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## ***SECTION FIVE***

### ***ENVIRONMENTAL IMPACT ANALYSIS***

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#### **5.1 Introduction**

The following sections describe the environmental impact analysis from its conceptual approach to its cumulative impact analysis. This analysis is directly related to the environmental management plan described in Section 6 of this document.

##### **5.1.1 Conceptual Approach**

It must be a basic premise that all developments will produce some environmental impacts and therefore the basic question is how much is acceptable under the circumstances? The obvious consensus is that the country needs development but only of the kind that is sustainable and in conformity to national development priorities. The challenge throughout is to find an acceptable level that will strike the necessary balance between the need to develop and the need to protect vital environmental processes. Also important is the planned scale of the infrastructural development and their potential to unravel the social fabric and lifestyles of the people in the area within which they are based.

The impacts of this development will be felt mainly in the areas of physical alterations to the coastal and inland ecosystem, solid and liquid waste disposal, water supply and distribution, energy generation, effects on the native wildlife species of the area from a combination of factors, extraction of materials and transportation. The point has been made that no project of this size can be successfully implemented without some negative environmental impacts, however it is incumbent on the developer to reduce these to their lowest possible level, or negate them entirely if the situation allows.

The developer will be aided in this undertaking by the impacts and mitigation discussion in the relevant sections of this report and summarized in the tables below. These cover the aspects of project activities which have been identified by the DOE as liable to produce significant environmental impacts among others.

##### **5.1.2 Environmental Principles in Impact Analysis**

In principle the need to address some requirement(s) of the human species gives rise to the definition and implementation of some specific development project(s) or program(s). In the context of the proposed development, the human requirement to be addressed is the need for recreation and knowledge of the ecosystem. In the case of the latter this relates to the research and educational components of the project.

Inherent in development projects and programs are activities which alter the environment, or cause some “environmental disturbance”. These environmental disturbances have a number of

“effects” which in turn leads to “environmental impacts”, which are categorized as being either negative or positive.

Environmental impacts are in principle hierarchical and in this regard are described as being sequentially ‘primary’, ‘secondary’, ‘tertiary’, etc., in orientation. An example of this impact sequence which specifically relate to the currently proposed project is shown in Table 5.1. Primary impacts are those impacts arising immediately from particular development activities such as land reclamation or dredging, and affect basic ecosystem functions such as primary productivity, metabolic rate, mechanical damage to anatomical structures and the physical destruction of habitats.

The ‘primary impact’ parameters in turn have another level of impacts on various ecosystem components, which are qualified by both magnitude and direction. This is unlike the ‘primary impacts’, which within the context of the current EIA varies in magnitude only (See EIA Rating Matrix outlined in Table 5.1). In the case of primary impacts, this may be explained by the fact that variations in the magnitude of these parameters in and of themselves are neither deleterious nor beneficial. Conversely, under the current analytical process outlined in the EIA Impact Rating Matrix (See Table 5.1), although a relationship may exist, the magnitude of change of the particular parameter may be so small or insignificant, that no discernible impact is identified.

## **5.2 Overview of Proposed Cumulative Impacts**

In considering the proposed project, the importance of identifying the anticipated cumulative environmental impacts is of great value. This approach is designed in such a way as to preserve and conserve the environment as much as possible while undertaking the required activities necessary to bring life to the project.

In addition, a monitoring plan must also be visualized in order to quantify the potential adverse impact that may result as part for a developmental activity. These plans must be carefully designed, planned and implemented to techniques designed to reduce and possibly eliminate the severity of the effects.

Such circumstances have been extensively studied by the Council for Environmental Quality (CEQ) and they have defined the measures as those that include:

1. *Avoiding* the impact
2. *Minimizing* the impact by limiting the degree or magnitude of the action
3. *Rectify* the impact by repairing, rehabilitating, or restoring the affected environment.
4. *Reducing* or eliminating the impact over time
5. *Compensating* for the impact by replacing or providing substitute resources or environments.

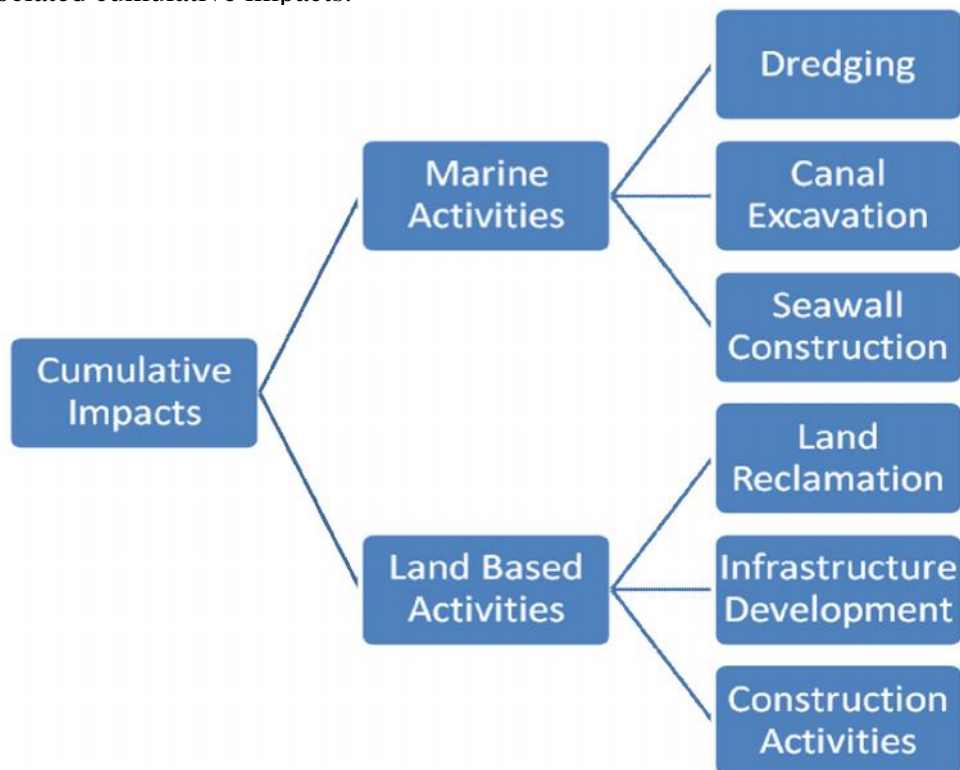
These measures applied by the Council, can be adapted to suit the proposed project and assist the decision makers in the course of action. Figure 5.1 illustrates the generic impacts and its related influences in regards to the measures implemented by CEQ.



**Fig. 5.1** CEQ’s Impact Structure

**5.2.1 Impact Rating Matrix**

Figure 5.2 summarizes the potential impacts that can be encountered during construction and operation of the project. These impacts can be view as affecting both sea and land environments and its associated cumulative impacts.



**Fig. 5.2** Cumulative Potential Impacts

The impact matrix was designed as a tool to understand the level of adverse, or alternatively, beneficial impacts on the ecosystem and in general of any given area in question. It is a function of the scope of the development, the ecological fragility or sensitivity of the receiving environment, and the conceptual value assigned to the integrity of the natural resources of the area by the wider community.

The connectivity or hierarchical nature of the impacts of the proposed project has been reinforced by the integration of a residual impact rating matrix outlined in Table 5.1. This matrix evaluates the mitigation measures options in the following terms:

- **Magnitude:** High (H), Medium (M), or Low (L);
- **Direction:** Beneficial (+) or Adverse (-);
- **Duration:** Instantaneous (I), Short term (S), Medium (M) or Long term (L);
- **Scope:** Instantaneous (I), Short term (S) , Medium (M) or Long term (L);
- **Significance:** Not Significant (NS), Low (L), Medium (M) or High (H) significance

The primary activities that are likely to result in some environmental impacts of note are the construction and operation of the marina, services provided as well as the construction of the buildings. The potential for pollution from air, noise, solid waste and a shift in the increase of land property are also of relevance.

**Table 5.1** Impact Rating Matrix for South Beach Belize

		Potential impact	Magnitude	Direction	Duration	Scope	Significance
<b>Sea Based Activities</b>	<b>Dredging Activities</b>	Benthic Fauna	H	-	M	M	L,M
		Marine Organisms	M,L	-	S,M	S	M
		Near Shore Ecosys./Reef	L	-	I,S	I,S	NS
		Toxic Bioaccumulation	L	-	S	S	L
		Water Quality	M	-/+	S	S	L
		Nutrient Re-suspension	L	+	M	M	L
	<b>Canal Network Excavation</b>	Sediment Re-suspension	M	-	I,S	I,S	L
		Benthic Fauna	M	-	S	S	L
		Toxic Bioaccumulation	L	-	I,S	S	NS
		Water Quality	L	-	S	S	L
		Nutrient Availability	L	-	I,S	S	NS
		Marine Organisms	L	-/+	S	S	L
	<b>Sea Wall Construction</b>	Sediment Re-suspension	L	+	I,S	I,S	H
		Benthic Fauna	M	+	S	S	M
		Toxic Bioaccumulation	L	-	S	S	NS
		Water Quality	L	+	S	L/+	H/+
		Nutrient Enhancement	L	+	S	S	L
		Marine Organisms	L	+	S	L/+	M/+
Socio-economic influence	M	+	S	S	M		

		Potential impact	Magnitude	Direction	Duration	Scope	Significance
Land Based Activities	Building Construction	Soil Alteration	M	-	I,S	I,S	L
		Land Alteration	L	-	L	L	L
		Surface Water Alteration	L	-	S	S	L
		Noise Generation	L	-	S	S	NS
		Fugitive Emissions	L	-	S	S	L
		Solid Waste Generation	L,M	-	S	S	L
		Socio-economic Influence	M	+	S,M	S,M	M
	Infrastructure Develop. & Oper.	Soil Alteration/Pollution	L,M	-	I,S	I,S	L
		Water Contamination	L	-	S	S	L
		Spills and Leaks/Services	L	-	I,S	I,S	L
		Drainage Alteration	M	-	S	S	L
		Fugitive Emissions	L	-	I,S	I,S	L
		Noise Generation	L	-	S,M	S,M	L
		Aesthetic Enhancement	H	+	L	L	H
	Socio-economic Influence	M	+	S	S	M	
	Land/Beach Reclamation	Habitat Alteration	M	-/+	I,S	I,S	L
		Soil Alteration	M	-	I,S	I,S	L
		Land Alteration	L	-	L	L	L
		Surface Water Alteration	M	+	S	S	L
		Drainage Alteration	L	+	S	S	L
		Aesthetic Appeal	H	+	L	L	H
Fugitive Emissions		L	-	I,S	I,S	L	
Socio-economic Attraction	H	+	L	L	H		

### 5.2.2 Overview of Environmental Impacts

Based on the Table 5.1 above, various potential cumulative impacts were identified as part of the Impact Rating Matrix for South Beach Belize. The level of adverse, or alternatively, beneficial impacts is a function of the magnitude of the development activity, the nature of the impact in question, the capacity of the environment to assimilate these influence and the methodology to be applied in relation to the particular project activity.

The primary activities that are likely to give rise to environmental impacts of note are the dredging activities, infrastructure development (supporting services) and canal construction (See Fig. 5.2 and Table 5.1).

The deposition of dredged spoils for land reclamation purposes, also gives rise to environmental impacts. The deposition of dredge spoils, although immediately related to dredging, is conceptually separate from dredging, which has been technically qualified as the physical excavation aspect of the operation.

Other primary impacts arising as a consequence of dredging relates to habitat alteration. These have been categorized as “ecological” impacts and include: a decrease in nursery habitat, an increase in benthic habitat, an increase in pelagic habitat and a decrease in mangrove prop root habitat.

The most notable primary aquatic impacts that are likely to arise from the general commissioning of operation of the proposed development are an increase in macro-nutrients and turbidity.

Apart from water quality issues and aquatic impacts otherwise, the engagement of the land based facilities is also relevant in term of environmental impacts. This includes the related impacts such as building and infrastructure development, board walks and the land and beach reclamation.

### **5.3 Details of Environmental Impacts**

The following sections summarize the potential cumulative impacts related to the proposed project for South Beach Belize. It is important to note that some of the information contained in the first EIA has been utilized in this Section.

#### **5.3.1 Dredging Impacts**

The most notable primary aquatic impacts arising from the dredging operations are expected to be an increase in sedimentation and turbidity, and an increase in hydrogen sulphide in the water column (See Table 5.1).

The areas that are expected to be affected from the dredging impacts are the near-shore ecosystems in the immediate vicinity of the ‘burrow pit’ (See ‘Detail B1’ in Fig. 2.12), the access channel to the canal (See ‘Detail D1’ in Fig. 2.12) and the excavation of the Grand Canal network for water transportation purposes (See ‘Detail C1 and C2’ in Fig. 2.12). In these activities the related acquisition of ‘spoils’ or ‘fill materials’ is to reclaim the project site (See ‘Dredged Material/Fill Requirements in Fig. 2.12).

The ‘burrow pit’ is to be located about 2.2 miles southwest of the greater Ambergris Caye. The turbidity and sedimentation impacts has been estimated to be ‘low to medium’ at its most extreme (See Table 5.1), given the volume of ‘fill’ material to be extracted, the time-frame over which the material is to be extracted, the physical form of the material, and the proximity of the ‘burrow pit’ to ecologically sensitive areas.

The burrow pits are to be located in areas characterized by sparse sea-grass rooted on a fairly thin substrate of consolidate calcareous sediments, intermixed with organic carbonate debris. This layer sits on a fairly substantial layer of firm, semi-compacted ‘Halimeda’ sand, which is of calcareous origin. Halimeda sand is made up primarily of the ‘tests’ or skeleton of the marine calcerous algae *Halimeda spp.*. It is this layer of sand that is being harnessed as the ‘dredge spoil’ to be deposited in the area to be reclaimed.

Given the coarse nature of the sand, and its relatively high density, the suspended sediments upended by the excavation process should re-settle in a relatively short time after the cessation of the overall dredging event. Thus even those areas that are nearest to the dredging site should not be catastrophically affected by the event. The particular area has been listed as the “Near-shore Ecosystem” in the EIA Matrix (Table 5.1), and is in effect the near-shore areas and mangrove

islands (Hol Chan Marine Reserve) immediately southwest of Ambergris Caye (See 'Detail ED' in Fig. 2.17).

The volume of the spoils to be dredged from the sea and canal network to 'elevate' the site of the different development areas by 3 feet is 2,027,747 cubic yards or 1,550,324 cubic meters (See 'Proposed Dredge Material/Fill, Fig. 2.12). It is noteworthy to point out that the 'offshore ecosystem' is not expected to be adversely affected by this activity. Thus the various components of this ecosystem, which includes the reef environment, have been accorded as not being affected in the Impact Rating Matrix (See Table 5.1).

The impact of sedimentation from the dredging activities in the burrow pits and canal excavation is for the most part rated as moderately adverse. This includes the sea floor of the surrounding impact sites which intermittently consists of some sparse sea grass and macro-algal productivity. In addition, the mangrove prop-roots of the project site are mostly underwater.

The 'moderate impact' category has been assigned to the "mangrove prop root habitat" mainly as a result of the fact that the dredge spoils will be deposited among the ecologically sensitive prop roots on the areas to be developed.

The magnitude of the adverse sedimentation impacts associated with the dredging activities are considered adverse mainly as a consequence of the substantial amount of peat and sand which are to be excavated (See 'Proposed Dredge Material/Fill' in Fig. 2.12). These fine sediments stays in suspension for a relatively long period of time after the cessation of the dredging event, with the consequence of the impacts being felt over a larger geographic area and for a more extended period of time.

Although the volume of material to be dredged from the burrow pits is larger than the inland excavations, the limited area to be physically impacted relative to the expanse of the sea should result in minor environmental impacts. The adverse impacts, which are all considered to be low to moderate in nature, relate to the productivity of the near shore ecosystem.

In addition, some impairment can occur with the fishing activities carried out by the traditional fishers of the area. The rapid deposition of heavier sediments combined with the poor visibility associated the suspended solids in the water column, makes it difficult for fishermen to see their traps and or catch. The overall impacts of the dredging events of the proposed areas on the fishery activities are projected to be very limited and localized in time.

#### *Dredging Impacts of Note*

It is also anticipated that the extraction of materials will have both physical and biological effects on the environment. Dredging operations can possibly affect lagoonal environment in a number of different ways, most notably the following:

## 1.0 Possible Biological Impacts

### *a. Direct biological impacts include:*

- Possible Death or temporary migration of fish and other marine life (only migration may occur)
- Destruction of sea grass beds (Sparse density in proposed dredging areas)
- Micro-algae and invertebrates are either entrained or crushed during dredging operations (Minimal considering habitat)
- Loss of habitat (minimal expected)
- If crocs, manatees or other animal of interest are near the dredged site, disturbance would likely occur possibly causing injury and migration (considered minimal)

### *b. Indirect biological impacts include:*

- Possible decrease in primary productivity due to increased turbidity (minimal)
- Effects on habitat and benthos intolerant of high sedimentation (use of curtains)
- Bioavailability of contaminants in dredged material if presently accumulated in the sediments (reduced by dredging in dry season only and use of curtains)
- Increased wildlife potential as deeper navigable waters are introduced (post dredging operations)

## 2.0 Possible Physical Impacts

### *c. Direct Physical Impacts include:*

- Possible increased siltation and turbidity (minimized by using curtains and dredging only on dry season).
- Changes in topography and bathymetry of lagoon.

### *d. Indirect Physical Impacts include:*

- Indirect turbidity of water column from sediments that are continuously introduced into the water column (minimize by using curtains)
- Changes in current speed (minimal and dredge only on dry season)
- Changes on water circulation due to changes in bathymetry (velocity during dry season will decrease)
- Increased erosion of shoreline (shoreline protection is required)
- Increased deposition of material on the shoreline (minimal)

### 5.3.2 Land Reclamation Impacts

The various land reclamation activities that will be carried out relate to the 'elevation' of the proposed project site to compensate for sea level rise. The cumulative impacts relating immediately to the reclamation process of the project site are: increased salinization of soils, increased beach erosion, increased turbidity in water quality and the deposition of anoxic sediments (See Table 5.1). Although there are identifiable primary impacts in relation to a number of these variables, these are not expected to translate into significant secondary and tertiary impacts as they relate to the various ecosystems and ecosystem components in the area.

### 5.3.3 Domestic Effluent Impacts

The two (2) main generic impacts relevant to the proposed undertaking are increased nutrients and fecal coliform in the water column.

The situation of increased nutrients in the water column is generally referred to as eutrophication. This relates to the macro-nutrients, which are 'phosphates' and 'nitrates'. These are generally derived from gray water effluents, as well as sewage effluents from the flushing of toilets.

In general a major source of macro-nutrients in gray water effluents is from detergents. This is also relevant to the proposed development. Another source of macro-nutrients is from fertilizer and the general decomposition of organic substances.

The level of phosphates and nitrates found in the waters in and around the caye as shown in Fig. 2.4 (Annex V) is relatively low and is in no way considered to be at a level where it can be considered as 'polluting'. The effect of increased levels of macro-nutrients in the water column is to, in general, increase 'primary production' or photosynthesis in autotrophic plant-life. This relates to micro-algae such as *Chaetocerus spp.*, and *Tetraselmis spp.*, flowering plants such as the sea grasses *Thalassia spp.*, and *Syringodium spp.*, and macro-algae such as *Halimeda spp.*, and *Udotea spp.*

Increases in nutrient levels for the proposed undertaking relates to both the construction and operational phases (See Table 5.1). The greater nutrient impacts are associated with the commissioning or operational phase of the development. It has been asserted that the level of primary impact should be of 'low change' (See Table 5.1). The most detectable nutrient impacts are expected to be in regards to the near shore ecosystem off the lagoon basin, and South Island development.

It is noteworthy to point out that the change in nutrient profile associated with the development should not impact any coral reef ecosystem. This is a function of distance or more appropriately 'dilution effect' of the sea, as well as the relatively modest increase in nutrient from the operation.

It is also noteworthy to point out that the coral reefs in the area are not in an optimal state of health. This is indicated from the relatively limited or sparse 'coral cover', as well as the

relatively low “species diversity” discerned from the coral survey outlined in the previous EIA.

The issue of fecal coliform associated with the development is an important one. As may be seen from Figs. 2.4 (See Section 2.1.2.6), there were no detectable levels of **fecal coliform** or *E. coli*. It is expected however that there may be a modest increase of these pathogens at full project development. Although a non-discharge tertiary treatment facility is to be expanded (See Annex V), an increase in non-project boats generally visiting the area to take advantage of the recreational beaches, the educational facilities, the marina and other facilities, is expected.

Associated with this is the increased probability of sewage discharge from these boats. The potential impacts of an increase in the levels of fecal coliform in the water column, is an indicator that there may be an increase in the probability contracting some pathogenic or infectious diseases. The impact associated with this, however, has been assessed to be low.

Although in principle there should be no fecal coliform or other associated pathogen in the ‘tertiary’ treated effluents from the treatment plants to be installed, the adoption of a ‘precautionary approach’ leaves room for a situation that is less than perfect. The use of tertiary treated effluents to flush toilets and water the lawn is a good conservation strategy. However the latter scenario brings with it the possibility for the presence of pathogens, albeit at low levels. This has been taken into account as being short and of low significance (See Table 5.1).

#### **5.3.4 Potable Water Impacts**

There will be an extractive process associated with the sourcing of potable water for the proposed development. The main source of potable water for domestic and human consumption is from water desalinization that will be supplemented by BWS and supplies from rain-fed cisterns. In relation to the water desalinization process, water will be extracted from two wells that will be dug in the Utility Zone.

The impacts associated with this undertaking are classified as minor deleterious considering the volumes that will be extracted to suffice the project site at full capacity. These impacts include the abstraction volume and its possible effect on the ground water movement within the zone of abstraction. The injection of the brine is considered to be the most deleterious action related to this issue, however, the associated potential impact to the receiving environment has yet to be determined by environmental and geohydrological engineers.

#### **5.3.5 Solid Waste Impacts**

The proposed management scheme for the management of the solid waste will involve the collection of the waste from the different sites and sorting to separate the organic from the inorganic waste. The inorganic components are to be compacted and ferried to the Belize City dump site at Mile 3 on a regular basis where it will be subsequently transported to the Mile 21 Sanitary Landfill once in operation. Therefore these will be assimilated at the site until enough has been accumulated to justify transportation into Belize City.

The two (2) main generic environmental issues related to the generation and management of

solid waste are the potential for the attraction of feral animals to the site and the potential for increasing the incidence of pathogenic diseases. The attraction of feral animals to the main development sites would be as a consequence of the increased availability of food in the form of discards from the restaurant and refreshment stands. The animals relevant in this regard would be predatory and omnivorous mammalian fauna such as rats and rodents, as well as predatory reptiles such as the crocodile and opportunistic bird species such as the Grackle (*Quiscalus mexicanus*), the Herring Gull (*Larus argentatus*) and the Frigate Bird (*Fregata magnificens*).

The impacts of feral animals in regards to the proposed development have been assessed as 'minor beneficial' impact in regards to crocodile, seabird and migrant bird populations. There are also some adverse impacts however and these relate to general species diversity and the possibility of injury from animals such as crocodiles. These impacts however have been all categorized as 'low'.

### **5.3.6 Energy Generation Impacts**

There will be no deleterious impacts associated with the generation of energy as the development will utilize energy from BEL to provide to its customers. The only possible impact related to energy generation is as a result of the supplementary source, which would be the commissioning of the standby generators to suffice about 80 % of the project site with energy. In view of this, the predicted impacts include the possibility of hydrocarbon spills and leaks as a result of generator operation (maintenance and refueling) and boat servicing

In considering the hydrocarbon spills and leaks, these can be deleterious to the receiving environment. This issue has been labeled as 'low' in the Impact Rating Matrix (See Table 5.1). This impact considers both land and sea environments which usually cause localized contamination if not properly contained.

### **5.3.7 Impacts from the Building Construction**

The associated impacts related to the construction and operation of the different buildings is wide and varied. It is anticipated that out of these two events, the construction phase will be the most deleterious. The main impacts associated with the construction phase include the reclaiming of land, the placement of construction material and the actual construction phase itself.

Considering that most of the project site will be reclaimed, the predicted impacts on the reclaimed surface are considered to be 'low'. Therefore the only plausible impact with this issue includes the actual construction phase that will primarily involve the generation of noise and other construction related pollution. This impact is anticipated to be 'short and low' (See Table 5.1).

In discussing the operational phase, the associated impacts include the subsequent maintenance of the reclaimed areas and proposed daily activities within the developed zones. Both these impacts are considered to be 'short and low' as it is anticipated that the activity will be enhanced by efficiency, especially the maintenance component.

### **5.3.8 Roadway Impacts**

The impacts of the roadway will consist primarily of the construction phase of the roads that will link the different development areas and lots of the proposed development. The designing and the routing of the road network would result in short term sedimentation, short term air pollution and sight pollution impacts (See Table 5.1).

In other words, the construction works associated with the road will result in the suspension of particulate matter associated with the dumping and grading of the road network. This in turn would in localized impacts along with the sedimentation of the drainage system and canal mouths.

### **5.3.9 Boating and Water Transportation Impacts**

The marine impacts are related to both sedimentation impacts and petroleum pollution impacts. The sedimentation impacts are related to the construction phase of the operation (See Table 5.1). It has been surmised that the impact from the dredging operation would be accorded a 'moderate adverse' categorization, given the relatively low volume of materials to be extracted and the location of area, relative to the open sea.

The petroleum pollution aspects are related to the fueling operation of boats at the fuel station. Another potential source of petroleum pollution is from the unauthorized and inappropriate discharge of 'bilges' within the canal network. The impacts of petroleum pollution on the sensitive ecologies of the area should be 'low' (See Table 5.1), given the perceived small volumes of accidental spillages and bilging, and the remote location of the service area from the open sea (See Fig. 3.7).

### **5.3.10 Social Impacts**

The social impact assessment will cover both the social and cultural impacts, and the social and economic impacts of the project. This assessment will also include the overall value and changes of the resources taking into account the future value of the natural resources by users and impacts of the proposed development on these areas; the general role of traditional users in response to both the fishery and tourism value, and future value of the fishery resource, as well as other impacts on increased usage of the area during post construction and development and completion phases (See Table 5.2).

#### *Development Activities*

- large population and equipment movement and use during all phases of construction
- demand for services
- marine traffic increase
- transportation of materials

During all phases of construction increased boat and human activity to the region will increase. Increased traffic to and from the site will include worker populations, and transportation of equipment, supplies and materials to the site (not to include the already regular scheduled trips to the project site by the investors). Demand for services by worker populations will also increase during all phases of construction.

*Current and Existing uses of the area*

Potential or proposed Impacts

- disruption of traditional user activities
- regulated use of traditional activities
- access to the area by traditional users
- ability of users to adapt to changes
- increased use by other newcomer users

One of the major concerns indicated by stakeholders was proposed dredging activities in traditional fishing grounds areas. Continued access and use of the area and views of the developers in respect to traditional uses is another main concern.

*Economic & Cultural*

Potential or Proposed Impacts

- impact on fishery resources
- decreased economic benefits by traditional users of the area
- Pressure on existing institutions and social groups
- Marginalization of minority groups and locals
- Pressure on existing lifestyles

Development activities of this nature, especially in areas of marine importance to fisher folk, do have impact to some degree. The major impact could see decreased economic benefits to those small fishermen who utilize the fishing grounds and impact on the fishery resource.

*Employment*

One of the major concerns is the availability of jobs, mainly for skilled laborers to satisfy the project's demand. Major impacts include the lack of adequate hospitality training as well as minimum wages for unskilled labor.

*Transportation / Sea Traffic*

Potential or proposed Impacts

- Increase in number of vessels to the area and the region
- Impact on natural environment by increased boat usage

Operation of construction and all machinery  
Safety for traditional users

*Emergency and Health Services*

Potential or proposed Impacts

Increased pressure on health and sanitary facilities

*Population and Housing*

Potential or proposed Impacts

Increased population density in the area  
Increased housing needs at site

The proposed development will experience a temporary increase in population (workers) during all phases of construction. The site can also support the proposed amount of temporary workers to be employed during all phases of construction.

*Social Impacts of Note*

The development is classified as a both a “Residential” and “Resort” for people from North America, Europe and Belize. The main **positive** concerns identified by those interviewed on the proposed development are:

- increased employment and job creation and the possibility for local residents to enter or expand their business, such restaurants, hardware supplies, handicraft marketing at the boutiques or shops to be established in the resort;
- a general sentiment by community leaders is that they hope the developer does “the right thing” to seek a balance between “tourism-natural environment-fishing” by following the proper protocols and getting the required permits before starting construction;
- the availability of a new and nearby market for the farm products from the mainland and marine products produced by the farmers and fishing cooperatives and the shrimp farms who will increase their income potential;
- increased income to the Town Council from property tax, building fees (\$1.00/sq. ft) and vehicle licensing by the owners of the condos and residencies in the development;
- a general increase in business activity and revenue generation during the construction and post-construction phase of the development; and
- there is always a window of opportunity to negotiate to make the development a win-win situation for all.
- The developer has contributed to the community by supporting 2 soccer teams, grading the roads with his machinery and supporting the CYDP to train the youth countrywide in vocational training programs with skills that can make these youth employable by the development during the next 5-6 years.

Other indirect benefits may result for existing tourism businesses that will cater to an increased retiree population and who may also specialize in tourism-related catering and related service businesses to this new population. The main negative concerns identified, in no order of priority, are:

- the development is too close to Hol Chan and the development activities may “destroy the main attractions ( Hol Chan, Shark Alley and sport fishing) of the island; once Hol Chan is destroyed the tourists will not come to San Pedro thus resulting in total economic loss;
- impact of dredging to this area of flats where most of the sports fishing is done by the tour guides;
- the dredging will destroy the habitat for the three important species of sport fish, namely bone fish, permit and tarpon;
- dredging will kill the juveniles of the three main sport fishing species and also others such as snook, jewfish, cubera snapper;
- the sedimentation from the dredging will “scare and chase” the important sport fishing species and will destroy the sea grass beds (feeding habitat) in the lagoon and corals on the reef;
- the main question on the dredging is where the source of fill material will come from since there is not much fill material in the flats;
- destruction of the mangrove ecosystem will have long term repercussion on the life of the island since mangroves are compared to the “kidneys of the human being” which clean and detoxify the island system;
- the cutting of mangroves resulting in lost breeding grounds (nursery habitat) and lack of protection from storms;
- cutting of mangroves will also remove the nesting areas for spoon bills, Ibis, etc;
- the resulting sedimentation of fine silt on the barrier reef and mangroves will also affect spawning aggregation sites, especially for lobster;
- displacement of sport fishers from their current tour guiding grounds due to the dredging and cutting of mangroves thus resulting in loss of their traditional livelihood;
- the development may cause restriction of traffic to fishers; a buffer area may be “buoyed off” to prevent fishers and tour guides from using the areas close to the development;
- disposal of solid and sewerage waste will increase this already existing problem;
- the vision for this development is short term and there is no need to recreate what already exists in the USA and Cancun;
- the development is not compatible with the eco-tourism on which the island was developed and currently living off;
- the “time share” system has created a situation among the “marketers of the rooms on the streets” who harass the tourists;
- employment of people from the town will be limited to lower positions while the senior management position will go to foreigners;
- housing for the workers are limited in the island and with over a 1000 additional workers, the shanty housing over swamps will increase;
- the developer does not have open communication with the community;
- some level of development was began without proper permits;

**Table 5.2** Potential Social Impacts & Residual Impact Rating on Proposed Activities for Project Implementation

Activities and Conditions	Potential Impacts	Comments by Consultants	Residual Impacts, Magnitude/ Direction/Duration/Scope
<b>Current and Proposed Land Use in Area</b>	<ul style="list-style-type: none"> <li>Location and size of development.</li> </ul>	<p>Adequate control development proposals, especially during the construction phase, take into consideration future development activities being undertaken in the island.</p>	High/ positive/high/local
<b>Activities during Construction and Post Construction Phase Activities</b>	<ul style="list-style-type: none"> <li>Transportation of construction materials and equipment during all phases of development.</li> <li>Operation of construction machinery</li> <li>High population densities during construction and post construction</li> <li>Housing and sanitary facilities for construction workers at the development site.</li> </ul>	<ul style="list-style-type: none"> <li>All vessels/vehicles transporting construction materials should be covered, and equipment secured to allow for safe transportation to the site; this should be monitored.</li> <li>Operators should be trained and involved in development plans.</li> <li>Workers should be trained in the safety procedures; operation of machinery and use of safety gear used.</li> <li>Adequate transportation, proper housing, and other basic facilities are available for workers in the island.</li> </ul>	<p>High/negative/years/ Central Coastal Zone (CCZ)</p> <p>High/positive/years/local</p> <p>High/positives/local/local</p> <p>High/positives/years/local</p>
<b>Marine and Terrestrial Traffic</b>	<ul style="list-style-type: none"> <li>Increased number of sea vessels and vehicles</li> <li>Increased traffic of work boats and barges between Big Creek and the island</li> </ul>	<ul style="list-style-type: none"> <li>Movement of workers, machinery/equipment and cargo, should be scheduled in advance.</li> <li>Marine traffic should also be regulated by routing marine vessels to designated “shipping lanes”.</li> <li>Management systems such as buoys, markers, and signs should be designated</li> <li>Materials transported should be properly covered and secured to prevent them falling into the sea.</li> </ul>	<p>High/negative/years/CCZ</p> <p>High/negative/years/CCZ</p> <p>High/negative/decades/CCZ</p> <p>High/negative/years/CCZ</p>
<b>Worker Population &amp; Housing</b>	<ul style="list-style-type: none"> <li>Increased population density in the area during construction and post construction phases</li> </ul>	<ul style="list-style-type: none"> <li>Temporary quarters be constructed</li> <li>Workers be transported to and from the site during all phases of construction</li> </ul>	<p>Low/ no change/years/local</p> <p>High/no change/decades/local</p>

<b>Activities and Conditions</b>	<b>Potential Impacts</b>	<b>Comments by Consultants</b>	<b>Residual Impacts, Magnitude/Direction/Duration/Scope</b>
<b>Education &amp; Health Services</b>	<ul style="list-style-type: none"> <li>Increased pressure on existing educational and health institutions.</li> </ul>	<ul style="list-style-type: none"> <li>Local education and health facilities should be strengthened and coordinated.</li> </ul>	High/positive/decades/district
<b>Employment</b>	<ul style="list-style-type: none"> <li>Skilled laborers from the region not employed during construction and post construction phase.</li> <li>Skills training may be required for some local employees.</li> </ul>	<ul style="list-style-type: none"> <li>Employment of individuals from other parts of the country encouraged and will strengthen local/regional skills and will include the potential for long-term employment</li> <li>Laborers should also be paid as per skill requirement (s)</li> <li>The Belize labor laws should also be observed.</li> <li>This skills training will be required especially in the post construction phase.</li> </ul>	<p>High/positive/decades/local</p> <p>High/positive/decades/district</p> <p>High/positive/decades/district</p> <p>High/positive/years/local</p>

- an increase of immigrant population will stress further the school and health services; and
- the cultural impacts that may result from workers coming from other districts and are not sensitive to the local environment as it relates to water usage and sewage treatment.

The other potential negative impact on local and regional tourism sector is the competition with Belizeans of the area that may arise should the retirees become investors and compete with locals. One of the direct effects of such competition is the possible increase in the price of land.

## **5.4 Indirect Impacts**

It is anticipated that the proposed program will have indirect cumulative impacts on the surrounding environment as summarized in the following sections below.

### **5.4.1 Impact on Fishing Activities**

Very little difference exists in comparing the relative impact data in terms of the fishing activities for Ambergris Caye. It is important to note that the caye falls within an area that is productive and there are a number of fishing operations in the area. The species primarily targeted are lobsters and conch, followed by a number of finfish species such as the Silk and Cubera Snapper, the Yellowtail, Jew, Snook and the Hog Fish.

The impacts of sedimentation and turbidity on lobster and conch fishing in the immediate vicinity of the dredging operation has been assessed as ‘low’ and which has been previously been discussed in Section 4. Two of the more important factors influencing this categorization have been the short-term and temporary nature of the dredging operation, and the limited dredging area of the actually physical excavation site or ‘burrow pit’.

### **5.4.2 Other Related Impacts**

The most notable impact not dealt with above is that relating to the encounter of different cultures. The major clientele for South Beach Belize has been, and should continue to be, foreign tourists. The encounter with local staff and stakeholders in the area in general has social impacts. These impacts have been considered as ‘moderate’ and include – boat access for sport fishing, diseases, ‘culture conflicts’, tourism related activities (reef visits, kayaking, parasailing etc.), injury and pollution (noise, soil and water).

The ‘boat access for fishermen catching bait fishes’ is another pertinent issue potentially bringing foreign guests in contact with local resource users. The various recreational activities of the proposed South Beach Belize operation could interrupt or erode the access of traditional fishermen to the area and its resources. However the level to which this is expected to happen is not significant. The critical areas relevant to sport fishing are the Laguna de Boca Ciega along with the Boca Chico canal which forms part of the Hol Chan Marine Reserve.

The issue of ‘pathogenic disease’ relates to those associated with insect pests such as mosquitoes. The development if allowed to proceed in an environmentally irresponsible way that would for example result in an increase in ‘standing water’ would provide a habitat of

mosquitoes, which would increase the risk of malaria. The increased contact of tourists/residents/guests with certain activities increases the potential for insect borne pathogenic diseases. The focus on handling solid wastes in a responsible way should leave no additional breeding habitat for mosquitoes.

The issue of 'sand-flies and associated pests' are relevant in the context of nuisance pests. They are generally discomfiting to humans in modest numbers and are intolerable to many when in abundance. The plying of tourists in unspoiled environments brings with it insect pests. The reclamation on various part of the island eliminates a number of inundated and wetland areas.

These reclamations in themselves eliminates breeding grounds for mosquitoes, however in many cases they provide additional habitats for sand flies. In the case of the latter, a number of species breed at the moist/dry interface just above the high tide line. Given that these pests could be in formidable numbers and given that if they are not managed in an environmentally sound way, this could also cause harm to the environment thereby requiring the need for some mitigative measure(s).

The 'culture conflicts' in principle arises from the encounter of two (2) different cultures with different languages, ethnicity, race, religion and value systems. Most of the residents that are to be the clientele of the South Beach Belize operation are 'white' or 'near-white' residents from the United States and to a lesser extent Europe. Their encounter with local stakeholders in the area, as well as the local staff could be an issue of some significance. This 'moderate adverse' categorization of impact signals the need for some Mitigative intervention.

The issue of 'reef visitation' relates to the impacts of residents/tourists and guest in general on the health and well-being of the nearby Mesoamerican Barrier Reef. This is limited almost exclusively to scuba diving and snorkeling since this is almost the only circumstance under which these guests are likely to encounter corals in any marked assemblages. The potential for holding onto coral, or standing on corals, or other physical modes of contact exists.

This could lead to breakages, or the physical crushing of coral polyps and skeleton, and subsequently diseases. The likelihood of this happening on a significant basis is low. This is related to the general environmental ethic incorporated into the pre-dive briefing of scuba divers and snorkelers in Belize.

The issue of 'injury and physical trauma' relates specifically to accidents and incidents that could occur on the project site either to a resident, hotel guest, visitor or member of staff. These include accidents and incidents while at the project site. Other associated incidents include the construction phase especially for the workmen and contractors since this phase experiences a high incident rate. Considering the potential for human safety being jeopardized, this impact was considered as moderate.

The issue of noise pollution would be associated mainly with construction phase of the development. This phase is expected to be short term and moderate only the development progresses. It is anticipated that the noise factor would slowly decrease as the project comes to

completion. The other potential impact associated with noise generation is the commissioning of the generators during emergencies such as power outages and maintenances.

## **5.5 Conclusion**

The analyses of the environmental impacts are an important tool in determining the appropriate mitigation measures to be employed. Identifying the related impacts is an exhaustive process that always has to be updated. In considering the anticipated development, the impacts are not that different from any other residential development involving dredging and land reclamation activities. What sets the projects apart is the size and magnitude of the anticipated development. The most important impact for the proposed South Beach development is the dredging activities and its associated effects on the rest of the development. The other impact of note is the social aspect of the development. It is anticipated that the potential impacts of the development will not have any detrimental effect on the receiving environment, especially to Hol Chan Marine Reserve.