Undisturbed

In general, the Broadleaf Coppice community consists of a dense, secondary or tertiary growth of native trees, ranging in height to 50 feet, with a sparse understory. Campbell (1978) describes both a Blackland Coppice and Whiteland Coppice. His Blackland Coppice compares closely with the Broadleaf Coppice noted on-site. Campbell notes that the tree species common to this habitat include: Mahogany (*Swietenia mahagoni*); Horseflesh (*Lysiloma sabicu*); Mastic (*Sideroxylom foetidissimum*); Cedar (*Juniperus barbadensis*); Gum Elemi or Gumbo Limbo (*Bursera simaruba*); Short-leaf Fig (*Ficus brevifolia*); Strangler Fig (*F. aurea*); Satinleaf (*Chrysophyllum oliviforme*); Pigeon Plum (*Coccoloba diversifolia*); Blolly (*Torrubia longifolia*); and Willow Bustic (*Dipholis salicifolia*). Campbell notes several common understory plants, including several species of Stoppers (*Eugenia* sp.); Bahama Strongbark (*Bourreria ovata*); and several species of wild coffee (*Psychotria* sp.). Campbell also cites the common occurrence of several species of epiphytes, including several species of orchids (*Epidendrum* sp. and *Vanilla* sp.) and several species of bromeliads of the genus *Tillandsia*.

Undisturbed Broadleaf Coppice at the project site contains a dense canopy of Pigeon Plum, Gum Elemi, Poisonwood, and Mastic. Undisturbed Broadleaf Coppice habitat contained the greatest assemblage of floral species of the habitats occurring at the South Ocean Beach Resort site. This is, in part, due to the presence of organic soils (i.e., leafmold soils). These consist of a very variable depth of humus over less than 5.9 inches of humic sandy earth, which in turn, often covers outcropping limestone rock (Sealy, 2006). Though the organic soils are thin, they provide a lush substrate for the coppice. Because the soils are so thin, care must be taken when clearing to prevent or minimize erosion.

Several examples of wild bromeliads occur in the Undisturbed Broadleaf Coppice, and two species of protected trees, Horseflesh and Caribbean Pine (*Pinus caribaea*) occur infrequently in this habitat. At the fringes/edges of the forest/coppice, a greater abundance of shrub-size specimens of the same trees and more understory plants occurs, as is typical of disturbed areas where solar radiation can reach the ground surface.

Based on fieldwork completed to date, 34 identifiable taxa occur at the project site, including the following:

- Pigeon Plum (*Coccoloba diversifolia*);
- Coconut Palm (*Cocos nucifera*);
- Gumbo Limbo (*Bursera simaruba*);
- Acacia (*Acacia macracantha*);
- Cabbage Palm (*Sabal palmetto*);
- Willow Bustic (*Bumelia salicifolia*);
- Indian Almond (*Terminalia catappa*);
- Silver top Palm (*Coccothrinax argintata*);
- Tree of Life (*Lignum vitae*);
- Poison Wood (*Metopium toxiferum*);
- Wild Tamarind (*Lysiloma latisiliquum*);
- Wild Madeira (*Alvaradoa amorphoides*);
- Mahogany (*Swietenia mahogoni*);
- Horseflesh (*Lysiloma sabicu*);
- Bastard Pigeon Plum (*Coccoloba swartzii*);
- Boar Pigeon Plum (*Coccoloba krugii*);
- Cinnecord (*Acacia chorioplyla*);
- Wild Guava (*Tetrazygia bicolor*);
- Satinleaf (*Chrysophylum oliviforme*);
- Yellow Pine or Caribbean Pine (*Pinus caribaea*);
- Wild Mamee (*Clusia rosea*);
- Sapodilla (*Manilkara zapota*);
- Bearded Fig (*Ficus citrifolia*);
- Strangler Fig (*Ficus aurea*);
- Unidentified Acacia (*Acacia* sp.);

- Chicken Toe (*Tabebuia bahamensis*);
- Pork and Doughboy (*Acacia acuifera*);
- Love Vine (*Cuscuta* sp.);
- Air plant (*Tilandsia* sp.);
- Bamboo Grass (*Lasiasis divaricata*);
- Bracken Fern (*Bumelia salicifolia*);
- Banyan (*Ficus* spp.); and
- Rubber Tree (*Ficus elastica*).

Of these Broadleaf Coppice species, several are protected under Bahamian law, including the:

- Tree of Life (*Lignum vitae*);
- Mahogany (*Swietenia mahogoni*);
- Horseflesh (*Lysiloma sabicu*); and
- Yellow Pine or Caribbean Pine (*Pinus caribaea*).

Several hundred individual protected trees occur at the project site. Caribbean Pine is the most common protected tree at the project site, and it occurs in clusters of a few individuals that are more or less scattered throughout the Broadleaf Coppice. Mahogany, Horseflesh, and Tree of Life are less common than Caribbean Pine at the project site, but specimens of these species likely are found throughout the Broadleaf Coppice.

Various exotic species occur in the undisturbed Broadleaf Coppice. These species typically were noted at the fringes of the golf course, where historical clearing has been undertaken. Exotics included the Royal Poinciana (*Delonix regia*) and two invasive exotics: Jumbey (*Leucaena leucocephala*) and the African Tulip (*Spathodea campanulata*).

<u>Broadleaf Coppice-Disturbed</u>

This subcategory of Broadleaf Coppice has been disturbed as a result of anthropogenic activities. Such disturbances allow the establishment of both native understory plants and non-native invasive species. Disturbed Broadleaf Coppice is characterized by the presence of non-native pest species, weedy shrubs, and groundcover species. Many of the un-maintained areas of the South Ocean Beach Resort site previously disturbed during golf course and resort construction have been re-colonized with various plant species.

Three areas of the project site were identified as disturbed Broadleaf Coppice, including: several narrow portions of former unimproved road extending to the west of the north entrance road along the west half of the golf course (this section is surrounded by undisturbed Broadleaf Coppice); a small area south of the blue hole on the 15th golf hole; and a large area south of the existing tennis courts, which extends in an irregular swatch along the north side of the coastal road to the western property boundary. The following species occur in disturbed Broadleaf Coppice at the project site:

- Coconut Palm (*Cocos nucifera*);
- Sea Grape (*Coccoloba uvifera*);
- Gumbo Limbo (*Bursera simruba*);
- Acacia (*Acacia macracantha*);
- Cabbage Palm (*Sabal palmetto*);
- Pigeon Plum (*Coccoloba diversifolia*);
- Indian Almond (*Terminalia catappa);*
- Wild Tamarind (*Lysiloma latisiliquum*);
- Love Vine (*Cuscuta* sp.);
- Wild Madeira (*Alvaradoa amorphoides;*
- Bastard Pigeon Plum (*Coccoloba swartzii*);
- Boar Pigeon Plum (*Coccoloba krugii*);
- Bracken Fern (*Bumelia salicifolia*);
- Unidentified Acacia (*Acacia* sp.); and
- Satinleaf (*Chrysophylum oliviforme*).

Of the above species noted in the disturbed Broadleaf Coppice, several are protected under Bahamian law. These include the:

- Tree of Life (*Lignum vitae*);
- Mahogany (*Swietenia mahogoni*);
- Horseflesh (*Lysiloma sabicu*); and
- Yellow Pine or Caribbean Pine (*Pinus caribaea*).

Several invasive exotic species occur in this habitat, including:

- Australian Pine (*Casuarinas* spp.);
- Brazilian Pepper (*Schinus terebinthefolia*); and
- Jumbey (*Leucaena leucocephala*).

Based on field surveys, Broadleaf Coppice is present over approximately 186.207 acres (49.3 percent) of the NSOD site. Of this, approximately 166.044 acres (43.97 percent) is considered undisturbed and 20.163 acres (5.34 percent) has been considered disturbed.

4.2.1.2 *Mixed Evergreen/Broadleaf Coppice*

The area along the east side of the resort includes both undisturbed and disturbed Mixed Evergreen/Broadleaf Coppice. Disturbed Mixed Evergreen/ Broadleaf Coppice fringe the golf course along portions of the 2nd and 3rd fairways. Undisturbed Mixed Evergreen/ Broadleaf Coppice back the disturbed habitat and extend to the fringe of the road along the eastern property boundary. The separation of disturbed and undisturbed vegetative habitat is marked by the location of a water collection trench cut into the limerock formation in years past.

Mixed Evergreen-Broadleaf Coppice - Undisturbed

The Mixed Evergreen/Broadleaf Coppice - Undisturbed habitat is a mix of the vegetative assemblages of the Broadleaf Coppice with an influence of Yellow (Caribbean) Pine (*Pinus caribaea*). Yellow Pine was not dominant, but clearly more prevalent than in the Broadleaf Coppice, its occurrence representing an estimated 10 percent or less of the assemblage. Pigeon plum (*Coccoloba diversifolia*); Poisonwood (*Metopium toxiferum*); and Gum Elemi (*Bursera simaruba*) also occur in this habitat type. This mosaic habitat essentially represents a transition zone between the Broadleaf Coppice and Pine Flatwoods habitat where Yellow Pine is the dominant canopy tree. The average height of the pines observed on-site ranged to 50 feet or more.

The presence of the narrow-leafed evergreens allows more sunlight to penetrate the canopy, thus providing a favorable habitat for shrubs to develop. Campbell (1978) notes that, in addition to Yellow Pine, a broad-leafed understory is present in these settings. Characteristic understory species include Bracken Fern (*Pteridium aquilinum*); Wild Guava (*Tetrazygia bicolor*); Five-finger (*Tabebuia bahamensis*); Snow Berry (*Chiococca alba*); Love

Vine (*Cassytha filiformis*); Poison Ivy (*Toxicodendron radicans*); and Poisonwood (*Metopium toxiferum*).

The following vegetative species occur within the Mixed Evergreen/Broadleaf Coppice-Undisturbed habitat at the project site:

- Sea Grape (*Coccoloba uvifera*);
- Gumbo Limbo (*Bursera simruba*);
- Acacia (*Acacia macracantha*);
- Cabbage Palm (*Sabal palmetto*);
- Pigeon Plum (*Coccoloba diversifolia*);
- Indian Almond (*Terminalia catappa*);
- Poisonwood (*Metopium toxiferum*);
- Wild Tamarind (*Lysiloma latisiliquum*);
- Bastard Pigeon Plum (*Coccoloba swartzii*);
- Boar Pigeon Plum (*Coccoloba krugii*);
- Willow Bustic (*Bumelia salicifolia*);
- Cinnecord (*Acacia chorioplyla*);
- Unidentified Acacia (*Acacia* sp.);
- Satinleaf (*Chrysophylum oliviforme*);
- Love Vine (*Cuscuta* sp.);
- Air plant (*Tilandsia* sp.); and
- Bracken Fern (*Bumelia salicifolia*).

Observed protected species within the undisturbed Mixed Evergreen/Broadleaf coppice included:

- Yellow Pine (*Pinus caribaea*); and
- Horseflesh (*Lysiloma sabicu*);

Both Yellow Pine and Horseflesh are widely distributed throughout the project site. Although they were not directly observed in the undisturbed Mixed Evergreen/ Broadleaf Coppice, additional protected species such as Mahogany and *Rauwolfia* may occur in this habitat.

Observed invasive exotic species included:

- Australian pine (*Casuarinas* spp.);
- Jumbey (*Leucaena leucocephala*); and
- African Tulip (*Spathodea campanulata*).

<u>Mixed Evergreen - Broadleaf Coppice - Disturbed</u>

As noted above, historical activities in the eastern extreme of the South Ocean Beach Resort have led to the establishment of a large area of Mixed Evergreen/Broadleaf Coppice. In the past, a long water collection trench was cut into the limestone formation in this area, presumably to collect storm water runoff, thereby enhancing ground water recharge. The physical disturbance caused by this construction led to the disturbed coppice fringing portions of the 2nd and 3rd fairways, extending from the edge of the fairways eastward to the trench. Because the tree canopy in this area was disturbed, the understory and ground cover became more abundant, and invasive exotic species such as Australian Pine became established and dominant along much of the trench. We have characterized the area as Mixed Evergreen/Broadleaf Coppice - Disturbed along the fairways, backed by undisturbed Mixed Evergreen/Broadleaf Coppice.

The following species have been observed in the disturbed Mixed Evergreen/Broadleaf Coppice at the project site:

- Gumbo Limbo (*Bursera simruba*);
- Sea Grape (*Coccoloba uvifera*);
- Acacia (*Acacia macracantha*);
- Coconut Palm (*Cocos nucifera*);
- Cabbage Palm (*Sabal palmetto*);
- Indian Almond (*Terminalia catappa*);
- Pigeon Plum (*Coccoloba diversifolia*);
- Bastard Pigeon Plum (*Coccoloba swartzii*);
- Boar Pigeon Plum (*Coccoloba krugii*);
- Calabash (*Crescentia cujete*);
- Willow Bustic (*Bumelia salicifolia*);
- Cinnecord (*Acacia chorioplyla*);

- Silver Top Palm (*Coccothrinax argintata*);
- Unidentified Acacia (*Acacia* sp.);
- Satinleaf (*Chrysophylum oliviforme*);
- Poisonwood (*Metopium toxiferum*);
- Wild Tamarind (*Lysiloma latisiliquum*);
- Love Vine (*Cuscuta* sp.);
- Bracken Fern (*Bumelia salicifolia*); and
- Beach Morning Glory (*Ipomea pes-caprae*).

Observed protected species within the Mixed Evergreen/Broadleaf Coppice-Disturbed included:

- Yellow Pine (*Pinus caribaea*); and
- Horseflesh (*Lysiloma sabicu*).

Observed exotics included Royal Poinciana (*Delonix regia*) and several invasive exotics, including:

- Australian Pine (*Casuarinas* spp.);
- Brazilian Pepper (*Schinus terebinthifolia*);
- Jumbey (*Leucaena leucocephala*); and
- Purple Morning Glory (*Ipomea purpurea*).

Mixed Evergreen/Broadleaf Coppice is present over approximately 9.435 acres, (2.49 percent) of the South Ocean Beach Resort site. Of this, approximately 4.689 acres (1.24 percent) has been considered undisturbed and 4.746 acres (1.25 percent) has been designated as disturbed.

4.2.1.3 *Cleared Coppice*

Several previously vegetated areas of land have been cleared at the project site. These areas are thought to have previously supported Broadleaf Coppice or Mixed Evergreen/Broadleaf Coppice assemblages. Due to the thin accumulations of organic soils overlying the native limestone throughout the area, soils are readily eroded when vegetation is removed and erosion prevention measures are not undertaken. Accordingly, soil cover was largely lacking in the cleared areas.

The most extensive cleared area is in the southwest portion of the site, just north of the coastal road and just east of the western site boundary. In this area, the land was cleared, apparently for agricultural purposes. During the site survey, this area was noted to consist essentially of exposed limestone with some small areas of soil in low points. The practice of "pothole farming" as described by Sealey (2006) was underway throughout this cleared area. This agricultural practice relies on the accumulation of soil in surficial solution cavities. The farmer then plants a tree or other crop plant in the accumulated soil, where the plant receives sufficient water and nutrients. Solution cavities were readily observable throughout this cleared area, providing further evidence of the likely widespread existence of these features throughout the project site. In this area, flora was largely limited to horticultural specimens, including:

- Coconut Palm (*Cocos nucifera*);
- Banana (*Musa* sp.);
- Papaya (*Carica papaya*);
- Orange (*Sinensis* sp.);
- Mango (*Mangifera indica*);
- Guava (*Psidium* sp.);
- Sugar cane (*Saccharum sp.*); and
- Avocado (*Persea americana*).

Representatives of former coppice species are present also, including sporadic examples of Gum Elemi, Stoppers (*Eugenia* sp.), Sage Cop (*Lantana involucrata*), *Ipomea* sp. vines, Pound Cake Bush (*Parthenium hysterophorus*), Sand Burr (*Cenchrus* sp., Jack-in-the-Bush (*Eupatorium odoratum*), spurges (*Chamasyce* sp.), and a single specimen of *Tillandsia* sp.

Subsequent observations in this area recorded the presence of two species of ferns, *Anemia* sp. and *Pteris longifolia* var. *bahamensis*, and single specimens of two species of terrestrial orchid, which were attributed to the common terrestrial species, *Oeceoclades maculata*, and an apparently less common terrestrial, *Eulophia alta*. During this most recent survey, approximately 45 specimens of juvenile Lignum Vitae (*Guaiacum sanctum*) also were noted near the south-central portion of the Cleared Coppice habitat, which co-occurs with the extreme southwest portion of the proposed marina development. Lignum Vitae and all orchids are designated protected species in the Bahamas.

A second area of cleared land was observed on the southeast side of the paved roadway entering the northern part of the site. Here, again, the area has been cleared of vegetation, presumably Broadleaf Coppice, which surrounds the clearing to the east.

A third cleared area was noted on the 1st hole of the golf course. While this area had been cleared, conditions allowed sufficient soil to remain for the area to sustain the growth of weeds.

The fourth area of Cleared Coppice was created in an area of Broadleaf Coppice with the construction of an apparent unimproved road extending westward from the main entrance road on the north side of the property north of the 17th and 18th golf fairways.

A fifth area of Cleared Coppice was noted adjacent to the north of the golf course maintenance buildings.

Cleared Coppice is present over approximately 20.451 acres (5.41 percent) of the South Ocean Beach Resort site.

4.2.1.4 *Aquatic Emergent Vegetation*

This habitat type consists of a small area of Cattails (*Typha domingensis*) present near the center of the man-made surface water body between the 4th and 5th golf holes. This pond is not lined. The area of emergent vegetation is approximately 115 feet long and 30 feet wide, with the long axis trending in the north/south direction. The reference freshwater pond is that same feature noted in the ATM survey report as feature OW-2 (see Section 4.2.1.7 of this report). This habitat occupies approximately 0.098 acres, representing less than one percent of the total site area, but may be locally important habitat for waterfowl due to the apparent scarcity of emergent vegetation in the immediate vicinity of the project site.

4.2.1.5 *Sand Strand*

Sand Strand - Undisturbed

Landward of the Sandy Beach habitat is a 3-5 foot high sand scarp that appears to have resulted from erosion. This scarp marks the seaward boundary of the Sand Strand habitat. The Sand Strand is a level, stable, sandy, vegetated hummock that generally is present on-site, behind the beach/coastal rock, to the south of the coastal road (South Ocean Drive) and north of the sandy beach. The Sand Strand occupies a low elevation landscape position and, due to storm water runoff, has a high water table. This nurtures the formation of a fairly dense canopy, which shades the understory and inhibits the succession of juvenile and other understory species. The Sand Strand landscape has a higher elevation than the adjacent Sandy Beach, due to vegetation trapping the windblown sands that otherwise blow unimpeded over the sandy beach; however, the Sand Strand habitat cannot be considered a dune system. This sand accumulation and the resulting higher elevation provide more resistance to storm erosion.

The Sand Strand habitat generally is shaded by a dense canopy, while the understory is somewhat thin with sparse ground cover. The canopy species observed included: Sea Grape (*Coccoloba uvifera*); Coconut Palm *(Cocos nicifera*); Gumbo Limbo (*Bursera simruba*); Acacia (*Acacia macracantha* and *Acacia sp.*); Buttonwood (*Conocarpus erectus*); Cabbage Palm (*Sabal palmetto*); Caribbean Pine (*Pinus caribaea*); Australian Pine (*Casuarina* sp.); and Indian Almond (*Terminalia catappa*). Screw Pine (*Pandanus utilis*), although less abundant, also was observed. *P. utilis* is an exotic. Species comprising the understory included: Inkberry (*Scaevola plumieri*); Jumbey (*Leucaena leucocephala*); and Brazilain pepper (*Schinus terebinthifolia*), an invasive exotic. Ground cover species include: Sandspur *(Cenchus sp.*) and the climbing Love Vine (*Cuscuta* sp.). The ATM report listed observed species that included: Beach Naupauka (*Scaevola taccada*); Panic Grass (*Panicum amarulum*); and Bay Cedar (*Suriana maritime*), and their subsequent survey related to the proposed marina additionally noted the presence of Geiger Tree (*Cordia sebestena*) and Privet (*Foresteria segregate*). ATM also noted two ground cover species, *Wedelia trilobata* and *Panicum amarulum*. Lastly, ATM reported the occurrence of Prickly Pear Cactus (*Opuntia* sp.), which is protected against export under CITES. ERM did not observe these taxa, but the species are consistent with those expected. One protected species, the Caribbean Pine, was observed in the Sand Strand.

Sand Strand - Disturbed

Two small areas of disturbed Sand Strand were identified. One of these areas is located immediately west of the beach condominiums on the western boundary of the Stuart Cove's parcel. This area had been disturbed historically by the improper disposal of solid waste. More recently, the area was additionally disturbed as a result of vegetation clearing by South Ocean Beach Resort personnel, with the permission of the Bahamian authorities (Personal Communication, Lawrence Williams, 2007b). During the clearing, most of the understory vegetation was eliminated, and large specimen trees were left in place. The area is bound to the north by South Ocean Beach Drive and to the south by Sandy Beach. The land surface is exposed unconsolidated and consolidated limerock. The remaining vegetation consists almost exclusively of Coconut Palm (*Cocos nucifera*), Cabbage Palm (*Sabal palmetto*), and mature Sea Grape (*Coccoloba uvifera*).

A second somewhat larger area of disturbed Sand Strand occurs between the beachfront and the residential complex adjacent to the eastern boundary of the beachside portion of the South Ocean Beach Resort. This disturbed Sand Strand likely was created when the residential units were constructed, and the area has been maintained since as decorative landscape.

ERM observed no protected species in either of these two disturbed sand strand areas.

Sand Strand habitat is present over approximately 2.52 acres (0.67 percent) of the New South Ocean Beach Resort site. Of this, approximately 1.853 acres (0.49 percent) has been considered undisturbed, and 0.667 acres (0.18 percent) has been considered disturbed.

4.2.1.6 *Coastal Rock*

Shoreline Coastal Rock habitat is present where beach sand has been eroded by wave action and nearshore currents. This rock is oolitic limestone formed from the precipitation of calcium carbonate from seawater. The oolitic limestone also contains the skeletons of coral and other calcareous marine organisms. The rock exists in subtidal, intertidal, and supra-tidal landscape positions. As viewed from above, the surface of the rock generally protrudes over a small concave subtidal area formed by the dissolution of the limestone by wave action. The Coastal Rock forms a protective barrier that resists erosion by waves, tropical storms, and hurricanes. The rock also restricts the erosion to the overlying sandy beaches and more landward landscapes, while providing a substrate for the re-establishment of the beaches during depositional periods between storm events and the like. On the existing South Ocean Beach Resort shoreline, Coastal Rock is present sparsely and intermittently in Sandy Beach areas, just west of the beach hotel to just west of the Stuart Cove's inlet.

The subtidal and intertidal zones generally are non-vegetated due to storm erosion, while the supra-tidal zone contains sparse halophytic vegetation. Species observed by ERM in January 2007 included Sea Purslane (*Sesuvium portulacastrum*) and Saltwort (*Batis maritima*). Later surveys of the Coastal

Rock in the area of the proposed marina entrance by ATM recorded Sea Ox-eye Daisy (*Borrichia* sp.) and stunted Buttonwood Mangrove (*Conocarpus erectus*). The unvegetated zone was 20 to 30 feet wide, while landward, the vegetated zone was 10 to 20 feet wide.

To date, the Coastal Rock habitat appears to have been altered physically at two locations, at the marina entrance to Stuart Cove's and fronting the existing South Ocean Beach Resort beachside facilities, where terraced structures and steps were constructed and by apparent historical beach re-nourishment. No protected species occur in the Coastal Rock habitat.

Coastal Rock habitat is present over approximately 1.284 acres (0.34 percent) of the project site.

4.2.1.7 *Sandy Beach*

East of the Coastal Rock habitat and to the east and west of the beach hotel complex is a thin strip of natural, soft, Sandy Beach, which generally is situated in an intertidal and supra-tidal landscape position. The beach slopes gently toward the sea. The beach is composed of sand-sized particles blown and washed ashore and trapped by vegetation. ATM reported that the Sandy Beach system formed, in part, by altered littoral drift due to influences of rock jetties at the entrance to Stuart Cove's. Since the vegetation here is sparse, the area is subject to erosion during tropical weather events. The beach was devoid of dune development at the time of the site visit. This infers the recent inundation of tidal waters that erode and flatten the beach. Further evidence of recent erosion, including fallen and leaning Australian Pines, occurred to the east of the beach hotel complex. Also, the Sandy Beach area apparent in historical aerials extended seaward of the concrete steps serving the beach hotel pool area. In early 2007, the beach had eroded, such that the base of the steps was being affected by wave action. The area immediately surrounding the beach hotel complex showed evidence of the beach having been, at least in part, man-made or renourished.

The Sandy Beach intertidal zone is devoid of vegetation. Vegetation observed during the site visit in the supra-tidal zone included: Sea Purslane (*Sesuvium portulacastrum*); Beach Morning Glory (*Ipomea pes caprae*); Moon Vine (*Ipomea macrantha*); Saltwort (*Batis maritima*); and Sandspur (*Cenchrus* sp.). Tree species encountered on the Sandy Beach included: Sea Grape (*Coccoloba uvifera*); Coconut Palm (*Cocos nucifera*); and Australian pine (*Casuarina* sp.). These specimens generally were observed at the landward edge of the community. No protected species were observed in the Sandy Beach habitat.

Sandy Beach habitat is present over approximately 1.062 acres (0.28 percent) of the project site.

4.2.1.8 *Landside Aquatic Habitats*

Blue Holes

Two natural blue holes are present on the South Ocean Beach Resort site. A large, sub-elliptical blue hole with near-vertical, limerock walls is located at the southern extreme of the golf course just east of the putting green of the 15^{th} hole. The distance to the water surface at this feature was estimated to be approximately 30 feet below land surface, and the long-axis diameter was approximately 125 feet. A second, smaller blue hole is located at the fringe of the Broadleaf Coppice just west and north of the putting green of the 17^{th} hole. This smaller feature was irregular in shape, with a long-axis diameter of approximately 30 feet, and distance to water surface of approximately ten feet. In total, the two blue holes cover approximately 0.197 acre, or approximately 0.05 percent of the total site area.

Observations of these features over several days in January 2007 suggested a tidal fluctuation of the water surface elevation in both blue holes. The fluctuation was marked by staining of the limerock and, in the case of the smaller blue hole, the formation of stalactites. The northernmost blue hole (OW-6) displayed a tidal fluctuation of approximately two to three feet while the southernmost blue hole (OW-3) demonstrated an apparent tidal fluctuation of approximately four feet.

Numerous other solution cavities were noted throughout the undeveloped portions of the property, primarily in the disturbed and undisturbed areas of the Broadleaf Coppice and Mixed Evergreen/Broadleaf Coppice. ERM was unable to observe a visible water table surface in any of these smaller solution cavities, and many of the cavities contain vegetative debris and, in some cases, non-vegetative solid waste (e.g., PVC piping), presumably emplaced to reduce the hazards posed by the open cavities. Several species of ferns occurred in the drainage ditch quarried in the limerock substrate near the eastern property boundary near the fringe of the coppice along the eastern margin of the 2^{nd} and 3^{rd} golf hole fairways; however, such ferns were not conspicuous in the solution cavities encountered in early 2007.

Six surface water bodies occur on the South Ocean Beach Resort. Four of these features are man-made and are described in the next subsection of this report. The other two features are the blue holes referenced above. In their report, ATM designated the blue holes as feature OW-3 and OW-6. Tidal fluctuations in the blue hole near the putting green of the 15th hole (OW-3) suggest a subsurface connection to the sea. The smaller blue hole, located on the 17th golf hole (OW-6), has somewhat clearer water than the larger blue hole, and also exhibits apparent tidal fluctuations in water level. While both blue holes are hydraulically connected to the sea, based on the apparent tidal fluctuations, ERM has no empirical data regarding the chemistry of the surface waters in the blue holes.

The BEST Commission (2002) notes that blue holes are present on all of the major Bahamian islands. Blue holes, solution cavities, and the caves that are often associated with such features represent unique geological, hydrological, and ecological systems. They can provide habitat for bats, owls, freshwater turtles, and endemic species such as blind cave fish and invertebrates. Depending on the subterranean structure of a blue hole and its connection with the sea, it can also support marine species. Sealey (2006) notes that some blue holes support aquatic life, depending on food availability, which is driven, at least in part, by the input of vegetative debris and other organic matter from surrounding sources. Additionally, BEST (2002) notes that blue holes have been found to contain archaeological artifacts and human remains.

Bahamian law (Chapter 260, 1997) regarding the Conservation and Protection of the Physical Landscape of The Bahamas specifically prohibits the filling of blue holes without the express written permission of the government. No evidence of filling or waste disposal in the two blue holes present on-site was noted by ERM during the site survey in early 2007.

Man-made Water Features

In addition to the two blue holes described above, four man-made water features occur at the existing South Ocean Beach Resort. Like the blue holes, these four man-made features are located on the golf course. They serve both as water hazards, storm water collection/retention, and sources of irrigation water. Based on observations made in the field, the four man-made water bodies are described as follows:

- OW-1: Concrete-lined system with minimal environmental value;

- OW-2: Unlined water body with moderate environmental value (various fauna noted, including waterfowl and turtles);
- OW-4: Concrete-lined system with minimal environmental value; and
- OW-5: Unlined water body with some shoreline vegetation and pond life with moderate environmental value.

Aquatic insects (dragonflies), turtles, and water-foraging birds (Cormorants, Moorhens, and Dabchicks) occur in each of these ponds. Bird activity was notable at OW-2. This pond is unlined and contains a stand of emergent vegetation (*Typha domingensis*) (see Section 4.2.1.3 above). Birds encountered at OW-2 during ERM's survey included numerous examples of several species of Ducks, Cormorants, Grebes, Coots, and Moorhens. At water body OW4, ERM noted a single wading bird, an unidentified Sandpiper of the genus *Tringa* and a number of freshwater turtles thought to be of the genus *Trachemys*. As noted above, OW-4 is lined with concrete, but the lower portion of the basin has a considerable accumulation of sediment.

No species of protected fauna or flora were observed in association with the natural blue holes or man-made water features at the site. Landside man-made surface water habitat comprises approximately 6.77 acres, accounting for approximately 1.79 percent of the total area of the project site.

4.2.1.9 *Summary of Terrestrial and Landside Aquatic Habitats*

Table 4.9 provides a summary of natural terrestrial ecosystems and landside aquatic ecosystems (blue holes and man-made water features) present on-site, as well as altered, man-made land uses (existing internal roads, golf course and other recreational facilities, clubhouse, hotel, maintenance facilities, etc.). For each category, the table enumerates the total land area and the percentage of total site area represented by the land use/habitat.

Table 4.9 Summary of Natural Habitat and Land Use Areas

Habitat or Land Use	Natural or Man-Made	Total Area (acres)	Percent of Total Site Area
Broadleaf Coppice – Undisturbed	Natural	166.044	43.96
Broadleaf Coppice – Disturbed	Natural*	20.163	5.35
Mixed Evergreen/Broadleaf Coppice – Undisturbed	Natural	4.689	1.24
Mixed Evergreen/Broadleaf Coppice – Disturbed	Natural*	4.746	1.25
Aquatic Emergent Vegetation	Man-made**	0.098	0.02
Cleared Coppice	Natural*	20.451	5.41
Sand Strand – Undisturbed	Natural	1.853	0.49
Sand Strand – Disturbed	Natural*	0.667	0.18
Coastal Rock	Natural	1.284	0.34
Sandy Beach	Natural***	1.062	0.28
Aquatic Features – Blue Holes	Natural	0.197	0.05
Aquatic Features – Man-made Water Features	Man-made	6.770	1.79
Developed Land – Golf Course (fairways & greens only)	Man-made	117.698	31.17
Developed Land – Structures/Support Facilities	Man-made	31.989	8.47
Totals		377.711	100

*These areas originally were natural habitat, but by definition have been altered by some form of human activity.

**The natural Aquatic Emergent Vegetation occurs in a man-made pond on the east portion of the golf course.

***The Sandy Beach habitat is partially natural with apparent man-made enhancement fronting the existing South Ocean Beach Resort facility.

4.2.1.10 *Faunal Observations*

During field surveys in January 2007, ERM recorded 24 bird species. Species observed included the:

- White-cheeked Pintail (*Anas bahamensis*);
- Ring-necked Dove (*Aythya collaris*);
- Laughing Gull (*Larus atricella*);
- Great Egret (*Ardea alba*);
- American Coot (*Fulica Americana*);
- American Kestrel (*Falco sparverius*);
- Common Ground Dove (*Columbina passerine*);

- White-crowned Pigeon (*Columba leucocephala*);
- Mourning Dove (*Zenaida macroura*);
- Smooth-billed Ani (*Crotophaga ani*);
- Bahama Woodstar (*Calliplox evelynae*);
- Eastern Wood Pewee (*Contopus virens*);
- Bahama Mockingbird (*Mimus gundlachii*);
- Northern Mockingbird (*Mimus polyglottos*);
- Yellow-rumped Warbler (*Dendroica coronata*);
- Neotropic Cormorant (*Phalacrocorax brasilianus*);
- Common Moorhen (*Gallinula chloropus*);
- Least Grebe (*Tachybaptus dominicus*);
- Yellow-billed Sapsucker (*Sphyrapicus varius*);
- Hairy Woodpecker (*Picoides villosus*);
- La Sagra's Flycatcher (*Myiarchus sagrae*);
- Gray Catbird (*Dumetella carolinensis*);
- Yellow-throated Warbler (*Dendroica dominica*); and
- Unidentified Sandpiper (*Tringa sp.*).

Of these taxa, two are listed by CITES, the Bahama Woodstar and the American Kestrel. ERM observed the Bahama Woodstar feeding daily from ornamental landscape vegetation at the existing South Ocean Beach Resort hotel. The American Kestrel was observed perching in treetops along the golf course fairway on several occasions. The Bahamian Wild Birds Protection Act establishes protective status for all wild birds, with the exception of certain specified game birds, which can be taken/harvested during specified hunting seasons detailed in the Act.

ERM observed no amphibians during the field surveys completed in January 2007. Three species of reptiles were observed, including the:

- Cuban Brown Anole (*Anolis sagrei*);
- Bahamian Green Anole (*Anolis smaragdinus*); and
- An unidentified freshwater turtle (*Trachemys* sp.).

The Brown Anoles were common throughout the South Ocean Beach Resort property. The Green Anole was noted at one location. The turtles were encountered in one of the man-made ponds present on-site, where approximately eight specimens were noted. None of the observed reptiles are protected, and no protected terrestrial reptiles (e.g., rock iguanas, boa constrictors, pygmy boa constrictors) were observed by ATM or ERM during surveys of the property. Information provided to ERM in January 2007 indicated that small "Fowl Snakes" are encountered on the property (Personal Communication, 2007a). Fowl Snake is the local common name for the Bahamian Boa Constrictor, *Epicrates* sp. Neither ERM nor ATM encountered any specimens of this protected species, but based on the observations of Mr. McFall, young boas apparently are present on-site, which also suggests a population of mature, breeding boas. Subsequent surveys documented the occurrence of an approximately three-foot-long snake skin, apparently shed by a boa constrictor, the only snake known to reach this length in the Bahamas.

Several apparently feral dogs and cats, but no wild mammals, were observed at the project site. Information provided by Mr. McFall indicated that the only known mammal resident at the South Ocean Beach Resort is the raccoon, *Procyon lotor*. *The National Invasive Species Strategy for The Bahamas* (BEST, 2003) recommends the control of raccoons on New Providence Island because the species is an introduced, invasive species. The rare, protected Hutia (*G. ingrahami*) does not occur on New Providence Island. Hutia are thought to occur only in the Exumas.

4.2.2 *Marine Ecosystems*

Please refer to Figure 4.8 for the following discussion on Marine Ecosystems.

4 *Figure 4.8 Marine Habitat*

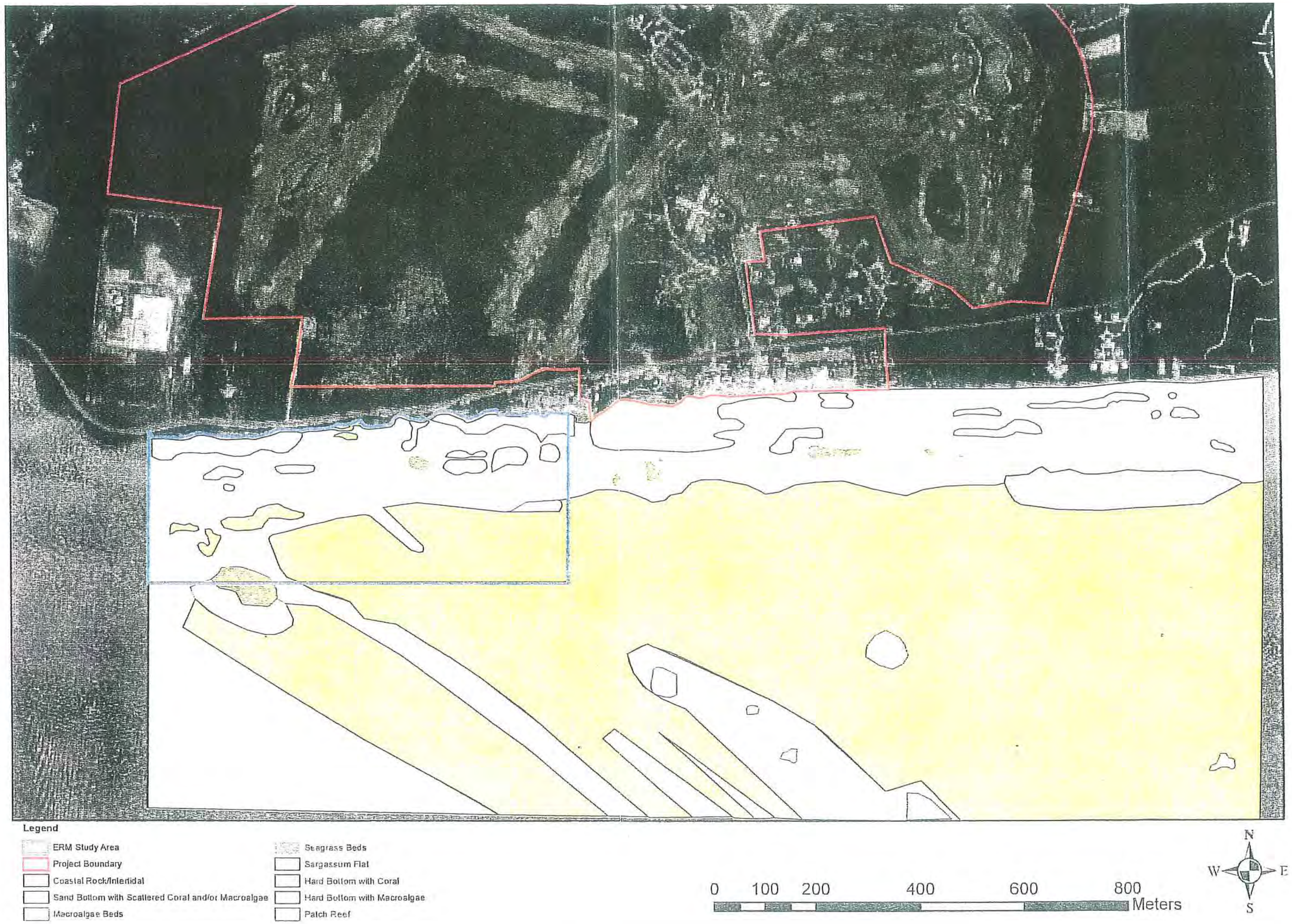

Figure 4.8 Marine Habitat

4.2.2.1 *Coastal Rock/Intertidal*

Rocky intertidal zones in The Bahamas may consist of both loose rock fragments and solid ironshore, and typically exhibit a dark stain due to cyanobacteria. Intertidal macrofauna may include the gastropods *Cenchritis muricatus; Nodilittorina angustior; Nodilittorina lineolata; Nodilittorina tuberculata; Nodilittorina ziczac* (Littorinidae); *Nerita peloronta*; *Nerita versicolor;* and *Nerita tessellata* (Neritidae), *Cittarium pica* (Trochidae) and, in shallow tide pools, *Batillaria minima* (Batillariidae). The neritid *Puperita pupa* may occur in dense concentrations along tide pool margins, sometimes accompanied by aggregations of small hermit crabs *Clibanarius* spp.. and *Pagurus* spp.. (Baca et al., 1996). Chitons (Polyplacophora) include *Acanthopleura granulata* and *Chiton tuberculatus*. Tide pools, depending upon their depth, extent, and proximity to the mean tide level, may support a limited to rich fauna ranging from a thin, closely-cropped or stunted algal turf (e.g., cyanobacteria, *Enteromorpha* sp., *Halimeda* sp.) to luxuriant and diverse macroalgae (e.g., *Padina sanctae-crucis* [Phaeophyta], *Acetabularia crenulata, Chaetomorpha* sp., *Batophora oerstedii, Neomeris angulata, Enteromorpha* sp., *Halimeda* spp.. [Chlorophyta], *Coelothrix irregularis*, and *Galaxaura* sp. [Rhodophyta]), accompanied by small star corals *Siderastrea radians* (Scleractinia), volcano barnacles *Tetraclita stalactifera* (Cirripedia), compound tunicates (Urochordata), rock snails *Thais deltoidea*, the rock-boring urchin *Echinometra lucunter*, small shrimp, crabs, and echinoderms, most of which are characteristic of the nearby subtidal zone (Baca et al., 1996).

With the exception of three small sandy areas covering less than 0.25 acre in aggregate, most of the intertidal zone at the site consists of low limestone bluffs approximately three feet in height. The top and seaward faces of these bluffs are covered with crevices and depressions resulting from the combination of erosion, chemical degradation, and physical weathering common to exposed limestone shorelines in The Bahamas. Cyanobacteria encrust the shoreline in many places. Both ATM and ERM noted chitons, anemones, and marine snails on the rock faces. Numerous small pools have formed in the splash zone immediately landward of the bluff face in the rough upper surface of the limestone. Marine amphipods, small marine snails, and a few small marine worms, which are presumably light enough to be transported through wave action were observed in the splash pools; however, the splash zones at the site lack the species richness that characterize larger, tidally influenced pools elsewhere in The Bahamas.

With the exception of the sandy areas and a few small depressions at the extreme seaward end of the bluffs, the intertidal zone is largely confined to the vertical or nearly-vertical seaward faces of the coastal rock. ERM observed no fish or corals in the few tide pools present at the site or in the sandy areas. The results of ERM's habitat survey suggest that, to the extent that these species exist in the nearshore environment offshore of the site, they are likely more common in the subtidal zone than in the intertidal zone. Several fish species occur within the intertidal and subtidal zones at the base of the coastal bluffs, including bluehead wrasse (*Thallasoma bifasciatum*), yellowfin mojarra (*Gerres cinereus*), slippery dick (*Halichoeres bivaittatus*), and sergeant major (*Abudefduf saxatillis*) (ATM, 2007; ERM, 2007).

This marine habitat type comprises approximately 1.23 acres (0.25 percent) of the marine habitat survey area.

4.2.2.2 *Sand Bottom with Scattered Coral and/or Macroalgae*

Sand can be an inhospitable environment where surf and strong current constantly shift sediment (Kaplan, 1988). Shallow waters are subject to a wide variety of environmental alterations inimical to reef development, including exposure and thermal disturbances, chemical alterations, and floods of fresh turbid water (Goldberg, 1983). Frequent and/or severe disturbance can return communities to an early successional stage or prohibit succession completely, producing areas of bare or nearly bare sandy bottom. Often described as underwater deserts, sand bottoms typically have little or no apparent flora or fauna (Sullivan, Sealey et al., 2002). Yellowfin Mojarras typically are found on sand or mud bottoms in shallow water and have been cited as being the most common sand-eating fish species (Kaplan, 1988). The Spotted Goatfish (*Pseudupeneus maculatus*) may feed on small organisms buried in the sand, using a pair of chemosensory chin barbels to stir up small invertebrates in sandy or muddy bottom (Randall, 1996). The Dasyatidae (stingrays) are found commonly on sandy or soft bottom and are represented by seven species in the Caribbean (Randall, 1996). Two particularly common ray species to The Bahamas are the Southern Stingray (*Dasyatis americana*) and the Yellow-spotted Stingray (*Urolophus jamaicensis*). Both are usually found on the bottom, often partially buried in the sand (Randall, 1996). Spotted Eagle Rays (*Aetobatis narinari*) often forage for buried invertebrates on sand bottoms, even in water less than three feet in depth.

Sandy bottoms harbor a diverse, but largely hidden fauna of macroinvertebrates, although some venture onto the seafloor surface at night. Echinoderms include clypeasteroid and spatangoid echinoids (e.g., *Clypeaster subdepressus, Clypeaster rosaceus, Encope aberrans, Meoma ventricosa, Plagiobrissus grandis*), the sea stars *Astropecten duplicatus* and *Oreaster reticulatus*), and the sea cucumbers *Isostichopus badionotus* and *Holothuria arenicola*. A wide variety of mollusks occur in sandy bottoms, including representatives of the gastropod families Cassidae, Terebridae, Strombidae (including *Strombus gigas*), Olividae, Marginellidae and Naticidae, and the bivalve families Veneridae, Lucinidae, Tellinidae and Cardiidae. Decapod crustaceans common to sandy bottom habitat include hippid mole crabs (*Emerita* spp. and *Albunea gibbesi*), shame-faced crabs (*Calappa* spp.), swimming crabs (*Callinectes* spp..), and hermit crabs (e.g., *Paguristes* spp., *Dardanus* spp., *Petrochirus diogenes*).

Much of the subtidal zone offshore of the site consists of unconsolidated sand with scattered macroalgae, sponges, and coral in this habitat (ATM, 2006; ERM, 2007). The sand bottom offshore of the site supports small clumps of filamentous green algae, *Halimeda sp.* and merman's shaving brush (*Penicillus capitatus*) on limestone fragments, shells, and other suitable substrates scattered throughout the sandy areas. Corals of any kind are rare on sandy bottoms offshore of the site, but soft corals were observed at a few locations throughout the sandy bottom habitats near the site, primarily near the edges of harder substrate. Bar Jacks (*Caranx ruber*) and Ocean Surgeons (*Acanthurus bahianus*), Spotted Goatfish, Yellowtail Snapper, and Great Barracuda (*Sphyraena barracuda*) occur over sand bottom immediately offshore of the site. ERM noted a single immature Queen Conch (*Strombus gigas*) in this habitat offshore of the site, and numerous burrows of unidentified infaunal organisms.

This marine habitat type comprises approximately 146.53 acres (31.85 percent) of the marine survey area.

4.2.2.3 *Macroalgae Beds*

Two areas offshore of the site identified as Macroalgae Beds support denser macroalgal growth than the areas characterized as Hardbottom with Macroalgae. The same species of macroalgae occur in these areas as on the Hardbottom with Macroalgae, but algal growth is more prolific in the macroalgae beds than in the sandy areas. Relatively few animals occur in the macroalgae beds offshore of the project site, although small Yellowtail Snapper were observed swimming through these areas. Based on ERM's habitat survey the macroalgae beds offshore of the site appear to support few corals, gorgonians, sponges, or other benthic fauna that are common in this habitat elsewhere in The Bahamas.

This marine habitat type comprises approximately 5.93 acres (1.30 percent) of the marine survey area.

4.2.2.4 *Seagrass Beds*

Three species of seagrass commonly encountered in The Bahamas are *Thalassia testudinum* (Turtle Grass), *Syringodium filiforme* (Manatee Grass), and *Halodule wrightii* (Shoal Grass). *Syringodium* tends to favor high energy sites, whereas *Thalassia* with lesser amounts of *Syringodium* and *Halodule,* tend to be more abundant in low energy sites (Smith et al., 1990). Turtle grass is the most common and forms extensive meadows throughout most of its range.

Sealey et al. (2002) describe three particular sandy seagrass ecotypes (patchy, sparse, and dense). Patchy (10-30 percent cover) and sparse (30-60 percent) seagrass ecotypes consist of up to all three seagrass species or *Sargassum* algae on platforms of calcareous rock as well as oolitic and skeletal sediment. Dense seagrass ecotypes have over 60 percent vegetation characterized by meadows of the three seagrasses and calcareous green algae (especially *Halimeda, Penicillus., Rhipocephalus* and *Udotea*) with interspersed areas of hard corals (Sullivan, Sealey et al., 2002). Corals may include Finger Coral (*Porites porites*) or Staghorn Coral (*Acropora cervicornis*). In protected areas, shallow water Starlet Coral (*Siderastrea radians*) and Rose Coral (*Manicia areolata*) may also be found (Kaplan, 1988).

Seagrass beds are complex communities that include large numbers of epiphytic organisms, burrowers, and other organisms requiring food and shelter (Nybakken, 1982). By directly providing shelter and food, their structural complexity may control or contribute to benthic community composition, and potentially increase species abundance and diversity (Berkenbusch et al., 2007). Extensive seagrass beds are typical and widespread habitats throughout shallow tropical waters and are often associated with coral reefs (Nakamura et al., 2007). Seagrass meadows form important nursery areas, providing habitat for juvenile fish and various invertebrates (Dawes, 1987) and a food source for herbivorous fishes and sea turtles (Buchan, 2000).

After passing through a pelagic larval stage, many coral reef fishes settle into surrounding habitats, such as seagrass beds and mangroves (Nakamura et al., 2007), thereafter entering the benthic juvenile stage. Some common fishes of The Bahamas that utilize seagrass communities are the Great Barracuda, Reef Silversides (*Allanetta harringtonensis*), Dwarf Herrings (*Jenkinsia lamprotaenia*) and the Redfin Needlefish (*Strongylura notata*). Herbivorous fishes known to eat Turtle Grass include parrotfish (Scaridae), surgeonfish (Acanthuridae) and Pinfish (*Lagodon rhomboids*). Small coral outcroppings that may be associated with grassbeds often will host Sergeant Majors and other damselfishes (Pomacentridae), wrasses (Labridae), such as Slippery Dicks and the Puddingwife (*Halichores radiatus*), and juvenile grunts (Haemulidae).

Other than corals, seagrass beds harbor a tremendous diversity of macroinvertebrates, including both infauna and epifauna. Most of the species mentioned under sand bottom habitats also occur in seagrass beds. Additional taxa include representatives of the gastropod families Cerithidae, Turbinidae, Fasciolariidae and Columbellidae; the hermit crab *Clibanarius vittatus*, the urchin *Lytechinus variegatus*, a variety of brittle stars and polychaete worms, and the anemones *Condylactis gigantea* and *Stoichactis helianthus*.

Six separate seagrass beds exist offshore of the site. The seagrass beds offshore of the site consisted primarily of Turtle Grass (*Thalassia testudinum*) with lesser amounts of Manatee Grass (*Syringodium filiforme*) (ERM, 2007), and some Shoal Grass (*Hodule wrightii*). Green macroalgae was mixed in with the seagrass, growing on the surface of the grass in some locations.

This marine habitat type comprises approximately 2.47 acres (0.55 percent) of the marine survey area.

4.2.2.5 *Sargassum Flats*

Three species of *Sargassum* have been identified off the eastern coast of New Providence Island (Sullivan Sealey, 2004). *Sargassum hystrix* is common in The Bahamas, but is rarely found in shallow waters typical of the survey area. Shallow-water species such as *S. polyceratium* or *S. pteropleuron* most likely dominate the Sargassum flat habitats within the survey area. *S. polyceratium* can grow to three feet in height and is found growing on rocks in moderately turbulent habitats to a depth of 45 feet. *S. pteropleuron* can grow to 12 feet in height and is found on small rocks or coral fragments in water up to 16 feet deep (Littler, 1989).

Other species of macroalgae may also be found among the *Sargassum*. Up to 23 species of algae have been identified at shallow-water sites in the Central Bahamas (Sullivan Sealey, 2004). Common genera include: *Caulerpa* spp.; *Halimeda* spp.; *Penicillus* spp.; *Valonia* spp.; *Ventricaria* spp.; *Dictyota* spp.; *Lobophora* spp.; *Padina* spp.; *Amphiroa* spp.; *Coelothrix* spp.; *Neogoniolithon* spp.; and *Schizothrix* spp.

Only one *Sargassum* bed exists in the vicinity of the site, approximately 500 feet offshore of the southeastern corner of the project site. The *Sargassum* is attached to bare, hardbottom or to hard substrate with a thin covering of sand in this area. Several species of coral and fish were observed within the *Sargassum* bed, but the corals are small and dispersed (ATM, 2006). This community structure is typical in disturbed areas of The Bahamas, where a combination of nutrient enrichment, increased particulate loads, and declines in natural predators have encouraged prolific *Sargassum* growth. *Sargassum* actively competes with corals for space on the seafloor, and in areas with large standing crops of *Sargassum*, coral growth is often limited.

This marine habitat type comprises approximately 28.91 acres (6.27 percent) of the marine survey area.

4.2.2.6 *Hard-Bottom*

Hard-bottom with Coral

This habitat is referred to as 'hard bar' in The Bahamas, and is descriptive of coral- and sponge-dominated hardbottom (Sullivan Sealey, 2004). Several natural processes of cementation, lithification, and levels of crystallization result in a hard underwater surface. Nearshore, hardbottom communities in the Bahamian Archipelago typically are expressed as an extension of island platforms. An oolite, mixed with skeletal or coral components is the dominant base sediment in many areas (Sullivan Sealey et al., 2002). Hard bar habitats tend to have low coral density and are dominated by many small individuals and few large coral colonies. Mean colony diameters are around 3 cm^2, perhaps because recruits are attracted to areas where space is less limited, or larger colonies may contribute to lower size classes through asexual fission. Hard bar environments tend to be affected by acute scouring from hurricane events, and small colony sizes may also be the result of recovery from hurricanes that affected The Bahamas in recent years. Small colonies are more subject to impacts from acute events, such as sedimentation and burial; survival tends to be low, as evidenced by low numbers of colonies in middle to large size classes (Semon, 2006).

The most abundant stony coral species are *Siderastrea radians, Favia fragum,* and *Porites astreoides*. These species tend to be less sensitive to chronic pollutants, are generally small in size, have high growth rates, and frequently reproduce via asexual fission (Semon, 2006). *Diploria clivosa*, a large broadcasting brain coral also is found commonly in the hard bar habitat. Surveys of hard bar habitat on Little Bahama Bank identified other common stony corals such as *Siderastrea siderea, Diploria labyrinthiformis, Montastrea annularis, M. cavernosa*, and *Porites porites*.

While found in lower densities on nearshore hard bar than on reefal habitats, sponges are also conspicuous inhabitants of this habitat. Common species may include: *Niphates digitalis; Xestospongia muta; Holopsamma helwigi; Cliona delitrix; Ircinia strobilina; I. felix; Monanchora unguifera; Spheciospongia vesparium;* and *Aplysina fistularis* (NCRI, 2003).

Gorgonian octocorals occur in nearshore hard bar habitats and range from scattered to high densities. Species include: *Eunicea* spp..; *Plexaura flexuosa; Pseudopterogorgia* spp.; *Pterogorgia anceps; Plexaurella* spp..; and *Pseudoplexaura* spp.. (NCRI, 2003). Numerous Purple Sea Fans (*Gorgonia ventalina*) also occur here. Macroalgae are not as obvious here as in they are macroalgae-dominated hardbottom, but they are common and may include: *Halimeda* spp..; *Rhipocephalus phoenix; Penicillus* spp..; and *Ventricaria ventricosa* (NCRI, 2003).

Rock ledges and crevices provide ideal habitat for cryptic reef fish, such as squirrelfish (Holocentridae). Wrasses and damselfishes typically dominate hard bar fish assemblages; commonly observed species include Bluehead Wrasse, Blue Chromis (*Chromis cyanea*), and Yellowtail Damselfish (*Microspathodon chrysurus*). Other fishes identified in this habitat type include: juvenile Nassau Grouper (*Epinephelus striatus*), Harlequin Bass (*Serranus tigrinus*), Ocean Triggerfish (*Canthidermis sufflamen*), small snappers (Lutjanidae), grunts (Haemulidae), and barracuda (NCRI, 2003).

Brain, star, and finger corals, as well as sea fans and a variety of sponges occur over coral-dominated hardbottom offshore of the site (ATM, 2006; ERM, 2007). Squirrel Fish (*Holocentrus sp.*), juvenile Nassau Grouper, Harlequin Bass, Ocean Triggerfish, Sergeant Majors, and Bluehead Wrasse occur in this habitat.

This marine habitat type comprises approximately 255.50 acres (55.52 percent) of the marine survey area.

Hard-bottom with Macroalgae

All of the three major groups of macroalgae are common in The Bahamas: green (Chlorophyta), brown (Phaeophyta), and red (Rhodophyta) (Kaplan, 1988). Green algae include Merman's Shaving Brush (*Penicillus* spp..), Mermaid's Fan (*Udotea flabellum*), Feather Alga (*Caulerpa sertularioides*), and *Halimeda* spp.. Brown algae produce the most complex plant bodies among the algae and are usually large and fleshy; many attach to hardbottoms. Brown algae include *Sargassum*, *Dictyota*, and *Padina*. Red algae are almost exclusively marine, common in tropical and subtropical waters and abundant in intertidal and subtidal zones. Red alga includes species of the genera *Laurencia*, *Hypnea*, *Wrangelia* and *Dasya*. A recent study at six sites in Montagu Bay, New Providence Island, identified 37 species of macroalgae (Sullivan Sealey, 2004).

From a faunal standpoint, shallow (<25 feet), nearshore hardbottom with macroalgae have been reported to function as important juvenile fish habitat (Baron et al., 2004). Newly settled and early juveniles are the dominant component (>84 percent) of the inshore fish community, consisting primarily (>90 percent) of grunts (Haemulidae), followed by wrasses (Labridae) at about 5 percent, and damselfish (Pomacentridae) at roughly 2 percent. Common Bahama wrasse species include the Bluehead Wrasse and Yellowhead Wrasse (*Halichoeres garnoti*). Juvenile groupers (Serranidae) and snappers (Lutjanidae) also may utilize this habitat.

Common invertebrates may include sponges, gorgonians and hard corals. Semon et al. (2006) identified 18 coral species in nearshore 'hard bar' environment and reported the dominant species by number to be *Siderastrea radians* (Lesser Starlet Coral), *Favia fragrum* (Golfball Coral), and *Porites astreoides* (Mustard Hill Coral). The dominant species by area covered were *Diploria clivosa* (Knobby Brain Coral), *Montastrea annularis* (Boulder Star Coral), and *Porites porites* (Finger Coral). The large edible urchin *Tripneustes ventricosus* is sometimes common on almost barren inshore hardbottoms where it grazes algae down to a fine turf.

The remains of a jetty or groin that joins the shore west of Stuart Cove's dive operation was included in this habitat type. Various *Porites*, *Diploria*, sea rods, and gorgonians occur in this habitat type, and juvenile grunts, groupers, and snappers occur in macroalgae-dominated hardbottom habitat near the site (ATM, 2006). The benthic community was somewhat more diverse in the western portion of the survey area than in the eastern part.

This marine habitat type comprises approximately 16.80 acres (3.63 percent) of the marine habitat area.

4.2.2.7 *Patch Reefs*

Patch reefs often develop in channels next to bank margins and are the dominant reef types found on the margin of the Great Bahamas Bank (Sullivan and Chiappone, 1992). Patch reefs are defined by their small size (65 – 100 foot diameter), lack of a lagoon, and a foundation of the carbonate sedimentary rock that forms The Bahama platform (Chiappone and Sullivan, 1991; Sullivan Sealey et al., 2002). Patch reefs are important fish habitats, and small patch reefs may be important as hard substrate habitats and as recruitment-refuge areas for commercially-targeted species, such as Spiny Lobster (*Panulirus argus*) and groupers (Serranidae) (Sullivan and Chiappone, 1992).

Nearshore patch reefs are structured by massive frame-building corals, but may exhibit substantial variability in relative abundance of algae, stony corals, sponges and gorgonians (Sullivan Sealey et al., 2002). Average coral colony density and diversity is higher in patch reefs relative to adjacent hardbottom habitat. Nearshore patch reefs also exhibit larger overall population sizes and contain greater numbers of larger older colonies. Most patch reef coral colonies are in middle size classes (1–3 inches), with few reaching large size. Densely populated patch reefs may have greater numbers of large colonies, indicating high sexual reproductive potential (Semon, 2006).

Approximately 30 species of hermatypic (reef-building) stony corals are commonly found in the Central Bahamas. Of these, only a few significantly contribute to the reef-building process: *Montastrea annularis; M. cavernosa; Siderastrea sidereal; Diploria* spp..; and *Porites porites* (Squires, 1958; Newell et al., 1959, cited in Buchan, 2000). Mature patch reefs are often dominated by these species, but many other species also may be abundant, such as *Porites astreoides, Dichocoenia stokesii, Favia fragum, Siderastrea radians, Agaricia agaricites*, and *Millepora alcicornis* (Chiappone and Sullivan, 1991; Semon, 2006).

Sponges are another group of dominant benthic invertebrates found on nearshore patch reefs. Sullivan and Chiappone (1992) found approximately 46 sponge species on the patch reefs of the Central Bahamas, of which they considered 16 abundant: *Amphimedon compressa; Aplysina cauliformis; A. fistularis; Callyspongia vaginalis; Chondrilla caribbea; Cliona* sp.; *Cliona varians;*

Chondrosia reniformis; Dictyonella ruetzleri; Epipolasis lithophagia; Haliclona hogarthi; Iotrochota birotulata; Ircinia felix; I. strobilina; Niphates digitalis; and *Siphonodictyon coralliphagum*. The taxonomy of these species has been updated here, using Humann and DeLoach (2002b) and Hooper and Van Soest (2002).

The mobile macroinvertebrate fauna of patch reefs is rich and diverse and includes grazers, suspension feeders, and predators. Surveys of similar patch reefs on Little Bahama Bank found that most fishes were concentrated around patch reefs and represented a typical reef fish assemblage of damselfishes, wrasses, and parrotfishes. Common species include Bluehead Wrasse (*Thalassoma bifasciatum*), Blue Chromis (*Chromis cyanea*), Bicolor Damselfish (*Stegastes partitus*), Graysby (*Cephalopholis cruentatus*), and Red Hind (*Epinephelus guttatus*) (NCRI, 2003). A few of the more obvious and common taxa are mentioned here. Gastropods include representatives of the families Cypraeidae, Ovulidae, Turbinidae and Fissurellidae; the bivalves Pteriidae, Limidae and Arcidae; *Octopus* spp..; decapod crustaceans belonging to the Stenopodidae, Hippolytidae, Alpheidae, Scyllaridae, Panuliridae (including *Panulirus argus*), Dromiidae, Menippidae, Majoidea and Xanthoidea; polychaete worms in the families Eunicidae, Terebellidae, Serpulidae, Sabellidae, Amphinomidae and Syllidae, and echinoderms such as the pencil urchin *Eucidaris tribuloides* and a variety of brittle stars (e.g., *Ophiocoma* spp.., *Ophioderma* spp.. and *Ophiothrix* spp..)

Offshore and east of the project site, there are several small patch reefs. The reefs will not be affected by the proposed marina and access channel. Several species of common reef fish occur at the patch reefs, including Queen Angelfish (*Holacanthus ciliaris*), Grey Angelfish (*Pomacanthus arcuatus*), Four-eye Butterflyfish (*Chaetodon capistratus*), Nassau Grouper (*Epinephelus striatus*), and juvenile Striped Parrotfish (*Scarus iserti*). Corals on the reefs generally appeared to be in good condition.

This marine habitat type comprises approximately 2.96 acres (0.63 percent) of the marine habitat survey area.

4.2.2.8 *Summary of Marine Habitats*

Table 4.10 provides a summary of marine habitats present in the waters offshore of the project site and nearby, as surveyed by ATM in 2006 and ERM in 2007. For each category, the table enumerates the total land area and the percentage of total site area represented by the land use/habitat.

Table 4.10 Summary of Marine Habitats Coverage

Marine Habitat	Total Area	Percent of Surveyed Area
Coastal Rock/Intertidal	1.23	0.25
Sandy Bottom with Scattered Coral and Macroalgae	146.53	31.85
Macroalgae Beds	5.93	1.30
Seagrass Beds	2.47	0.55
Sargassum Flats	28.91	6.27
Hardbottom with Coral	255.50	55.52
Hardbottom with Macroalgae	16.80	3.63
Patch Reef	2.96	0.63
Totals	460.33	100%

4.2.2.9 *Commercially Important Marine Species*

Commercial fishing is an important component of the Bahamian economy. Most commercial fishing takes place within the approximately 45,000 square mile area of Little Bahamas Bank, Great Bahamas Bank, and Cay Sal Bank (Bahamas Department of Fisheries, undated). Several species are commercially fished throughout the country. Table 4.11 lists the most important commercial marine species in The Bahamas.

Table 4.11 Commercially Important Marine Species[1]

Common Name	Scientific Name
Caribbean Spiny Lobster (Crawfish)	*Panulirus argus*
Queen Conch	*Strombus gigas*
Stone Crab	*Menippe mercenaria*
Sponge (various species)	*Spongia* spp..
Blue-striped Grunt	*Haemulon sciurus*
White Grunt	*Haemulon plumieri*
Jolthead porgy	*Calamus bajonado*
Queen Triggerfish (Turbot)	*Balistes vetula*
Rock Hind	*Epinephelus adscensionis*
Nassau Grouper	*Epinephelus striatus*
Misty Grouper	*Epinephelus mystacinus*
Yellowfin Grouper	*Mycteroperca venenosa*
Lane Snapper	*Lutjanus synagris*
Blackfin Snapper	*Lutjanus buccanella*
Yellowtail Snapper	*Ocyurus chrysurus*
Schoolmaster	*Lutjanus apodus*
Hogfish	*Lachnolaimus maximus*
Goggle-eye	*Selar crumenophthalmus*
Bar Jack	*Caranx ruber*
Black Jack	*Caranx lugubris*
Green Turtle	*Chelonia mydas*
Loggerhead Turtle	*Caretta caretta*

[1]Bahamas Department of Fisheries, undated

The Caribbean Spiny Lobster (*Panulirus argus)* is better known by its vernacular name "crawfish" in The Bahamas. It is a nocturnal predator, and forages on a variety of invertebrates on the reefs. Adults are exclusively demersal and inhabit small caves and other crevices in coral, but during the approximately nine-month larval period, immature lobster known as phyllosomes drift in the ocean currents as plankton. Their prolonged planktonic larval stage allows Caribbean spiny lobsters to colonize areas far removed from their natal reefs. Recent research suggests that a significant number of Caribbean spiny lobsters recruiting to nearshore habitats in the United States originate in The Bahamas (SEDAR, 2005). As young juveniles, Caribbean spiny lobsters are dependent on a variety of shallow-water habitats, including mangroves, seagrass beds, and shallow reefs for shelter from predators and food (Bahamas National Trust, 2003). Adults are generally large enough to escape predation from most fish, but require hard coral *refugia* to escape sea turtles, sharks, and other large predators. Habitat for Caribbean spiny lobsters at the project site is scarce. The seagrass beds offshore may provide limited nursery habitat for juvenile lobsters, but hard coral is uncommon offshore of the project site, and the coral that is present provides little suitable refuge for adult lobsters.

The Queen Conch *(Strombus gigas)* is a culturally significant species in The Bahamas and has been a staple food for native Bahamians for centuries (Bahamas National Trust, 2003b). Juveniles and adults are exclusively demersal and occur most often in seagrass or macroalgae beds, which constitute the species' primary food source. Adults produce string-shaped egg masses that adhere to sandy bottoms. Larval Queen Conch, or veligers, drift in the plankton for approximately two months before settling to the ocean bottom as juveniles. The seagrass and macroalgae communities near the project site provide moderately valuable habitat for Queen Conch. During the marine habitat verification exercise, one immature "roller" queen conch was observed adjacent to a macroalgae bed in approximately eight feet of water at the project site. In their Environmental Impact Assessment of the adjacent Albany site, Turrell and Associates cite personal communication with Mr. Pericles Maillis in 2005, in which Mr. Maillis noted that Queen Conch populations in the vicinity of the project site had been reduced significantly by over-fishing.

Stone Crabs *(Menippe mercenaria)* are found in several marine habitats, including reefs, mudflats, and vegetated marine habitat. They prey on a variety of other marine invertebrates (Wenner, undated), and may be found wherever sufficient food and cover from predators is available. The most valuable habitat for stone crabs near the project site is likely in the macroalgae and seagrass beds, which may provide nursery habitat for young crabs as well.

Several species of sponges are commercially exploited in The Bahamas. Sponges are sessile as adults. They may occur in virtually any type of marine habitat that provides sufficient hard substrate on which to attach. Hard substrate in the vicinity of the project site provides habitat for sponges, but sponges are not plentiful in the near the project site. Several individual sponges were observed scattered over hardbottom areas during the marine habitat survey, but they were not common anywhere within the surveyed area. Sponges may be harvested occasionally in the project area, but harvestable sponges are not common near the project site. Further, The Bahamas Department of Fisheries does not consider the project area to be a commercial fishing area. Therefore, extraction of sponges does not likely occur in the immediate vicinity of the project on a commercial basis.

Blue-striped Grunts *(Haemulon sciurus)* and White Grunts *(H. plumieri)* are similar in size, shape, and habit. Both are small to medium-sized fish with dorso-ventrally compressed bodies. Blue-striped and White Grunts typically are found in groups of a few individuals near coral reefs, and blue-striped grunts are particularly common near underwater ledges (Humann, 1996). *Thalassia testudinum* beds are important nursery habitat for juveniles of both species (Froese & Pauly, 2006). The general lack of coral at the project site limits the value of the nearshore environment for adults of either species, but the seagrass beds within the project area may provide habitat for juveniles of both species.

Jolthead Porgies (*Calamus bajonado*) are a medium-sized fish that generally are solitary as adults, but may school as juveniles (SAFMC, undated). Like grunts, Jolthead Porgies typically are found over reefs, although they also may occur over sand bottoms adjacent to reefs or vegetated sandy areas (SAFMC, undated). No significant hard coral exists within the nearshore zone adjacent to the project site; however, patch reefs exist to the immediate east and south of the project site, and the *Thalassia testudinum* beds immediately offshore of the project site provide potential habitat for Jolthead Porgy.

The vernacular name "Turbot" is used to describe several species of triggerfish throughout the tropical western Atlantic Ocean and Caribbean Sea, but in The Bahamas it is most often used as a synonym for Queen Triggerfish, *Balistes vetula* (Froese & Pauly, 2006). Queen Triggerfish may be found in areas of benthic vegetation areas, but are more common on reefs. This species is adapted behaviorally and anatomically to preying on sea urchins (Humann, 1996), and are most common where sea urchins are abundant. Queen triggerfish are likely rare immediately offshore of the project site, although they may be found occasionally in the seagrass beds near the project site.

All of the commercially important groupers in The Bahamas primarily inhabit coral reefs. Two species, the Rock Hind (*Epinephelus adscensionis)* and Nassau Grouper (*Epinephelus striatus)*, are common in shallow waters. The Rock Hind prefers rocky shallow areas with numerous caves and other crevices in which to hide (Humann, 1996). Nassau Groupers are rarely found deeper than 90 feet. Adults are almost exclusively reef dwellers (Humann, 1996), but juveniles may be found in seagrass beds. Adult Yellowfin Grouper (*Mycteroperca venenosa*) may occur in a variety of depths where coral is abundant, and juveniles use shallow turtle grass (*Thalassia testdudinum*) beds as nursery habitat. Misty Grouper (*Epinephelus mystacinus*) are primarily a deepwater species, rarely if ever occurring shallower than 100 feet (Froese & Pauly, 2006). Most of the hardbottom adjacent to the project site is smooth limestone with few crevices, so with the exception of the jetty near the central portion of the project site shoreline the marine habitat in the vicinity of the project site does not likely provide high quality Rock Hind habitat. Juvenile Nassau and Yellowfin Grouper may use the seagrass beds adjacent to the project site as nursery habitat, but the absence of reefs in the immediate project area limits the area's value as habitat for adults of both species. Misty Groupers would not be expected to occur near the project site, owing to the species preference for deeper water.

The commercially important snappers in The Bahamas have diverse habitat preferences. Most are found predominantly over shallow reefs, but Lane Snapper (*Lutjanus synagris*), Schoolmasters (*Lutjanus apodus*), and Yellowtail Snapper (*Ocyurus chrysurus*) may be found in other shallow water habitats, as well (Humann, 1996). Schoolmasters often use estuarine areas as nursery habitat. Blackfin Snapper are found exclusively in deep water as adults, but may be found near rock ledges and reefs as shallow as 20 feet as juveniles (Humann, 1996). Juvenile Yellowtail Snapper were observed immediately offshore from the project site at the nearshore hardbottom/sand bottom interface during the marine habitat survey, and Lane Snapper and Schoolmaster also may be found occasionally in the area immediately offshore of the project site. The deeper habitats and submarine outcrops preferred by Blackfin Snapper do not occur in the immediate vicinity of the project site, so this species is not likely to occur in the immediate area.

The vernacular name "Goggle-eye" is used throughout the world to refer to a variety of marine and freshwater fish. In The Bahamas, Goggle-eye is a local synonym for Bigeye Scad *(Selar crumenophthalmus)* (Froese & Pauly, 2006). This species is pelagic, but it ranges across a variety of habitats throughout the ocean and appears occasionally close to shore (Humann, 1996). Goggle-eyes likely occur in the vicinity of the project site on a transient basis.

Hogfish (*Lachnolaimus maximus*), unlike most other commercially important fish species in The Bahamas, are generally found over bare bottom adjacent to reefs where they dig into the substrate for shrimp, worms, and other infaunal prey (Bester, undated.). Their affinity for bare bottom habitat in close proximity to reefs makes the nearshore area adjacent to the project likely habitat for juvenile and adult hogfish.

Both the Bar Jack (*Caranx ruber*) and Black Jack (*C. lugubris*) are typically considered pelagic, open-ocean species. Black Jacks generally are found near drop-offs and walls adjacent to deep water (Humann, 1996). Bar Jacks are common in open water environments, but juvenile bar jacks were observed over shallow hardbottom habitat adjacent to the project site during the habitat survey. Bar Jacks are known to follow stingrays and goatfish. The project site may likely provide forage habitat for juvenile Bar Jacks.

Green Turtles (*Chelonia mydas)* are herbivores as adults. Generally, they are found in coastal lagoons and shoals with abundant marine grass and algae. Juvenile Green Turtles are known to seek refuge and food in Sargassum rafts, where they feed on a variety of plants and small animals. (U.S. Fish & Wildlife Service, 2005). Loggerhead Turtles (*Caretta caretta*) are found in a wider variety of habitats from the open ocean to inshore bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers (U.S. Fish & Wildlife Service, 2006). The Loggerhead Turtles' diet varies according to habitat. In coastal areas they consume primarily shellfish and crabs, but also scavenge fish or fish parts. In the open ocean, they feed on the many of the species found with Sargassum rafts, especially sea snails, jellyfish, and other slow-moving macroinvertebrates (SEAMAP, undated). Either species of turtle could be found in the coastal waters near the project site. The macroalgae and seagrass beds near the project site could attract Green Turtles, and Loggerhead Turtles could occur on a transient basis. Both species require relatively undisturbed sand beaches to nest. Adequate nesting habitat does not occur along the project shoreline for either species.

4.2.3 Protected Habitat/Species

4.2.3.1 Protected Terrestrial and Aquatic Habitats

As detailed in The Bahamas Environmental Handbook (BEST Commission, 2002), The Bahamas has signed and ratified several international conventions that are intended to sustain and promote biological diversity and the ecological resources throughout The Bahamas. Among these are the:

- Convention on Biological Diversity (CBD - signed 1992/ratified 1993);
- Cartegena Protocol on Biosafety to the CBD (signed 2000);

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES – acceded to 1979); and
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention – ratified 1997).

National-level efforts undertaken by The Bahamas in response to these international conventions include the creation of the Development of The Bahamas Biological Diversity Plan (BDP - 1997) and The Bahamas National Biodiversity Strategy and Action Plan (NBSAP - 1998). A partial list of actions taken at the national level to support the BDP and NBSAP include the:

- Completion of a Country Study of Biodiversity (1995);
- Establishment of regulatory requirements for Environmental Impact Assessments (EIAs);
- Designation of 12 National Parks, under the management of The Bahamas National Trust, and the protection of habitat, communities and species in all such protected areas;
- Establishment of the national Botanical Gardens; and
- Development of plans and programs by the BEST Commission for outreach and awareness programs to foster the appreciation and protection of biological diversity.

In response to the Ramsar Convention, The Bahamas enacted the Conservation and Protection of the Physical Landscape of The Bahamas Act to preserve and protect wetlands that might otherwise be destroyed or compromised by development. Additionally, in 1999, The Bahamas created the National Ramsar Committee under the administration of the BEST Commission. In the same year, The Bahamas initiated the National Creeks and Wetlands Restoration Initiative (NCWRI). The objectives of the NCWRI were to (i) identify creeks and wetlands in need of restoration; (ii) to implement corrective measures and management protocols; (iii) to encourage public awareness and involvement in the protection; management, and restoration of creek and wetland resources; (iv) to undertake an inventory and characterization of Bahamian creeks and wetlands that should be considered for preservation; and (v) to develop and implement management plans for sites to be preserved.

The Bahamas National Trust has established numerous national parks, nature reserves and wilderness areas. To date, 25 such parks and reserves have been established. Bahamian parks and reserves on New Providence include the:

- The Retreat;
- Bonefish Pond National Park;
- The Primeval Forest; and
- Harrold and Wilson Pond National Park.

According to the BEST Commission (2002), the Bahamian Department of Fisheries, in consultation with The Bahamas Reef Environmental Education Foundation (BREEF), The Bahamas Natural Trust, and other participants, has identified a number of areas of marine habitat for the establishment of marine protected areas or MPAs. These include North Bimini, the Berry Islands (from Frozen Cay to Whale Cay), South Eleuthra (Powell Point to Schooner Cay), Exuma Cays (south of Land and Sea Park in the area of Lee Stocking Island), and the northern Abaco Cays.

With the exception of the Primeval Forest, located approximately 0.5 miles to the northeast of the South Ocean Beach Resort, no existing landside or marine parks, reserves, or protected areas currently exist in proximity (i.e.; within approximately 3 miles) to the proposed NSOD project site. The Primeval Forest represents one of the few untouched natural terrestrial habitats remaining on New Providence Island. The floral assemblage present at the Primeval Forest is ancient, primary-growth, broadleaf forest that has not been disturbed historically, unlike the coppice habitat on the project site.

Additionally, according to the BEST Commission (2002), The Bahamas National Trust is considering the designation of a protected marine environment off the southwest coast of New Providence Island to the south of the proposed project, owing to the ecological and socio-economic value provided by this habitat. This general area is known to include patch reefs and hardbottom habitat, which supports populations of stony corals, soft corals, and other soft-bottom, hard-bottom, and reef invertebrates and fishes. Aside from their inherent ecological value, these living resources attract and support commercially significant recreational diving (snorkel and SCUBA) activities.

Additionally, Chapter 260 of laws of The Bahamas (1997), regarding The Conservation and Protection of the Physical Landscape of The Bahamas, specifically prohibits the filling of blue holes without the express written permission of the government.

4.2.3.2 *Protected Terrestrial and Aquatic Flora and Fauna*

The Bahamas Environmental Handbook (2002), enumerates endangered terrestrial and aquatic flora and fauna of The Bahamas, based on CITES. Additionally, Bahamian laws and regulations have been promulgated that protect specific faunal and floral species. These regulations include the:

- Wild Animals Protection Act (Chapter 248); and
- Wild Bird Protection Act (Chapter 249).

Protected Flora

Nine terrestrial plant groups and species are listed, including all members of the Cactaceae (cactus), Cycadaceae and specifically *Zamia* (cycads), Orchidacceae (orchids), Mahogany (*Swietenia mahagoni*), Lignum vitae (*Guaiacum sanctum* and *G. officinale*), and all species of the genera *Euphorbia* and *Aloe*. No marine plants are listed.

Flora protected by Bahamian regulations (BEST, 2005) include:

- Rauwolfia (*Rauvolfia nitida*);
- Red Cedar (*Juniperus virginiana*);
- Silk Cotton Tree (*Ceiba petandra*);
- Horseflesh (*Lysiloma sabicu*);
- Lignum vitae (*Guaiacum officinale*);
- Mahogany (*Swietenia mahagoni*);
- Brasiletto (*Caesalpinia bahamensis var. reticulata*);
- Candlewood (*Gochnatia ilicifolia*);
- Caribbean Pine (*Pinus caribaea var. bahamensis*);
- Beefwood (*Guapira discolor*); and
- Black Ebony or Boa Wood (*Disopyros* spp).

Vegetation surveys of the adjacent Albany site in 2005 by Turrell & Associates, Inc. recorded Caribbean Pine, Mahogany, and Beefwood. Floral surveys completed on the South Ocean Beach Resort site in 2006 by ATM confirmed the presence of only one protected plant species, Caribbean Pine, in the on-site, mixed Evergreen/Broadleaf forest (coppice). ATM survey findings in the Broadleaf Forest (Broadleaf Coppice) documented the occurrence of Horseflesh and scattered specimens of Caribbean Pine. ATM also noted fairly common occurrences of Mahogany in the developed portions of the resort. Also, intermittent occurrences of Mahogany, Horseflesh, and Caribbean Pine were noted on the existing golf course.

Surveys of the upland habitats of the South Ocean Beach Resort in January 2007 by ERM documented scattered, infrequent occurrences of Mahogany, Horseflesh, and Caribbean Pine as part of the coppice habitat located on-site and within the developed portions of the resort and golf course. No other protected floral species were noted.

Protected Fauna

Based on the BEST Commission (2002) citation of CITES endangered species, three species of mammals, 15 species of birds, and six species of reptiles present in The Bahamas or Bahamian waters are considered endangered. Endangered mammals include the:

- West Indian Manatee (*Trichechus manatus latirostris*);
- Humpback Whale (*Megaptera novangliae*); and
- Northern Right Whale (*Eubalaena glacialis*).

In addition, The Bahamas Wild Animals Protection Act (1968) provides protective status to three additional mammalians, including wild horses on Abaco (*Equus caballus*), iguanids of the genus *Cyclura*, and the Agouti or Hutia (*Geocapromys ingrahami*).

Endangered avifauna listed by CITES include the:

- West Indian Tree Duck or West Indian Whistling Duck (*Dendrocygna arborea*);
- Sharp-shinned Hawk (*Accipter stiatus*);
- Red-tailed Hawk (*Buteo jamaicensis*);
- March Hawk (*Cicrus cyaneus*);
- Osprey (*Pandion haliaetus*);
- Peregrine Falcon (*Falco peregrinus*);

- Merlin (*Falco columbarius*);
- American Kestrel (*Falco sparverius*);
- Bahamas Parrot (*Amazona leucocephala bahamensis*);
- Barn Owl (*Tyto alba*);
- Burrowing Owl (*Speotyto cunicularia*);
- Cuban Emerald (*Chlorostilbon ricordii*);
- Bahamas Woodstar (*Calliphlox evelynae*);
- Ruby-throated Hummingbird (*Archilochus colubris*); and
- Rufous Hummingbird (*Selasphorus rufus*), although according to The Handbook of the Birds of the World (del Hoyo, 1999), this species is not present in The Bahamas.

Endangered herpetofauna listed by CITES include the:

- Bahamian Boa Constrictors (*Epicrates* spp.., actually *E. chrysogaster, E. exsul,* and *E. striatus*);
- Pygmy Boa Constrictor (*Tropidophis canus*);
- Bahamian Rock Iguana (*Cyclura spp..*, actually *C. carinata* in the southern Bahamas, *C. cychlura* in the northern Bahamas, and *C. rileyi* in the central Bahamas);
- Cat & Eleuthra Island Terrapin (*Trachemys terrapin*);
- Inagua Terrapin (Trachemys stejnegeri); and
- American Crocodile (*Crocodylus acutus*)**.

(**The website "Caribherp" for West Indian Amphibians and Reptiles, published by Penn State University, does not list this species as occurring in The Bahamas).

BEST (2002) cites four endangered marine turtles based on CITES, including the:

- Loggerhead Sea Turtle (*Caretta caretta*);
- Green Sea Turtle (*Chelonia mydas*);
- Hawksbill Sea Turtle (*Eretmochelys imbricata*); and
- Leatherback Sea Turtle (*Dermochelys coriacea*).

No evidence of marine turtle nesting was noted during environmental surveys of the sandy beach areas completed by Turrell & Associates for the Environmental Impact Assessment of the adjacent Albany site. In the same report, the authors cite personal communication with Mr. Pericles Maillis in 2005, in which Mr. Maillis reported that sea turtle nesting had not been observed on the beach fronting the Albany site, or at any adjacent beach areas, which would include the South Ocean Beach site.

Endangered invertebrates recognized by CITES and listed by the BEST Commission (2002), are limited to marine taxa. They include all species of Black Corals (*Antipathidae*), Fire Corals (*Milleporidae*), Organ Pipe Corals (*Tubiporidae*), as well as all species in the *Schleractinian* (stony corals), including those species in the genera *Acropora, Platygyra, Favia, Labophylia, Seriatopora, Heliopora, Euphylia, Pavona, Stylophora, Pectinia, Merulina, Pocillopora, and Polyphylia*. Detailed taxonomic surveys of corals were not undertaken as part of this assessment; however, the planned development of the NSOD project, including the construction of coastal infrastructure, marina, marina inlet, and marina approach channel will be undertaken to prevent and/or suitably mitigate potential impacts to all marine habitats and species.

No protected or endangered fauna were observed at the site during ATM's survey work in 2006. During ERM's surveys in January 2007, two animal species were observed that enjoy protection under Bahamian Law. These were the Bahamian Woodstar, an endemic hummingbird seen feeding from ornamental landscape on the site, and the American Kestrel, which was noted on the golf course on several occasions over several days.

Additionally, as noted earlier in this report, "Fowl Snakes" are encountered on-site occasionally by grounds maintenance personnel (Personal Communication, 2007a). Fowl Snake is the local common name for the Bahamian Boa Constrictor, *Epicrates* sp. Neither ERM, nor ATM encountered any specimens of this protected species, but based on the observations of Mr. McFall, young boas apparently are present on-site, which also suggests a population of mature, breeding boas. This is evidenced further by the observation in late January/early February 2007 of a shed snake skin, which was attributed to a boa constrictor.

4.3 SOCIOECONOMICS ASPECTS

4.3.1 Land Use

4.3.1.1 Existing Land Use

New Providence Island is a total of 80 square miles in size. In general, most of the intensive land uses occur on the northern and eastern sides of the Island, with the southwestern portion of the Island remaining less developed.

The NSOD project site is located in the southwest portion of New Providence Island, approximately 13 miles from Nassau. In the vicinity of the project site, land use is mixed. South Ocean Boulevard and an electric transmission line corridor separate the NSOD property from private residences and undeveloped land to the east and north, respectively. A brewery abuts the site on the west and separates the NSOD property from The Bahamas Electric Company (BEC) power plant and tank farm, which is located to the west of the brewery. The southern edge of the NSOD property is bounded by the ocean. Southwest Bay Road runs through the southern portion of the property. A small residential enclave sometimes referred to as South Ocean Village sits north of South West Bay Road, south of the golf course, and east of the hotel access road. Figure 4.9 shows existing land use within and in the vicinity of the NSOD property.

Within the NSOD parcel, an 18-hole golf course and buildings remain from the former South Ocean Golf & Beach Resort. With the exception of the hotel's kitchen, which sells breakfast and lunch daily to the maintenance crew working on the grounds and golf course construction crew, none of the existing South Ocean Golf & Beach Resort facilities is currently open for public use. The golf course is currently being renovated and will be open to the public upon completion.

The South Ocean golf course was originally laid out in the early 1970s by architect Joe Lee who incorporated lakes and ponds as well as old ruins that have been identified as ancient slave quarters. Anecdotal information indicates that the former South Ocean Golf Club was a favored destination for both residents of New Providence Island and tourists.

The waterfront along Southwest Bay Road in the NSOD property is generally rocky. A portion of the shoreline in front of the existing waterfront hotel structures contains a seawall behind which a beach was constructed.

This existing man-made beach area is currently in poor condition. Project plans call for developing a natural beach in equilibrium with existing ocean conditions.

On the waterfront in front of the NSOD property is a small inlet and facilities that house Stuart Cove's Dive Shop and operations. The dive shop and facilities support an active business that is used by Bahamians, tourists, and filmmakers, and focuses on offshore diving and snorkeling at sites south of the NSOD property and off the western tip of New Providence Island.

Royal Beach States is a residential gated community located southeast of the ocean front hotel. It is a cluster of 26 two-story townhouses and one-story condos on the ocean front. Some of these units are available for rent and others are owner-occupied.

3 *Figure 4.9 Existing Land Use*

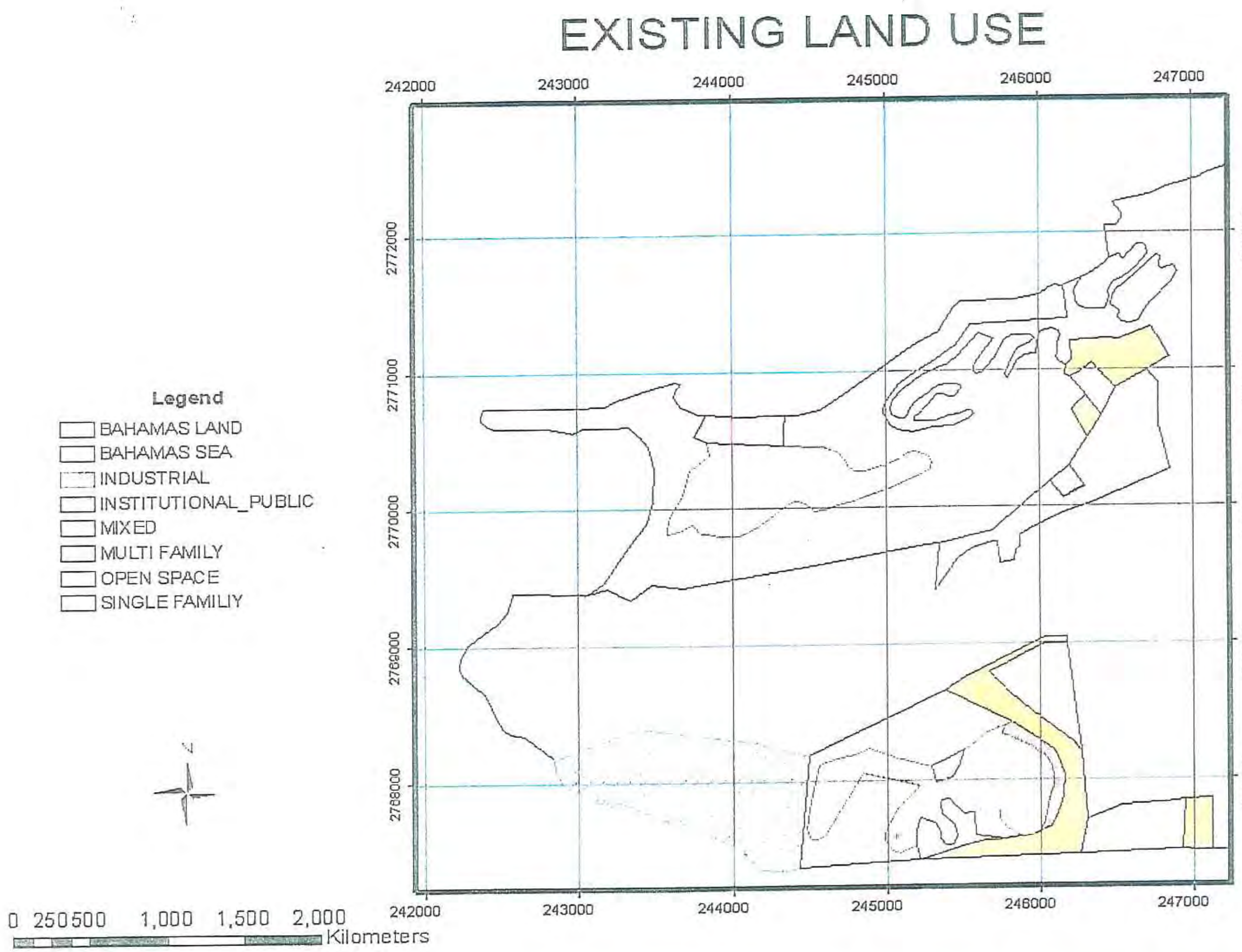

Figure 4.9 Existing Land Use

4.3.1.2 *Planned Land Use*

A major goal of New Providence is to enhance and expand tourist opportunities, and there is considerable interest in the development of the western portion of the island as a destination for both tourists and residents (interview with D. Johnson, Deputy Director General, Ministry of Tourism, 31 January 2007). At this time, several major changes in land use are in varying stages of planning and development on the western portion of the island. Proposed for development to the east of the NSOD site and currently undergoing environmental review, Albany will be a private golf, marina and residential community comprising approximately 570 acres. The project will include 100 apartments and 375 single family home-sites, a marina, an 18-hole golf course with clubhouse, a fitness center and beach club, an equestrian center, and a family water-park. The marina will contain about 90 slips sized to accommodate "mega-yachts" (Turrell & Assoc. 2005).

There are some informal plans for moving the existing container port from downtown Nassau to the western end of New Providence. At this time, an environmental impact assessment has been completed and the Southwest Port Joint Task Force has contracted for the development of a business plan for the port.

The development of Clifton Heritage Park on the western end of New Providence is also underway. The three-phased restoration began in the summer of 2005 and is ultimately to include the purchase of adjacent land and development of the area as a national park and heritage site. The property has been characterized as a "meeting ground of cultural, environmental and historical significance" (Brennan. 2004). With the combined development of the NSOD project, Clifton Heritage Park, Albany, and the Port, the New Providence government hopes that southwest New Providence will become "a destination on its own that will lure Bahamians and tourists" (Bahamas News, 2006). Figure 4.10 shows the location of the Clifton Heritage Park, the proposed container port, and the Albany development in relation to the NSOD property.

Figure 4.10 Planned Development

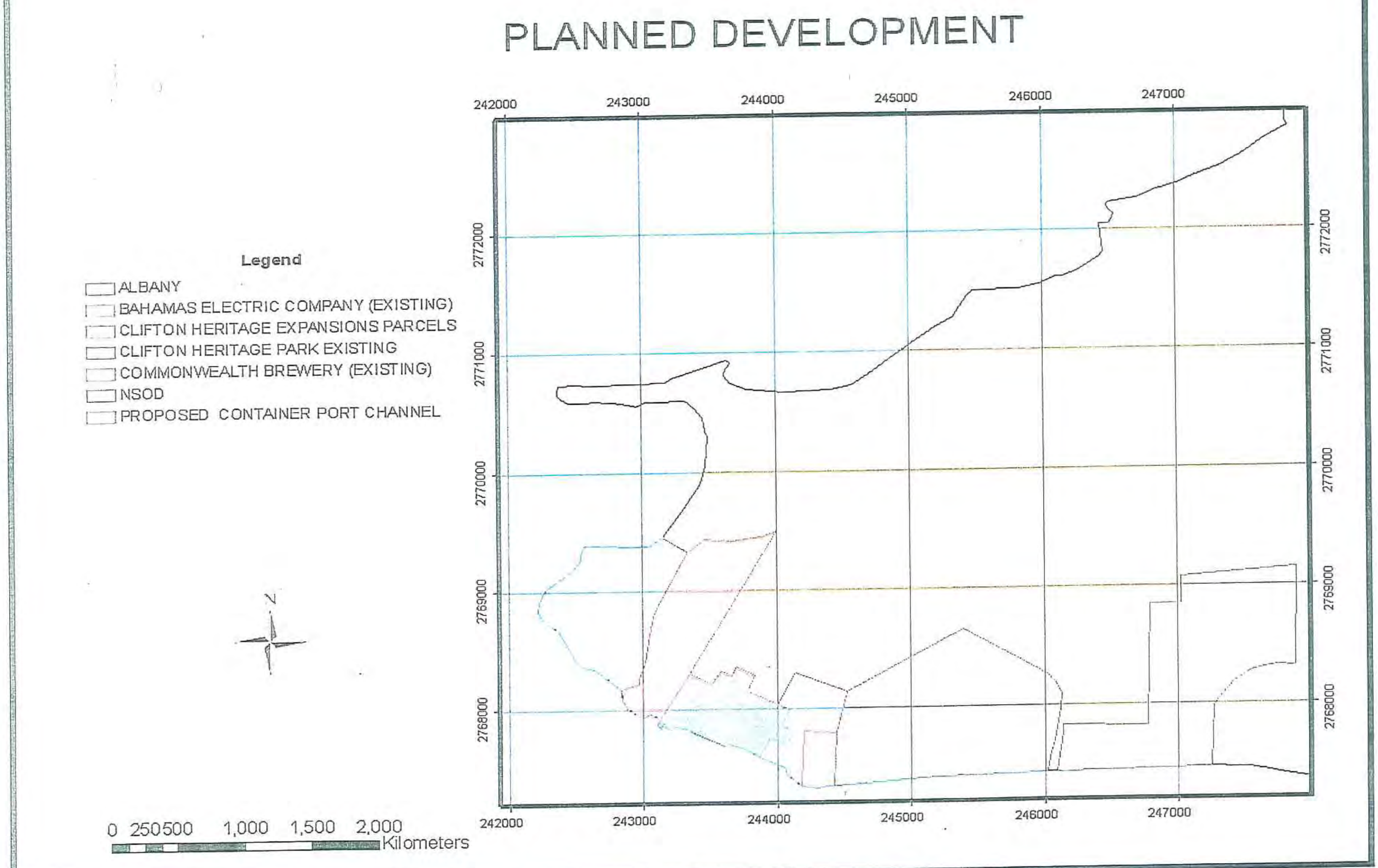

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Figure 4.10 Planned Land Developments

In addition to the Southwest Port, the Albany development, and Clifton Heritage Park, a new residential community has been announced to be constructed in Coral Harbour, also in southwest New Providence. Coral Breeze Estates will contain 260 homes on a 50-acre tract (The Bahamas Journal, www.jonesbahamas.com). The project will include single family and duplex lots.

4.3.1.3 *Zoning*

New Providence zoning is based on existing land uses. Within the NSOD property, the land is identified as open space (existing golf course), touristic (existing hotel buildings and related facilities), single family, and multi-family. Property to the west of the NSOD project site, which contains the brewery and BEC power plant, is identified as a special development area. To the north of the property, land is designated as undeveloped. Immediately east of the NSOD property the land is designated as multi-family and single family. Figure 4.9 shows existing land use (zoning designations) within and in the vicinity of the NSOD project site.

4.3.2 *Population*

4.3.2.1 *Population*

The estimated population of The Bahamas for 2006 is 303,770, and the estimated annual population growth rate is 0.64 percent (CIA, 2006). The last national census was undertaken in 2000, at which time The Bahamas contained 303,611 people at an average population density of 56 people per square mile. New Providence contains the largest portion of the Country's population and the highest population density. With approximately 69 percent of the Country's population in 2000 (210,832 people), New Providence had an average population density of 2,635 people per square mile (Sealey, 2005). Approximately 85 percent of the Country's population is black, 12 percent is white and 3 percent is Asian and Hispanic.

The country had an estimated net migration rate of -2.17 per 1000 people in 2006. Table 4.12 provides the breakdown of residents by citizenship.

Table 4.12 The Bahamas Population by Citizenship – 2000

Nationality	Population	Percent of Total	Percent of Foreigners
Jamaica	3919	1.3%	10.2%
Haiti	21,426	7.1%	55.7%
Turks and Caicos	507	0.2%	1.3%
Rest of West Indies	865	0.3%	2.2%
All West Indies	26,717	9%	69.4%
Canada	1404	0.5%	3.7%
USA	4467	1.5%	11.6%
All North America	5885	2%	15.3%
UK	1771	0.6%	4.6%
Rest of Europe	1062	0.4%	2.8%
All Europe	2833	1%	7.4%
Rest of world	3019	1%	7.9%
All foreign	38,454	13%	100%
All Bahamian	265,157	87%	
Total Bahamas Population	303,611	100%	

Source: Sealy 2005.

As Table 4.12 shows, while more people are migrating out of The Bahamas than are moving in, there are a significant number of foreign immigrants within the country. Most immigrants choose to reside in New Providence or Grand Bahama Island (Department of Statistics, 2004).

Foreign immigrants account for approximately 13 percent of the Country's population. Immigrants from the West Indies comprise roughly 9 percent of the population; Haitians alone constituted at least 56 percent of all foreign born residents in 2000 (Sealy, 2005). On New Providence, the largest Haitian communities are located on Carmichael Road, roughly ten miles west of Nassau, and in the Englerston and Fox Hill communities of Nassau (Treco, 2002).

Within The Bahamas as a whole, there has been a consistent rural to urban migration trend over several decades, with Bahamians in the more remote islands moving to the Nassau and Freeport areas in search of work, particularly for jobs in, or related to, the tourism industry. Approximately 25,000 people (8 percent of the country's 2000 population) migrated from the Family Islands to Nassau and Freeport between 1980 and 2000 (Sealey, 2005).

Currently, New Providence faces several concerns, including an inadequate supply of freshwater, lack of farmland, and frequent road congestion (Sealey, 2005).

The distribution of the population on New Providence has changed since 1980. Table 4.13 shows that, while the suburbs have always had the greatest number of residents, there has been a growing trend of migration from central Nassau to the suburbs on New Providence.

Table 4.13 *Distribution of Population by Residential Area*

Area	Total Population in 1980	Percent of population in 1980	Total Population in 2000	Percent of population in 2000
Central Nassau Area	43,000	32%	46,403	22%
Inner Residential Area	26,668	20%	25,408	12%
Suburbs	65,769	48%	139,011	66%
Total- New Providence	135,437	100%	210,832	100%
Source: Sealy 2005.				

4.3.2.2 Housing

Overcrowding has been recognized as a problem on New Providence, where low-cost housing is in short supply. The Bahamas' Housing Authority was established by the government in 1983, with a mandate to develop housing for low-income people. In 2001, the government of The Bahamas initiated a program to renovate dwellings in traditional communities and to create new housing opportunities in urban centers, particularly for low-or middle-class residents (Gale, 2006).

Private residential development has generally focused largely on middle-income housing. However, in the 1980s there was a proliferation of low-income, government-sponsored, low-cost housing developments around Nassau (Sealey, 2005). Housing of all categories has been increasing westward and currently, housing for New Providence residents exists as far west as South Ocean, including a number of middle-income houses in the immediate vicinity of the NSOD project site. As noted in section 4.3.1.2, a new gated community, the Coral Breeze Estates, targeted for middle- to upper- income residents is planned for development in Coral Harbour, also in the southwest portion of the Island.

Adelaide Village located approximately three miles east of the NSOD site along South West Bay Road and on the eastern side of the proposed Albany Resort site, is a low-income/lower middle class community. Adelaide's residents have electricity, but limited or no running water; many households rely on a central water supply via public pumps. Many of the streets in Adelaide are not well-paved, indicating that the level of development in the village is not in step with the rest of the area, which features growing middle-income housing and tourism development.

4.3.2.3 *Income*

Average household income in The Bahamas and New Providence in 2004 was $39,626 and $41,119, respectively (Department of Statistics, 2005). Table 4.14 shows that income in Delaporte, the statistical district that encompasses the NSOD project area, is $87,329, which is very high in relation to both the national and island average. This may be due, in part, to the district's inclusion of Lyford Cay, a wealthy private community located north of NSOD. Of the three poorest quintiles in the 2001 Bahamas Living Conditions Survey (BLCS), approximately 64 percent were Haitian immigrants.

*Table 4.14 Household Data**

	Total Number of Private Households**	Average Household Income (B$)	Average Household Size (2000)
The Bahamas	97,570	39,626	3.5
New Providence	67,450	41,119	3.5
Adelaide district[3]	3,111	41,355	3.7
Delaporte district[4]	3,280	87,329	2.6

*The number of households and average household income is for 2004 for The Bahamas and New Providence and 2000 for districts.

**Total households for which income was stated.

Source: Department of Statistics, 2007.

4.3.3 Economy

4.3.3.1 Economy

The Bahamian Department of Statistics characterizes the Bahamian economy as having experienced three distinct phases since 1989: "a recession in the early 1990's, followed by a strong recovery through 1999 and continued growth through 2005." The GDP grew by 3.7 percent, from $5.7 billion to $5.9 billion in 2005, due largely to capital development by government in the housing market and private investments primarily in the hotel industry (Dept. of Statistics, 2006).

[3] The Adelaide statistical district is bounded on the North by South West Bay Road, Adelaide Road and Carmichael road; on the east by Iguana Bay, Ambergris Street, an unnamed road, St. Vincent Road, Faith Avenue, Cowpen Road and Marshall Road; on the South by the Sea; and on the West by an imaginary line that extends from the Sea to South Ocean Boulevard.

[4] The Delaporte Statistical District is bounded on the North by the Sea; on the East by Grove Avenue, Sea View Drive, Marlin Drive, Emery Street, Dolphin Drive, Edmond Street, an imaginary line that extends to Saunders Road, Saunders Road, Lightbourne Avenue, Maxwell Lane, Haven Avenue, Farrington Road, Hawthorne Road David Street, Thompson Boulevard, John F Kennedy Drive, Harrold Road, Theodora Lane and Gladstone Road; on the South by Carmichael Road, Adelaide Road, South West Road, and the Sea; on the West by the Sea, including Lyford Cay.

The Bahamas' economy is highly dependent on tourism and financial services, which accounted for 40 percent and 15 percent, respectively, of the Gross Domestic Product (GDP) in 2004. Following behind tourism and financial services are construction (10 percent), which focuses largely on supporting the tourism industry, and manufacturing (8 percent), which focuses primarily on pharmaceuticals and rum. The tourism industry's contribution to GDP, if tourism-related construction is included, represents approximately half of the Bahamian economy. Table 4.15 lists economic sectors by percentage of the GDP.

Table 4.15 Economic Sectors by Percent of GDP – 2004

Sector	Percent of GDP
Tourism	40%
Government Spending	20%
Financial Services	15%
Construction	10%
Manufacturing	8%
Agriculture and Fisheries	3%

New Providence Island captures the majority of revenues for The Bahamas. As indicated in Table 4.16 below, 2005 revenue from tourism in New Providence, which encompasses Nassau and Paradise Island, was approximately $291 million, reflecting roughly 82 percent of the $325 billion tourism revenues for the country as a whole. As the table also indicates, New Providence occupancy rates for hotels have been steadily increasing, indicating that tourism continues to grow.

Table 4.16 Hotel Occupancy and Revenue 2001-2005

	Bahamas			New Providence		
Year	Revenue (B$)	ADR	% Occ.	Revenue (B$)	ADR*	% Occ.
2001	$ 314,016,004	$ 148.26	60.5%	$260,299,678	$ 164.13	67.2%
2002	$ 332,851,175	$ 155.93	62.0%	$279,393,409	$ 178.20	67.8%
2003	$ 312,463,738	$ 148.39	59.2%	$259,504,795	$ 166.60	66.4%
2004	$ 325,406,257	$ 149.96	66.4%	$266,755,408	$ 166.51	71.0%
2005	$ 355,403,326	$ 156.56	70.4%	$290,978,965	$ 166.00	75.4%

*ADR=Average Daily Rate

Source: Ministry of Tourism, 2005.

Hotels and resorts are the primary source of tourism revenues in The Bahamas and generate approximately 70 percent of all Bahamas tourism revenues and capture about 90 percent of stopover visitors (Edwards, 2004). Although The Bahamas tourism industry is private sector driven, approximately 20 percent of the hotel room inventory was owned by the government in 1992. Since that time, the government has adopted a market-friendly economic policy to facilitate the expansion and diversification of the economy and to deepen the economic benefits derived from the tourist industry and most government-owned hotels have been privatized (Geographia, 1995). In addition, the Hotels Encouragement Act (Statute Laws, chapter 289), amended in 1992, allows for duty-free entry of approved construction materials, furnishings and fixtures for hotel development. The Act reduces the demand on cash flow for hoteliers and encourages regular property renovations (Geographia, 1995).

As indicated in Table 4.16, 2005 revenues for tourism in New Providence, which encompasses Nassau and Paradise Island, was roughly $291 million, reflecting roughly 82 percent of all tourism revenues for The Bahamas in 2005, which amounted to $325 billion. As the table also indicates, New Providence occupancy rates have been increasing as annual demand continues to grow.

Between 2004 and 2005, the Bahamian tourism industry suffered a slowdown in annual growth, from a rate of 8.9 percent in 2004 to 0.9 percent in 2005. This slowdown can be directly attributed to damage to resorts from the 2004 hurricanes Jeanne and Frances (CDB, 2005); this setback in hotel revenues served, however, as a boost to the construction industry. Despite hurricane damage, the country's tourism industry is thriving and hotel developers, including Baha Mar, Kertzner International, and the Tavistock Group, are fueling a multi-billion dollar effort to meet rising tourism demand.

The Bahamas does not have income, sales, estates or inheritances taxes. The only direct tax is a real property tax. Casinos are specially taxed, and there is a $15 departure tax levied at the airports and harbors (US State Department, 2006b). Most government revenue is derived from tariffs and import fees.

4.3.3.2 *Employment/Unemployment*

Over 70 percent of The Bahamas' labor force is employed on New Providence Island. Table 4.17 lists employment in The Bahamas by industry sector.

Table 4.17 Employed Persons by Industry Sector – Bahamas 2004

Industry Group	Total Employed	Percent of Total
Agriculture, Hunting, Forestry & Fishing	7,010	4
Mining, Quarrying, electricity, Gas & Water	2,575	2
Manufacturing	6,175	4
Wholesale & Retail	26,905	17
Hotels & Restaurants	23,765	15
Transport, Storage & Communication	10,335	7
Financing, Insurance, Real Estate & Other Business Services	17,575	11
Community, Social & Personal Services	47,160	30
Not Stated	170	-

Source: Bahamas, 2007.

In 2004, labor force participation in The Bahamas was roughly 76 percent; in New Providence, the participation rate was approximately 78 percent, (Department of Statistics, 2005). Table 4.18 provides a breakdown of employees by occupation in 2000. The majority of the population is engaged in industries other than agriculture, fishing, tourism, or community services. Notably, "other industries" encompasses the financial industry, a major employer in The Bahamas, particularly in New Providence, which is a center for offshore banking.

Table 4.18 *Number and Percentage of People Engaged in Various Industries, 2000*

	Total	Agriculture, Hunting, Forestry & Fishing		Wholesale & Retail Trades, Hotels and Restaurants		Other Community, Social & Personal Services Activities		Other Industries		Not Stated	
		#	%	#	%	#	%	#	%	#	%
The Bahamas	147,206	5,058	3	46,908	32	8,499	6	86,189	59	552	0
New Providence	104,274	1,877	2	33,221	32	6,123	6	62,693	60	360	0
Adelaide district	5,852	254	4	1,716	29	304	5	3,561	61	17	0
Delaporte district	5,179	42	1	1,177	23	316	6	3,614	70	30	1

Source: Statistics Department, 2007.

Approximately 30 percent of the Bahamian population is employed in the wholesale, retail trade, hotel and restaurants industry, from the country to the island district level. In the Delaporte District, the district in which the NSOD property is located, almost 70 percent of residents are engaged in "other industries", the second highest category is wholesale, retail trade, hotel and restaurant (27 percent of residents). Only 1 percent of this district's population is engaged in agriculture, hunting, forestry or fishing.

Unemployment rates for New Providence and The Bahamas as a whole are relatively high. Table 4.19 lists unemployment rates for The Bahamas and New Providence from 1994 through 2004.

Table 4.19 Unemployment Rates – 1994 through 2004[1]

	1994	1995	1996	1997	1998	1999	2001	2002	2003	2004
The Bahamas	13.3	10.9	11.5	9.8	7.8	7.8	6.9	9.1	10.8	10.2
New Providence	14.1	10.8	11.9	10.4	7.3	7.8	6.9	9.6	11.9	10.9

[1]Labour Force Data is not available for the Year 2000, which was a Census year. Since the Census is a major national project, the Department of Statistics undertook no other household surveys in that year.

Even with the high unemployment rate, one of the major economic challenges facing the government is meeting the continued employment demands for construction workers and employees in the various tourism-related industries. As part of a larger push to get residents more interested in jobs in the tourism industry, the government of New Providence Island conducted a general public survey on the attitudes of residents toward tourism (Ministry of Tourism, 2005). Among the interviewees, 64 percent agreed or strongly agreed that "tourism will have to be the main industry in the islands of The Bahamas for at least the next thirty years." The survey also determined that about 50 percent of those interviewed felt that there is little job security in the tourism industry and 46 percent felt that the "salaries and benefits of the tourism industry are not on par with similar positions in the private sector" (Ministry of Tourism, 2005).

Tourism Industry Employment

The hotel industry employs roughly 30 percent of the economically active population (Statistics Department, 2007.) The average weekly wage in the hotel industry in 2004 was $335, which is approximately 27 percent less than the average weekly wage across all occupations in The Bahamas of $457 (Department of Statistics, 2005, iv).

A total of 12,023 employees were working in The Bahamas hotel industry in 2005, versus 10,365 in 2000, a 16 percent increase over five years. Similarly, the average weekly wage in this sector has increased by 18 percent from $310 to $367. In New Providence, the average weekly wage for the hotel industry in 2005 was $367, generally on par with the national average for the industry.

According to the report, "Occupations and Wages in the Hotel Industry: 2005," the largest occupational group in the hotel industry was the service workers and shop and market sales group, which accounted for 40 percent of all hotel industry workers in 2005 (Department of Statistics, 2005). The occupational group with the highest weekly wages (about $846) was senior officials and managers.

Construction Industry

The construction industry contributed approximately 10 percent to The Bahamas GDP in 2004. In 2003 to 2004, approximately 4,879 workers, roughly 10 percent of all employed persons over the period, were engaged in the construction industry at an average weekly wage of $491, seven percent higher than the national average across all industries (Department of Statistics, 2005b).

In 2005, the construction sector experienced a boost in activity with the commencement of Phase II of the Atlantis expansion project, valued at $1 billion, and hurricane related repairs and renovation, as well as a favorable interest rate (CDB, 2005). Other major tourism construction projects, including the rebuilding of several Cable Beach Resorts valued at $2 billion, and the development of the Albany Resort, valued at $1.3 billion, will support construction industry revenues in New Providence for at least the next several years if not the next decade (Cable Beach Resorts, 2007; Government of Bahamas, 2006).

The residential construction market is also growing, as reflected in the increase of over 270 percent in mortgage commitments, from $118.9 million to $330.4 million between 2004 and 2005 (CDB, 2005). The majority of increased lending in 2006 was earmarked for residential projects, which are valued at $165.6 million, a 15.4 percent increase from 2005 (Culmer, 2007).

Concomitant with the forthcoming construction boom will be the pressures on the local labor and construction materials markets. According to the Department of Tourism there will be a need for foreign labor to supplement Bahamian labor, the volume of which is not sufficient to meet industry demand. The labor shortage will also be exacerbated by the lack of skilled workers. In January 2007, the president of The Bahamas Contractors Association indicated that even during this period of high demand for construction workers, many workers have been laid off due to lack of skills; furthermore, there is an "acute shortage" of senior construction personnel, including project managers, estimators, supervisors and foremen (Culmer, 2007).

In The Bahamas, the majority of construction management positions are held by Americans, Canadians, and the British, while labor positions include Bahamians, other West Indians (e.g., Haitians and Jamaicans), and South Americans. The government actively promotes the use of Bahamian labor in construction (McDermott, 2007).

Commercial Fishing Industry

The government considers fishing an important industry to the Bahamian economy and the Bahamian way of life. In 2002, the commercial fishing industry earned $102.7 million, $99.5 million of which was earned through export of crawfish, scalefish and other marine products. The main commercial fishery resources include lobster/crawfish, conch, shallow water scalefish (e.g., groupers, jacks, snappers and grunts), sponge helmet shells, and deepwater scalefish such as snappers (Fisheries, 2007). Table 4.20 provides a breakdown of 2005 landings by island.

Table 4.20 Total Landings by Bahamian Island, 2005

	Sum of Weight (Pounds)	Sum of Value
Abaco	1,244,009	$10,844,972
Acklins/Crooked Islands	71,629	$342,413
Andros	369,854	$3,330,457
Bimini/Berry Island	11,055	$116,461
Cat Island	54	$154
Eleuthera	2,074,789	$22,338,731
Exuma	4,564	$59,260,469
Grand Bahama	1,688,236	$15,253,530
Long Island	938,526	$6,759,030
New Providence	704	$7,218
Ragged Island	23,672	$222,893
San Salvador/Rum Cay	1,547	$4,952
TOTAL	6,428,639	$118,481,280

As noted in Table 4.15, the fishing industry is not a major contributor to the New Providence economy. The most productive fishing grounds are located in Little Bahama Bank, north of Grand Bahama, and the Great Bahama Bank (Fisheries, 2007).

In 2005, the value of all landings (encompassing the commercial species listed in Table 4.11) was approximately $118 million, of which only $7,218 (0.01 percent) was landed in New Providence. As discussed in Section 3.1, The Bahamas Fisheries Department does not believe there are any commercial fishermen operating in the vicinity of the project area, as most of the fisheries near to New Providence are located on the north side of the island.

4.3.4 Transportation

4.3.4.1 Existing Roadway Infrastructure

The NSOD project site occupies the northwest quadrant of the intersection of South West Bay Road, which generally follows an east-west alignment, and South Ocean Boulevard, which generally follows a north-south alignment. South West Bay Road is part of the New Providence Island circumferential road system, linking the community of Adelaide with NSOD and the industrial area further west. South Ocean Boulevard connects NSOD with Lyford Cay to the north.

Two roads provide access to the project site (see Figure 4.11). South Ocean Road (a local access road, different from South Ocean Boulevard, described above) provides access from South West Bay Road to the existing hotel. Non-functioning traffic signals are present at the intersection of South Ocean Road and South West Bay Road. South Ocean Road also provides access to the local streets of the South Ocean Village neighborhood (Muirfield Drive and Merion Drive). South West Bay Road is a two-lane paved road with level terrain in the project area. Lanes are approximately 11 ft wide, with grass shoulders averaging approximately 2 ft wide. Pavement on South West Bay Road is in fair condition. South Ocean Boulevard is also a two-lane paved road with rolling terrain in the project Area (generally ascending from south to north). Lanes are also approximately 11 ft wide, with grass shoulders averaging approximately 6 ft wide. Pavement on South Ocean Boulevard is in good condition.

Golf Boulevard provides access from South Ocean Boulevard, at the northern side of the NSOD site, to the golf clubhouse at the center of the NSOD site. Some private residences are located along Golf Boulevard.

9 *Figure 4.11 Existing Road Network*

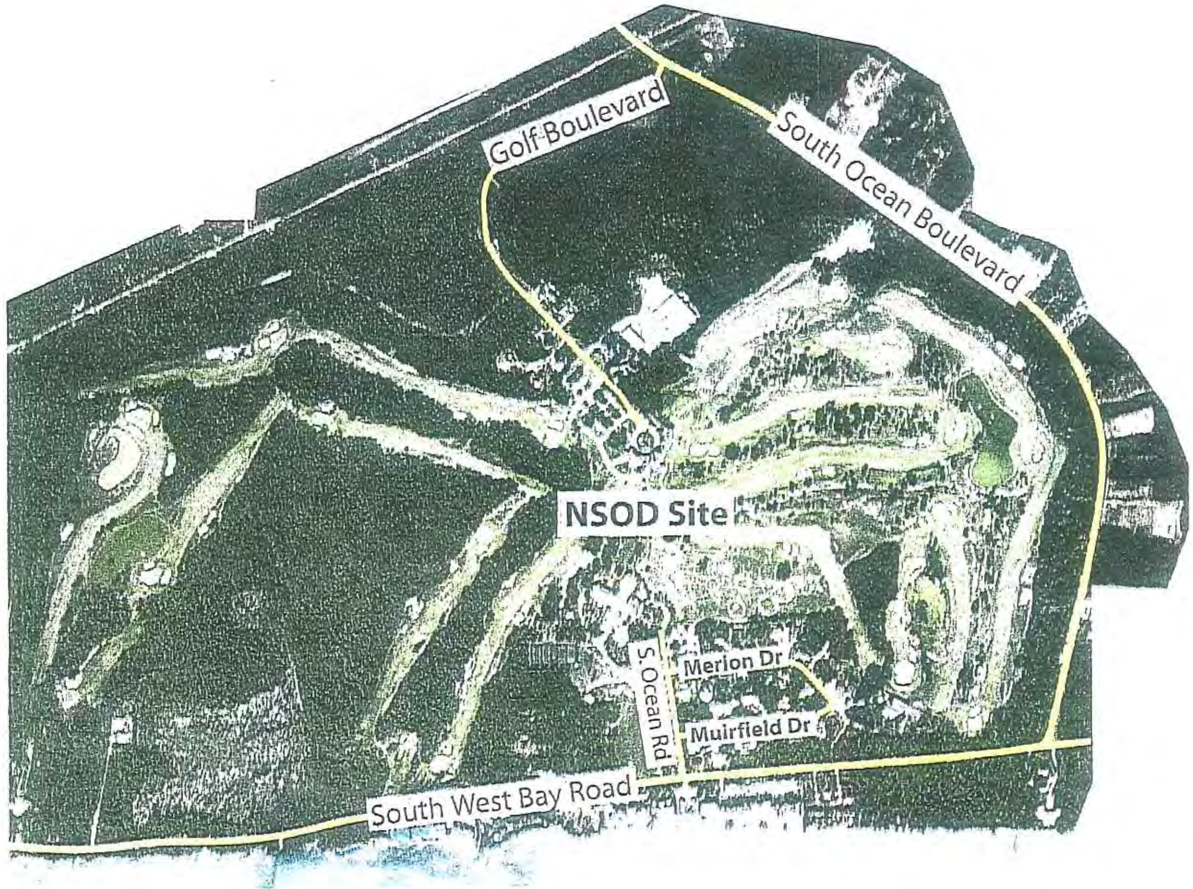

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Figure 4.11 Existing Road Network

Not to scale

4.3.4.2 *Existing Vehicular Traffic*

Traffic studies were conducted to determine the existing traffic volumes in the vicinity of the site. These studies included comprehensive recordings of intersection movements at two key intersections, as shown in Figure 4.12:

- South Ocean Boulevard at South West Bay Road (at the edge of the NSOD site); and
- South Ocean Boulevard at West Bay Street (in the vicinity of Lyford Cay).

7 *Figure 4.12 Intersection Traffic Count Locations*

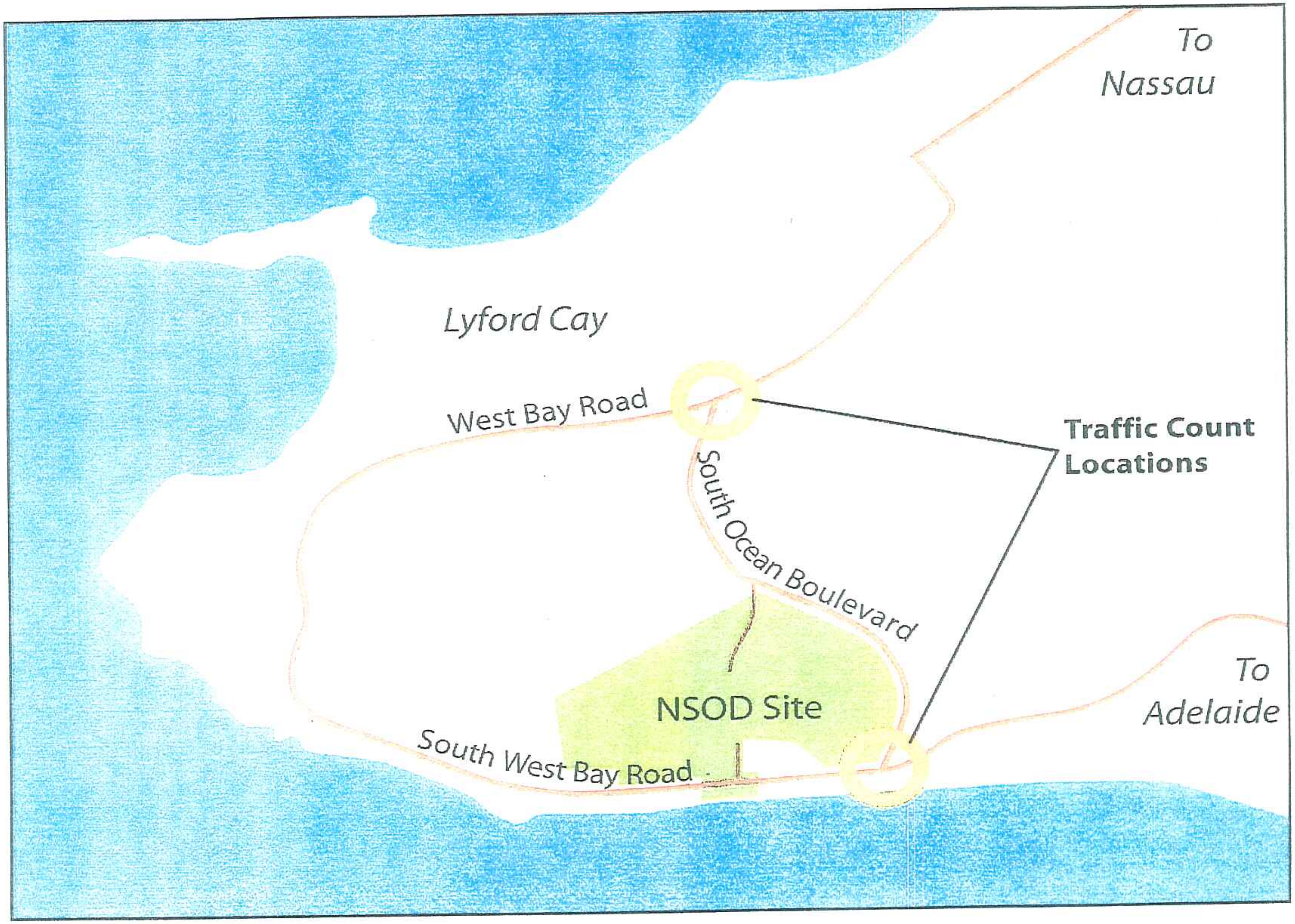

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Figure 4.12 Intersection Traffic Count Locations

Not to Scale

Intersection traffic volumes were recorded on Tuesday, January 30, 2007 and Wednesday, January 31, 2007, from 7:00 a.m. to 6:00 p.m. Separate counts were kept, at 15-minute intervals, for all through and turning movements, and for car (passenger automobiles and taxis) and truck traffic (cargo vehicles, buses, and any other vehicles not used for personal transportation). Peak traffic hours, volumes, and the resultant intersection Level of Service (LOS) are shown in Table 4.21. The intersection turning movement counts also identify peak hour traffic volumes along South West Bay Road and South Ocean Boulevard. These volumes and the resultant LOS are shown in Table 4.22.

LOS calculations are a standard methodology for characterizing the functionality of a road or intersection. Intersection LOS is based primarily on the amount of delay that a driver experiences when traveling through the intersection, while LOS for road segments is based primarily on traffic density and speed (as compared to the road's maximum capacity and design speed). There are six possible LOS categories, ranging from LOS A, which represents the best operating conditions, to LOS F, which represents the worst (or "failure"). Generally LOS D or above are considered acceptable. X SOFTWARE was used to calculate intersection LOS for this study; the Highway Capacity Manual (TRB, 1994)[5] was used to calculate LOS for the major roads.

Table 4.21 Intersection Level of Service

	South Ocean Blvd at South West Bay Road	South Ocean Blvd at West Bay street
Peak Hour	7:30 a.m. to 8:30 a.m.	8:00 a.m. to 9:00 a.m.
Peak Hour Volume (Total)	465	319
Peak Hour Volume (Automobiles)	454	310
Peak Hour Volume (Trucks and Buses)	11	9
Resulting Level of Service	A	A

5 Specifically, the Worksheet for General Terrain Segments from the Two-Lane Highways chapter.

Table 4.22 Major Road Level of Service

	South West Bay Road Total volume (2-day average)	South Ocean Boulevard Total volume (2-day average)
Peak Hour Traffic Volume	186	247
Resultant Road LOS	A	B

Peak traffic on the major roads (and at their intersections) generally occurs from 7:30 to 8:30 a.m. During this time period, South West Bay Road operates at LOS A, while South Ocean Boulevard operates at LOS B. LOS A indicates free-flow conditions and a lack of significant travel delays. LOS B is also a high level of service, marked by few travel delays.

4.3.4.3 *Planned Transportation Facilities*

Several major land use changes and new transportation facilities are being considered for the western portion of New Providence Island. In particular, the Albany project to the east of the NSOD project site proposes to realign South West Bay Road. In addition, the proposed Southwest container port to the west of the project site could also result in a re-alignment of South West Bay Road, possibly along or parallel to the electric transmission lines that form the NSOD site's northwestern border.

4.3.4.4 *Waterway Infrastructure*

A small inlet and marina associated with Stuart Cove's Aqua Adventures are located adjacent to the project site, just west of the existing South Ocean Golf & Beach Resort beachfront hotel buildings. Stuart Cove's has ten medium-sized vessels (eight greater than 40 ft in length) used for diving, snorkeling, and other underwater excursions. There are also several small docks associated with private waterfront property to the east of the project site.

4.3.5 *Infrastructure and Public Services*

The principal cities of Nassau and Freeport possess the best developed infrastructure in The Bahamas, where there are relatively good paved roads and international airports. Electricity is generally reliable, although many businesses have their own backup generators. The Bahamian government has made infrastructure improvements a national priority and has spent tens of millions of dollars on improvements since 1992, resulting in modern telecommunications and transportation networks (www.gloriousbahamas.com). The Bahamas Water and Sewer Corporation (WSC) is currently involved in a planning process that will set national water and waste water strategy for the next ten years.

4.3.5.1 *Power*

The Bahamas Electricity Corporation (BEC) is a Government Corporation established under The Commonwealth of The Bahamas Electricity Act of 1956. As the nation's primary electricity provider, BEC owns and operates the generation plants and the distribution network that supply the Bahamian archipelago, excluding Grand Bahama Island (www.bahamaselectricity.com).

BEC has a total installed generation capacity of approximately 400 megawatts produced by plants that burn fossil fuels (oil) to generate electricity. Oil is transported via bulk carrier and off-loaded at Clifton Pier, site of one of the power generation plants. The plant is less than one mile from the project site. BEC employs approximately 1,000 employees. The largest portion of BEC's consumer base resides on New Providence inclusive of Paradise Island.

BEC performs ten year load forecasting, taking into consideration incremental growth and potential major development projects such as NSOD. During discussions with BEC, it was confirmed that generation capacity will be sufficient to provide power for the New South Ocean Development (NSOD) project site (personal communication, Mr. Carl Stubbs, Assistant General Manager Technical Planning, January 17, 2007).

4.3.5.2 *Water and Wastewater*

The Water and Sewerage Corporation (WSC) is charged with the responsibility of providing potable water to communities throughout The Bahamas. This is often challenging, especially because each island - and different parts of certain islands - may have vastly different water resources at its disposal (www.wsc.com.bs). The Government of The Bahamas directed the WSC to initiate a national program "to effectively alleviate the water and wastewater problems in New Providence and the Family Islands." A national water and wastewater program is currently being developed. One of the objectives will be to expand the water supply in New Providence to allow for the provision of potable water to all residents.

New Providence, the busiest tourist destination, with a high concentration of persons and businesses, is particularly hard pressed to meet its water needs at this time. This high population density raises the real threat of overpumping and pollution of ground water supplies; hence there is a great emphasis placed on water conservation effort (www.wsc.com.bs).

Water supplied to New Providence comes from several sources:

- Barging water from neighboring Andros Island - approximately five million gallons per day (mgd);
- New Providence well fields (approximately 2.5 mgd); and
- Reverse Osmosis (RO) water (approximately 5 mgd).

The WSC indicates that there is a common misconception that private well water in the Bahamas is safe and cheap. In reality, persons who use private well water place their health and that of their families at serious risk. Businesses and residents should avoid using well water to prepare food, wash hands, or utensils to reduce the risk of contracting water-borne diseases (www.wsc.com.bs). The WSC treats and monitors its water to ensure that international standards are met and that the water is safe to drink.

WSC is also charged with the safe disposal of sewage and assisting in monitoring and enforcing any laws that seek to prevent environmental impacts.[3] Plans are currently being developed to upgrade and expand existing wastewater plants and add several 'state of the art' facilities to address the projected growth associated with several planned large development projects.

Several discussions have taken place with the WSC regarding potable water and wastewater treatment capacity, and the ability to provide these services to NSOD. The WSC has agreed in principle and committed to delivering potable water to NSOD and processing waste water from NSOD. A letter of commitment from the WSC is provided in Appendix D.

4.3.5.3 *Telecommunications*

The Bahamas have hard-wire telecommunications via a submarine cable connection to Florida (www.bahamasbusiness.com, www.geographia.com). As one of the world's leading international financial centers, the increasing demands of money management and computerization have lead to a close alliance between the many banks and trust companies and The Bahamas

Telecommunications Corporation (BaTelCo), the national telephone company. A quasi-public corporation created in 1966, BaTelCo is owned by the government, but receives no subsidies from it.

The Bahamas have hard-wire telecommunications via a submarine cable connection to Florida. As one of the world's leading international financial centers, the increasing demands of money management and computerization have led to a close alliance between the many banks and trust companies and The Bahamas Telecommunications Corporation (BaTelCo), the national telephone company. A quasi-public corporation, created in 1966, BaTelCo is owned by the government, but receives no subsidies from it. Recently, in conjunction with the Swiss telecommunications company Swiss Telecom PTT, BaTelCo developed a digital satellite communication system between Switzerland and The Bahamas, two of the world's prominent financial centers.

BaTelCo's portfolio covers telephone networks, facsimile, telex, cellular radio telephone, and private line services, packet switching, satellite leasing, and radio licensing. It has more than 64,000 phones in a 100-percent digital, fully-automated switching system, providing Direct Distance Dialing to more than 100 countries including the United States, Canada, Europe and the Caribbean. The infrastructure services also include: redundant high-speed fiber optic links; leased line services; wireless (WLAN) connections; local and international PSTN and IDD service; Internet broadband (cable modem and DSL); and commercial data center hosting and disaster recover services.

Additional telecommunication services include:

- Bahamas General Communications (BGC) has created a wireless infrastructure within The Bahamas designed to operate at much faster speeds than conventional dial-up services. Their objective is to integrate state-of-the-art technology and services, aimed at offering customers high-speed connectivity via their high-speed wireless network. BGC's goal is to create a single wireless network service that allows computers to be connected wherever and whenever throughout the Caribbean Islands.
- Caribbean Crossings, which is an international telecommunications company, owns and operates a sub-sea fiber optic network that links the four major islands of the Bahamas to the continental United States. Through this fiber network and the fiber terrestrial local network of its parent, Cable Bahamas Ltd., Caribbean Crossings can provide 100 percent all optical connectivity requirements in the Bahamas.

4.3.6 *Cultural Resources*

Cultural Resources include any prehistoric or historic site, building, structure, object, or district with historical significance. They also include all records, artifacts, and physical remains associated with these resources. They may consist of the traces of all of the past activities and accomplishments of people. Cultural resources include:

- Tangible traces such as sites, buildings, structures, and objects; and
- Landscapes, vistas, and cemeteries if they have historic or cultural value.

The NSOD Property contains archaeological sites, landscape features, and natural features that do or may possess historical significance. These resources are described in greater detail in Section 4.3.7 below.

4.3.7 *Archeological and Historic Resources*

Archival and limited field research, conducted 29 January to 1 February 2007, identified the levels of sensitivity for the potential presence of archaeological and historical resources within the NSOD site. Archival research included:

- The review of reports of previous archaeological and historical investigations within and near the project property;
- The review of the listings of recorded archaeological sites on New Providence; and
- Consultations with the Chief Archaeologist of the Antiquities, Monuments, and Museums Corporation.

Field research included:

- A visual inspection of selected portions of the NSOD property.
- Interviews with other team members who visited and inspected other portions of the property; and
- Interviews with those currently involved in the reconstruction of the existing golf course.

Historical records show the NSOD property encompasses portions of at least two former Loyalist-era plantations: Little Cocoa Hill (owned by John Moultrie) and Peter Edwards', although much of these former properties were or may have been granted to others during the early to mid-18th century. During the middle 19th and early 20th centuries, portions of the NSOD property were incorporated into the neighboring Promised Land (owned by William and later James Moss) and Clifton (owned by William Wylly) Plantations. Both were established during the Loyalist-era. Loyalist's and their owners were extremely important to the development and evolution of the plantation system and social history of The Bahamas.

Archival Research

Archival research (Aarons, Outten and Turner, 1990) indicates that two archaeological/historical sites have been recorded in the NSOD property, and one other described site may be present in the property. The two recorded sites include the remnants of the primary settlement of the Loyalist era, Peter Edwards' Plantation, and the Pre-Columbia/Contact era Sandpiper site. The other site is the "Clifton Banana Hole." All are described briefly below.

Field research indicates that there may be the possibility of undocumented elements of the Loyalist plantations encompassed within the property (e.g., dry-stacked stone field and paddock/pasture walls and a possible limestone quarry), two "blue holes," numerous large sinkholes, and a collapsed cave).

Descriptions in the literature of the Pre-Columbian/Contact-era Sandpiper site suggest a scatter of Lucayan artifacts and deposits on the seashore in the general area. Unfortunately, there are no maps or plans that indicate its precise location. This site was discovered by Ian Lothian, then with the National Museum, in 1991, as construction began for the Sandpiper Hotel. Mr. Lothian collected pottery fragments, mollusk shells, and burned rock associated with a Lucayan Indian occupation from areas disturbed along the dune between South West Bay Road and the sea. He excavated a number of "test squares," and encountered artifact-filled refuse pits and fire pits associated with the Lucayan occupation. He also recovered artifacts of beaten copper and a few fragments of pottery manufactured by Europeans. He felt these artifacts indicate an occupation that continued after the arrival of Europeans in The Bahamas. While the records are not clear, this site likely was affected by the construction of the hotel and pool that currently stand in the south central portion of the property.

Ruins of buildings associated with the Loyalist-era Peter Edwards Plantation stand adjacent to and near the 11th and 12th holes of the golf course within the NSOD Tract. Aarons et al. (1990) excavated extensive portions of the three building remnants that comprise the primary plantation settlement on the ridge between the now 11th and 12th tees. They describe a terraced garden and dump (midden / dense artifact scatter) on the slopes south of the buildings, between the golf course and South West Bay Road, and walls (one with a gate/opening) to the west of the ruins. They also describe another building that stands on the coppice west of the 12th green and remnants of other buildings in this area. Here also they note that numerous walls intersect to form possible paddocks or other enclosures. Oral history and artifacts indicate that some of these buildings were occupied by the descendents of Edwards' freed slaves until 1926, when the great hurricane of that year destroyed the roofs of the buildings and all residents moved to nearby Adelaide. This plantation site and its associated components clearly reflect the Loyalist period of plantation development and later occupations, possessing historical significance for the people of The Bahamas. Only four Loyalist-era plantations, including the Edwards Plantation, have been examined in any detail on New Providence, with one of those four subsequently destroyed.

Notes in the archaeological site files at the AMMC indicate that the "Clifton Banana Hole" lies 1.9 miles south of the "Divi crossroad." This sinkhole contains a man-made water catchment in its northeast corner and a rock ramp that once extended to the rim that likely provided access to the floor. Excavations in the west overhang recovered fragments of Hutia bone from 0-50 centimeters below the current floor of the sinkhole. No one interviewed during the current investigations could identify the former "Divi crossroads." Thus, the precise location of this feature cannot be determined at present.

Field Research

The current field research revealed the presence of remnants of numerous dry-stacked stone walls throughout the western portions of the property. Small segments can be observed on the edges of the golf course; longer segments extend through the wooded lands that separate the fairways. At least one wall extends north of the golf course, in the wooded area between the course and the northern boundary of the property. These walls were built during the late 18th and early 19th centuries as part of the plantations established throughout The Bahamas at that time. These walls define and reflect the landscape of that era, from which most modern Bahamians trace their arrival in the islands. Some of the walls define former property lines (a 1927 plat included in Aarons et al. 1990 describes one such as "Peter Edwards wall"); others reflect efforts to enclose agricultural lands. Walls observed near large sinkholes or areas with numerous sinkholes during the current investigation. This could reflect the widespread running of stock in western New Providence during Loyalist period or the connections of the plantation owners with the British agricultural movement that accompanied the Enlightenment and efforts in Britain to enclose as much land as possible during the late 17th and 18th centuries. These walls have not been mapped in any fashion even when they occur in close proximity to the buildings examined by Aarons et al. (1990).

Project ecologists reported a possible limestone quarry southwest of the Edwards' Plantation ruins. This feature reflects a specific activity associated with the former plantations, and thus possesses historical significance. The quarry may have provided building stones for the Edwards' plantation buildings or those of his neighbors. It has been assumed that a quarry exists somewhere on the west end of New Providence that provided building stone for the many buildings at nearby Clifton Plantation. Such a feature has not been identified to date within the Clifton Heritage Park to the west.

There are two "blue holes" located in the western portion of the property. Blue holes in other parts of The Bahamas often contain Lucayan artifacts (including burials) as well as bones and fossil bones of now extinct animals. These deep water filled sinkholes also provided a constant source of freshwater for the Lucayan Indians who inhabited The Bahamas prior to European exploration and colonization.

Similarly, there are a number of large sinkholes (having an opening greater than 10 ft) and at least one collapsed cave in the wooded western portions of the NSOD property, including the narrow stands of trees that separate the fairways of the golf course. Like "blue holes," larger sinkholes and caves in other parts of New Providence and The Bahamas may contain Lucayan artifacts (including burials) and evidence of now extinct animals.

Other areas with a potential to contain Lucayan artifacts and deposits include portions of the undisturbed dune line along the southern shore of the NSOD property. Lucayan sites occur frequently along such dunes on New Providence and throughout The Bahamas. Significant Lucayan sites lie to the west and east of the NSOD along the south and west shores of New Providence. Most of the former dune line along the southern edge of the NSOD property has been destroyed by 20th century developments in this portion of New Providence. There is a small area at the southeast corner of the property where approximately 32 to 50 ft of undisturbed dune line appears to be present, between the current high water line and the two-story buildings that stand immediately east of the former hotel. Also, a vacant lot lies immediately west of the hotel, bounded to the west by Stuart Cove's Dive facility. Here, the former dune line also may remain intact. Between the hotel and the sea, the dune appears to have been graded and filled with materials less likely to erode; gravel, bottles, and other debris are visible in the exposed bank at the high water line between the hotel and the sea. Farther west, the dune appears to have been destroyed by the construction of the dive facilities, private residences in a privately owned parcel excluded from the NSOD property, and South West Bay Road. All of the shore here is exposed limestone rock. Interestingly, remnants of a former dock extend into the sea from the rock shore to west of the excluded modern residences and southwest of the Edwards' plantation ruins. Wooden pilings set in holes in the limestone appear to have once supported additional elements of this structure, and presumably provided safer and easier access to vessels attempting to load or unload from the shore. The age of this feature is unknown.

Levels of Sensitivity

The NSOD property can be divided into levels of archaeological/historical sensitivity based on the information recovered from the archival and field research conducted to date and 20th century development and uses of the property (see Figure 5.15). Three levels of sensitivity can be defined:

- Areas of high sensitivity are currently known to possess archaeological deposits and architectural features or possess a high potential to contain such deposits and features.
- Areas of moderate to low sensitivity contain or may contain plantation-era walls and large sinkholes.
- Areas of limited sensitivity contain no visible evidence of pre-20th century occupations primarily due to extensive modifications and disturbance.

There are three small areas and one large area of high sensitivity. The small areas include the possible intact dune line in the southeast corner of the property; the possible intact dune line in the south central portion of the property; and the wooded areas within 200 ft of the northern edge of the blue hole and the blue hole itself on the 16th fairway of the golf course. The western edges of the 11th and 12th fairways, the southern edge of the 13th fairway, and the eastern edge of the 14th fairway define the large area of high sensitivity in the eastern portion of the NSOD. The blue hole at the south end of the 14th fairway lies within this area as well as the wooded areas within 200 ft to the west of the blue hole and wooded areas between the blue hole and the property boundary. This area also contains the ruins of the

Edwards' plantation, both the buildings examined by Aarons et al. (1990) and those on the wooded coppice west of the 12th fairway. Many walls, large sinkholes, and a collapsed cave also occur in this area.

All of the wooded areas in the eastern, northern, and western portions of the NSOD property, and the cleared area in the southwest corner all possess a moderate to low potential to contain archaeological or historical resources. These areas include the narrow wooded spaces between the fairways of the golf course in the western portion of the property as well. Remnants of walls exist on the edges of these areas and likely extend into and through them. Also, there may be large sinkholes and caves in some of these areas.

The remainder of the NSOD property contains a limited potential to contain archaeological or historical resources. These areas have witnessed such extensive alterations during the 20th century that it is highly unlikely that any archaeological deposits or features remain within them. These areas include:

- Hotel sites and dive facilities between South West Bay Road and the sea;
- Shore west of the private residences and south of South West Bay Road;
- Hotel site, golf club, and private residences in the central portion of the property; and
- Portions of the golf course in the east central portion of the property.

4.3.8 *Paleontological Resources*

The remains of now-extinct animals or plants (bones, fossil bones, coprolites, seeds, etc.) often occur in blue holes, large sinkholes, and caves throughout The Bahamas. Reports of Hutia bone in the "Clifton Banana Hole," a large sinkhole somewhere near the NSOD property (see Section 4.3.7 above), indicate that such remains may exist in this portion of New Providence. The two blue holes, numerous large sinkholes, and a collapsed cave observed to date within the NSOD property are potential locations for paleontological remains. These features plus similar features that may exist within the undisturbed portions of the NSOD property all possess some potential to contain paleontological resources.

4.3.9 *Tourist and Recreational Areas*

4.3.9.1 *Tourism Overview*

Tourism forms the backbone of the Bahamian economy, and New Providence is an essential component of the Bahamian tourism sector. As discussed in Section 4.3.3, in 2004, The Bahamas' tourism industry directly accounted for approximately 40 percent of the GDP. The two main centers of tourism in New Providence, Nassau and Paradise Island, accounted for roughly 82 percent of Bahamian tourism revenues in 2005 (Ministry of Tourism, 2005).

The Bahamas receives visitors from all over the world. U.S. citizens constitute the majority of visitors to the country, comprising about 86 percent of all stopover visitors. Table 4.23 shows the number of stopover visits by place of origin in 2005. Such visitors include day visitors from cruise ships as well as visitors staying overnight.

Table 4.23 Number of Stopover Visitors to The Bahamas - 2005

Region	Number of Stopover Visitors
USA	1,380,083
Canada	75,643
Europe	85,277
Caribbean	17,698
Latin America	11,497
Rest of the World	37,955
Total	**1,608,153**

Hotels generate roughly 70 percent of The Bahamas' tourism revenues (Edwards, 2004.) Table 4.24 depicts the hotel and hotel room breakdown across The Bahamas. In New Providence, there are at least 64 hotels, of which 51 are in Nassau and 13 are in Paradise Island. These 64 hotels account for 51 percent of all hotels and 59 percent of all hotel rooms in The Bahamas.

Table 4.24 Number of Hotels /Hotel Rooms in The Bahamas - 2005

	Number of Hotels	Number of Hotel Rooms
Nassau	51	4,625
Paradise Island	13	4,037
Abaco	37	720
Acklins	6	35
Andros	35	397
Berry Islands	1	17
Bimini	10	323
Cat Island	15	171
Crooked Island	6	41
Eleuthera	29	247
Exuma	22	438
Harbour Island	15	219
Inagua	4	21
Long Island	15	147
Mayaguana	2	21
Rum Cay	0	-
San Salvador	2	328
Spanish Wells	1	19
Grand Bahama	27	2,994
TOTAL	**291**	**14,800**

***Nassau includes Cable Beach**

Source: Ministry of Tourism, 2005.

Recreation options in New Providence include shopping, dining, and nightlife options as well as sports and activities such as golfing, boating, fishing, diving, and snorkeling. There are seven marinas/boat basins in Nassau and two in Paradise Island. There are four golf courses across New Providence.

4.3.9.2 *New Providence Tourism*

Three main tourist areas - Cable Beach, Nassau, and Paradise Island - contain 88 percent of the hotels in New Providence (Sealy, 2005). Nassau has been the traditional center of tourism in The Bahamas since the 1800s. Most of the hotels in Nassau are small, with less than 25 rooms; the British Colonial Hilton, with 200 rooms, is Nassau's only large hotel. Cable Beach joined Nassau as a major tourist area in the 1950s and currently contains five major hotels, a large casino, and conference facilities.

The latest area to undergo major development is Paradise Island, which has been attracting tourism since the 1960s, but only evolved into a major tourism center in the early 1990s when the Atlantis Resort was built. Atlantis, which encompasses 60 percent of hotel rooms on Paradise Island, features over 2000 rooms, a casino, large outdoor marine aquarium, large marina, conference facilities, and a golf course (Sealy, 2005.)

Recreation opportunities in New Providence include shopping, dining, gambling, and nightlife as well as sports and activities such as golfing, boating, fishing, world-renowned diving, and snorkeling. Among the underwater attractions for visitors are reefs, wrecks, coral walls, and underwater movie sets. Many of the prime underwater destinations are located off the western and southwestern sides of the Island.

There are seven marinas/boat basins in Nassau and two on Paradise Island. New Providence contains a total of four public golf courses, but one, the Lyford Cay course at the west end of New Providence, is private, and another is available only to members and guests at Atlantis properties, One & Only Ocean Club and Comfort Suites. The course at the Albany development, when completed, will also be open to the public.

Western New Providence

Western New Providence is relatively undeveloped in comparison to the rest of New Providence. Only approximately 12 percent of all hotel rooms on New Providence Island are located in the areas outside of Nassau, Cable Beach and Paradise Island. Western New Providence encompasses Lyford Cay, an exclusive gated community with a private marina, in the northwestern part of the island. Lyford Cay is highly developed, but its high level of exclusivity renders it off-limits to most tourists to the island.

Prior to its closure, the New South Ocean Golf & Beach Resort was the only major hotel on the southwestern side of the island ("South Ocean"). The resort featured over 100 rooms, an 18-hole golf course, and beachfront. Located next to the South Ocean Golf & Beach Resort is Stuart Cove's dive facility, which remains in operation. Stuart Cove's offers diving trips to shipwrecks and areas with sharks, along with other scuba and diving related activities.

Currently, there are a number of proposed tourism-related projects in the South Ocean area. The largest is the Tavistock Group's proposed resort, Albany, which will be a 565-acre exclusive private resort located to the east, and adjacent to, the South Ocean Golf & Beach Resort (Turrell, 2005). Tavistock Group intends to partially open the Albany Resort in fall of 2008. Albany will feature luxury accommodations, an 18-hole championship golf course, and a mega-yacht marina (Tavistock, 2006).

Also in development in the South Ocean vicinity are the Clifton Heritage Park and the Bahamian National Trust's Primeval Forest. The former, which is being developed by the Clifton Heritage Authority, will feature a variety of pre-Columbian and plantation-era ruins as well as feature the local ecology. The Heritage Park will allow visitors to have self-guided tours via information plaques placed in significant areas; there will be no support infrastructure (e.g., buildings) on-site other than a parking lot accommodating 200 cars. A bus will provide transportation from the parking lot to the trail head (Antiquities, 2007).

The Bahamas National Trust (BNT) is developing a small tract of land to the northeast of South Ocean Golf & Beach Resort as a tourist attraction called the Primeval Forest. The area contains trees that are approximately 200 years old as well as other natural features such as limestone caves and important plant species. The BNT has not yet determined when this attraction will be open to the public (BNT, 2007)

Notably, representatives of the Clifton Heritage Authority and the BNT have indicated that the success of their respective tourist sites will also depend on the development of the South Ocean area, including Albany and the proposed New South Ocean Development (BNT, 2007; Antiquities, 2007.)

Tourism Trends

According to the Department of Tourism, the southwestern part of the island (in the vicinity of South Ocean Golf & Beach Resort and the upcoming Albany Resort) constitutes the "last frontier" for development of the island. With the combined development of the NSOD, Clifton Heritage Park, Albany, and the Port, it is hoped that southwest New Providence will become "a destination on its own that will lure Bahamians and tourists" (Bahamas News, 2006). Concurrent with this development will be redevelopment of several of the large hotels in Cable Beach as well as the additional development of the Atlantis Resort. The tourism industry may be strained by the demand for labor in construction and operation over the next five years (Department of Tourism, 2007).

4.3.10 *Visual Quality and Aesthetics*

The southwestern portion of New Providence contains a mix of developed and undeveloped areas, including residential and industrial uses. Section 3.5 describes existing land use. The project site contains the two- to three-story hotel buildings and a golf course that were developed for the South Ocean Golf & Beach Resort. Although not currently in use, the project site retains the visual context of a tropical resort-type environment.

To the east of the NSOD property the land is either developed with relatively large residences or open land. To the north of the NSOD property the transmission line is the primary focal point, with residential uses beyond it. On the west side of the NSOD site, the land is primarily industrial, with the brewery and the BEC power plant dominating the views. The ocean dominates views on the south side of the property. Figure 4.9 shows existing land use types on and in the vicinity of the NSOD property. Site photographs and aerial photographs of the NSOD property are provided in Appendices B and C, respectively.

4.3.11 *Native Populations*

Most of the Bahamian population is of African descent, many with varying amounts of Caucasian blood. A minority of the population is descended from English pioneer settlers and loyalist refugees. There are also minorities of Greeks, Syrians, Haitians, and other West Indians. English is the only language native to Bahamians, although since the influx of Haitian immigrants (see section 4.3.2.1), French or its Creole dialect is also spoken.

The ethnic breakdown of The Bahamas population is 85 percent black, 12 percent white and 3 percent Asian and Hispanic. According to the 2000 census, the vast majority of Bahamians are Protestants, with the largest denominations being Baptist, Church of God, Anglicans and Methodists.

4.3.12 *Community Organizations*

The majority of community organization in the South Ocean area is undertaken by local community churches. There were no non-religious community organizations found to be operating in or focusing in the project vicinity.

Other organizations that may have an interest in the NSOD project include environmental organizations such as The Bahamas Reef Environment and Education Foundation (BREEF) and the Nature Conservancy. By virtue of their stated missions, these organizations would likely be interested in the ecology of the project area.

5 ANTICIPATED ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

The following checklist (Table 5.1) summarizes anticipated potential impacts that may be associated with the proposed NSOD project. All environmental and socioeconomic factors have been addressed. A brief explanation of the determinations is provided in Table 5.2, with complete analyses in the remainder of Section 5.

Definitions of impact determinations used:

"Potentially Significant Beneficial Impact" indicates that there is substantial evidence that an effect is significant and beneficial.

"Potentially Beneficial Impact" indicates that there is evidence that an effect is beneficial, but the evidence is not substantial and/or the beneficial impact is not significant.

"No Impact" indicates that the impact does not apply to the project.

"Potentially Adverse Impact" indicates that there is evidence that an effect is adverse, but the evidence is not substantial and/or the adverse impact is not significant.

"Potentially Significant Adverse Impact" indicates that there is substantial evidence that an effect is significant and adverse.

3755 *Table 5.1* *Anticipated Environmental Impacts Checklist*

Category/Environmental Factor	Potentially Significant Beneficial Impact	Potentially Beneficial Impact	No Impact	Potentially Adverse Impact	Potentially Significant Adverse Impact
I. LAND USE - Will the project:					
(a) Be compatible with existing land use in the project area?		X			
(b) Be compatible with zoning and/or other land use requirements?		X			
(c) Be compatible with environmental laws, policies, and/or regulations applicable to the nature of the project and/or required of the project Proponent?			X		
(d) Include unique or unusual landforms (e.g., bluffs, dunes, geological formations) in the immediate project area (i.e., project footprint)?			X		
(e) Include unique or unusual landforms (e.g., bluffs, dunes, geological formations) in the project vicinity (i.e., surrounding areas)?			X		
II. GEOLOGY - Will the project:					
(a) Include activities, such as construction, that involve disturbance to soils (e.g., excavation, disturbance, alteration)?				X	
(b) Result in the subsidence of land?				X	
(c) Influence landslides or mudflows?			X		
(d) Influence erosion and changes in topography?				X	
(e) Be located in a seismically active area?			X		

Category/Environmental Factor	Potentially Significant Beneficial Impact	Potentially Beneficial Impact	No Impact	Potentially Adverse Impact	Potentially Significant Adverse Impact
III. WATER QUALITY - Will the. Project					
(a) Alter the quality, amount, direction, or rate of flow of ground water?				X	
(b) Affect any municipal or private drinking water supplies'?				X	
(c) Alter the exposure of certain sensitive receptors to water pollutant?				X	
(d) Alter drainage flow/patterns or absorption rates of surface water'?			X		
(e) Occur within a floodplain?			X		
(f) Result in discharge to surface waters (both fresh and saltwater) and alter surface water quality (e.g., temperature, turbidity, dissolved oxygen, salinity)?			X		
(g) Result in siltation to a surface water body (both freshwater and marine areas)?				X	
IV. BIOLOGICAL RESOURCES - Will the project:					
(a) Affect globally, regionally, or locally rare plant or animal species or their habitat?				X	
(b) Affect the overall biodiversity of the affected ecosystem(s)?				X	
(c) Affect coral reef communities?		X			
(d) Affect mangroves?			X		
(e) Affect sea grass beds?				X	
(f) Affect dunes?			X		
(g) Affect other sensitive coastal environments?			X		
(h) Affect freshwater,			X		

Category/Environmental Factor	Potentially Significant Beneficial Impact	Potentially Beneficial Impact	No Impact	Potentially Adverse Impact	Potentially Significant Adverse Impact
riparian, or other coastal wetlands (i.e., non-mangrove areas such as salt marshes)?					
(i) Affect upland habitats?				X	
(j) Affect protected areas (e.g., parks, wildlife refuges, marine sanctuaries)?			X		
V. AIR QUALITY - Will the project:					
(a) Alter local air quality directly (e.g., from construction activities or the nature of the project)?				X	
(b) Alter local air quality indirectly (e.g., from an increase in cars, boats, parking lots)?				X	
(c) Alter the exposure level of certain sensitive receptors to air pollutants?			X		
VI. CULTURAL RESOURCES - Will. the project:					
(a) Disturb known archaeological resources?				X	
(b) Likely disturb undiscovered archaeological resources?				X	
(c) Disturb historical resources and places of historical significance?				X	
(d) Disturb religious resources, and/or affect the current and future use of those resources?			X		
VII. ENERGY - Will the project:					
(a) Be consistent with existing energy conservation plans?				X	
(b) Involve renewable resources?			X		
(c) Involve non-renewable resources (e.g., minerals) that could be of future				X	

Category/Environmental Factor	Potentially Significant Beneficial Impact	Potentially Beneficial Impact	No Impact	Potentially Adverse Impact	Potentially Significant Adverse Impact
value to the region?					
VIII. SOCIOECONOMICS -Will the project:					
(a) Directly or indirectly result in increased population growth in the project vicinity?		X			
(b) Affect unemployment/job availability?	X				
(c) Directly or indirectly result in additional (i.e., non-project related) economic growth in the project vicinity?	X				
(d) Affect fish, shellfish, or other commercially important marine species?			X		
(e) Affect the local housing availability?				X	
(f) Displace or otherwise affect existing housing developments, especially involving minority and low-income communities?			X		
(g) Impact public health and safety due to the intentional or unintentional release of hazardous substances, flammable liquids, toxic pollutants etc.?			X		
(h) Impact worker health and safety due to the intentional or unintentional release of hazardous substances, flammable liquids, toxic pollutants, etc.?			X		
IX. COMMUNITY SERVICES - Will the project:					
(a) Affect availability of, or demand for, fire protection services?				X	
(b) Affect availability of, or demand for, police protection?				X	

Category/Environmental Factor	Potentially Significant Beneficial Impact	Potentially Beneficial Impact	No Impact	Potentially Adverse Impact	Potentially Significant Adverse Impact
(c) Affect availability of, or demand for, medical and other health care services?				X	
(d) Affect availability of, or demand for, public water services, including municipal water supplies and storm water drainage?				X	
(e) Affect availability of, or demand for, public wastewater services?				X	
(f) Affect availability of, or demand for, schools and related educational support services?				X	
(g) Affect availability of, or demand for, communication systems?				X	
(h) Affect availability of, or demand for, power?				X	
(i) Affect availability of, or demand for, solid waste disposal services?				X	
X. AESTHETICS- Will the project:					
(a) Result in objectionable odors to surrounding areas?			X		
(b) Affect local noise standards (or existing conditions)?			X		
(c) Affect visibility or view sheds (e.g., scenic views)?				X	
(d) Create light or glare?			X		
XI. RECREATION - Will the project:					
(a) Affect the quality of land-based recreational opportunities?		X			
(b) Affect the quality of water-based recreational opportunities?		X			
(c) Increase the demand for recreational facilities or opportunities?			X		

Category/Environmental Factor	Potentially Significant Beneficial Impact	Potentially Beneficial Impact	No Impact	Potentially Adverse Impact	Potentially Significant Adverse Impact
(d) Affect the quality and quantity of open space?			X		
XII TRANSPORTATION- Will the project:					
(a) Affect the local roadway infrastructure directly or indirectly (i.e.				X	
(b) Affect the local waterway infrastructure directly or indirectly (i.e.		X			
(c) Alter emergency access to the project area and surrounding areas (e.g.		X			
(d) Create hazards for pedestrians			X		
(e) Affect the likelihood of transportation accidents			X		

3756 *Table 5.2* *Explanation for Checklist Responses*

Category	Explanation
I. LAND USE – Will the project:	
(a) Be compatible with existing land use in the project area?	The project is similar to the existing development, but larger. The benefits will be generally economic. If sustainable practices are adopted, more long term benefit can be expected.
(b) Be compatible with zoning and/or other land use requirements?	The proposed land use is consistent with current site zoning.
(c) Be compatible with environmental laws, policies, and/or regulations applicable to the nature of the project and/or required of the project Proponent?	The proposed project will comply with all applicable Bahamian environmental requirements and standards.
(d) Include unique or unusual landforms (e.g., bluffs, dunes, geological formations) in the immediate project area (i.e., project footprint)?	Two blue holes are located on the golf course. Further site development will not affect these features.
(e) Include unique or unusual landforms (e.g., bluffs, dunes, geological formations) in the project vicinity (i.e., surrounding areas)?	There are no unique or unusual landforms in the project vicinity.
II. GEOLOGY - Will the project:	
(a) Include activities, such as construction, that	Marina construction will require major

Category	Explanation
involve disturbance to soils (e.g., excavation, disturbance, alteration)?	excavation.
(b) Result in the subsidence of land?	Existing karst features will require engineering studies to address potential sinkholes and ground subsidence.
(c) Influence landslides or mudflows?	Not Applicable to this site.
(d) Influence erosion and changes in topography?	Potential impacts exist but will be addressed with erosion control measures and site engineering.
(e) Be located in a seismically active area?	The area is not seismically active.
III. WATER QUALITY - Will the project:	
(a) Alter the quality, amount, direction, or rate of flow of ground water?	The excavation of the marina will impact any shallow freshwater lenses that may exist in the affected area.
(b) Affect any municipal or private drinking water supplies?	No municipal water supplies will be affected. Potable water is planned for the area through the WSC. There are no known shallow private wells in the immediate area that could be affected by the marina excavation.
(c) Alter the exposure of certain sensitive receptors to water pollutants?	The existing sinkholes may intersect ground water layers and potentially provide a pathway for contaminants.
(d) Alter drainage flow/patterns or absorption rates of surface water?	Although caliche contributes to the low permeability and low infiltration rate of the rock, low areas with sinkholes and subsurface conduits may become active.
(e) Occur within a floodplain?	The project is not situated in a floodplain.
(f) Result in discharge to surface waters (both fresh and saltwater) and alter surface water quality (e.g., temperature, turbidity, dissolved oxygen, salinity)?	The marina design meets flushing standards.
(g) Result in siltation to a surface water body (both freshwater and marine areas)?	There may be temporary siltation issues during construction. In addition, there may be long-term marina and channel siltation requiring occasional maintenance dredging.
IV. BIOLOGICAL RESOURCES - Will the project:	
(a) Affect globally, regionally, or locally rare plant or animal species or their habitat?	On-site terrestrial habitat, primarily broadleaf coppice and mixed evergreen/broadleaf coppice, which support several plant species protected by Bahamian regulations and, potentially, several protected animal species (e.g. birds and reptiles) may be affected by planned development within these habitats. Individuals of these protected plant and animal species will be relocated as appropriate.
(b) Affect the overall biodiversity of the affected ecosystem(s)?	Local affects to biodiversity are anticipated, but overall ecosystem impacts are not anticipated.
(c) Affect coral reef communities?	No direct impacts to coral reef communities are anticipated. However, any live coral found in the footprint of the marina access channel will be

Category	Explanation
	transplanted and propagated onto the artificial reefs that will be created using ReefBalls.
(d) Affect mangroves?	No mangroves are present in the proposed development or immediately adjacent areas.
(e) Affect sea grass beds?	No physical impacts to seagrass beds are anticipated.
(f) Affect dunes?	A "Sand Strand" vegetative habitat is present along portions of the shoreline of the property; however, no dune system, *per se*, is present.
(g) Affect other sensitive coastal environments?	No other sensitive coastal environments are present at the site.
(h) Affect freshwater, riparian, or other coastal wetlands (i.e., non-mangrove areas such as salt marshes)?	No freshwater riparian or other freshwater wetland habitat is present on-site. A small area of wetland is present in an adjacent parcel south of the coastal road and southeast and east of existing residential structures. The wetland is surrounded by a Sand Strand vegetation community. The proposed development is not anticipated to impact this off-site wetland area. Two water-filled blue holes are present on the existing golf course. These blue holes contain brackish water and are tidally influenced. The blue holes will not be disturbed during the development or operation of the new resort complex.
(i) Affect upland habitats?	Upland plant communities, primarily broadleaf coppice and mixed evergreen/broadleaf coppice will be physically affected as a result of the construction of residential buildings and resort structures.
(j) Affect protected areas (e.g., parks, wildlife refuges, marine sanctuaries)?	No parks, wildlife refuges, or marine sanctuaries are present. No impacts to the Primeval Forest are anticipated.
V. AIR QUALITY - Will the project:	
(a) Alter local air quality directly (e.g., from construction activities or the nature of the project)?	Emissions will be minor and will not affect local air quality.
(b) Alter local air quality indirectly (e.g., from an increase in cars, boats, parking lots)?	The project will generate an increase in vehicular emissions, but overall the amount of these emissions is minor.
(c) Alter the exposure level of certain sensitive receptors to air pollutants?	The amount of emissions generated by the project will be small and no sensitive receptors are located in the immediate area.
VI. CULTURAL RESOURCES - Will the project:	
(a) Disturb known archaeological resources?	Portions of Edwards Plantation site lie in areas scheduled for development (e.g. clearing vegetation, changes in terrain, proposed construction)

Category	Explanation
(b) Likely disturb undiscovered archaeological resources?	Areas within project possess a potential to contain archaeological deposits and have not been examined sufficiently to determine if such resources are present. Additional archaeological research is underway.
(c) Disturb historical resources and places of historical significance?	Plantation-era walls extend through much of the project and may possess historical significance. These walls may be affected by construction activities. Additional archaeological research is underway.
(d) Disturb religious resources, and/or affect the current and future use of those resources?	None identified to date
VII. ENERGY - Will the project:	
(a) Be consistent with existing energy conservation plans?	Energy consumption may be high, and in New Providence it is generated by burning fossil fuel.
(b) Involve renewable resources?	The project design process is considering the potential for using renewable resources.
(c) Involve non-renewable resources (e.g., minerals) that could be of future value to the region?	Energy generation is from fossil fuel.
VIII. SOCIOECONOMICS - Will the project:	
(a) Directly or indirectly result in increased population growth in the project vicinity?	Some construction workers are expected to relocate to the project area, but only for the duration of construction. The project will provide new housing units that will support a small increase in population in the project area.
(b) Affect unemployment/job availability?	The project will create approximately 2,235 jobs as a direct impact from both the construction and operation phases.
(c) Directly or indirectly result in additional (i.e., non-project related) economic growth in the project vicinity?	As an indirect effect of the development and other local projects (e.g., Albany, potential South West Port, etc), the South Ocean area of New Providence is expected to become more desirable as a destination for Bahamians and tourists, which is likely to spur additional economic growth in the area.
(d) Affect fish, shellfish, or other commercially important marine species?	No commercially important marine species will be affected.
(e) Affect the local housing availability?	Construction workers may create a demand for local housing; however, this demand should be short-term in duration, lasting only through project construction. On-site employee housing may be developed as part of the project and should minimize the need for the majority of NSOD employees to seek housing elsewhere.
(f) Displace or otherwise affect existing housing developments, especially involving minority and low-income communities?	No existing housing will be displaced by this project.

Category	Explanation
(g) Impact public health and safety due to the intentional or unintentional release of hazardous substances, flammable liquids, toxic pollutants, etc.?	Public health and safety will not be affected.
(h) Impact worker health and safety due to the intentional or unintentional release of hazardous substances, flammable liquids, toxic pollutants, etc.?	Adverse conditions that could affect worker health and safety are not anticipated. On-site contractors will be required to establish and maintain adherence to a worker's health and safety program.
IX. COMMUNITY SERVICES - Will the project:	
(a) Affect availability of, or demand for, fire protection services?	The project will add road infrastructure to a relatively undeveloped area. This infrastructure would not only provide emergency vehicle access to a larger amount of land, but also gives a broader variety of evacuation options.
(b) Affect availability of, or demand for, police protection?	The project will likely result in an increased demand for police services.
(c) Affect availability of, or demand for, medical and other health care services?	The project will result in a small increase in the permanent resident population in the project area, which will proportionately result in an increase in demand for medical and other health care services...
(d) Affect availability of, or demand for, public water services, including municipal water supplies and storm water drainage?	The NSOD project will increase area demand for potable water and storm water drainage measures. However, the project has received an agreement in principle from the Water and Sewer Corporation that they have the capacity and will provide potable water services. Storm water will be managed by project design elements that will effectively address retention and detention of site storm water. Therefore, potential adverse impacts are not significant and will not require mitigation.
(e) Affect availability of, or demand for, public wastewater services?	The NSOD project will increase area demand for wastewater services. However, the project has received an agreement in principle from the Water and Sewer Corporation that they will have the capacity and will provide treatment of all waste water. Therefore, potential adverse impacts are not significant and will not require mitigation.
(f) Affect availability of, or demand for, schools and related educational support services?	The project will result in a small increase in the permanent resident population in the project area, which may result in an increase in demand for schools and related educational support services, but the number of school-aged children living at the resort is expected to be minimal.
(g) Affect availability of, or demand for, communication systems?	The NSOD project will increase area demand for telecommunication services. However, the Bahamas Telephone Company has the capacity to

Category	Explanation
	meet these demands. Therefore, potential adverse impacts are not significant and will not require mitigation.
(h) Affect availability of, or demand for, power?	The NSOD project will increase area demand for power/energy. The Bahamas Electric Corporation's 10 year load forecasting addresses the power needs associated with incremental growth and large development projects such as NSOD. BEC has indicated that they have the capacity and can meet the project's energy needs. Therefore, potential adverse impacts are not significant and will not require mitigation.
(i) Affect availability of, or demand for, solid waste disposal services?	It is expected that high volumes of solid waste will be generated during the construction phase of the proposed project, specifically during the dredging of the marina, the demolition of existing structures and during land clearing activities. There is also a potential that approximately 2 tons per day of domestic waste would be generated during the operational phase.
X. AESTHETICS - Will the project:	
(a) Result in objectionable odors to surrounding areas?	The project will not create any objectionable odors.
(b) Affect local noise standards (or existing conditions)?	The project will not exceed local noise standards.
(c) Affect visibility or view sheds (e.g., scenic views)?	The proposed project should have an overall positive affect on views of the property. At present the existing facilities are not in use and the area is somewhat neglected. The development of NSOD will restore the area to use and clean up the neglected areas.
(d) Create light or glare?	Operation of the NSOD will increase the amount of light in the area at night, however, lighting associated with the project will not be focused up but, rather, will be focused on lighting specific resources within the property (e.g., the golf course, amphitheater, marina, etc.
XI. RECREATION - Will the project:	
(a) Affect the quality of land-based recreational opportunities?	The project is expected to have a beneficial effect on recreational resources in the southwestern part of New Providence by providing additional resources
(b) Affect the quality of water-based recreational opportunities?	Stuart Cove's dive shop and operations will be relocated to the new marina within the NSOD site and will have new and improved facilities. The marina will support enhanced water-based recreational opportunities.
(c) Increase the demand for recreational facilities or opportunities?	It is likely that tourists visiting NSOD will be interested in other recreation activities on New Providence.

Category	Explanation
(d) Affect the quality and quantity of open space?	Restoration and re-development of the golf course will improve the quality of that space. Once opened, it will also increase the quantity of open space available to the public.
XII. TRANSPORTATION -Will the project:	
(a) Affect the local roadway infrastructure directly or indirectly (i.e., congestion, quality)?	Proposed development at the project site may have both beneficial and adverse effects on local roadway infrastructure. The realignment of South West Bay Road may inconvenience some motorists, but will provide more direct access from Nassau to southwest New Providence for most motorists. The project will generate some 550 new vehicle trips at the peak hour.
(b) Affect the local waterway infrastructure directly or indirectly (i.e., congestion, quality)?	The project would have a potentially significant beneficial effect on waterway infrastructure by adding a large marina to an area with little in the way of water transportation infrastructure.
(c) Alter emergency access to the project area and surrounding areas (e.g., during natural disaster events)?	The project would have a potentially beneficial effect on emergency access. New roads on the project site would provide improved emergency vehicle access.
(d) Create hazards for pedestrians, bicyclists, commercial boats, pleasure craft, etc.?	With proper signage, speed controls, and enforcement, the project should not create any significant hazards for pedestrians, bicyclists, commercial boaters, or pleasure craft.
(e) Affect the likelihood of transportation accidents, including oil spills, highway collisions, etc.?	The project will increase vehicular and boating traffic volume, but improved road conditions and signage should improve traffic safety.

5.1 IMPACTS ON THE PHYSICAL ENVIRONMENT

5.1.1 Water Quality Impacts

5.1.1.1 Freshwater

The proposed project will use approximately 1.6 million gallons per day of water. Table 5.3 summarizes the estimated water demand for the proposed project.

Ground Water Use

The NSOD project does not propose to withdraw any ground water for potable, irrigation, or other uses. The project proposes to obtain all of its potable water from the WSC.

Ground Water Quality

Activities that have the potential to impact ground water quality include excessive use of fertilizers and pesticides in green areas, machinery maintenance operations (in which spills might occur) and the excavation of the inland marina basin.

The highly porous limestone underlying the golf course could promote the infiltration of nutrients and pesticides from golf course maintenance. The 'south' blue hole appeared to have elevated concentrations of total suspended solids (TSS) that may, in part, be due to nutrient enrichment and the increase in algae growth. Nutrient enrichment of surface water bodies and blue holes could also cause a reduction in water quality due to reduction in dissolved oxygen (DO) concentrations.

Mitigation for nutrient and pesticide runoff will be accomplished through the development of a fertilizer and pesticide management plan and the collection of runoff water for reuse. Mitigation measures for potential spills at machinery maintenance areas will be covered in a Spill Control and Countermeasure Plan (SPCC) and will be controlled through the construction of secondary containments around potential spill areas.

Saltwater intrusion would occur as a result of excavation of the proposed inland marina basin. The thickness and geometry of the fresh ground water lens within the proposed marina basin footprint is unknown, but are expected to be limited in that fresh ground water was only found at a single point (an unused open well located in the cultivated area) within the immediate area. There are no known shallow wells in the vicinity of the marina that would be susceptible to saltwater intrusion. Further, since saltwater is denser than fresh water, the expected saltwater intrusion impacts would be expected to be more pronounced in the vertically downward direction. Nevertheless, it would be reasonable to expect horizontal migration of the saltwater/fresh ground water mixing zone up to several hundred feet surrounding the excavated basin.

3797 *Table 5.3* *Summary of Estimated Water Demand from Proposed Project*

Component	Quantity	Units	Water use per unit (GPD/person)	Persons per unit (80% occupancy)	Total water usage (GPD)
Four Star Hotel (Rooms)	650	Rooms	120	1.5	117,000
Four Star Hotel Casino, including Restaurant	40,000	square feet	1 gal/SF	N/A	40,000
Four Star Hotel Conference Center	27,000	square feet	1 gal/SF	N/A	27,000
Four Star Hotel (condos)	100	Units	120	1.5	18,000
Residential Large Estate Lots (estates)	40	Units	120	3	14,400
Mid-Size Estates	33	Units	317	2	20,922
Fractional Villas	48	Units	120	1.5	8,640
Timeshares	180	Units	120	1.5	32,400
Five Star Hotel including Restaurant, Priveé and Spa	100	Rooms	317	1.5	47,550
Commercial Space, including Amphitheater, TV and Recording Studios, and Utilities.	268,125	square feet	1.75 gals/SF	N/A	469,219
Racquet Club	10,000	square feet	4.80 gals/SF	10 persons/day	48,000
Marina & Stuart Cove's Facilities	118	Approximate number of berths	120	1.5	21,240
Roads	N/A		N/A	N/A	
Golf course	185	Acres	2,500 gals/acre	N/A	462,500
Support areas to the Golf Course	44,000	square feet	1 gal/SF	N/A	44,000
Landscaped areas	90	Acres	2,500 gals/acre	N/A	225,000
Employee Housing	50	Units	120	2	12,000
TOTAL	-				1,607,871

5.1.1.2 Surface Freshwater

Stormwater Runoff

The site will drain approximately 198.3 ac of impervious surfaces (see Table 5.4), as well as the 149.020 ac golf course. The site is low-lying and relatively flat with pervious soils, indicating that the stormwater design will focus on localized infiltration practices rather than large collection facilities and detention/retention basins. We anticipate that such a stormwater design pattern would minimize adverse surface water impacts by i) allowing for stormwater infiltration; ii) filtering stormwater through best management practices (BMPs); and iii) minimizing the use of complex interconnected stormwater management practices.

Table 5.4 Impervious Surface for Proposed Development

Amenity	Impervious Acreage
Four-star Hotel	38.8
Large Estate Lots	27.9
Five-star Hotel	26.0
Fractional Villas	11.3
Mid-Size Estates	31.4
Timeshares	10.6
Commercial Space	22.8
Racquet Club	8.0
Roads	21.5
TOTAL	**198.3**

One of the blue holes on-site already shows evidence of eutrophication, or excessive biological growth, indicating potential nutrient enrichment from excess fertilizer running into the hole with the stormwater runoff. To reduce the existing adverse effect and avoid future adverse effects of nutrient enrichment, we recommend that the golf course include infiltration facilities that intercept runoff prior to reaching the blue hole or other man-made ponds (water hazards).

Wastewater

The proposed project will generate wastewater that will be handled and treated by the WSC. The project will then accept treated wastewater effluent from the WSC to use as irrigation for the golf course and landscaping activities in order to minimize use of potable water.

Construction Activities

Construction activities, land clearing, and modification of natural topography can all result in temporary erosion and sedimentation. Deposited sediments can cover plants and sedentary animals and modify habitats. On land, construction activities can aggravate erosion and impact plants and animals in the construction areas. Sediment control measures should be taken to protect the areas surrounding the construction site, both on land and in the water. The document "Guidelines for Sediment Control Practices" has been consulted to ensure minimization of erosion and sediment impacts from the proposed project (CEP Technical Report, No. 32, 1994). Moderate impacts are expected and are to be controlled and mitigated with typical construction control measures.

5.1.1.3 *Marine Water*

Channel Sedimentation

The entrance channel to the marina may also experience irregular sedimentation and erosion. With the proposed inlet structure, it is unlikely that there will be any significant migration of sand from the eastern side of the eastern jetty into the entrance channel during normal conditions. During seasonal and episodic events, however, there could be some channel in-filling.

The dredged channel connecting the open sea to the marina entrance may also experience sedimentation during seasonal and episodic events. An artificial reef constructed out of ReefBalls will be placed between the four-star beach and the entrance channel, in order to minimize siltation due to sandbar formation during storms. Clamshell dredging will be employed to reduce the potential for sedimentation effects in the channel. We also recommend turbidity screens be used during dredging activities to minimize impacts. These activities will produce dredge material, which may be reused for beach nourishment (see Section 5.2.2 Aquatic Systems Impacts).

During initial construction and periodic maintenance dredging, the entrance channel and trench will produce turbidity plumes around the worked areas that may extend several hundred feet, depending on the current speed and direction. In marine environments, construction activities can increase sediment loads and turbidity in the water near construction sites. Increased turbidity reduces light penetration for marine plants and animals.

When the marina is opened to the sea and filled with water, initial turbidity in the marina will be high as loose sediments are suspended. This plume of high turbidity will exit the marina and dissipate in the sea over a relatively short period of time. Marina walls will be stabilized before it is opened to seawater to minimize suspended sediments.

Marina Discharge

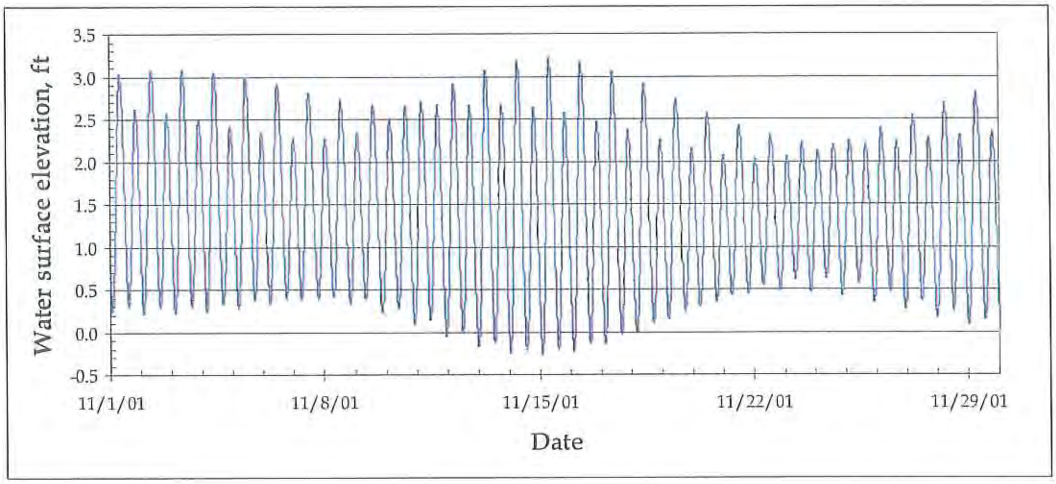
There is the potential for accidental spills within the proposed marina, as well as for low-level increases in nutrients, hydrocarbons, algae, and suspended solids. Sources of undesirable materials include refueling stations and waste disposal facilities for yachts and boats, among others. Dilution and dispersion characteristics of these materials can be examined by estimating the flushing potential of the marina (i.e., the time required to replace the water in the marina with new water from the sea). Several flushing experiments were run and are discussed below. The modeling approach shows that spills or regions of temporarily poor water quality in the marina are diluted and disperse to 90 percent of their initial concentrations well within 24 hours.

The USEPA (http://www.epa.gov/owow/nps/MMGI/Chapter5/ch5-2a.html) methodology is used to evaluate marina flushing, which recommends that the marina be flushed over a 24-hour period. Several flushing estimates are presented covering a range of tidal conditions.

The flushing rate calculation considers the entire marina volume and the number of tidal cycles it would take to replace that volume. The marina volume is approximately 240 acre-feet computed from its surface area of 16 acres (63,800 m^2), depth of 15 feet. A mean tide range of 2.5 feet sends approximately 40 acre-feet of water into the marina twice a day. At this rate, the marina will be refreshed in 3 days (3 = 240/40/2). The spring tidal range of 3.5 feet sends a tidal prism of 56 acre-feet into the marina twice a day. At this rate, the marina volume will be refreshed in 2.4 days (2.4 = 240/50/2). Assuming that flushing occurs linearly over time, these values can be scaled to show that the marina flushes to 90 percent of its volume between 2.7 and 2.16 days.

The Generalized Environmental Modeling System for Surfacewaters (GEMSS) 3-D hydrodynamic and transport model was used to provide a more spatially detailed, time-varying calculation of the marina's flushing potential as recommended by EPA. The model uses as input data the marina and channel layout and depth, offshore bathymetry, representative tide data, observed wind speed and direction, and water temperature and salinity. For this analysis, a nominal historic period of November 2001 was used, i.e., all the time-varying input files were assembled for this particular period, but they are representative conditions. The tidal elevations used in the model are shown in Figure 5.1, with November 8 as the neap tide condition and November 15 as the spring tide condition. The model uses these inputs and boundary conditions to simulate currents in the marina and near-shore areas. Once the currents are established after running the model for three days of simulated time, part or all, of the marina is marked with a hypothetical numerical dye and the dye is followed as it disperses from the marina. Two types of experiments were run.

Figure 5.1 Tidal Variation Used in 3-D Model Simulations



The first experiment involved neap tide conditions observed. This experiment provides a conservative estimate of the flushing time. The model was run for the three day spin up period, and then the dye was injected with an initial concentration of 100 mg/L (Figure 5.2). Two types of output from this simulation are presented here: (1) surface concentrations at various times (i.e., snapshots of the dye concentration) and (2) total dye mass within the marina as a function of time (time series of the dye mass). After one day, concentrations throughout the marina drop slightly, indicating that very little overall flushing has occurred (Figure 5.3). Areas near the entrance and the southern part of the marina exhibit the most flushing. Figures 5.4 and 5.5 show that flushing is not fully achieved in portions of the marina after two days.

A more realistic approach to determining the marina's flushing potential is to insert the numerical dye at a specific location to represent a spill or a region of temporarily poor water quality. This type of simulation is run using the same spin up time; once currents are established, the area of interest is numerically dyed and allowed to dilute within the marina and flush into the sea. The sequence of contour plots shown in Figure 5.6 through Figure 5.11 shows that the 90 percent dilution occurs in less than half a day. Figure 5.12 shows the time series output for the fraction of dye mass remaining within the marina and confirms the rapid dilution and flushing of the dye.

The illustrative calculation and the first modeling approach show that the combination of marina configuration and tide conditions are such that it cannot flush (replace) 90 percent of the water in the entire marina within 24 hours. The project will provide additional culverts to the ocean to improve flushing as needed. The second modeling approach, however, shows that spills or regions of temporarily poor water quality in the marina are diluted and disperse to 90 percent of their initial concentrations well within 24 hours.

Shoreline Erosion

According to oceanographic and sediment transport investigations, sediment movement is predominantly from east to west under normal conditions. Seasonal and episodic events are possible, however, that cause occasional transport towards the east. However, the magnitude of this transport is not significant, as evidenced by the lack of sand on the shoreline downstream and the lack of accumulation of sediment on the upstream side of the upstream jetty that currently shelters Stuart Cove's. Thus it is anticipated that the presence of inlet structures at the mouth of the marina will not have a significant impact on the shoreline downstream (to the West).

Figure 5.2 Surface Dye Concentrations at the Start of the Neap Tide Simulation – the Entire Marina is Dyed

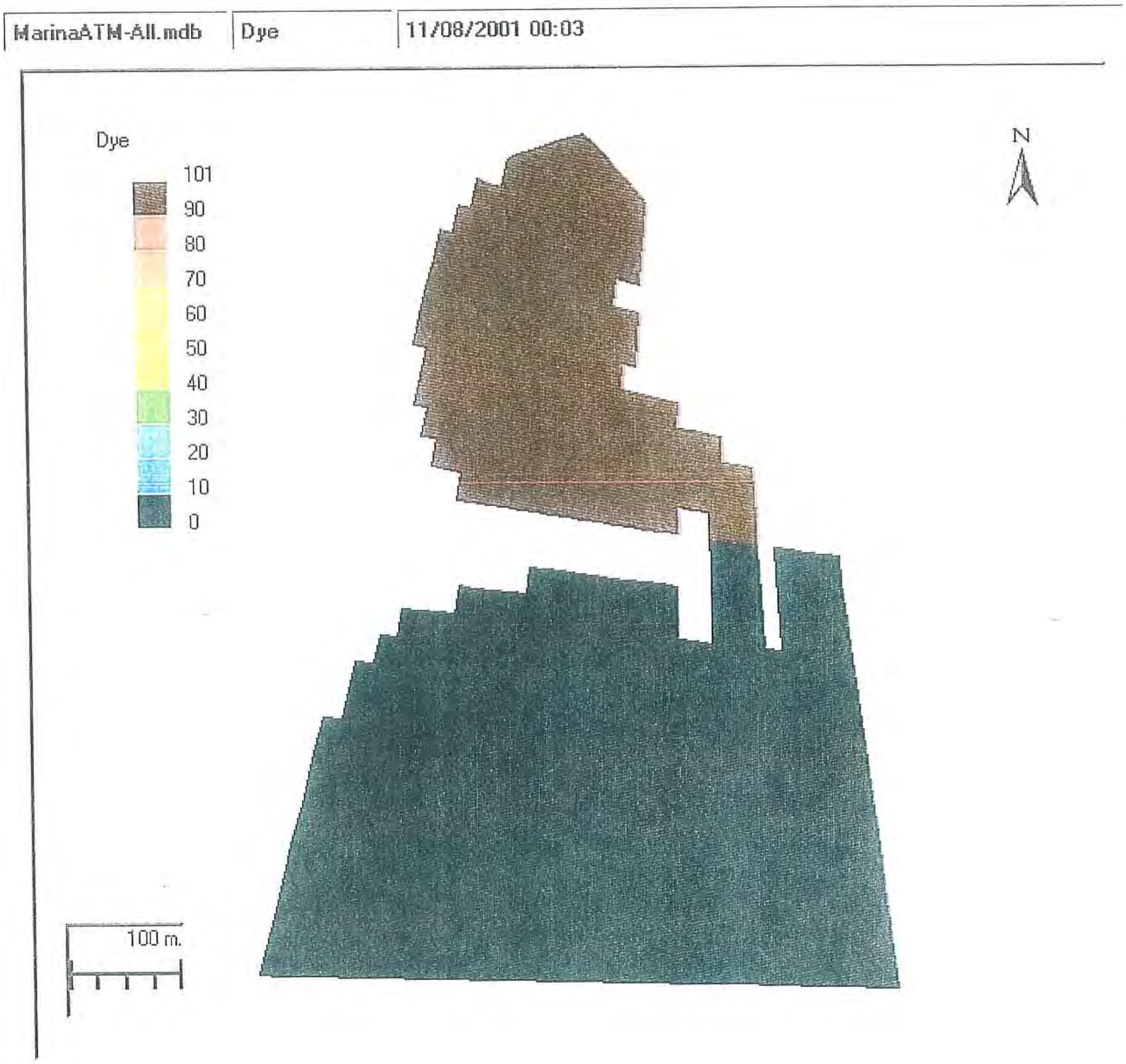


Figure 5.2 Surface Dye Concentrations at the Start of the Neap Tide Simulation- the Entire Marina is Dyed

9 *Figure 5.3 Surface Dye Concentrations One Day after Introduction of the Dye*

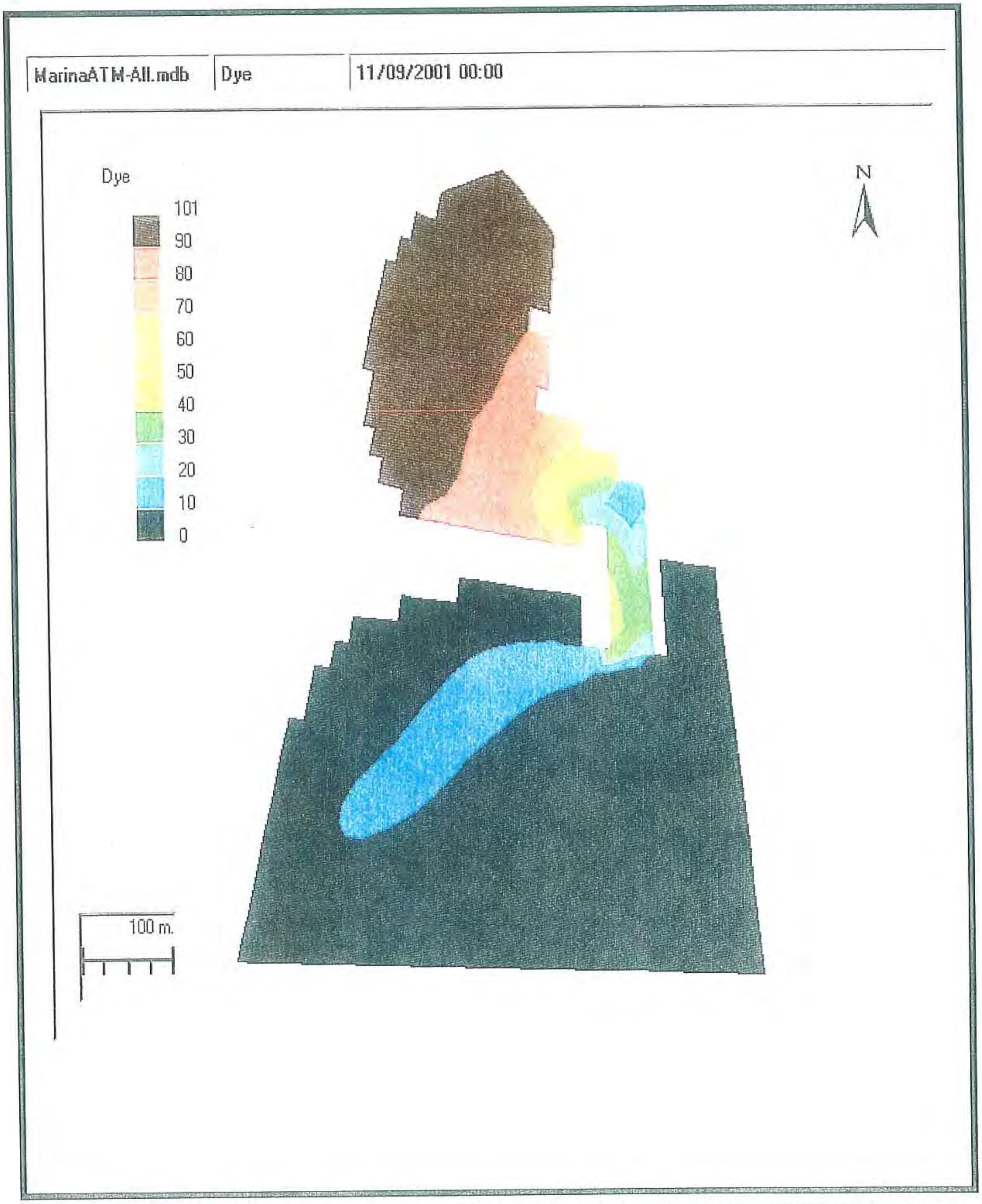


Figure 5.3 Surface Dye Concentrations One Day after Introduction of the Dye

0 *Figure 5.4 Surface Dye Concentrations Two Days after Introduction of the Dye*

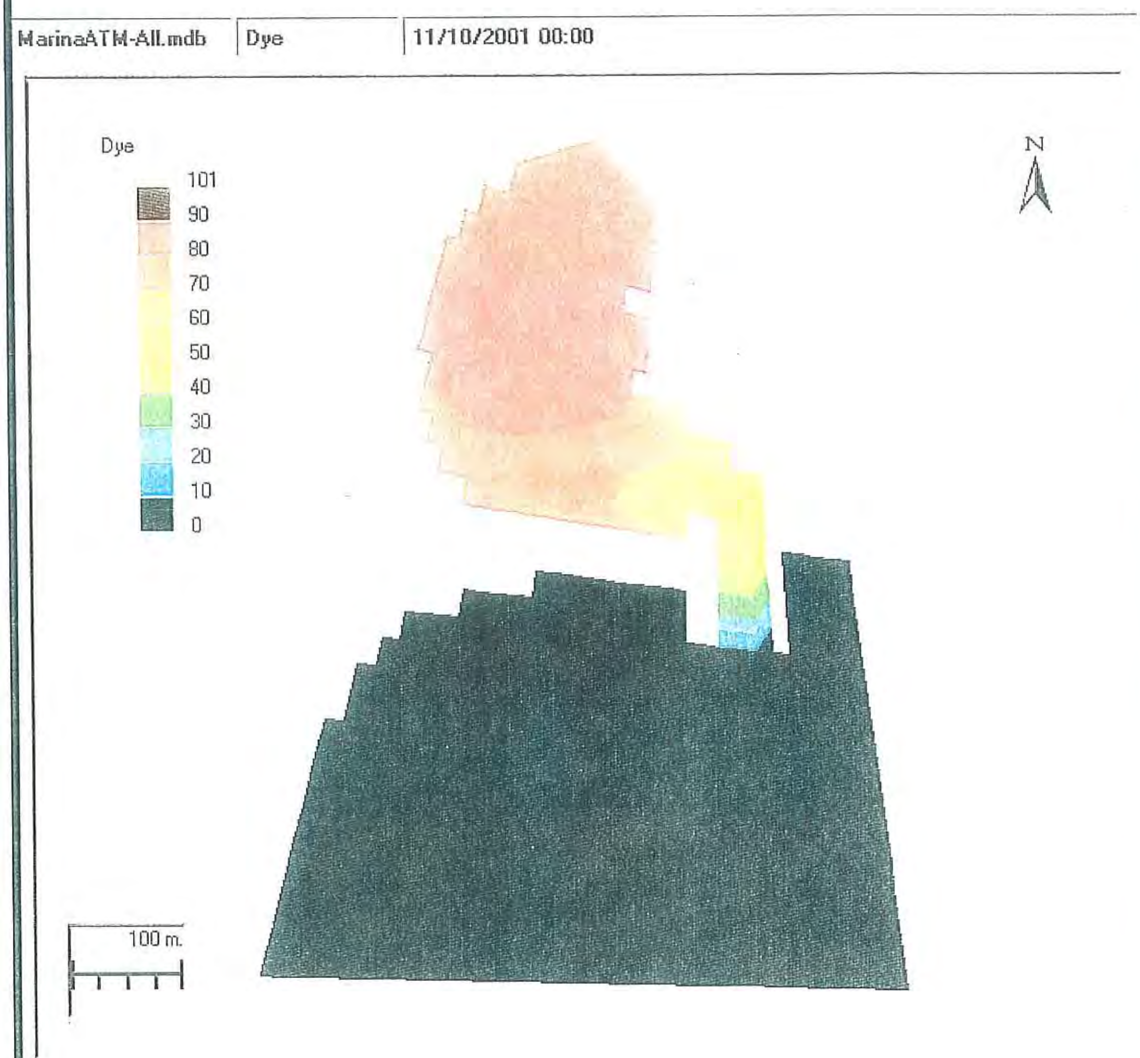
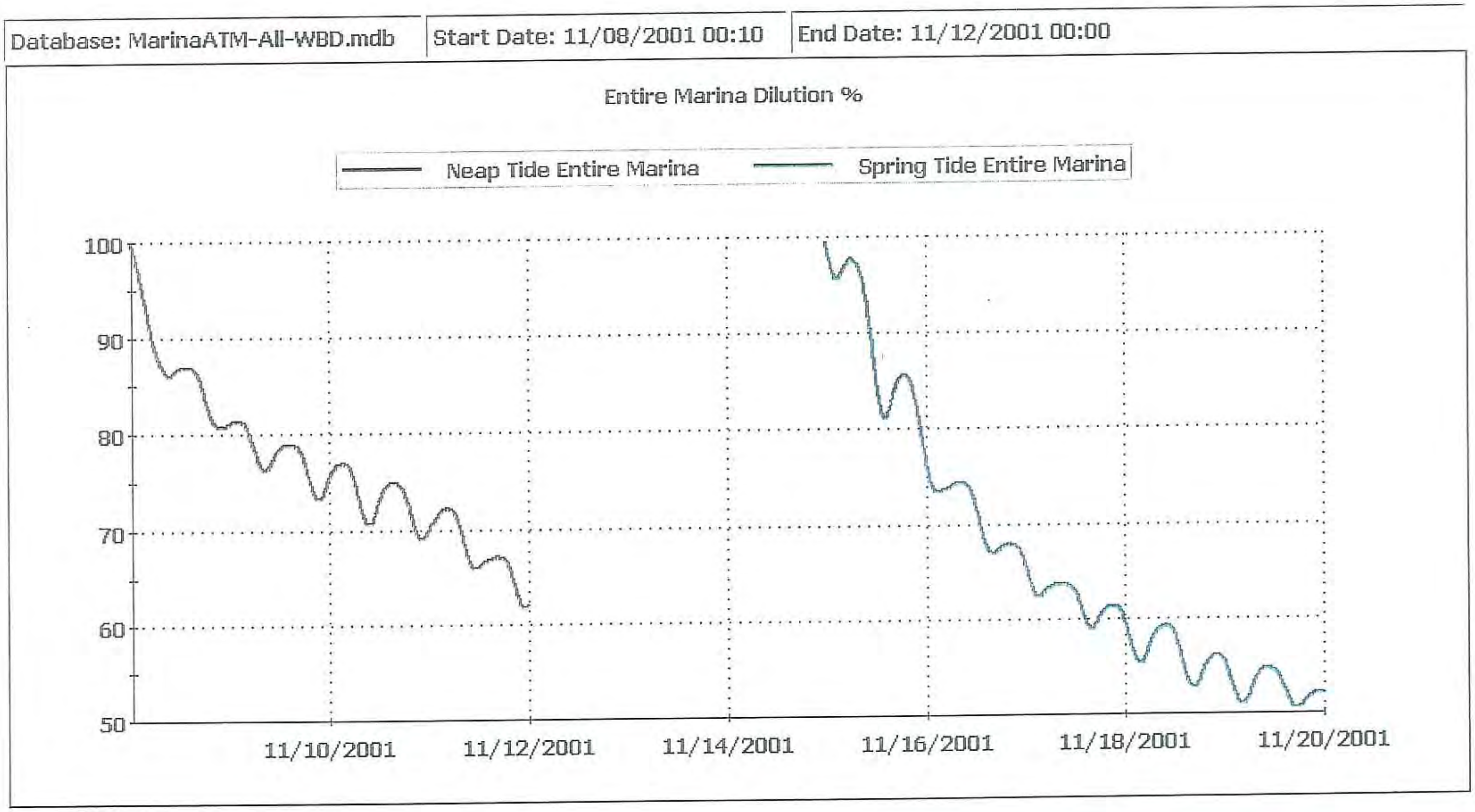


Figure 5.4 Surface dye Concentrations Two Days after Introduction of the Dye

Figure 5.5 Dye Mass Within the Marina as a Percentage of the Initial Mass for the Neap and Spring Tide Simulations



ERM

Figure 5.5 Dye Mass Within the Marina as a Percentage of the Initial Mass for the Neap and Spring Tide Simulations

Figure 5.6 Surface Dye Concentrations at the Start of the Neap Tide Simulation – the Center of the Marina is Dyed

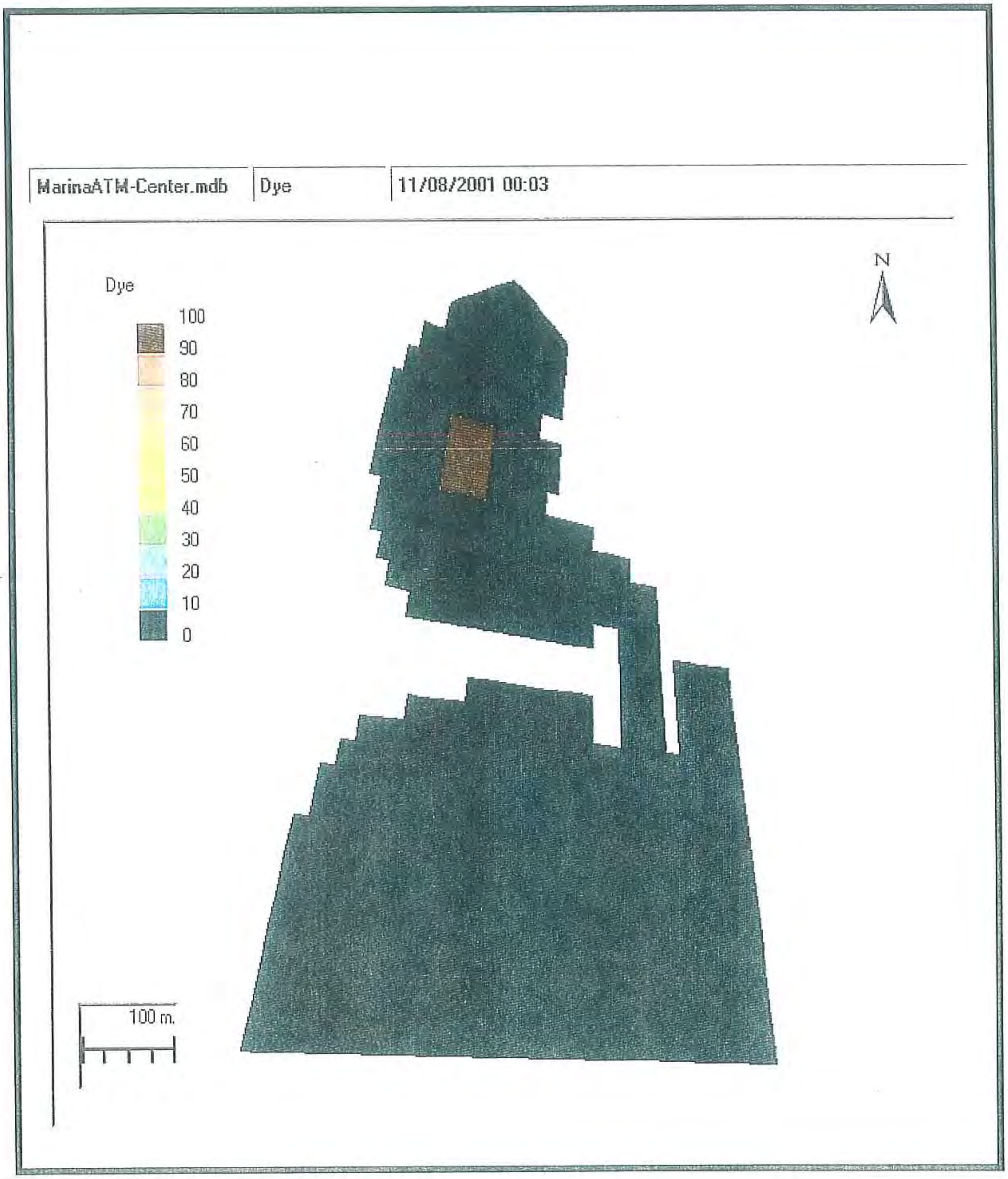


Figure 5.6 Surface Dye Concentrations at the Start of the Neap Tide Simulation- the Center of the Marina is Dyed

Figure 5.7 Surface Dye Concentrations One Hour after Introduction of the Dye

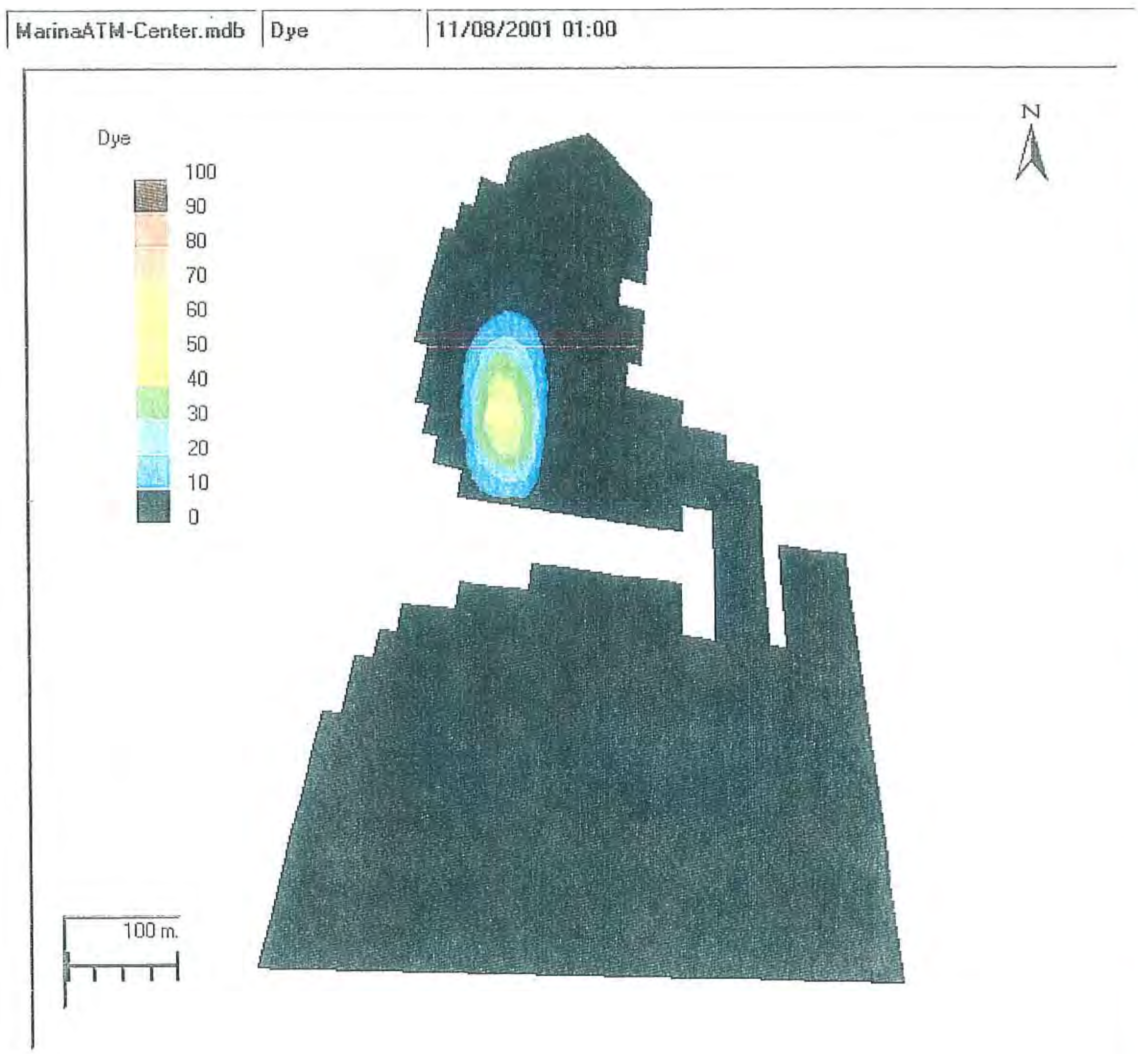


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Figure 5.7 Surface Dye Concentrations One Hour after Introduction of the Dye

6 *Figure 5.8 Surface Dye Concentrations Two Hours after Introduction of the Dye*

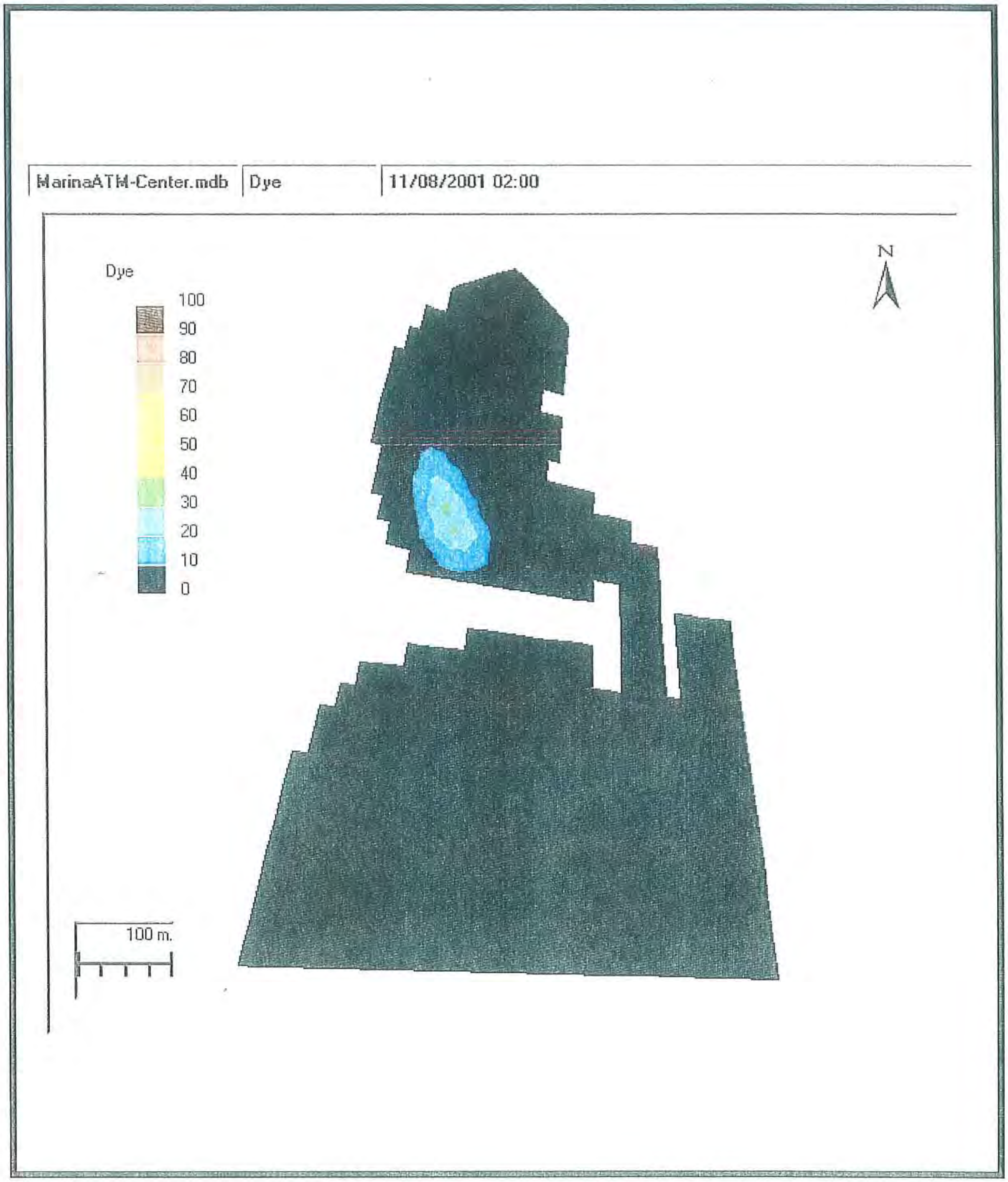

Figure 5.8 Surface Dye Concentrations Two Hours after Introduction of the Dye

.7 *Figure 5.9 Surface Dye Concentrations Four Hours after Introduction of the Dye*

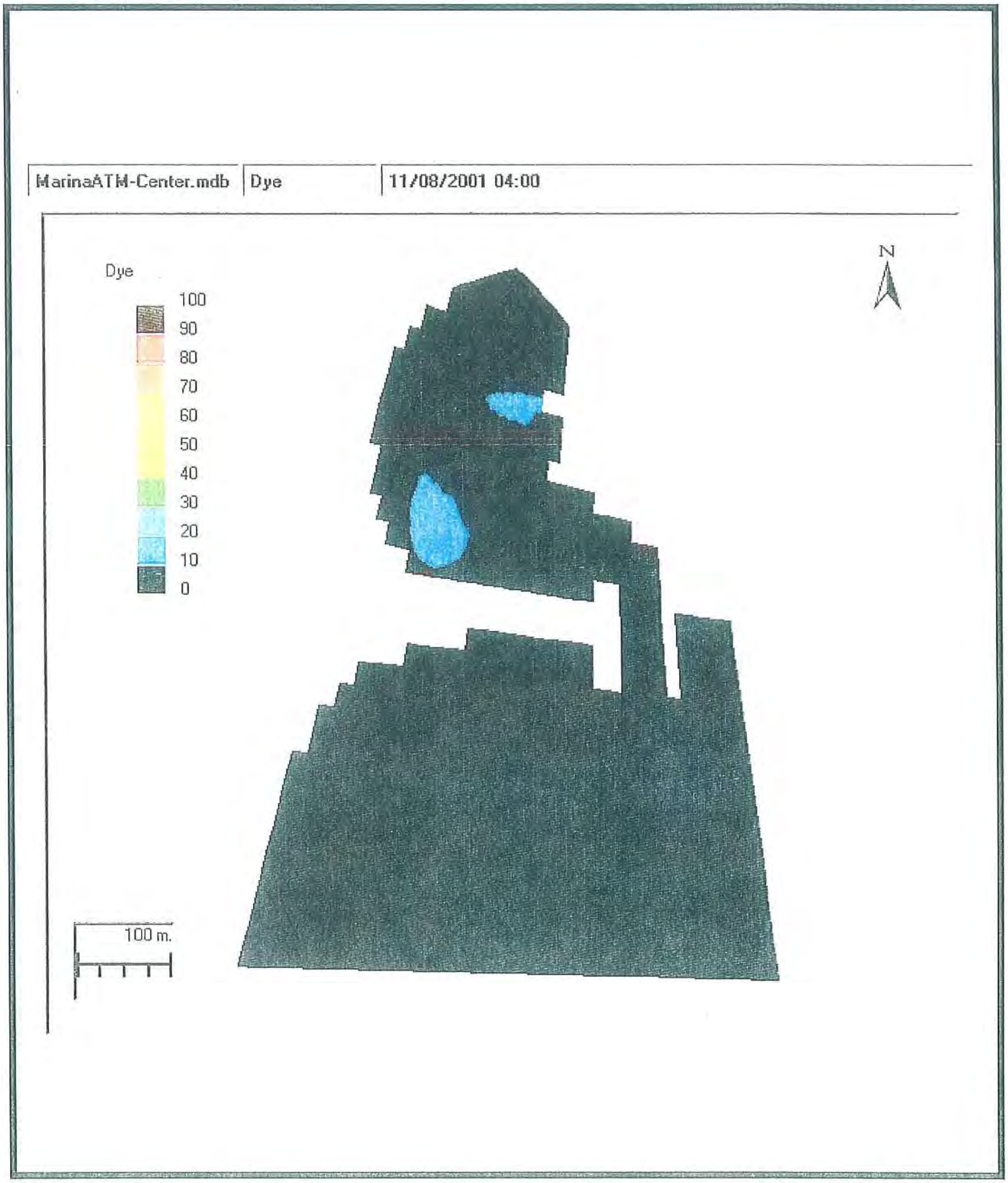

Figure 5.9 Surface Dye Concentrations Four Hours after Introduction of the Dye

8 *Figure 5.10 Surface Dye Concentrations Six Hours after Introduction of the Dye*

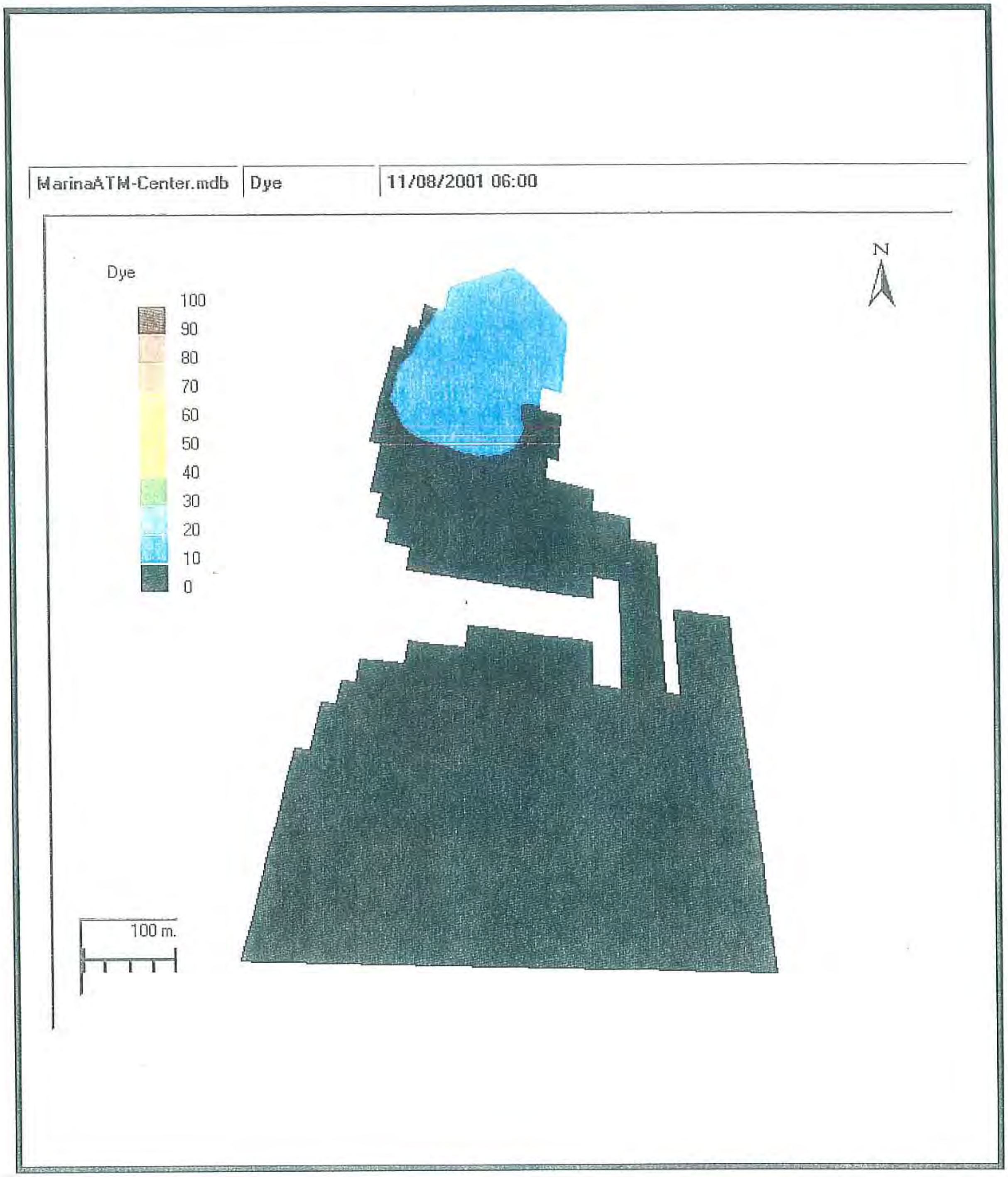

Figure 5.10 Surface Dye Concentrations Six Hours after Introduction of the Dye

9 *Figure 5.11 Surface Dye Concentrations Seven Hours after Introduction of the Dye*

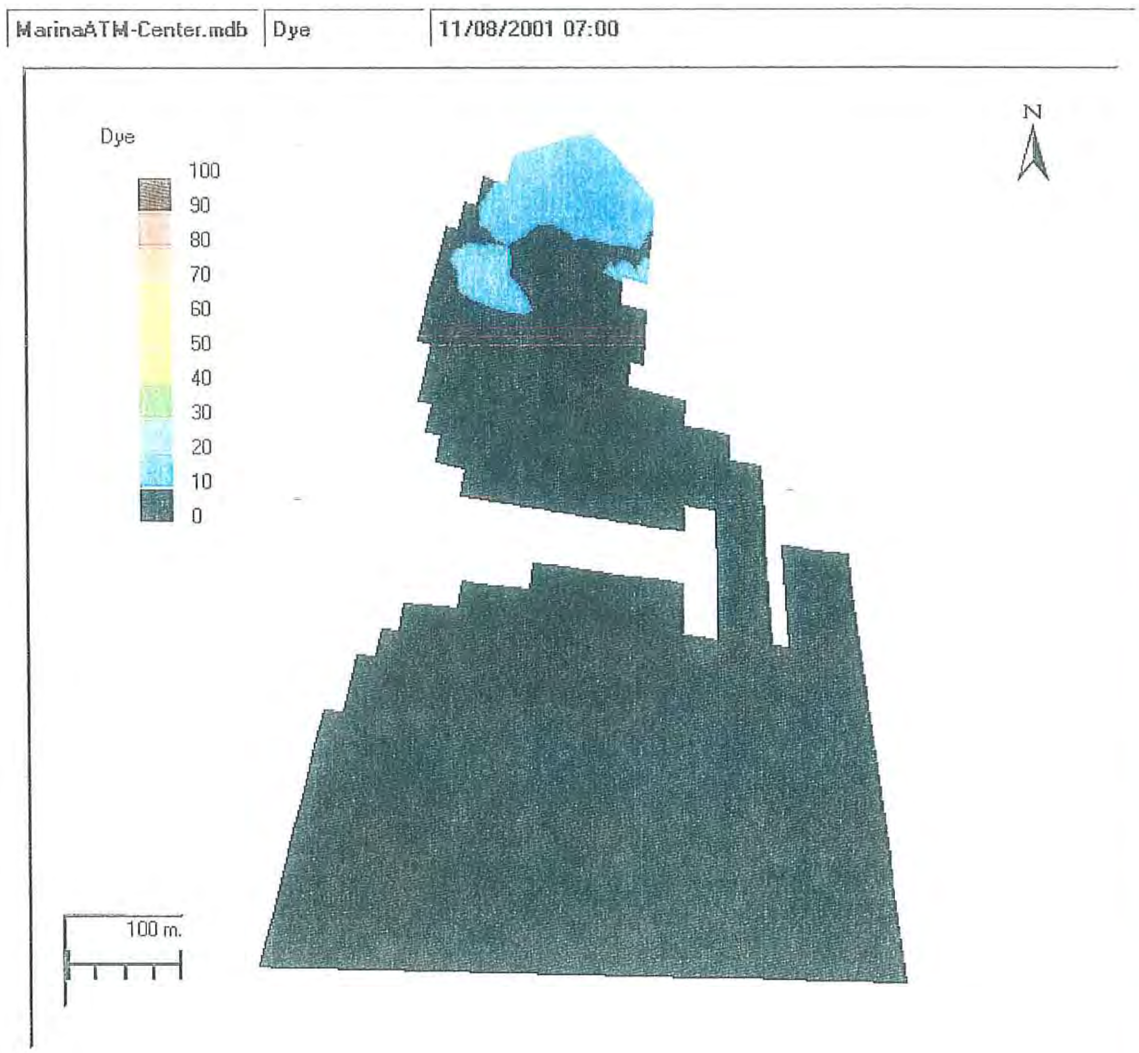

Figure 5.11 Surface Dye Concentrations Seven Hours after Introduction of the Dye

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Figure 5.12 Dye Mass Within the Marina as a Percentage of the Initial Mass for the Neap and Spring Tide Simulations for the Cases of Dyeing the Entire Marina Volume and Dyeing the Center Section of the Marina

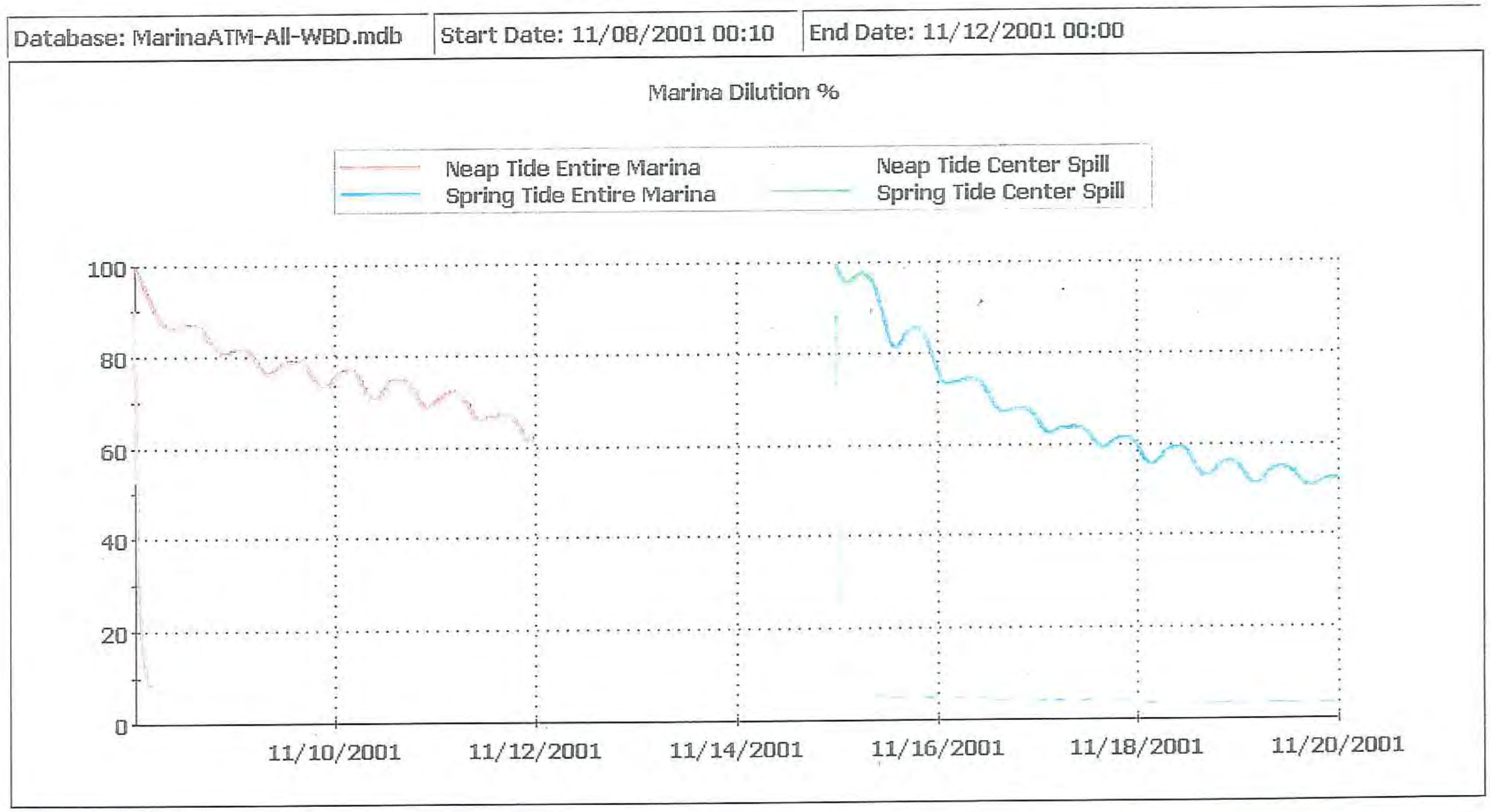


Figure 5.12 Dye Mass Within the Marina as a Percentage of the Initial Mass for the Neap and Spring Tide Simulations for the Cases of Dyeing the Entire Marina Volume and Dyeing the Center Section of the Marina

5.1.2 Air Quality Impacts

5.1.2.1 Construction Phase Air Quality Effects

The emissions during the construction phase of the NSOD project will be temporary and limited to the fugitive dust typical of construction projects and to combustion emissions from mobile sources such as trucks and front loaders. The main source of fugitive dust will come from the removal and movement of the earth and traffic movement. It is estimated that around 850,000 cubic yards of soil will be removed for the 16-acre marina development, and will be used to fill other areas of the resort.

The fugitive dust will be controlled through the use of water tank trucks and water sprinklers. The combustion emissions of the construction equipment will be reduced by means of preventive maintenance of the engines and turning equipment off when not in use for long periods of time. Trucks and heavy vehicle loads will be covered at all time when in the vicinity of residential areas and the roads will be periodically cleaned as needed.

5.1.2.2 Operations Phase Air Quality Effects

Resort projects are not considered major sources of air pollution or an imminent threat to air quality. The only aspects of the project that have been identified as having potential air quality effects are the expected increase in vehicular emissions and the use of boilers, emergency generators and fire pumps, which will operate only in case of emergency.

5.1.2.3 Greenhouse Gas Emissions

This type of project is not a major source of greenhouse gas emissions due to the low level of emissions generated and their temporary nature. Therefore, no adverse impact is expected to air quality as a result of the construction or operation of this project.

5.1.3 Noise Impacts

5.1.3.1 Construction Phase Noise Effects

Construction noise typically occurs intermittently and varies depending upon the nature or phase of construction (e.g., demolition/land clearing, grading and excavation). Construction noise will be generated from activities such as site preparation, truck hauling of material, pouring of concrete, and

use of power tools. Noise would also be generated by construction equipment, including earthmovers, material handlers, and portable generators. Although noise ranges are generally similar for all construction phases, the grading phase tends to involve the most equipment. According to the EPA, the noisiest equipment types operating at construction-sites typically range from 88 dBA to 91 dBA L_{max} at 50 feet (Table 5.5). Typical operating cycles may involve two minutes of full power, followed by three or four minutes at lower settings. Average noise levels at construction sites typically range from approximately 65 to 89 dBA L_{eq} at a reference distance of 50 feet ($L_{eq(ref)}$), depending on the activities performed (EPA, 1971).

Table 5.5 Construction Equipment Noise Levels

Type of Equipment	Typical Noise Level (dBA) at 50 feet: Without Feasible Noise Control	Typical Noise Level (dBA) at 50 feet: With Feasible Noise Control[1]
Dozer or Tractor	80	75
Excavator	88	80
Compactor	82	75
Front-end Loader	79	75
Backhoe	85	75
Grader	85	75
Crane	83	75
Generator	78	75
Truck	91	75

Note: dBA = A-weighted decibels

[1] Feasible noise control includes the use of intake mufflers, exhaust mufflers, and engine shrouds in accordance with manufacturer's specifications.

Source: EPA 1971

Source: EPA 1971

For stationary sources, a 6 dB reduction in sound level is achieved per doubling of distance (assuming hard non-absorptive ground conditions). However, for soft absorptive ground conditions like the project site, a standard equation used to calculate noise levels based on distance from a reference source is shown in equation 1:

$$L_{eq\,(receiver)} = L_{eq\,(ref)} - 20\text{Log}\,(D/\text{Ref. Distance}) - 10G\text{Log}\,(D/\text{Ref. Distance}) \quad \text{---} (1)$$

Where D is the receiver's distance from the source and G is the ground factor ($0 \leq G \leq 1$). Larger ground factors mean larger amounts of ground attenuation with increasing distance.

During each construction phase, several pieces of construction equipment would be spread throughout the project site. It is expected that the construction equipment would be located no closer than approximately 400 feet away from the closest NSAs. Using an average ground factor, G of 0.5 for the soft absorptive ground, typical noise levels of 89 dBA L_{eq} at 50 feet from construction activities will be heard as 66 dBA at 400 feet. Based on the existing noise levels at the four NSAs, these construction noise levels would only be perceptible (i.e., exceed 5 dBA above ambient noise levels) at NSA # 3 and 4. Construction noise would be temporary and would occur during daylight hours when occasional loud noises are more tolerable. Because equation 1 does not account for attenuation from surrounding vegetation, the actual noise heard by the receiver is expected to be lower. Extended disruption of normal activities is not anticipated. Provisions will be included in the plans and specifications requiring the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and maintenance of muffler systems.

5.1.3.2 *Operations Phase Noise Effects*

The major noise sources associated with the project are expected to include marina boats/yacht idling (stationary source) and increased vehicular traffic (mobile source). Noise levels from these exterior sources are expected to dominate noise levels from interior sources or enclosed buildings such as the amphitheater, recording studio, television studio, casino and racquet club, etc. The computed or modeled noise levels associated with the marina, and vehicular traffic (as well as its effects on nearby receptors) is discussed below.

Amphitheater

The potential amphitheater would likely generate some noise when being used for regional and community events such as plays, recitals, community celebrations, and concerts. Noise levels generated by amphitheaters are primarily a function of the type of performance to be provided. Noise levels can vary substantially depending on the use. Sound levels associated with symphony orchestra typically average approximately 90 dBA, whereas sound levels from a rock concert with an amplified speaker system can reach levels of approximately 120 dBA at six feet. Because noise associated with such events is typically directional, noise levels at equivalent distances to the rear and sides of the amphitheater stage would likely be considerably less than sound levels at areas located directly in front of the stage.

Presently, there are no nearby noise sensitive receptors or residential dwellings located on parcels in the line of sight of the stage. Using equation 1 (with G = 0.5) and assuming a maximum noise generation potential of 120 dBA at 6 feet, predicted maximum noise levels at the property line of the closest residences to the east (NSA # 4 or Point #4), approximately 2,800 feet away would be approximately 53 dBA. Because equation 1 does not account for attenuation from surrounding vegetation, the actual noise heard by the receiver is expected to be a few decibels lower. Based on the existing noise levels at the four NSAs, these noise levels would not be perceptible.

As part of this project, a 2-acre employee housing area would be constructed northeast of the amphitheater. Using equation 1 with the same assumptions (i.e. 120 dBA at 6 feet and G = 0.5), predicted maximum noise levels at the property line of the closest employee residence approximately 1,600 feet northeast of the amphitheater would be approximately 59 dBA. Because equation 1 does not account for attenuation from surrounding vegetation, the actual noise heard by the receiver is expected to be a few decibels lower. Furthermore, high generating noise events are not expected to occur frequently at the amphitheater. Therefore, the amphitheater is not expected to cause any significant adverse impact to the noise quality of the area.

Marina

Boats (or yachts) coming into the marina, idling dockside, and departing would likely generate some noise from the exhaust systems. The estimated sound exposure level (SEL_{ref}) at 50 feet for boat landing[6], idling, and departing is 91 dBA (FTA, 2006). Computation of hourly L_{eq} for the marina boats (from the SEL_{ref}) at 50 feet is shown in equation 2 as follows:

$$L_{eq}(h) = SEL_{ref} + 10\text{Log}(N) - 35.6 \quad (2)$$

Where N is the number of boat events of that occur during one hour.

[6] Boat landings are categorized as stationary sources because the noise from the landing remains in one area even though the boats move in and out (FTA, 2006).

At this stage of the project, exact number of hourly events is not known. Assuming not more than 10 boats would dock (land, idle, and depart) at the marina over a one-hour period; the hourly L_{eq} would be 65 dBA at 50 feet. Using equation 1 (with G = 0; since water is a non-absorptive/reflective surface) and assuming a maximum noise generation potential of 65 dBA at 50 feet, predicted maximum noise levels at the property line of the closest receptor (NSA # 2 or Point #2), approximately 1,500 feet away from the center of the marina would be approximately 35 dBA. Based on the existing noise levels at the four NSAs, these noise levels would not be perceptible. Therefore, the marina boats are not expected to cause any significant adverse impact to the noise quality of the area.

Vehicular Traffic

Increase in vehicular traffic volume in the local area as a result of the proposed project will likely generate some noise. The proposed project is expected to increase vehicular traffic volumes at two major roadways in the vicinity of the site. The two roadways as shown in the design layout of the NSOD site (see Appendix B) are:

- South West Bay Road, which generally follows an east-west trajectory; and
- South Ocean Boulevard; which generally follows a north-south trajectory.

Based on traffic studies conducted for the proposed project, Table 4.6 presents the existing and future peak hour traffic volumes for both roadways.

Table 5.6 Peak Hour Traffic Volumes at Two Major Roadways

Roadway	South Ocean Boulevard		South West Bay Road	
	Northbound	Southbound	Eastbound	Westbound
Existing Peak Hour Volumes				
Automobiles	216	50	37	137
Trucks and Buses[1]	5	2	1	4
Total	221	52	38	141
Future Peak Hour Volumes				
Automobiles	320	147	37	156
Trucks and Buses[1]	6	3	1	4
Total	326	150	38	160

[1] Sixty percent of the trucks are assumed to be medium trucks and forty percent are assumed to be buses.

The FHWA Traffic Noise Model (Version 2.5) was used to estimate the increase in traffic noise level associated with the proposed project based on the increase in the future peak hour volumes. The FHWA model was used because the vehicle equations are applicable to speeds typical of freely-flowing traffic on city streets and access roads.

Traffic counts were conducted within segments of both roadways (i.e., approximately 2,000 feet apart on South West Bay Road and approximately 5,000 feet apart on the South Ocean Boulevard). There are no traffic light signals on segments of both roadways surrounding the proposed project.

Table 5.7 presents the results of the FHWA Traffic Noise Model as well as the FHWA allowable noise increase for the nearest receptors (NSA #1 and 3). The noise modeling results are based on the vehicles (automobiles, medium trucks, and buses) operating between 50 and 100 feet away from the nearest noise sensitive receptors at an average speed of 55 miles per hour (mph).

Table 5.7 Noise Effects of the Proposed Project Based on Increased Peak Hour Traffic Volumes

Parameters	South West Bay Road	South Ocean Boulevard
Nearest Sensitive Receptors[1]	NSA # 1 (Residences; approx. 50 ft to roadway)	NSA # 3 (Residences; approx. 100 ft to roadway)
Ambient Noise[2]	62.2	53.1
Existing Peak Hour Traffic Noise (including Ambient Noise)[2]	62.6	63.7
Future Peak Hour Traffic Noise (including Existing Traffic Noise)[2]	64.5	65.8
Noise Increase[2]	1.9	2.1
FHWA Allowable Noise Increase[2, 3]	10	10
FHWA Noise Abatement Criteria for Category B Land Use Activity (developed land)[2, 4]	67	67

[1] NSA # 1 and 3 are the nearest sensitive receptors to the roadways.

[2] Noise expressed as L_{Aeq}(hour) in dBA

[3] Most State highway agencies use either a 10 dBA increase or a 15 dBA increase in noise levels to define a "substantial increase" in existing noise levels (FHWA 1995). For the purpose of this noise assessment, a 10 dBA increase in noise level was conservatively used to define "substantial increase".

[4] See Table 4.7 for the FHWA Noise Abatement Criteria

Source: FHWA Traffic Noise Model, Version 2.5

The results of the FHWA Traffic Noise Model shown in Table 5.6 indicate that the increased peak hour traffic volumes along South West Bay Road and South Ocean Boulevard would add approximately 1.9 to 2.1 dBA (L_{Aeq}(h)) above the existing peak hour traffic noise of 62.6 to 63.7 dBA. Table 5.7 also indicates that the future traffic noise levels are below the FHWA Noise Abatement Criteria (NCA) for Category B land use activity. Therefore, the increased traffic volumes associated with the proposed project are not expected to cause any significant adverse impact to the noise quality of the area.

5.1.4 Solid and Hazardous Waste Impacts

Table 5.8 shows estimated solid waste generation during the construction and operation phases of the project along with the intended disposal methods.

4134 **Table 5.8** **Waste Impact Summary**

Source	Estimated Amount	Phase	Disposal Method	Impact
Land clearing (vegetative residues)	324,000 ton	Construction	Mulching/composting	Impacts will be minimized by using sustainable practices such as materials reuse and recycling.
Demolition debris	315,000 ton	Construction	Reuse as filling material/Concrete recycling	Impacts will be minimized by using sustainable practices such as material reuse and recycling.
Used motor oil from machinery and other equipment	1.1 ton/year	Construction/ Operation	Recycling	Impacts will be minimized by establishing best management practices and spill control and countermeasure methods. All residues of used oil will be handled according to best management practices and recycled whenever possible at facilities approved by DEHS.
Maintenance activities that generate hazardous waste (i.e. fuel, solvents, flammable paints, herbicides, fluorescent light ballasts, mercury-containing switches, pesticides, wet/dry batteries)	0.11 ton/month	Construction/Operation	Coordination with DEHS for appropriate collection, storage and final disposition.	Impacts will be minimized by establishing best management practices and spill control and countermeasure methods. All residues of hazardous materials will be handled according to best management practices and recycled whenever possible at facilities approved by DEHS. Procedures will be established to substitute hazardous materials with more ecologically friendly alternatives whenever possible (e.g. mercury free fluorescent light ballasts and switches).
Special Waste (asbestos and/or lead containing	Undetermined	Construction	Coordination with DEHS for appropriate collection, storage and final disposition	Based on the age of the structures at the proposed site, (i.e. 35 years) there exists the potential that asbestos and/or lead containing materials could be present. The proposed project includes the demolition of all existing structures.

Source	Estimated Amount	Phase	Disposal Method	Impact
materials				For this reason, an asbestos and lead containing materials survey will be conducted prior to demolition activities. In case any of these materials are found, a removal and disposal plan will be prepared to ensure the adequate handling and disposal of such materials.
Dredged material	1,265,823 cubic yards	Construction	Will be used as filling material at other areas of the project.	Impacts will be minimized by using reusing material for beach nourishment.
Cooking Oil	192 cubic yards/year	Operation	Recycling	Impacts will be minimized by establishing best management practices. All residues of vegetable oil will be handled according to best management practices and recycled whenever possible at facilities approved by DEHS.
Domestic waste, including but not limited to: paper, aluminum cans, plastic bottles, landscaping residues, glass bottles, disposable plates, utensils etc.	2 tons/day	Operation	Recycling/ Composting	The estimated rate of domestic waste disposal at the proposed project during the operational phase is 2 tons/day. This generation rate would shorten the life of the new Harrold Road landfill by 0.3 percent in a yearly basis. Pollution prevention measures and waste minimization strategies will be implemented during the construction and operational phases of the project

As shown in Table 5.8, it is expected that the highest volumes of solid waste will be generated during the construction phase of the proposed project, specifically during the excavation of the marina, the demolition of existing structures and during land clearing activities. There is also the potential for approximately two tons of domestic waste to be generated during the operational phase.

The potential adverse impacts to be generated by these scenarios will be minimized by establishing environmentally sound management practices. Pollution prevention, waste minimization practices and eco-efficiency, are alternatives that will be evaluated, considered and implemented throughout the construction and operational phases of the project. The implementation of these alternatives would represent a reduction of up to 100 percent in construction debris and of up to 73 percent in domestic waste that otherwise would need to be disposed off in a landfill.

5.1.5 *Fire and Hurricane Risks*

The proposed project will not entail risks for fires or hurricanes. In the final design of the project, fire prevention and control devices will be included. Safety manuals will be developed, outlining the protocols and procedures to be followed during emergency situations including fires and storms.

The Bahamas, like all countries in the Caribbean basin, is vulnerable to hurricanes. Hurricane season officially runs from June 1 to November 30, although hurricanes have been known to occur outside that time period. Due to its low relief topography, hurricanes may cause storm surge damage mainly to the coastal side of the NSOD property. A contingency plan will be developed by the NSOD in order to minimize the environmental impacts of hurricanes. Proper containment measures will be provided for all hazardous materials in the plan. All staff members that would be required to handle hazardous materials as part of their duties will undergo training in emergency procedures, in the operation of fire control equipment and in methods for securing facilities such as fuel storage tanks and hazardous material containers.

5.2 IMPACTS TO THE NATURAL ENVIRONMENT

This section summarizes anticipated impacts to the natural environment at the NSOD project site. As detailed earlier in this report, many of the features of the NSOD project will occur within previously disturbed/developed areas of the former South Ocean Golf & Beach Resort, which currently is not operational. As a result, many impacts to the natural environment that normally would result from the development of a greenfield site will not occur. Additionally, after development, the future site use will be identical in many aspects to the operations of the original South Ocean Golf & Beach Resort. Accordingly, with the possible exception of the proposed marina, no new operational impacts are anticipated. Examples of this identical land-use redevelopment are noted below.

Greg Norman Championship Golf Course, Clubhouse, and Support Facilities

The golf course and associated maintenance complex, clubhouse, and clubhouse parking will be constructed in previously developed areas currently occupied by other similar structures. Accordingly, no new negative impacts to the natural environment are anticipated with respect to the construction or future operation of these facilities.

Five-Star Hotel and Support Facilities

The future five-star 100-room hotel and associated hotel parking near the south central portion of the future complex will be erected in previously developed portions of the site that currently house the existing hotel, hotel parking, the south entrance road, tennis courts, and vacant property on the west side of the south entranceway.

Marina Basin and Associated Retail/Residential Facilities

Much of the future marina basin, surrounding retail facilities, and condominium hotel units are scheduled for construction in an area that has been essentially cleared of native vegetation. This former coppice habitat is largely exposed oolitic limestone. Land use in this area currently consists of small-scale pothole agriculture. Additionally, portions of the casino and conference center will occupy cleared land along the western boundary of this portion of the site where an access drive and single-family residence have been partially constructed. Other terrestrial habitat in this area will be affected, as discussed below.

Other aspects of the planned redevelopment of the South Ocean Golf & Beach Resort site will require impacts to natural habitats. These aspects of the project will result in minor impacts to terrestrial and marine habitats, as detailed below.

5.2.1 *Terrestrial Ecosystem Impacts*

This section summarizes potential impacts to on-site terrestrial habitats as a result of the construction and operation of the planned improvements. Consideration has been given to both the physical impacts that may occur during site development, as well as potential impacts stemming from the future operation of the resort.

Impacts caused by site development will be more significant than impacts resulting from site operation because future operational impacts will be essentially identical to those associated with the historical operation of the former South Ocean Golf & Beach Resort. The NSOD project will occupy a larger amount of land than the original resort. With the exception of this larger geographic scale and the marina, land use at the new resort will be the same as the former resort. Construction of the future marina will impact the existing terrestrial ecosystem to a minor extent (the marina is being constructed in an area of previously cleared land); however, future marina operations are not expected to pose appreciable impacts to onshore natural habitats. Rather, potential impacts stemming from the future operation of the marina, if any, are expected to affect the marine environment and are addressed in Section 5.2.2.4 of this report.

5.2.1.1 *Broadleaf Coppice-Undisturbed*

Undisturbed Broadleaf Coppice is the most extensive undisturbed habitat on-site, occupying approximately 166.0 acres (43.96 percent of the site). Development of the project will require clearing an estimated 75-85 percent of the undisturbed coppice (124.5 to 141.1 acres) at the site.

Removal of undisturbed broadleaf habitat will have localized, potential adverse effects on vegetation and wildlife on the project site, and will constitute the most important potential terrestrial biological impact associated with the proposed project. These effects would be mitigated at least in part because the 24.9 to 41.5 acres of undisturbed coppice that will remain on-site will provide some refuge for displaced wildlife, and adjacent off-site forested areas, including the Primeval Forest, would provide additional habitat for wildlife displaced from the project site.

Losses of undisturbed Broadleaf Coppice will have limited adverse effects on biological resources. Given the amount of clearing associated with the proposed project, some mortality of wildlife that is unable to avoid machinery or find suitable habitats elsewhere, either within the remaining coppice at the project site or in nearby coppice habitat off-site, likely, will occur. These effects will be limited largely to common species and will not significantly impact protected species, in view of proposed mitigation measures. The proposed project includes several measures that will minimize impacts on protected species, including identifying protected trees, minimizing clearing of protected trees, and relocating protected trees and wildlife from disturbed areas. These measures will further reduce potential impacts of the proposed project on the most sensitive components of the Broadleaf Coppice community on the site.

5.2.1.2 *Broadleaf Coppice-Disturbed*

Disturbed Broadleaf Coppice is present on over approximately 20.2 acres of the site (5.35 percent), predominately along the coastal road near the southeastern portion of the property. Small areas of disturbed coppice are also present around the blue hole near the putting green of the 15th hole and along a former unimproved road through the undisturbed coppice on the northwest portion of the site. An estimated 65 - 75 percent (13.1 to 15.1 acres) of disturbed Broadleaf Coppice habitat will be eliminated during development of the project.

Losses of disturbed Broadleaf Coppice will have potential limited adverse effects on biological resources. The proposed project will affect a much smaller area of disturbed Broadleaf Coppice than undisturbed broadleaf coppice, and the disturbed nature of this habitat makes it relatively less valuable than undisturbed coppice. The same factors that will mitigate the biological impacts of clearing undisturbed coppice, including retention of undisturbed coppice on-site, availability of similar habitats at nearby locations off-site, minimizing clearing, and retention/relocation of protected species will also mitigate effects on disturbed Broadleaf Coppice.

5.2.1.3 *Cleared Coppice*

Approximately 20.5 acres of Cleared Coppice are present on-site, representing approximately 5.4 percent of the total site. These areas formerly consisted of Broadleaf Coppice or Mixed Evergreen/Broadleaf Coppice. Clearing was conducted historically by various parties for various purposes. These areas have little functional ecological value. Small areas of existing Cleared Coppice are present in the north central and northeast portions of the site.

A considerably larger area of Cleared Coppice exists at the southwest portion of the site, just north of the coastal road and adjoining disturbed

Broadleaf Coppice. Much of this area of Cleared Coppice currently is being used for pothole agriculture.

These areas will be affected by construction of housing, the marina, and the other facilities noted; however, owing to the existing condition of these parcels, there will be no net loss of productive natural habitat. Additionally, mitigation efforts to relocate protected species throughout the project site, in advance of construction should prevent the loss of the few examples of protected plants noted in this area.

5.2.1.4 *Mixed Evergreen/Broadleaf Coppice-Undisturbed*

Approximately 4.7 acres of undisturbed Mixed Evergreen/Broadleaf Coppice are present along the eastern boundary of the site. This habitat type accounts for approximately 1.2 percent of the total site. Development of the project will require the clearing of approximately 60 to 70 percent of the undisturbed mixed coppice, representing approximately 2.8 to 3.3 acres.

Losses of undisturbed Mixed Evergreen/Broadleaf Coppice will have potential minor adverse effects on biological resources. Although the proposed project will remove more than half of the undisturbed Mixed Evergreen/Broadleaf Coppice habitat at the project site, this habitat comprises a relatively small amount of the project site, accounting for less than two percent of the terrestrial habitat at the project site. The limited distribution of undisturbed Mixed Evergreen/Broadleaf Coppice at the project site would effectively limit the magnitude of potential impacts associated with clearing this habitat type. Wildlife displaced from the relatively small area of affected Mixed Evergreen/Broadleaf Coppice at the project site would likely relocate to similar habitat at nearby off-site locations. Measures designed to identify, retain, and relocate protected species as necessary will mitigate project effects on protected species.

5.2.1.5 *Mixed Evergreen/Broadleaf Coppice-Disturbed*

Just to the west and bordering the undisturbed Mixed Evergreen/Broadleaf Coppice, is a stand of disturbed mixed coppice. This area has been affected historically by the installation of a storm water drainage trench in the coppice and along the fringe of the golf course. Development of the project will require clearing approximately 90 percent (4.3 acres) of disturbed Mixed Evergreen/Broadleaf Coppice.

Losses of disturbed Mixed Evergreen/Broadleaf Coppice will have potential minor adverse effects on biological resources. This habitat's disturbed condition makes it less valuable than undisturbed Mixed Evergreen/ Broadleaf Coppice. The same factors that will mitigate the biological impacts of clearing undisturbed Mixed Evergreen/Broadleaf Coppice will also mitigate project-related effects on disturbed mixed coppice.

5.2.1.6 *Sand Strand-Undisturbed*

Undisturbed Sand Strand occupies a narrow, 1.9 acres strip of land south of the coastal road at the extreme southwest corner of the site. The entire Sand Strand habitat on-site will be cleared to develop the project. Assuming as little natural vegetation is removed as possible during clearing, approximately 90 percent of the habitat (1.7 acres) will be cleared.

Losses of undisturbed Sand Strand will have minor adverse effects on biological resources. Although all of the Sand Strand habitat at the site will be developed, this habitat comprises a relatively small amount of the project site, accounting for less than 1 percent of the terrestrial habitat at the project site. Measures designed to identify, retain, and relocate protected species as necessary will mitigate project effects on protected species.

5.2.1.7 *Sand Strand-Disturbed*

Two areas of disturbed Sand Strand are present on-site, a small parcel near the east end of the undisturbed Sand Strand noted above and a second larger parcel that fronts the existing multiple-unit housing development adjacent to the eastern boundary of the current South Ocean Golf & Beach Resort beachside complex. Together, these parcels comprise approximately 0.7 acres (0.2 percent of the total project site). Both of these areas of disturbed Sand Strand will be eliminated as a result land clearing and construction.

Losses of disturbed Sand Strand will have minor adverse effects on biological resources. This habitat's disturbed condition and the lack of protected species makes it less valuable than undisturbed Sand Strand. The same factors that will mitigate the biological impacts of clearing undisturbed Sand Strand will also mitigate project-related effects on disturbed Sand Strand.

5.2.1.8 *Aquatic Emergent Vegetation*

A small area (0.1 acres) of aquatic vegetation (cattails) is present in the man-made pond near the southeast portion of the golf course. There are no plans to alter this feature during redevelopment, nor will site operations differ so as to affect the vegetation. Therefore, no impacts to this habitat are anticipated.

5.2.1.9 *Sandy Beach and Coastal Rock*

At present, Sandy Beach habitat is present along most of the beach fronting the current South Ocean Golf & Beach Resort and Stuart Cove's. A small area of Coastal Rock fronts the vacant, grass-covered parcel between the original resort and Stuart Cove's, and rock is also present near the east jetty of the inlet to Stuart Cove's. Much of Sandy Beach in front of the resort was man-made, based on-site observations, and is prone to erosion during storm events. The Conceptual Master Plan (2007) calls for preservation and apparent widening (re-nourishment) of the full extent of the beach fronting the beachfront resort parcel. Also, the jetty marking the former inlet to Stuart Cove's will be retained, despite filling the Stuart Cove's marina (see Impacts to Marine Habitats below).

To the west of Stuart Cove's is a private condominium complex that will not be part of the NSOD project. A small area of Sandy Beach is located seaward of the disturbed Sand Strand. As noted above, this parcel of disturbed Sand Strand will be eliminated with the construction of the inlet to the marina, as will the small area of Sandy Beach. To the west of this small area of Sandy Beach, the shoreline is Coastal Rock habitat. According to the Conceptual Master Plan (2007), this area to the west of the new inlet, will be the site of the future 400-Room, Four-star Hotel and/or hotel-associated amenities (swimming pools, beachfront walkways, out buildings, etc.). The plan also indicates that a Sandy Beach will be constructed to front these landside improvements.

The project would include several measures designed to avoid, minimize, and/or mitigate effects on terrestrial components of the natural environment. The following measures would be implemented during the construction and operational phases of the proposed project:

- The remaining coastal strand vegetation along the beach would be protected through building setbacks and boardwalks to the greatest extent possible;
- Exterior landscaping would use native plants to the extent possible;
- Flora or fauna would not be disturbed without the specific written approval of the Bahamian authorities; and
- No herbicides, fungicides, or other agrichemicals would be used or stored (prior to or after use) in natural habitats.

5.2.2 *Aquatic Ecosystem Impacts*

This section summarizes potential impacts to onshore and offshore aquatic systems as a result of the construction and operation of the planned improvements. With respect to landside aquatic features, future resort operations are not anticipated to cause any new impacts beyond those experienced at the site historically during operation of the former South Ocean Golf & Beach Resort.

5.2.2.1 *Impacts to Landside Blue Holes*

Two blue holes are present on the subject property. Neither of the blue holes will be affected during the construction or future operation of the NSOD project. Blue holes are protected under Bahamian Law and cannot be filled without the express permission of the authorities. Future resort management will implement Best Management Practices (BMPs) to preclude the introduction of any solid waste or golf course pesticides and fertilizer to these blue holes to ensure impacts to water quality do not occur as a result of the proposed project.

5.2.2.2 *Impacts to Landside Aquatic Features*

Four man-made ponds, some concrete-lined, are present on the existing golf course. Historically, these ponds have been used for storm water management, as golf course water hazards, and sources for irrigation water. Several of the ponds were noted to provide at least temporary habitat for water fowl and freshwater turtles. No observable impacts to these ponds were noted as a result of historical golf course operations. The Conceptual Master Plan (2007) calls for retaining these ponds for similar applications when the new golf course operations commence. As a result, the four on-site man-made ponds will not be differentially affected during the construction or future operation of the NSOD project.

5.2.2.3 *Summary of Impacts to Terrestrial and Landside Aquatic Features*

Losses of terrestrial and landside aquatic habitat at the site will have potential minor adverse effects on biological resources.

Table 5.9 summarizes the areal extent and relative percentages of net habitat loss anticipated to occur as a result of the development of the NSOD project. The most significant habitat loss will occur in the undisturbed and disturbed Broadleaf Coppice habitat where planned development will result in the loss of 75 to 85 percent of the undisturbed habitat (125 to 141 acres) and 65 to 75 percent of the disturbed coppice (13 to 15 acres). The total net loss of Broadleaf Coppice is anticipated to approach 138 to 156 acres. These estimates are based on the assumption that land clearing will proceed in a manner that will protect as much of the existing terrestrial flora, especially protected species, and to utilize the existing floral assemblage in fringe areas, gardens, and the like. Where specimens of protected species must be removed, the management will attempt to re-use the specimens in resort/golf course landscaping, as possible.

Table 5.9 Terrestrial and Landside Aquatic Habitat Change Associated with the Proposed Project

Habitat or Land Use	Existing Area (acres)	Percent of Total Site Area	Estimated Percent of Net Habitat Change Due to Development	Estimated Net Habitat Change (acres)*
Broadleaf Coppice - Undisturbed	166.044	43.96%	75 – 85%	124.533-141.137
Broadleaf Coppice – Disturbed	20.163	5.35%	65 – 75%	13.106-15.122
Mixed Evergreen/Broadleaf Coppice – Undisturbed	4.689	1.24%	60 – 70%	2.813-3.282
Mixed Evergreen/Broadleaf Coppice – Disturbed	4.746	1.25%	90%	4.271
Aquatic Emergent Vegetation	0.098	<1%	0%	0
Cleared Coppice	20.451	5.41%	0%	0
Sand Strand – Undisturbed	1.853	<1%	90%	1.667
Sand Strand – Disturbed	0.667	<1%	100%	0.667
Coastal Rock	1.284	<1%	100%	1.28
Sandy Beach	1.062	<1%	100%	1.062
Aquatic Features – Blue Holes	0.197	<1%	0%	0
Aquatic Features – Man-made Water Features	6.770	1.79%	0%	0
Golf Course	117.698	31.15%	0%	0
Developed Land-Structures/Support Facilities	31.989	8.47%	0%	0
Totals	377.711	100%	---	149.399-168.488

* All habitat changes are negative except for Sandy Beach

5.2.2.4 *Impacts to the Marine Environment*

This section discusses the potential impacts of construction and operation of the proposed project on nearshore marine habitats and on commercially important marine species. Potential impacts of the proposed project include physical effects of habitat disturbance, injury and/or mortality of marine flora and fauna through collisions with construction equipment, entrainment in dredges, reduced fitness or survivorship of marine flora or fauna due to localized changes in water quality, and increases in potentially harmful human activity or boat traffic.

Physical Effects on Marine Habitat

The most substantial effect of the proposed project on marine habitat will be associated with the proposed marina access channel (the proposed channel). This effect will be minor and will be localized within a small portion of the habitats surveyed. Development of the channel would require an access channel to be dredged from the inlet to the marina seaward to a depth of approximately 15 feet. Blasting is not anticipated at this time. The proposed channel would affect intertidal habitat, macroalgae-dominated hardbottom, and Sandy Bottom with Scattered Macroalgae and Coral immediately offshore of the project site. Marine habitats near the proposed channel will be monitored visually during construction of the channel to ensure that sediments suspended during the dredging operation do not accumulate excessively in these areas. Corrective actions will be taken if necessary to prevent significant impacts from sedimentation in marine habitats near the channel during construction.

As mentioned previously, corals found to be within the dredging path will be salvaged and later transplanted and propagated onto the artificial reefs that will be created, thus minimizing any impact to these organisms.

None of the proposed project facilities would occur within Macroalgae Beds, Seagrass Beds, Sargassum Flats, or Patch Reefs. Therefore, the proposed project would have no direct effect on these habitat types. Construction of new sand beaches will entail excavating the existing marine shoreline landward across much of the site's coastline, and filling the littoral zone with sand. Several piers, jetties, and/or groins will be constructed to stabilize these beaches and the entrance to the new marina channel. Table 5.10 summarizes the area of disturbance that would be required within each habitat type identified in the marine habitat surveys (see Section 4.2.2), as related to the construction of the proposed channel.

Table 5.10 Marine Habitat Loss Associated with the Proposed Project

Habitat type	Area of Habitat Change (acres)*	Percent of Survey Area	Percent of Habitat type in Survey Area
Intertidal Zone	(+) 0.2	<1	<1
Hardbottom with Macroalgae	-8.6	2	52%
Sand Bottom with Scattered Macroalgae and Coral	-10.5	2	7%
Macroalgae Beds	0	0	0
Seagrass Beds	0	0	0
Sargassum Flats	0	0	0
Hardbottom with Coral	-1.2	<1	<1
Patch Reefs	0	0	0
Totals	-20.1	<5%	

* All habitat changes are negative except for changes to the intertidal zone

Physical Effects on Coastal Rock/Intertidal Habitat

Construction of the proposed channel will require the removal of 0.1 acres of intertidal habitat within the existing rock in the footprint of the proposed channel, but will replace this habitat with similar habitat along the sides of the marina channel. The proposed beaches along the coast will be built seaward of the existing intertidal zone and will convert the rocky intertidal zone east of the proposed marina from limestone bluffs to sand. The intertidal zone along the beaches will be wider that the intertidal zone on the existing rock, so there will be a very small net increase in the amount of intertidal zone at the site. It is impossible to calculate the total change in intertidal habitat at this time because the width of the intertidal zone fronting the proposed beach is not known, but the change would be minor.

Clinging and encrusting organisms present on the rock faces that will be affected by the proposed project will be removed. The project will adversely affect habitat availability and connectivity for mobile, intertidal organisms, including various crab, sea urchin, shrimp, and marine worm species that occur on the rocks, but these impacts will be localized. The new intertidal habitat that will be constructed along the shores of the proposed channel and marina will be similar to the intertidal zone that currently exists along the site's existing coastal rock shoreline, and will offer ample opportunities for re-colonization. The project will remove a small amount of foraging habitat for shorebirds and other fauna that feed in the intertidal zone or the supra-tidal splash pools, but other coastal rock areas will remain to the immediate west of the project site, so the potential impacts of the project on shorebirds and other terrestrial wildlife will not be significant. The beaches will provide new habitat for species adapted sandy intertidal zones.

Physical Effects on Sand Bottom with Scattered Coral and/or Macroalgae

Most of the impacts associated with the proposed project will occur on Sand Bottom with Scattered Coral and Macroalgae. The proposed project will disturb 10.5 acres of Sand Bottom with Scattered Coral and Macroalgae, which corresponds to two percent of the entire survey area and approximately seven percent of this habitat type offshore of the project site. Losses of this habitat type associated with the proposed project will have potential minor adverse effects on biological resources. Construction activities will disturb habitat for a variety of infaunal and cryptic organisms, including echinoderms, mollusks, crustaceans, and some fishes, but the extent of these effects will be limited to the footprints of the proposed channel and shoreline improvements, and some re-colonization of sandy bottom habitat within the proposed channel will occur. These effects will reduce the availability of food for several species of larger fish that commonly forage on sandy bottoms, but sufficient sand bottom habitat will remain in the immediate vicinity to support organisms displaced by the construction and operation of the resort.

Physical Effects on Hardbottom with Macroalgae

Construction of the proposed project will disturb 8.6 acres of Hardbottom with Macroalgae, which corresponds to two percent of the entire survey area and approximately 52 percent of this habitat type offshore of the project site. Losses of this habitat type associated with the proposed project will have potential minor adverse effects on biological resources. Macroalgae-dominated hardbottom communities support several species of macroalgae, as well as hard corals, sponges, and gorgonians, but they were somewhat less abundant at the specific hardbottom units that will be affected by the proposed channel than at other similar nearby habitat units (see Section 4.2.2.6), so the project would disturb the least valuable patches of this habitat type. Many of these species grow slowly and will not likely be capable of withstanding the frequent prop wash and other disturbances associated with frequent boat traffic in the proposed channel, but limited re-colonization within the proposed channel and the base of the proposed jetties and groins along the shore will likely occur over time. Re-colonized hardbottom communities will support fewer species and less vigorous growth than the existing hardbottom community within the channel footprint. Hardbottom with Macroalgae is considered nursery habitat for several fish species, including grunts, snappers, damselfish, wrasses, and some groupers, so disturbance of this bottom type will constitute a potential minor adverse impact on nursery habitat for these species.

Physical Effects on Hardbottom with Coral

The proposed beaches, groins, jetties, and piers will remove 1.2 acres of Hardbottom with Coral habitat, which corresponds to less than one percent of the entire survey area and less than one percent of this habitat type offshore of the project site. These structures will eliminate many of the infaunal organisms adapted to burrowing in unconsolidated sediment; however, the new habitat will provide additional substrate for colonization by algae, sponges, and corals.

Physical Effects of other Shoreline Development on Marine Habitat

Development along the shoreline will entail excavating the existing marine shoreline landward across much of the site's coastline, and several piers, jetties, and/or groins will be constructed along the new shoreline. Table 5.10 summarizes the area of disturbance that will be required within each habitat type identified in the marine habitat surveys (see Section 4.2.2) to re-configure the project shoreline and to erect the proposed structures.

Table 5.11 Habitat Changes Associated with Shoreline Reconfiguration and Headland, Jetty, and Terminal Groin Construction

Habitat Type	Area Affected (acres)
Intertidal	0.6
Hardbottom with Macroalgae	1.7
Sand Bottom with Scattered Macroalgae and Coral	0.6
Macroalgae Beds	0
Seagrass Beds	0
Sargassum Flats	0
Hardbottom with Coral	0
Hardbottom with Macroalgae	0
Patch Reefs	0
Supratidal Coastal Rock Converted to Nearshore Marine Habitat	3.3
Total	6.2

It is unclear at this point what type of intertidal habitat would be provided by the new shoreline, but it will likely incorporate more Sandy Beach and less Coastal Rock than currently exist at the site. Approximately 0.5 acre of Intertidal zone east and west of the proposed marina inlet will be re-located landward of its current position by the proposed project. Approximately 3.5 acres of habitat that currently is supra-tidal coastal rock will be converted to nearshore sandy or hardbottom marine habitat. These habitat changes will alter the species composition of the littoral zone at the project site, but will have no significant effect on biological resources beyond the immediate vicinity of the project site.

Several proposed headlands, jetties and terminal groins will extend into the existing marine habitat at the project site. These structures will be constructed on what is now Hardbottom with Macroalgae and Sandy Bottom habitats and will likely consist of boulder-sized rock fill. Construction of the proposed jetties, groins, or piers will convert 0.5 acre of existing Hardbottom habitat, which generally has little relief, and 0.2 acre of Sandy Bottom habitat. Piers, jetties, and groins provide many of the same ecological functions as natural Hardbottom habitat and are often colonized by many of the same macroalgal species that are found on natural Hardbottom, so the structures built on Hardbottom habitat will have little permanent biological impact on the Hardbottom community. Structures built on sandy bottom will eliminate many of the infaunal organisms adapted to burrowing in unconsolidated sediment; however, the new habitat will provide additional substrate for colonization by algae, sponges, and corals.

Development of the proposed project will involve the re-location of the existing Stuart Cove's marina operations, which currently are outside the former South Ocean Golf & Beach Resort, to the new marina. The existing Stuart Cove's marina will be filled as part of the proposed project. The existing Stuart Cove's marina is silt-bottomed with sheer rock walls and provides little value as marine habitat, although some common species such as mullet (*Mugil* sp.), needlefish (*Strongylura* sp.), and Yellowfin Mojarra occur occasionally in the marina basin. The marine species that occur in the existing marina will be displaced as a result of the proposed project, but these species will likely become re-established in the much larger marina and associated inlet within the resort. Construction of the new marina will increase the availability of inshore, lagoon-like habitat, but this additional habitat will have little value for marine wildlife. Therefore construction of the new marina will have little effect on biological resources.

Water Quality-Related Effects on Marine Habitat

The proposed project has the potential to affect the various marine habitats offshore of the project site through changes in water quality and/or induced changes in the nature and/or frequency of human activities in the marine environment. Sewage will be treated at an off-site central treatment facility operated by WSC. Appropriate Best Management Practices (BMPs) will be put in place to manage runoff from the golf course appropriately and prevent nutrient enrichment or other contamination of the nearshore marine environment. No discharge of untreated waste to the marine environment will occur as a result of the proposed project, so there will be no significant water-quality related impacts to marine habitat from waste streams originating from the landside Resort facilities or the golf course.

There are several potential mechanisms through which water quality-related impacts associated with the proposed marina could indirectly affect nearshore marine habitat. Accidental spills as well as low-level increases in nutrients, hydrocarbons, algae, and suspended solids in the marina basin could indirectly impact the quality of marine habitat in the vicinity of the site. The potential for these impacts to occur is a function of the degree of water exchange between the marina and the ocean, the sensitivity to water quality impairment of the marine habitats within the mixing zone outside the marina, and the likelihood of a spill or other event that affects water quality at the marina.

Based on water quality modeling performed as part of this assessment, the proposed marina will continuously flush through natural tidal exchange at rates depending on seasonal fluctuations in tide range, and the water from the marina will mix with ocean water in a zone extending south and west from the marina entrance (see Section 5.1.2). The mixing zone associated with the proposed marina will not intersect any patch reefs, and will avoid most of the Seagrass Beds in the vicinity of the site, so the nearby reefs and seagrass communities, which are particularly sensitive to decreases in water quality, will be largely buffered from potential influxes of water from the proposed marina. A portion of the Hardbottom with Macroalgae and Coral habitat offshore of the project site does occur within the mixing zone, so isolated corals within this habitat could potentially be exposed to minor decreases in water quality in the event of a spill or other acute impairment of water quality.

Appropriate BMPs will be put in place to minimize the risks of spills or other contamination within the marina basin. The implementation of appropriate BMPs and the absence of the most sensitive marine habitats within the predicted mixing zone will reduce the potential of indirect adverse impacts on marine habitats, as result of decreased water quality in the proposed marina.

The marine habitats within the mixing zone outside the proposed marina are moderately sensitive to decreases in water quality, but appropriate BMPs will be put in place to limit the potential for the risks of spills or other events that significantly degrade water quality, and the marina will have only limited hydraulic connectivity with the ocean. Therefore the proposed project will not have significant adverse water-quality related effects on the marine environment.

Effects of Human Activity on Marine Habitat

There will be little potential for significant adverse impacts to the marine habitat from human activity as a result of the proposed project. Human activity in the nearshore marine environment resulting from the proposed project could increase the incidence of anchor impacts and hull groundings, in seagrass beds or corals, and the collection of corals, but significant impacts are unlikely. Most of the Patch Reefs in the area are located several hundred feet offshore, so their exposure to collecting and trampling will be relatively low. The location and orientation of the access channel will tend to focus boat traffic away from the Patch Reefs and Seagrass Beds to the east of the channel, so potential damage to these communities from hull groundings and prop scarring from large boats will be minimal. The larger Seagrass Bed located southwest of the proposed channel is in sufficiently deep water that prop scarring from small vessels will not occur.

Small boats will continue to be able to navigate over several of the Patch Reefs and Seagrass Beds east of the proposed channel, particularly at high tide. Mooring buoys in this area will reduce the potential for anchor damage, and a vessel speed zone near shore, east of the proposed channel will reduce the potential for prop scarring in Seagrass Beds in the area.

5.2.2.5 *Impacts to Commercially Important Marine Species*

The proposed project has the potential to directly affect commercially important marine species through the construction and operation of the proposed marina channel, and changes in the availability of habitats in the channel and along the shoreline. However, this potential is limited to a very small area and potential benefits will be generated by the construction of artificial reefs. This is described in more detail below. Indirect effects on commercially important species could occur as result of induced changes in other habitats or in human activities in the vicinity of the project site.

Physical Effects on Commercially Important Marine Species

Several commercially important species utilize the three habitats that will be directly affected by the proposed channel for nursery or foraging habitat. Jolthead Porgy and Hogfish are both adapted to foraging over sandy bottom habitats, which will be affected by the proposed channel. The potential adverse impact of habitat loss on these species will be minor because of the limited amount of sandy bottom habitat that will be affected. Construction of artificial reefs and additional rocky structures within the footprints of the proposed groins, jetties, and piers along the project site's shoreline will constitute a potential beneficial effect on Rock Hind, but the potential benefit to the species will be minor, considering the limited area that will be affected.

The species that will be most susceptible to being injured or killed by construction-related activities are bottom-dwelling species common in the project area. Potential project-related impacts on commercially important bottom dwelling species including spiny lobster, queen conch, stone crab, and sponges will be minor. These species are found primarily on coral reefs and in seagrass, which will not be directly affected by the proposed project. In fact, the construction of the proposed artificial reefs will entail the expansion of habitat for many of these species. Sponges, queen conch, and stone crabs also occur on Hardbottom with Macroalgae where they will be exposed to potential injury and/or mortality from dredging in hardbottom habitat, but the area of hardbottom habitat that will be directly affected by construction activities is relatively small, so the proposed project will not pose significant risks to these species.

The proposed channel will be dredged with clamshell-type dredging equipment, which will minimize the potential for planktonic marine organisms, including larval fish and invertebrates, to be entrained in the dredge.

Water Quality-related Effects on Commercially Important Marine Species

The effects of the proposed project on water quality in the various marine habitats offshore of the project site will have the potential to affect marine species within those habitats, but the effects on commercially important marine species will not be significant. The most productive marine habitats in the vicinity of the project site are not within the anticipated mixing zone outside the marina. The proposed project is not expected to have significant negative effects on coastal water quality, and most of the marine species that could occur in the vicinity of the proposed project will be able to either tolerate or avoid minor, temporary changes in water quality. Therefore, changes in water quality as a result of the proposed project are not anticipated to pose significant adverse impacts on commercially important marine species.

Effects of Human Activity on Commercially Important Marine Species

Spiny lobster, grunts, turbot, and some of the groupers will have the highest potential to be affected by human activities, because they occur in reefs and sea grass beds that are sensitive to the negative effects of human activities; however, human activity associated with the proposed project will have only minor effects on these species. The reefs in the area are located offshore, which will reduce their exposure to human activity and limit casual contact with sensitive reef-adapted species. Mooring buoys and a nearshore speed zone east of the proposed channel will reduce the potential for significant adverse impacts on seagrass and reef habitats and on commercially important marine species that depend on these habitats. The proposed project could increase fishing pressure near the project site, which also could impact commercially important finfish species, but this potential adverse effect will be localized and is not considered potentially significant. Additionally, fishing activities are regulated under Bahamian law, which will provide some degree of control over the magnitude of potential fishing-related impacts. Finally, the creation of the proposed artificial reefs will provide reef habitat for these species which is currently non-existent.

5.2.3 *Protected Habitat and Species Impacts*

Construction activities could cause potential impacts on protected habitats. Construction activities could add or remove sand from a protected habitat, making it too deep or too shallow, changing the substrate, decreasing light penetration, and altering the species that live there. The physical extent of these impacts will be limited to the entrance channel, trench, and both sides of the jetties. Turbidity plumes generated by dredging (during construction and maintenance) could reach protected habitats further from the site, such as the seagrass and coral beds offshore.

Residual impacts are those that remain after construction of the facilities. While mitigation efforts have been incorporated to protect natural resources, there remain residual and cumulative effects on natural resources that cannot be completely prevented. Marine and land habitat creation and loss for plants and animals may or may not be balanced. The potential risk of accidental spills is increased. Long-term increases of nutrient and chemical additions to ground water, marina, and nearshore environments will likely occur.

5.2.3.1 *Impacts to Protected Habitat*

No terrestrial or marine parks or preserves are present on-site, nor are any in sufficient proximity to suffer any impacts resulting from the construction or future operation of the proposed NSOD project. One Marine Protected Area (MPA) was proposed several years ago several miles west of the proposed site, but has not yet been approved by the government. The proposed project would have no effect on the MPA. As noted above, blue holes, which enjoy protection under Bahamian Law, are present; however, these features will be preserved and managed by the NSOD management as valued site landscape assets.

5.2.3.2 *Impacts to Protected Species*

Several species of trees protected under Bahamian Law are known to occur on-site. These include Mahogany, Horseflesh, the Tree of Life, and Yellow Pine. The presence of these species has been documented in or near certain portions of the property that will be cleared for resort accommodations, timeshare and privately owned housing, and other resort-related uses, such as the casino, the amphitheatre, racquet club, recording/television studios, and the like. Details regarding the scope of the habitat that will be affected are provided in Section 5.2.1. Prior to construction in areas known to harbor protected flora, NSOD will undertake detailed field surveys to locate and mark protected species in areas destined for clearing, to avoid removing protected species where possible, or if not possible, to relocate specimens in landscape areas.

Several protected animal species were noted on-site, or were reported to occur on-site. These included two avian species, The Bahamas Woodstar and the American Kestrel and, based on communication with site personnel, Bahamian Boa Constrictors. The proposed site redevelopment will not necessarily lead to the direct mortality of any individuals of any protected species; however, the Conceptual Master Plan (2007) does call for the removal of considerable areas of native vegetation, including undisturbed and disturbed areas of Broadleaf Coppice and Mixed Evergreen/Broadleaf Coppice. Details on the extent of anticipated habitat loss is present in Section 5.2.1. Any boa constrictors encountered during construction will be safely captured and relocated to an off-site protected area in consultation with the Bahamian government. No direct impacts to the two protected bird species are anticipated, the birds will likely relocate to suitable nearby habitat, although there will be net loss of on-site habitat for these species.

There are a number of listed endangered marine turtles, mammals (e.g., whales and manatee), and invertebrates (e.g., various species of coral) that could occur in the vicinity of the project site. There is no evidence or recent records of marine turtles nesting in the project area; however, the applicant has identified several measures to mitigate potential impacts on sea turtles should sea turtle nesting activity be documented at the site in the future. Marine mammals should be able to easily avoid the clamshell dredge during dredging of the access channel. Although detailed taxonomic surveys of corals were not undertaken as part of this assessment, the proposed alignment of the access channel is confined to predominantly sandy bottom habitat and should have no effect on any endangered corals.

5.3 SOCIOECONOMICS IMPACTS

5.3.1 *Land Use Impacts*

The development of the proposed project will have a beneficial impact on the area in which it is located. Overall, NSOD development will clean up parts of the property that have been neglected since the former facility closed; the golf course is currently being renovated and improved. Work on the golf course includes a complete set of new and bigger greens, new tees, a new driving range and bunkers, and a new clubhouse. Although some new, more intense land uses are proposed to be developed within the property, these uses are consistent with the resort character of the former facility and area zoning. Discussions with representatives of the Ministry of Tourism indicate that there is a desire to bring new development to the southwestern portion of New Providence Island and the proposed NSOD Resort is consistent with that goal.

New areas of development within the NSOD property include the westernmost area on which the amphitheater, parking facility, and recording and television studios will be located; the parcel between the ocean and the golf course where the four-star hotel, casino, conference center, marina and timeshare units are proposed; and the area north of the golf course where employee housing, the racquet club, and single family estates and semi-attached housing will be constructed.

The NSOD project will increase and improve recreational opportunities for Bahamians and tourists. A major benefit of the project will be the completely redesigned and rebuilt golf course, which will be open to the public. Discussions with Bahamians indicate that, when previously open, the existing golf course offered more challenging terrain and features than other courses on New Providence Island and was a favorite of both Bahamians and tourists. The proposed amphitheater will also be open to the public and provide opportunities for large scale performances and gatherings. In addition, public fishing facilities will be provided.

NSOD is studying the feasibility of providing housing for employees; this would also assist in meeting some of the demand for housing within New Providence. As noted in section 4.3.2.2, low-cost housing has been an issue in New Providence.

Stuart Cove's operations, which include a dive shop and is the home of Stuart Cove's Dive Bahamas and Stuart Cove's productions, is currently located on a small parcel of land outside of the project area on the waterfront. Stuart Cove's operations will be relocated to new facilities within the NSOD marina. The new location will provide improved quarters for the various Stuart Cove's operations and include docking facilities for company-owned boats.

5.3.2 *Visual and Aesthetic Impacts*

In general, the proposed project will have a beneficial visual impact on the area. Since the property was previously developed for the South Ocean Golf

& Beach Resort, its visual character is established and generally will not change. NSOD will clean up areas that have been vacant and maintain the property to upscale resort conditions. Demolition of the existing structures and construction of new facilities will occur, during which time, the facility will have the appearance of a construction site. Vegetative screening on the periphery of the property will, however, screen some of the construction activities from viewing locations outside the property boundaries.

Following completion of construction, the property will be cleaned of construction debris and landscaped. Although the proposed project will include some taller structures than are currently present on-site and residential units north and east of the golf course in areas that were previously undeveloped, landscaping on the project periphery will limit views of these additional facilities and screen them from adjacent properties.

The primary visual change will occur in views of the property from the water. Proposed development on the waterfront includes the casino, 4-star and 5-star hotels, and the inlet to the new marina. This will present a more densely developed waterfront to viewers from the water than currently exists. Landscaping around the proposed facilities will aid in softening the appearance of the new facilities and minimize their visual impact. Overall, the property will remain less developed in appearance than the northern or eastern portions of the island.

5.3.3 *Impacts on Neighborhoods and Communities*

The project site is located in an area with limited residential development. Single-family homes are located to the east of the property along with the land on which Albany is to be constructed. The village of Adelaide is several miles to the east of the Albany site. The NSOD Conceptual Master plan is designed to avoid affecting private homes in the area. The greatest impact on neighborhoods and communities may be an increase in property values as an indirect result of project development.

Both construction and operation of NSOD will provide opportunities for employment that could also benefit local residents. This could also have a positive impact on New Providence unemployment (see section 4.3.3).

As previously noted, there is a shortage of labor (skilled and unskilled) in The Bahamas as a whole to meet the anticipated industry demand. There is an inadequate supply of construction workers available on New Providence; therefore, workers will need to be recruited from locations off-island. In order to meet the anticipated construction demand, housing will be required to accommodate the influx of construction workers to New Providence. Mega-resorts such as Atlantis have purchased adjacent resorts to house construction workers in the past. To develop Atlantis, for example, Kertzner International used a Club Med that it had purchased for this purpose (McDermott, 2007).

The NSOD area is surrounded by relatively affluent communities, but is also not far from less affluent areas like the village of Adelaide (within three miles). Although displacement is not anticipated, construction workers could create an increased demand for low to moderate priced housing that could adversely affect the less affluent areas. A large influx of workers would also inadvertently place demands on the existing resources such as land, water, and local infrastructure.

Worker –Community Interface

To construct and operate the project, NSOD will require workers from other parts of the country, and other countries. The way in which these workers interact with the local residents will produce a set of impacts, classified as "Worker-Community Interface." The key influencing factors for worker-community interface impacts are:

- The numbers and skill sets of non-local workers;
- Type, location and management of worker housing; and
- Cultural awareness of non-local workers and cultural acceptance of non-locals by the local communities.

5.3.4 Relocation Impacts

The NSOD project will not require the relocation of any individuals or households. It is reported that a few squatters are using land on which the proposed marina is to be developed.

5.3.5 Transportation Impacts

5.3.5.1 Impacts on Roadway Infrastructure

Local Road System

The proposed project will involve the following transportation modifications:

- The addition of a roundabout at the intersection of Golf Boulevard and South Ocean Boulevard;
- Considerable re-routing of South West Bay Road to circumnavigate the proposed five-star hotel and the proposed marina, as well as a new intersection with internal NSOD roads, to the west of the proposed marina; and
- Multiple new internal roads, in particular a new road paralleling the western and northwestern boundary of the project site before intersecting with Golf Boulevard.

The intersection of South Ocean Boulevard with South West Bay Road would be unchanged. Access to the South Ocean Village neighborhood would be maintained. Residents would enter the neighborhood directly from the relocated South West Bay Road, which would follow the former path of South Ocean Road (the access road for the existing hotel).

Traffic

This section summarizes the future traffic volumes and road and intersection operations in and around the NSOD site. Future traffic volumes are based on the program summary for the Conceptual Master Plan (see Section 2.1), the existing traffic volumes described in Section 4.3.4.2, and the road layout shown in Appendix B. ERM estimates that during the morning peak hour, the propose project will generate 554 net external trips—285 entering the site, and 269 leaving the site (see Figure 5.13 for further detail). Table 5.7 shows the future peak-hour LOS at the two intersections described in Section 4.3.4.2. Table 5.7 shows the future peak-hour traffic volumes and LOS on major roads in and around the NSOD site.

1926 *Figure 5.13 Per Hour Trip Generation at Project Buildout*

Peak-Hour Trip Generation at Project Buildout

Land Use	ITE Code	Intensity	PM Peak-Hour Trip Ends					AM Peak-Hour Trip Ends				
			Total	In		Out		Total	In		Out	
				%	Trips	%	Trips		%	Trips	%	Trips
Four Star Hotel/Casino	310	400 Rooms	224	45%	101	55%	123	132	60%	79	40%	53
Included Condominimums	230	100 DU	60	67%	40	33%	20	52	17%	9	83%	43
Large Estates	210	37 DU	44	63%	28	37%	16	35	25%	9	75%	26
Five Star Hotel	310	140 Rooms	78	45%	35	55%	43	46	60%	28	40%	18
Golf Course	430	185 Acres	39	74%	29	26%	10	56	34%	19	66%	37
Fractional Villas	Survey	48 Units	18	43%	8	57%	10	20	59%	12	41%	8
Mid-Size Estates	210	33 DU	40	63%	25	37%	15	33	25%	8	75%	24
Timeshare Units	Survey	180 Units	68	43%	29	57%	39	74	59%	44	41%	30
Commercial Space/Amphitheatre	441	2500 Seats	50	50%	25	50%	25	No Data Available				
Racquet Club	491	12 Courts	16	50%	8	50%	8	40	50%	20	50%	20
Marina Retail	820	75 ksf	281	48%	135	52%	146	77	61%	47	39%	30
Subtotals			637		328		309	487		227		260
Internal Capture Reduction @ 13%			-83		-43		-40	-63		-29		-34
Net External Trips			554		285		269	424		197		226

Source: ECFRPC Survey:, ITE *Trip Generation* 7th Edition

HDR Engineering

ERM

Figure 5.13 Per Tour Trip Generation at Project Buildout

Table 5.12 Future Intersection Level of Service

	South Ocean Blvd at South West Bay Road	South Ocean Blvd at West Bay Street
Peak Hour Volume (Total)	399	289
Peak Hour Volume (Automobiles)	363	254
Peak Hour Volume (Trucks and Buses)	36	35
Resulting Level of Service	A	B

Table 5.13 Future Major Roadway Traffic and LOS

	South West Bay Road East of S. Ocean Blvd.	South Ocean Boulevard North of SW Bay Road
Morning Peak Hour Traffic Volume	243	466
Resulting Morning Road LOS	A	B
Evening Peak Hour Traffic Volume	197	390
Resulting Evening Road LOS	A	B

Highway Capacity Manual Worksheet for General Terrain Segments – Two-lane highways (TRB 1994) was used to calculate LOS.

The short-term provision of an on-site road that would link South Ocean Boulevard with South West Bay Road near the brewery would reduce trip length for most motorists and redirect truck traffic originating at the proposed Southwest Port and the brewery away from existing residential areas along South West Bay Road and thereby potentially improve traffic conditions in the project area. Ultimately, the planned bypass road from the new Southwest Port along the powerline right-of-way to South Ocean Boulevard would allow traffic to avoid both the existing residential areas as well as the NSOD Resort.

LOS at the two key intersections near the project will drop from LOS A to LOS C. LOS C represents a relatively well-functioning intersection with moderate delays. LOS on South West Bay Road would decline from LOS A to LOS C. For road segments, LOS C represents relatively dense, flowing traffic with some reduction in travel speed.

5.3.5.2 *Impacts on Local Waterway Infrastructure*

A major element of the proposed project is the creation of a new approximately 118-slip marina. The proposed marina would increase waterway infrastructure capacity for the entire southwestern portion of New Providence Island.

Data on the number of new boat trips are not available; Stuart Cove's ten excursion boats and a few private craft constitute the entirety of existing boat traffic. Thus, the proposed project would increase boat traffic considerably over current conditions. This impact is probably acceptable given the size of the marinas and waterways, but may result in queuing for fueling and other services as well as ramp access. Accordingly, the project would have a potentially significant beneficial impact on waterway infrastructure.

5.3.5.3 *Impacts on Emergency Access*

The impacts on local infrastructure described in Section 5.3.5.1 relate to traffic operations under typical conditions. Under emergency conditions, police, fire, ambulance, and other emergency response vehicles would typically have priority over all other vehicles. The net impact of the project would be to add road infrastructure to a relatively undeveloped area. This infrastructure would not only provide emergency vehicle access to a larger amount of land, but also give a broader variety of evacuation options for project residents and guests in the event of a natural disaster. During periods of coastal flooding and other emergencies, local residents will have enhanced access. Accordingly, the project would have a potentially beneficial impact on emergency access.

5.3.5.4 *Potential Transportation Related Issues*

The proposed project would involve the construction of new roads and the realignment of South West Bay Road through an area of intense residential and tourist-oriented development. As described in Section 5.3.4.1, the project would generate several hundred new vehicle trips per day.

At the same time, given the density of proposed development, the number of new intersections and turns, and the relationship between new buildings and roads, it is likely that traffic speeds would likely be considerably lower than are currently present. This is especially true on South West Bay Road, whose flat, straight geometry and lack of active surrounding uses encourages higher rates of speed.

5.3.6 *Economic Impacts*

The potential impacts discussed in this section are based on the draft conceptual plan and general tourism industry trends and practices associated with resort construction and operation for resorts of the size, caliber and character described by the conceptual program. The impacts discussed in this section will also draw from the findings in the Tourism Economics report entitled "The Economic Impact of South Ocean Beach, New Providence, The Bahamas: An Analysis of GDP, Jobs, Wages and Tax Generation" dated March 5, 2007.

5.3.6.1 *Economy*

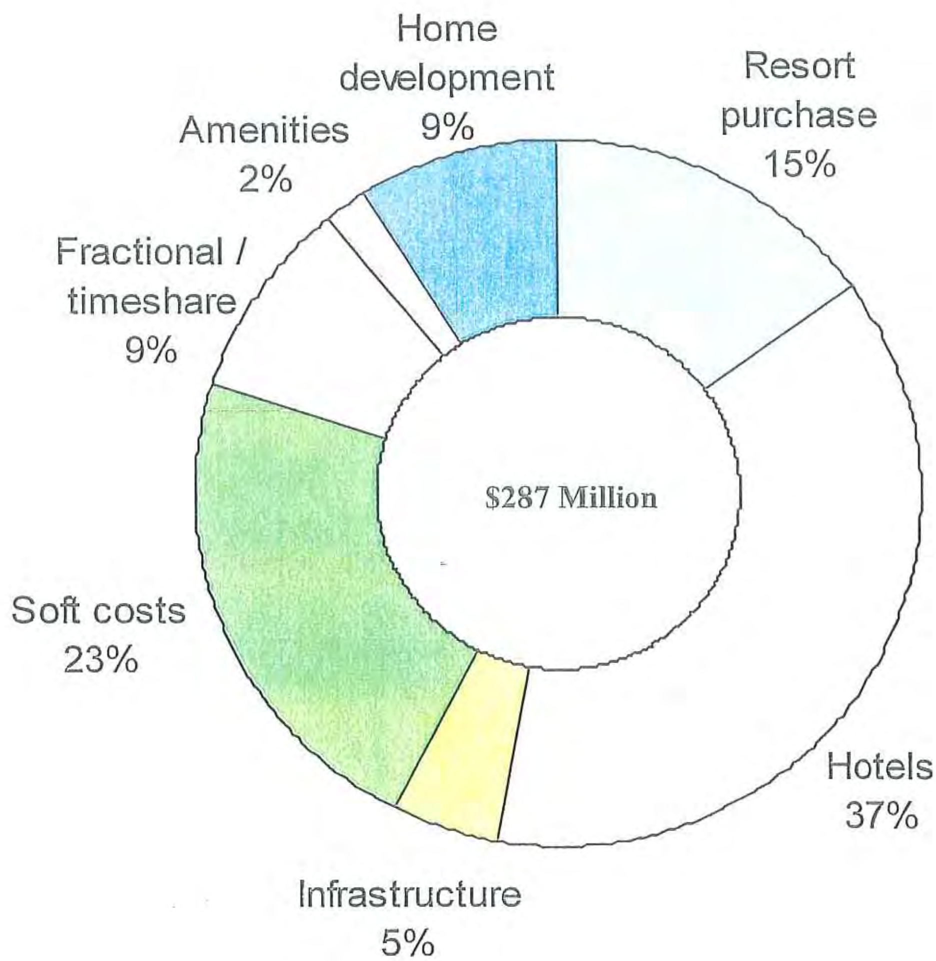
Tourism Economics' report provides an analysis of the project's impacts on GDP, jobs, wages and tax generation. Included in the report are analyses of the of the capital investment over 25 years of development, visitor spending, jobs generated and wages earned during construction and operations, and the cumulative impact of the project on GDP.

The NSOD will have a significant beneficial impact on the Bahamian economy, resulting in additional project-related and indirect economic growth in the project vicinity. The project related impacts include the immediate benefit to persons and companies that provide goods or services directly to NSOD visitors. The non-project related economic growth can be correlated with the indirect and induced impacts stemming from the NSOD resort construction and operation. Indirect impact includes secondary benefits to suppliers of goods and services to the directly-involved companies, but excluding imports. An example of an indirect impact is a wholesaler providing goods to a restaurant. Induced impacts reflect the tertiary benefit to the local economy as wages of employees affected by direct and indirect impacts is spent on goods and services. For example, NSOD employees' spending on retail goods represents an induced impact. The employment related to the direct, indirect and induced impacts are discussed in Section 5.3.6.2.

As discussed in Section 4.3.3, tourism is an essential part of the island's economy and in turn, the national economy at large. NSOD will be a major resort in terms of size and caliber (i.e., hotel quality and clientele). As such, NSOD will contribute substantially to the economy through capital investments, the addition of jobs during the construction and operations phases of the Resort and through government revenues such as taxes and duties. The tourist visitors to NSOD will also contribute to the economy through fees paid to the resort as well as money spent visiting other attractions in New Providence.

According to Tourism Economics' study, the project's total capital investment budget, including purchases (e.g., property purchases), will be \$867 million, of which approximately \$399 million (46%) will reflect the lodging product (e.g., hotels, timeshares, and villas.) Figure 5.14 provides a graphic depiction of the capital investment components.

5022 *Figure 5.14 Capital Investment Budget Components*



ERM

Figure 5.14 Capital Investment Components
Source: Tourism Economics, 2007

5.3.6.2 *Construction Impacts*

The majority of construction (e.g., hotels, marina, casino, retail, condominiums, etc.) will occur between 2007 and 2010, with construction from 2010 to 2015 focusing on residential development. The Tourism Economics report estimates that the project's total construction costs will amount to $738 million over 9 years of construction, of which $541 million (73%) reflect hard construction costs related to actual local construction. Approximately $179 million reflects soft construction costs, which include architectural, engineering, and planning services. The country's construction sector is expected to benefit from $158 million (29%) of the project's hard costs.

The direct impacts of the project construction on the GDP or economy will be $158 million, while indirect and induced impacts will be approximately $23 million and $36 million respectively. Thus the total cumulative impact on the Bahamas GDP will be approximately $217 million.

Table 5.14 provides an overview of the construction impacts, including direct, indirect and induced impacts.

Table 5.14 Construction Impacts

Construction Impacts	Monetary Impact
Total Capital Expenditures	**$737,835,328**
Hard Capital Expenditures	**$541,374,855**
Gross Domestic Product (GDP)	
Direct	$158,010,810
Indirect	$22,973,647
Induced	$36,196,891

Source: Tourism Economics, 2007.

5.3.6.3 *Operations Impacts*

The Tourism Economics report estimates that NSOD operations over 20 years (i.e., from 2010 to 2030) will generate a cumulative total of $3.7 billion in GDP, of which the direct impact constitutes $3 billion, and indirect and induced impacts constitute $140 million and $618 million, respectively.

Table 5.15 provides an overview of the economic impacts from operations.

Table 5.15 Overview of the Economic Impacts from Operations

Operations Impacts on GDP	20-Year Cumulative Monetary Impacts
Direct	$ 2,949,687,930
Indirect	$ 140,034,926
Induced	$ 617,944,571
TOTAL	*$ 3,707,667,428*

Source: Tourism Economics, 2007.

5.3.6.4 Visitor Spending

Tourism Economics' report estimates that person-visits to NSOD will reach nearly 100,000 by 2014. Visitor expenditures, which include rooms, other resort accommodations, transport (including taxis, tour buses, and rental cars), and casino revenues, are estimated to be $172 million in 2011 when the resort is fully built. Over 20 years, it is estimated that the total visitor spending would amount to $5.3 billion (see Table 5.16).

Table 5.16 Visitor Spending

Expenditures	2011 (Full Build)	20-Year Sum
Rooms	$56,057,830	$1,656,839,692
Other resort	$66,265,634	$2,304,030,974
Transport	$3,101,358	$90,089,834
Casino	$44,186,312	$1,220,005,666
Off-resort	$1,919,599	$55,867,767
Home owners	$584,000	$10,651,068
TOTAL	*$172,114,732*	*$5,337,485,001*

Source: Tourism Economics, 2007.

5.3.6.5 Government Revenues

The project is estimated to provide, over the course of 23 years (three years of construction and 20 years of operation), approximately $1.8 billion in government revenues, not including any tax and duties concessions (Tourism Economics, 2007). The majority (roughly 70%) of these revenues reflect operations import duties (43%) and occupancy tax (27%). Table 5.17 below provides a breakdown of those revenues.

Table 5.17 Project-Related Government Revenues

Government Revenue Categories	23-Year Cumulative Value
Land Purchase Stamp Tax	$13,000,000
Stamp Conveyance (10%)	$31,978,643
Stamp Conveyance on Resales (3% of stock/yr)	$34,653,363
Casino tax, win tax < $20 mn	$94,600,000
Casino tax, win tax > $20 mn	$47,055,694
Casino tax, floor tax	$88,000,000
Property Tax on lots/homes	$53,916,374
Business License Fee	$15,135,803
National Insurance	$113,270,852
Construction Import Duties	$11,864,052
Operations Import Duties	$770,163,660
Departure Tax	$31,610,075
Occupancy Tax	$490,474,521
TOTAL REVENUE	*$1,795,723,035*

Source: Tourism Economics, 2007.

Taxes drawn from visitor expenditures directly related to the NSOD, which include stamp, departure, property, and occupancy taxes, will amount to $19 million per year.

5.3.6.6 Employment

Tourism Economics estimates in their report that roughly 2,235 jobs will be generated from the project, of which 1,358 jobs (61%) would be in operations and 877 (39%) in construction. These jobs will produce $1.2 billion in wages, $81.7 million (7%) and $1.1 billion (93%) of which would be direct impacts from the construction and operations phases, respectively.

The indirect and induced impacts in the area of employment and wages related to the project also provide a significant contribution to the economy. Total indirect impacts from construction and operations are estimated to generate 196 jobs and $73 million in wage. Total induced impacts would generate 821 jobs and $313 million in wages.

These findings on the economic impact of employment and wages are summarized in Table 5.18.

Table 5.18 Wages and Employment Impacts from Construction and Operations

Wages Summary	Construction	Operations	Total (Construction and Operations)
Direct	81,659,896	1,137,814,247	1,219,474,143
Indirect	6,649,578	66,447,817	73,097,395
Induced	17,661,895	295,705,711	313,367,606
TOTAL	105,971,369	1,499,967,776	1,605,939,145
Employment Summary	Average (2008-2010)		
Direct	877	1,358	2,235
Indirect	91	105	196
Induced	241	580	821
TOTAL	*1,209*	*2,042*	*3,251*

Source: Tourism Economics, 2007.

Given the high number of people to be employed either directly or indirectly by the project, the project will present significant opportunities for local contractors and suppliers to provide goods and services both during project construction and operation. In addition to labor, project construction will require construction materials, transportation of equipment and supplies, and communication services, all of which can provide opportunities for the local communities to benefit from the project.

Some of the potential opportunities for local employment (i.e., in the immediate project vicinity) are:

- In Delaporte, where the project is located, almost 70% of residents are engaged in 'other industries' such as the financial industry; the second highest category is wholesale, retail trade, hotel and restaurant (27% of residents). The project may thus provide more managerial and technical job opportunities for the already skilled workforce in the area.
- The project will also present employment opportunities for both skilled and unskilled workers. It is reported by the communities in Adelaide that

the lack of local opportunities forces their educated/skilled workforce such as engineers, doctors and lawyers to work in Nassau. The project thus presents opportunities to meet some of this local demand for employment. Carmichael Road has a settlement of immigrants (mostly Haitians) who work as day labor in construction work. The project will provide opportunities of such casual labor during the construction phase.

Concurrent with the development of NSOD and Albany developments, there will be redevelopment of several of the large hotels in Cable Beach as well as the additional development of the Atlantis Resort and the port relocation. Given the large amount of construction occurring over the next five years, there is concern that continued development of tourist facilities may be constrained by the demand for labor in construction and operation.

As noted in section 4.3.3.2, unemployment in The Bahamas has been consistently high over the past decade. Although sufficient skilled labor may not be available for the construction phase of the project, the government (Ministry of Tourism in particular) has identified the need to increase Bahamians' interest in tourist industry employment and is developing and implementing training and other programs that should assist in developing a skilled native population that can meet the growing employment needs of the industry.

The project may result in an overall population increase in New Providence. As discussed in Section 4.3.3, the current boom in the construction industry is anticipated to incur a construction labor shortage on New Providence, as several major hotels in Cable Beach and other large projects, such as the port relocation and Albany development, are planned to be developed over the next decade. To meet the increasing demand, there will be an influx of workers to New Providence from other parts of The Bahamas or other countries. As part of this trend, there may also be a rise in the number of illegal immigrants settling in New Providence, as news spreads of available job opportunities among local illegal immigrant populations and their families and friends in their home countries

5.3.6.7 *Other Potential Economic opportunities*

The project is likely to induce the creation of new business opportunities. While the exact nature and the reality of such opportunities cannot be ascertained at this time, some potential impacts may include:

- Small shops such as grocery stores, small eateries or shopping centers that may choose to operate in the project area vicinity in order to cater to the workforce and, during operation, visitors to NSOD; and
- Local resources such as dumpers, loaders, bulldozers and excavators may also be tapped for use during construction.

Some residents may invest in building houses or extra rooms to provide accommodations for foreign labor that may be brought in by various contractors to supplement the domestic workforce.

5.3.7 *Cultural Resources Impacts*

The following discussions of the potential effects of the proposed project are derived from the information gathered to date. This information suggests that there may be unidentified historical and archaeological resources within some of the undeveloped portions of the NSOD property. Additional archaeological investigations within portions of NSOD property will be necessary to evaluate any potential effects to potential historical and archaeological resources that may be present. The scope of these additional investigations appears in greater detail in Section 6.1.6.

Archival research and field reconnaissance indicate that the NSOD property contains four areas of high sensitivity that may possess a potential to contain archaeological deposits or architectural features (see Figure 5.15). Based on archival research and field reconnaissance, it appears that ground disturbing activities associated with this development are likely to take place within the four areas of high sensitivity identified during these investigations. If the proposed activities can be designed to avoid the known and/or potential resources or the resources can be incorporated into the proposed development without severe alterations of the resources, then these effects can be minimized. Possible actions to mitigate potential adverse effects appear in Section 6.1.6.

The wooded areas in the eastern, northern, and western portions of the NSOD property, and the cleared area in the southwest corner possess a moderate to low sensitivity for archaeological resources. These areas may contain plantation-era walls and large sinkholes. These areas also include the narrow wooded spaces between the fairways of the golf course in the western portion of the property. Remnants of walls exist on the edges of these areas and likely extend into and through them. A possible quarry where limestone blocks were extracted for the construction of nearby plantation buildings lies in the cleared area in the southwest portion of the property.

Figure 5.15 Archeological Sensitivity Areas

ERM

Figure 5.15 Archeological Sensitive Areas of the Property

Based on archival research and field reconnaissance, it appears that ground-disturbing activities associated with this development are likely to take place within the areas of moderate to low sensitivity identified during these investigations. In particular, the construction of the marina may affect plantation walls and a possible quarry associated with the Edwards' plantation. As noted above, if the proposed activities can be designed to avoid the known and/or potential resources or the resources can be incorporated into the proposed development, then these effects can be minimized. If not, appropriate actions to mitigate the loss of potential resources will be necessary (see Section 6.1.6).

The remainder of the NSOD property contains a limited potential to contain archaeological or historical resources. These areas have witnessed such extensive alterations during the 20th century that it is highly unlikely that any archaeological deposits or features remain within them. These areas include the hotel sites and dive facilities between South West Bay Road and the sea; the shore west of the private residences and south of South West Bay Road; the hotel, golf club, and private residences in the central portion of the property; and the portions of the golf course in the east central portion of the property.

Given the modifications associated with development activities observed in the areas identified as having limited sensitivity, it is likely that most archaeological deposits in these portions of the property are severely disturbed. Thus, construction activities in the areas identified as limited sensitivity will not affect any archaeological/historical resources that possess or are likely to possess significant information about the history and development of The Bahamas.

6 ENVIRONMENTAL MANAGEMENT PLAN

6.1 MITIGATION MEASURES

A summary of proposed mitigation measures for potential project impacts is presented below.

6.1.1 Proposed Water Quality Mitigation Measures

The following mitigation measures are proposed to address potential project impacts associated with:

Erosion/Sedimentation

- Upland sediment control – during and after construction
- Shoreline erosion control via the establishment of a beach in equilibrium

Marina

- The marina basin will be excavated and will be isolated during construction from marine waters by an upland plug.
- Marina walls will be stabilized before opening the basin to seawater.
- Curved corners of basin to avoid stagnant areas.
- Slope basin towards entrance to promote flushing (i.e., water depths of approximately -12 feet MLW along edges and upper reaches of basin).
- If natural flushing is inadequate, provide additional openings to the sea in the form of one or more culverts.
- Prevent stormwater runoff from the golf course and minimize stormwater runoff from other areas from entering the marina.
- Prohibit the discharge of wastewater or brine from yachts in the basin and provide sewerage hookups for all vessels with onboard restroom facilities (heads) to prevent the direct discharge of sanitary waste to the marina basin.
- Prohibit dockside or in-marina fish cleaning, disposal of live or dead bait and the like to prevent the attraction of birds and feral cats, and to prevent water quality degradation.
- Monitor water quality and sedimentation regularly (at least monthly) in the marina and marina inlet to ensure safe boat entry, to prevent prop

wash causing turbidity problems, and to ensure the natural flushing of the marina occurs.

- Provide waste and recycling bins around the marina.
- Locate fuel tanks on uplands within spill containment basins.
- Provide fuel shut off valves and emergency shut off valves in convenient locations.
- Develop a Spill Prevention Control and Countermeasures (SPCC) Plan. And acquire spill equipment and supplies (e.g. fuel absorbent materials and floating booms), and place the equipment in areas of fueling and fuel storage. Ensure these personnel receive proper spill response and health and safety training.
- Provide unlighted and lighted channel markers in sufficient number to mark the entrance channel to the marina in order to prevent groundings.
- Establish and enforce a "no-wake" zone in the marina, marina inlet, the approach channel, and between the eastern site boundary and the marina access channel, seaward to a minimum depth of 10 ft MLW.
- Establish the area to the east (near the five-star resort) as a swimming-only, no-boating zone.
- Provide anchor buoys at nearby patch reefs and in the general area to allow vessels to moor, rather than anchor, thus preventing physical damage to reef structure.
- Prepare and disseminate environmental awareness information (brochures, signage, etc.) to improve public awareness and participation in programs to reduce boating- and diving-related impacts.

Dredging and Beach Nourishment

- Clamshell dredges should be used to dredge the access channel to minimize entrainment of immature marine organisms.
- Ensure the use of turbidity screens during all dredging activities and monitor turbidity on a real-time basis during dredging. Cease dredging if turbidity escapes the screens, at least until the screens can be repaired and/or re-deployed.
- Visually monitor the patch reefs and other nearby sensitive marine habitats for sediment accumulation during dredging. Take corrective actions, if warranted.

- Collect, transplant, and propagate any live corals found within the footprint of the entrance channel to the marina onto the proposed artificial reefs.

Golf Course

- Do not alter or fill the two blue holes on the golf course and provide limited re-grading around these features to divert golf course drainage from entering the blue holes.
- Monitor water quality in the two blue holes monthly for the same parameters noted above.
- Use no golf course herbicides, fungicides or other agrichemicals in natural habitat areas, and do not store virgin or waste agrichemicals in areas of natural vegetation.
- If treated sanitary wastewater is re-used for irrigation, do not apply the re-use water in areas that will drain to blue holes or on-site freshwater ponds and basins.

6.1.2 *Proposed Air Quality Measures*

The removal of earth during site preparation and construction will generate sporadic emissions of fugitive dust that will be controlled using traditional mitigation measures. These measures include:

- Control fugitive dust through the use of water tank trucks and water sprinklers
- Reduce combustion emissions of the construction equipment by means of preventive maintenance of the engines and turning equipment off when not in use for long periods of time.
- Cover trucks and heavy vehicle loads at all times as long as they are on public roads or near residential areas.
- Control heavy vehicles speed.
- Stabilize and seed disturbed areas as soon as possible.

6.1.3 *Proposed Noise Mitigation Measures*

As previously discussed, no significant adverse impacts are expected at any noise sensitive receptors in the project area. Therefore, mitigation for operational noise impacts is not warranted.

Although noise impacts are anticipated to be minor and temporary during construction activities, mitigation measures will include:

- Implement best management practices for noise abatement during construction, including use of appropriate mufflers and limiting the hours of construction.
- Ensure that construction occurs only during daylight hour when occasional loud noises are more tolerable.
- Implement a complaint resolution procedure to assure that any complaints regarding construction or operational noise are adequately and efficiently investigated and resolved.
- Limit the cutting/clearing of vegetation (noise buffer) surrounding the proposed new residences to the minimum amount necessary.

6.1.4 *Proposed Solid and Hazardous Waste Mitigation Measures*

Solid waste will be generated on the project site at two distinct phases or time periods, construction and operations. There are minor amounts of potentially hazardous wastes that may be generated at any stage, and may consist of:

- Pesticides and herbicides residues and their containers;
- Possible presence of asbestos, lead, mercury from florescent lamps and switches; and
- Possible presence of batteries of all sorts (lead, cadmium, alkaline, zinc - based).

Recommended mitigation measures include:

- Evaluate the potential for biological controls to eliminate pesticides and herbicides.
- Minimize waste disposal (especially building debris) by maximizing reuse/recycling/composting on-site or sale to third parties.
- Dispose of hazardous waste according to applicable international regulations and in approved government facilities.
- Implement a Hazardous Materials Inventory and Control Plan. Proper management of such wastes includes reuse and recycling possibilities, or safe disposal methods.

- Develop chemicals, solvents and materials use policy and Inventory Control to prevent the introduction of toxic ones that have low-toxicity analogs. Refrigerant gases and aerosols are included in this category.

6.1.5 *Proposed Mitigation Measures for Terrestrial and Aquatic Ecosystems*

The proposed project would incorporate several measures to mitigate potential unavoidable impacts on upland areas and aquatic systems. These measures include design-based measures and operational measures that would reduce the proposed project's impacts on terrestrial and marine ecosystems and protected habitats.

Upland Areas / Terrestrial Ecosystems

- Keep clearing to a minimum.
- Implement customary sediment control measures during construction as outlined in the Guidelines for Sediment Control Practices in the Insular Caribbean.
- Use native plants to the greatest extent possible for exterior landscaping.
- Conduct follow-up vegetation surveys within the Broadleaf Coppice and Mixed Evergreen/Broadleaf Coppice to identify and flag mature, protected trees and epiphytes and minimize their removal.
- Preserve as much Broadleaf Coppice and Mixed Evergreen Broadleaf Coppice as possible in future swales, landscaped areas, buffer zones, and the like.
- Retain a vegetative buffer of undisturbed native vegetation around the northwest and northeast perimeters of the site. This would provide a road-noise and aesthetic buffer. A similar buffer could be preserved to separate the golf course and developed areas, with golf cart paths connecting the two zones.
- Do not remove or otherwise disturb protected fauna or flora without the specific written approval of the Bahamian authorities.
- Provide adequate warning, fencing, and flagging to prevent damage to trees if specimens of protected species are left in place near active construction or areas of heavy equipment operation.
- Provide training/instruction to work crews involved in land clearing and landscaping on how best to avoid damage to floral and faunal protected species.

- If a protected plant species must be removed, identify a proper location for re-locating the plant prior to excavating the root ball. Once excavated, transplant immediately and provide adequate watering and care to enhance survivorship.
- Remove invasive exotic plants and pest plants in any areas not cleared for construction to reduce competitive threats to the native flora and to sustain native habitat.
- If any protected fauna is encountered (e.g., boa constrictors, iguanas, etc.), do not harm the animal. If the animal can be safely removed from the area, do so by relocating the animal to a protected area.

Aquatic Ecosystem

(Several of these suggested mitigation measures were already provided in the *Water Quality* section above.)

- Provide unlighted and lighted channel markers in sufficient number to mark the entrance channel to the marina, in order to prevent groundings.
- Establish and enforce "no-wake" zone in the marina, marina inlet, the approach channel, and between the eastern site boundary and the marina access channel, seaward to a minimum depth of 10 ft MLW. The area to the east also could be designated a swimming-only, no-boating zone.
- Prepare and disseminate educational materials highlighting the importance of seagrass and coral to the ecology of the area; and signage discouraging collection of attached coral should be prominently displayed at the marina and the swimming beaches.
- Clamshell dredges should be used to dredge the access channel to minimize entrainment of immature marine organisms.
- Ensure the use of turbidity screens during all dredging operations and monitor turbidity on a real-time basis during dredging. Cease dredging if turbidity escapes the screens, at least until the screens can be repaired and/or re-deployed.
- Prohibit dockside or in-marina fish cleaning, disposal of live or dead bait and the like to prevent the attraction of birds and feral cats, and to prevent water quality degradation.
- Acquire spill prevention, control and countermeasures equipment and supplies, and place the equipment in areas of fueling and fuel storage. Also, develop a SPCC Plan and determine who will respond to spills and

how. Ensure these personnel receive proper spill response and health & safety training.

- Monitor sedimentation in the marina and marina inlet to ensure safe boat entry, to prevent prop wash causing turbidity problems, and to ensure the natural flushing of the marina occurs optimally.
- Monitor marina water quality monthly or more frequently if problems are suspected. Testing minimally should include temperature, salinity, conductivity, turbidity, fecal & total coliform bacteria, selected golf course agrichemicals (e.g., pesticides and nitrates, total phosphorus) and oil and grease.
- Create new reef ecosystems using ReefBalls and live corals rescued from the marina channel footprint (and transplanted onto the ReefBalls).

6.1.6 *Proposed Mitigation Measures for Socioeconomic Impacts*

- Retain portions of the existing hotel complex to provide temporary housing for foreign construction workers. Provide additional housing on-site as needed.
- Work with the government housing department once the resort is close to opening to ensure that incoming workers do not put pressure on local populations in terms of housing, and with the local health and education department to ensure that incoming workers are not putting pressure on local services (schools, medical services, etc.).
- Implement employment policies that would act as a deterrent to illegal immigrants. This will be a requirement imposed on the General Contractor managing construction of the project.
- To the extent practicable, materials, goods, and services for construction and operation will be purchased from Bahamian vendors.
- Conduct HIV/AIDS training, especially for foreign construction workers.

Community Relations

- Hold regular meetings and/or provide a newsletter or mailings to local residents keeping them apprised of upcoming construction activities or other changes that may be of interest to the local community.
- Establish a grievance mechanism during construction where neighbor complaints are recorded and addressed.

Visual and Aesthetics

As noted in section 5.3.2, the project should have a beneficial visual impact. To ensure that the impact is beneficial, landscaping will be provided that is consistent with native vegetation and a high-end resort image.

Cultural Resources

- Conduct an intensive survey of designated High Sensitivity Areas and conduct a systematic reconnaissance of Moderate-Low Sensitivity Areas.
- Develop a protocol in the event of discovery of bones/artifacts during construction.
- Provide a buffer around all building ruins to be preserved during construction.
- Incorporate all sites (both above and below ground deposits/features) into protected green areas to the extent possible.

6.2 MONITORING PLANS

An important part of the EMP is a monitoring program. Monitoring specific areas of concern, construction activities, and resort operations will provide feedback on the success of proposed mitigation measures, and allow the development of adaptive management prescriptions to make corrective adjustments in critical environmental areas. To insure these issues are addressed, monitoring plans will be developed as follows:

- Construction Phase
- Prior to construction activities, conduct surveys within the Broadleaf Coppice and Mixed Evergreen/Broadleaf Coppice to identify and flag mature, protected tree species and epiphytes for avoidance or to minimize their removal.
- Monitor earth-moving operations in areas of high cultural sensitivity.
- Monitor marine habitats near the proposed channel during construction of the channel to ensure that sediments suspended during the dredging operation do not accumulate excessively in these areas.

6.2.1 Operations Phase

Golf Course:

- Monitor water quality in the two 'blue holes', freshwater ponds and basins monthly.

Marina:

- Monitor water quality and sedimentation monthly in the marina and entrance channel to insure proper flushing is occurring, boat entry is not unsafe, and to prevent prop wash from causing turbidity problems.

Shoreline and Offshore Marine Environment:

- Conduct an annual sedimentation survey to quantify the width of the entrance channel, and shoreline both within the project boundaries and on adjacent beaches, to detect erosion.
- Visually monitor the patch reefs and other sensitive marine habitats for sediment accumulation during dredging operations.

Hotels and Facilities:

- Monitor hazardous wastes inventories, use and disposal. This will be a component of a Hazardous Materials Inventory and Control Program.

7 CONCLUSIONS REGARDING ENVIRONMENTAL ACCEPTABILITY OF THE PROPOSED PROJECT

This section of the EIA discusses the overall environmental acceptability of the proposed NSOD Resort. Environmental acceptability is evaluated in two ways:

- The extent to which the proposed project will comply with applicable environmental standards and requirements; and
- A comparison of the unavoidable negative environmental impacts with the net project benefits.

These two measures of environmental acceptability are discussed below.

7.1 COMPLIANCE OF THE PROPOSED PROJECT WITH APPLICABLE ENVIRONMENTAL STANDARDS AND REQUIREMENTS

The proposed project will comply with all applicable Bahamian environmental standards and requirements. NSOD will work with the BEST Commission during the EIA process to meet these requirements, and comply with the commitments agreed to in the project's Environmental Management Plan during project development and operations.

7.2 CUMULATIVE IMPACTS

Cumulative impacts are the environmental, social, or other impacts from the proposed Project, added to the incremental impact of similar projects in the same or nearby locations. While the impact from each individual project may be minor, the additive impacts from multiple projects could be major. This section identifies positive and negative cumulative impacts related to the proposed Project, and identifies some potential mitigation strategies to address these cumulative impacts.

7.2.1 *Identification of Cumulative Impact Projects*

This section discusses cumulative impacts that could occur in concert with NSOD project development. The spatial extent of the other projects considered includes other major development projects on the southwestern tip of New Providence Island. Developments in southwest New Providence Island that were reasonably expected to occur before, during, or shortly after completion of the proposed Project, and that were large enough to potentially produce regional impacts (such as noticeably increased traffic) were included as cumulative impacts.

Specifically, the following projects have been included in the cumulative impact analysis:

7.2.1.1 *Albany*

Proposed for development to the east of the Project site and currently undergoing environmental review, Albany will be a private golf, marina and residential community comprising approximately 570 acres. Albany will include 100 apartments and 375 single family home-sites, a marina, an 18-hole golf course with clubhouse, a fitness center and beach club, an equestrian center, and a family water park. The marina will contain about 90 slips sized to accommodate mega-yachts. The entrance to the marina includes a jetty to prevent sedimentation of the entrance channel.

7.2.1.2 *Container Port*

The government of the Bahamas is developing plans to move the existing container port from downtown Nassau to the western end of New Providence Island. At this time, an environmental impact assessment has been completed and the Southwest Port Joint Task Force has contracted for the development of a business plan for the port.

This project will require the re-alignment of area roads to enable direct access to the port, specifically South West Bay road. As currently envisioned, the re-aligned road (which has not yet been officially proposed or approved) would detour to the north of the Albany site, and would then run along or parallel to the electric transmission lines that form the Project site's northwestern border. Under this scenario, South West Bay Road would also be abandoned east of South Ocean Boulevard and west of the Project site's western boundary.

7.2.1.3 *Clifton Heritage Park*

The development of Clifton Heritage Park (to be managed by the Clifton Heritage Authority) on the westernmost tip of New Providence Island is underway. The three-phased restoration began in the summer of 2005 and will ultimately include the purchase of adjacent land and development of the area as a national park and heritage site. Figure 4.9 shows the location of the Clifton Heritage Park, the proposed container port and the Albany development in relation to the NSOD property.

7.2.1.4 *Marine Protected Area*

The Bahamas National Trust, in conjunction with the Clifton Heritage Authority has proposed the creation of a Marine Protected Area stretching from the shoreline near Clifton Heritage Park into the Atlantic Ocean. If implemented, this area would impose restrictions and even prohibitions on boating activities in order to protect key diving sites and traditional fishing areas.

7.2.1.5 *Other Development*

A number of smaller but significant development projects have been proposed or envisioned for the southwestern portion of New Providence Island:

- Several tracts of land along South Ocean Boulevard (to the north of the Project site) have been or could likely be subdivided for residential development. Several hundred new residential lots could be created in this area; and
- A new shopping center has been envisioned along West Bay Street east of its intersection with South Ocean Boulevard.

7.2.2 *Cumulative Transportation Impacts*

7.2.2.1 *Cumulative Impacts on Roadway Infrastructure*

Future traffic volumes related to the proposed projects identified in Section 7.2.1, are not available. However, a number of broad assumptions can be made related to cumulative transportation impacts from these projects.

- The master plan for Clifton Heritage Park shows as many as 400 automobile parking spaces, 12 bus parking spaces, and six boat trailer parking spaces. During peak visitation (likely on weekends) these parking lots could generate 100-200 vehicle trips per hour. Traffic would access the park via West Bay Road.
- Traffic to and from the port is expected to be heavy, and would include a large volume of trucks. Much of this traffic would likely drive directly from the port toward Nassau via the newly realigned South West Bay Road.
- Compared to NSOD, Albany would contain approximately 175 more residential units and similar golf, marina, and commercial uses, but would not include hotels. Given this information, it is likely that the

number of external automobile trips generated by the Albany project would be similar to the 400-500 peak hour trips from the Project site (see Figure 5.13. Traffic from Albany would likely use the realigned South West Bay Road and South Ocean Boulevard.

- Traffic from new residential units along South Ocean Boulevard could generate approximately one peak-hour trip per unit—resulting in several hundred additional future trips along South Ocean Boulevard, West Bay Road, and the re-aligned South West Bay Road.
- Traffic from a new shopping center could generate on the order of one peak-hour trip per 250 square feet. Depending on the size of the facility, this could add approximately 100 additional future peak-hour trips, primarily to West Bay Road and South Ocean Boulevard.

Taken as a whole, the cumulative impact of the proposed projects described above would add large traffic volumes (perhaps more than 1,000 vehicles in a single hour) to the local road network. With the exception of traffic related to Clifton Heritage Park, the peak traffic volumes from these projects are likely to coincide with current morning and evening peak hours (as described in Section 4.3.4.2), when traffic in the Project vicinity is already highest. Increased volumes would be likely on South Ocean Boulevard and West Bay Road, but most cumulative impact trips would use the realigned South West Bay Road.

These increased traffic volumes would cause travel delays on local roads, leading to a lower Level of Service (see Section 4.3.4.2).

7.2.2.2 *Cumulative Impacts on Local Waterway Infrastructure*

Relocation of Nassau's container port to the project vicinity would add considerable seagoing traffic to the project area, particularly large cargo-carrying vessels. The 90-slip marina associated with the Albany project will be a private marina capable of hosting large "mega-yachts" and would be similar in size to the proposed public marina associated with the NSOD project.

Taken together, these projects would significantly increase the amount of waterway infrastructure, including port and docking facilities as well as associated repair, fueling, and other marine services.

However, these projects would also significantly increase water-borne traffic near southwestern New Providence Island. Since large container ships frequently need a sizeable buffer for safe navigation, the container port in particular would reduce the available navigating area for non-port vessels (including pleasure craft, fishing, diving, and other charter vessels). The presence of a marine protected area could further reduce navigable area, although those impacts would occur further offshore.

7.2.2.3 *Cumulative Impacts on Emergency Access*

The net impact of the proposed projects would be to add considerable road infrastructure (including a major transportation facility in the realigned South West Bay Road) to a relatively undeveloped area. This infrastructure would provide enhanced emergency vehicle access to the area, and would also give a broader variety of evacuation options for nearby residents and guests in the event of a natural disaster. Finally, development of the container port could include new emergency services (such as firefighting or police facilities), which would benefit the entire southwestern portion of the island. Accordingly, the Project would have a potentially beneficial impact on emergency access.

7.2.2.4 *Cumulative Impacts on Hazards and Transportation Accidents*

The proposed projects would influence hazards and transportation accidents in two ways. First, the projects would add large new traffic volumes, including cargo truck traffic—presumably including tanker trucks with the potential for oil and fuel spills in the event of an accident—and marine traffic. At the same time, the NSOD and Albany projects would add a considerable amount of pedestrian traffic. Even with appropriate intersection signalization and geometric improvements to roadways, these changes would increase the risk of transportation accidents on land and on the water.

The second, and somewhat mitigating, effect involves the reconfiguration of the regional road network (particularly with the realignment of South West Bay Road). This reconfiguration would route almost all existing traffic and a great deal of future traffic (particularly traffic associated with the port) away from pedestrian- and tourist-oriented areas. The realigned South West Bay Road itself would likely be designed to a higher safety standard (e.g., wider lanes and shoulders, with better lighting and broader curves) than is present on the current road. This reconfigured network would mitigate or avoid many of the potential hazards and accidents described in this section.

7.2.2.5 Potential Mitigation Strategies for Cumulative Transportation Impacts

Local Roadway Infrastructure

The addition of several hundred (possibly more than 1,000) peak-hour vehicles to the local roadway system could substantially reduce road LOS. Options for addressing this problem could include signalization (specifically at major intersections such as South Ocean Boulevard at the realigned South West Bay Road) or geometric improvements such as wider lanes and shoulders, shared center right-turn lanes, or new left or right turn lanes at intersections.

Design of the realigned South West Bay Road will also be important. Given the large volume of truck traffic that would be generated by the new port, a two-lane configuration on South West Bay Road (similar to the existing configuration on West Bay Road where it intersects South Ocean Boulevard) may not be adequate to handle through and turning movements. Turn lanes or even a four-lane configuration may be necessary.

Local Waterway Infrastructure

The largest adverse cumulative impact associated with waterway infrastructure is the loss of navigable area for non-port vessels due to the presence of large cargo vessels near the relocated port. Establishment of strictly enforced shipping lanes associated with the port could minimize this loss of navigable area. Similarly, the establishment of a designated anchoring area (for cargo ships waiting to access the port) could be considered. Such an area should be located farther offshore to further minimize potential conflicts with smaller vessels from the two proposed marinas.

Emergency Access

No mitigation measures are envisioned for cumulative impacts to emergency access.

Hazards and Accidents

In addition to the mitigation strategies described for road and waterway infrastructure, other mitigation strategies related to hazards and accidents could include:

- Improved lighting along major roads;
- Well-marked pedestrian crossings or other physical improvements in areas with heavy pedestrian traffic; and
- Enhanced enforcement of traffic laws—particularly speeding—and safety regulations related to the condition of commercial vehicles (e.g., maintenance of brakes and tires).

7.2.3 *Cumulative Sediment Drift Impacts*

7.2.3.1 *Cumulative Impacts on Sediment Budgets*

The proximity of the proposed Albany marina and its jetties, neighboring to the east of the NSOD project, may have a negative cumulative impact on the sand budget of the shoreline between the two marinas. With the predominant direction of littoral drift being from east to west, the adjacent property's jetties will intercept this flow of sand. The amount of sand currently being transported from East to West at the NSOD project site, however, is negligible. Therefore, it is not anticipated that the NSOD project will significantly affect the sand budget downstream (to the West).

7.2.3.2 *Potential Mitigation Strategies for Cumulative Sediment Impacts*

The beach design for the NSOD project will not be able to count on sand coming from upstream (the East) to maintain the equilibrium of the beaches. Therefore, the beaches will be designed to be in static equilibrium.

7.2.4 *Freshwater/Ground Water Cumulative Impacts*

In conjunction with the Bay Street Redevelopment project, the Nassau Ports Authority plans to relocate marine terminal facilities from their present location (west of Paradise Island Bridge) to the Clifton Pier area. The new marine terminal would be an inland facility, with the entrance channel located between the brewery and the Bahamas Electric Corporation power station. The terminal basin would be located to the west or northwest of the project site. An excavated basin of sufficient size to accommodate a marine terminal would likely have a significant impact on local fresh ground water resources and would likely overshadow ground water impacts associated with the NSOD project (ATM, 2007).

7.3 COMPARISON OF UNAVOIDABLE NEGATIVE ENVIRONMENTAL IMPACTS TO PROJECTS BENEFITS

The NSOD project has taken many measures to avoid and minimize environmental impacts through careful design and environmentally sensitive construction and resort operation. Further, Section 6.2 identifies an extensive set of mitigation measures to further reduce the net impact of the project. Nevertheless, the project will result in some unavoidable negative impacts. These impacts include:

- Loss of approximately 160 ac of natural terrestrial habitat, which will also result in a net loss of habitat available for fauna on New Providence Island;
- Loss of some protected trees, which either are too large to transplant or do not survive relocation;
- Increased demand for electricity, which will require the importation of more oil and the emission of more air pollution;
- Increased demand for freshwater, which will require increased desalination or the import of freshwater to New Providence;
- Generation of solid waste, which will use limited sanitary landfill volume;
- Increased potential for accidental spills and use of fertilizers and pesticides, which will cumulatively impact water quality; and
- Increased vehicular traffic, which will result in increased mobile source air emissions.

These unavoidable negative impacts are offset by several significant project benefits. Many of these benefits are social and economic, and include:

- Creation of over 877 direct temporary construction jobs and 1,358 direct permanent positions, which will help reduce unemployment on New Providence;
- Significant contributions to the local economy through visitor spending;
- Significant contributions to the government of The Bahamas through various tax payments;
- Contribution to achieving government's vision for southwest New Providence; and

- Increased quality of life for residents of New Providence as a result of increased employment opportunities, recreational opportunities, and infrastructure improvements.

Although it is difficult to compare beneficial and adverse effects on different resources, overall the social and economic benefits are quite significant and consistent with the government's plans for New Providence, while the environmental impacts will not affect overall biodiversity, or significantly affect water or air quality. The effects of the project on water demand, electrical generation, and solid waste generation are issues common to all development on a small island such as New Providence. Therefore, we conclude that the benefits of the proposed project significantly exceed the project's environmental impacts. The developer should fully implement the Environmental Management Plan and track its performance through an Environmental Management System to assure that the environmental impacts are avoided, minimized, and mitigated to the full extent possible.

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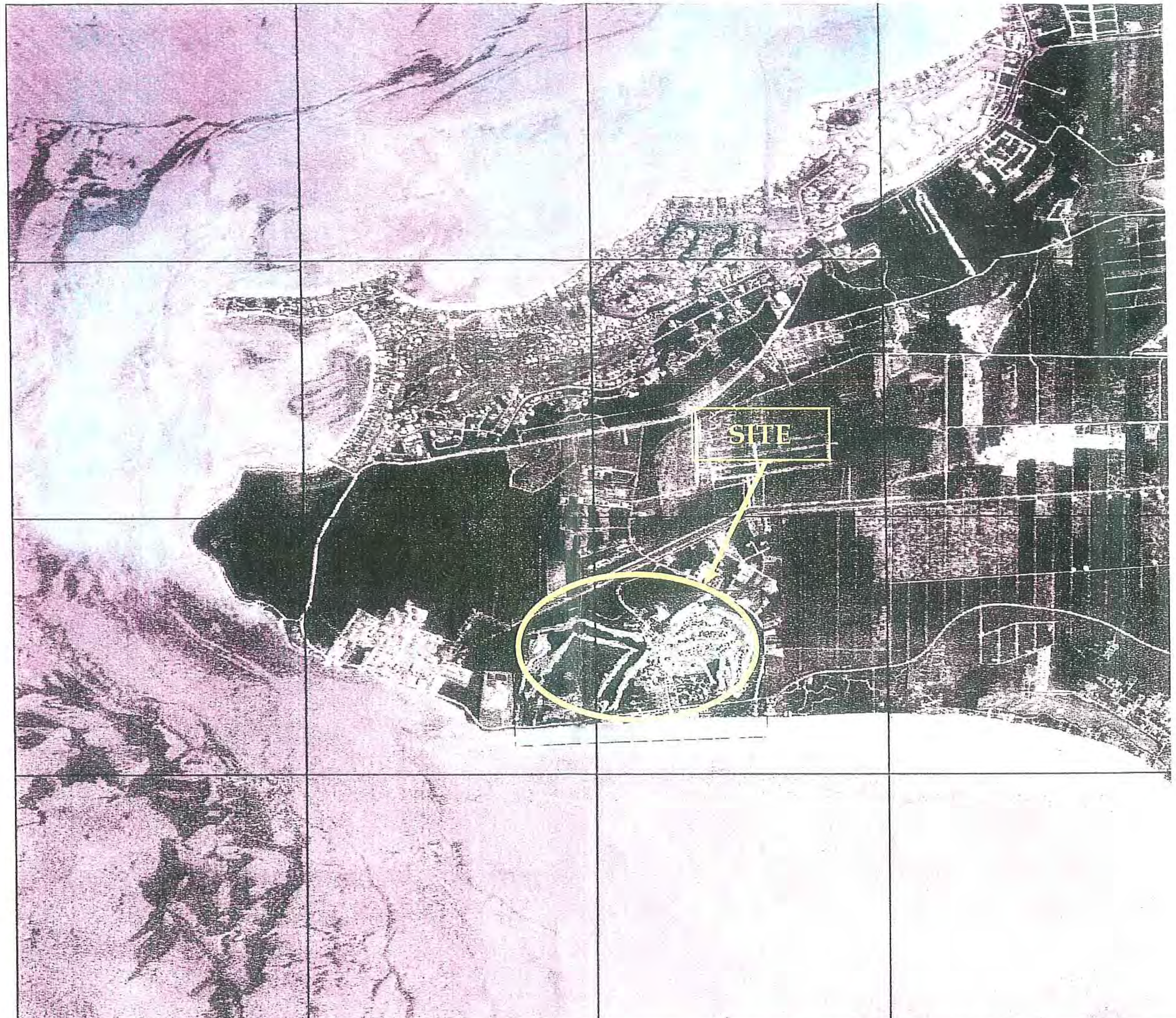
8 APPENDICES

Appendix A.1

Site Location Aerial Photograph



ERM

Appendix A Site Plan

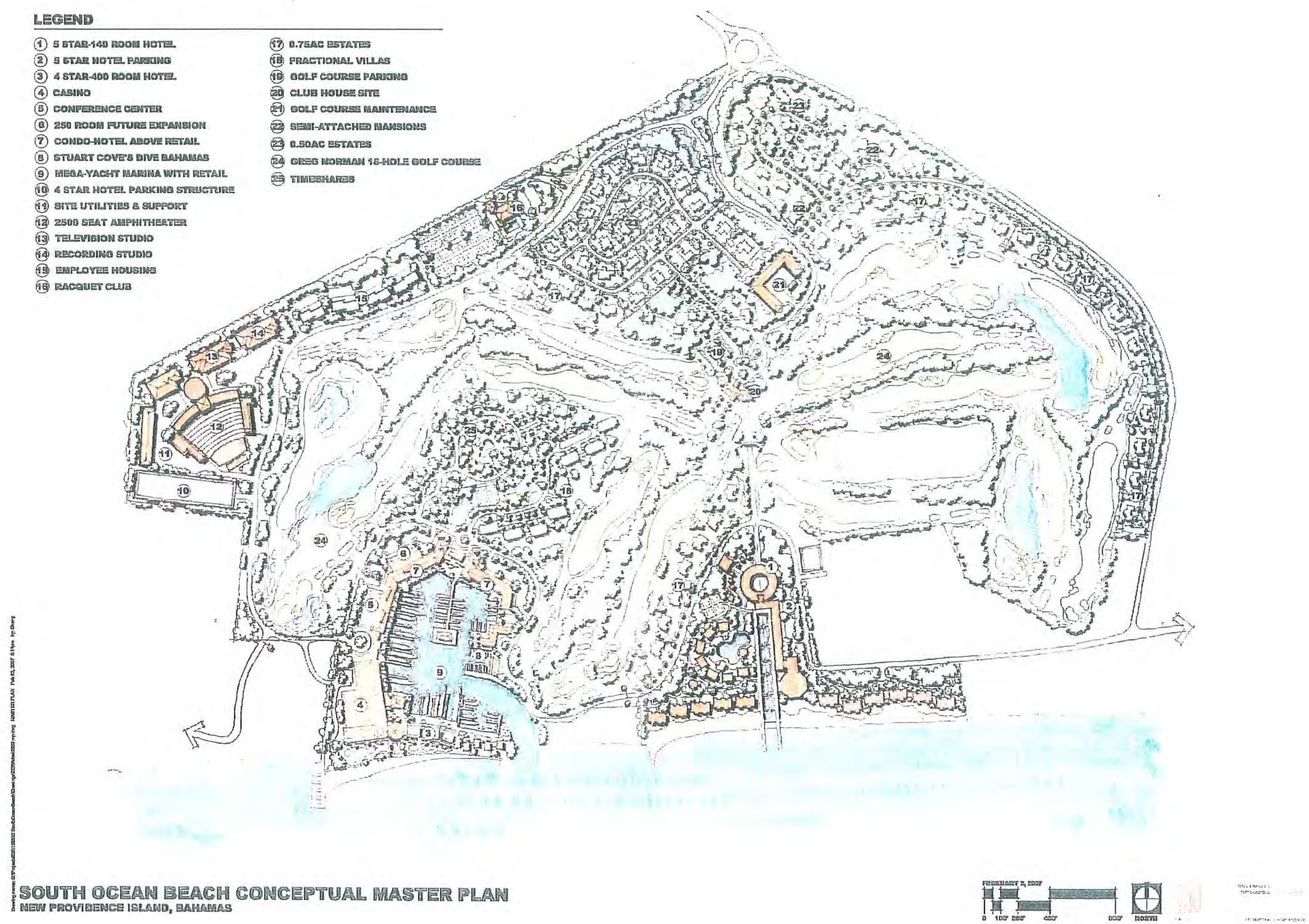
Appendix A.2

New Providence Island Location Image

Appendix A New Providence Island Location Map
Source: Google Earth

Appendix B

Conceptual Master Plan



ERM

Appendix B New South Ocean Development Master Conceptual Plan

MICHAEL GRAVES & ASSOCIATES

LEGEND

1. Four Star Hotel
2. Large Estate Lot Program # 1, #2, #3,
3. Five Star Hotel
4. Golf Course
5. Fractional Villas
6. Mid-Size Estate Lot Program
7. Timeshares
8. Commercial Space
9. Racquet Club

SITE PLAN DIAGRAM

SOUTH OCEAN BEACH DEVELOPMENT

NEW PROVIDENCE ISLAND, BAHAMAS

Appendix C

Site Rendering

MICHAEL GRAVES ARCHITECT

HOTEL AND MARINA
SOUTH OCEAN DEVELOPMENT
NEW PROVIDENCE ISLAND, BAHAMAS