
SECTION FIVE

ENVIRONMENTAL IMPACT ANALYSIS

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 expansion 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 hierarchal 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 clearing 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 expansion 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 expansion 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 marina and land environments and its associated cumulative impacts.

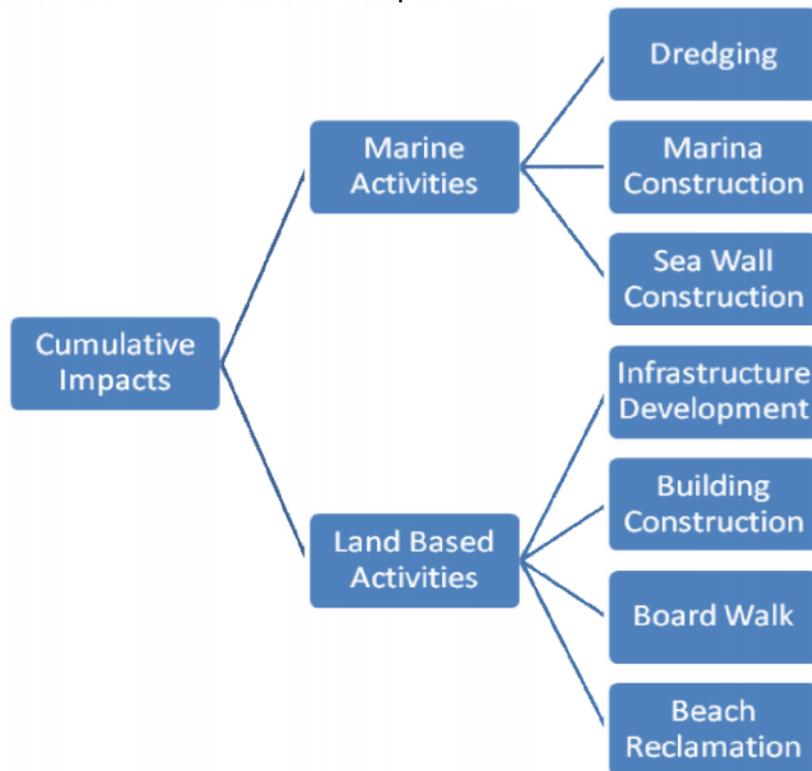


Fig. 5.2 Cumulative Potential Impacts

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 hierarchal 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 Hugh Parkey’s Belize Adventure Island

		Potential impact	Magnitude	Direction	Duration	Scope	Significance
Marine Environment	Dredging Activities	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
	Marina Construction	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
		Socio-economic influence	M	+	S	S	M
	Sea Wall Construction	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 Facilities	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	
	Board Walk	Soil Alteration	L	-	I,S	I,S	NS
		Surface Water Alteration	L	-	S	S	NS
		Ecological Disturbance	L	-	S	S	NS
		Benthic Alteration	L	-	S	S	NS
		Mangrove Alteration	L	-	S	S	NS
	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 Hugh Parkey's Belize Adventure Island. 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 marina 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 and aerial extent. 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 expansion project for Hugh Parkey’s Belize Adventure Island. 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 East Side development and the near-shore ecosystems in the immediate vicinity of the ‘burrow pits’ of the three (3) dredging sites (See ‘Detail ED’ in Fig. 2.7). In the case of the latter, this is related to the acquisition of ‘spoils’ or ‘fill materials’ to reclaim the expansion areas of the caye (See ‘Dredged Material/Fill Requirements in Fig. 2.7 and 2.8).

The closest ‘burrow pit’ is to be located 1000 ft. north north-west of the Dolphin Lagoon. 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 sea-grass rooted on a fairly thin substrate of consolidate calcereous sediments, intermixed with organic 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 calcereous algae *Halimeda spp.*. It is this layer of sand that is being harnessed as the ‘dredge spoil’ to be deposited in the area of the main expansion.

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 areas have been listed as the “Near-shore Ecosystem” in the EIA Matrix (Table 5.1), and is in effect the near-shore areas and mangrove stands immediately east of the expansion areas, and north north-west of the Dolphin Encounter Lagoon (See ‘Detail ED’ in Fig. 2.7).

The volume of the spoils to be dredged from the sea to ‘elevate’ the site of the different expansion areas by 5 feet is 139,228.9 cubic yards (See ‘Proposed Dredge Material/Fill, Fig.2.7). 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 marina basin and South Island Development is for the most part rated as moderately adverse. This includes both the mangrove prop roots circumventing the dredged areas and the adjacent sea floor of the surrounding impact sites which intermittently consists of some sea grass and macro-algal productivity. 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 not be deposited among the ecologically sensitive prop roots immediately adjacent the expansion areas to be developed.

The magnitude of the adverse sedimentation impacts associated with the dredging activities are considered moderate mainly as a consequence of the substantial amount of peat and fine sediments which are to be excavated (See ‘Proposed Dredge Material/Fill’ in Fig. 2.7). 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.

Other dredging event associated with the proposed development includes the recreational beach expansion on the north-west portion of the Caye (See Fig. 2.8), north end dredging activity and the Kayak Return Canal (See Fig. 2.7). The excavation in these areas is relatively limited in volume. This aspect combined with the geographic location with the sea should result in minor impacts only to the environment.

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 sea grass productivity, lobster and conch populations in 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 on lobster traps combined with the poor visibility associated the suspended solids in the water column, makes it difficult for fishermen to locate their traps. The issue of visibility and harvesting efficiency is also relevant to the conch fishery.

The overall impacts of the dredging events of the proposed expansion areas on the conch and lobster fishery are projected to be very limited and localized in time.

5.3.2 Land Reclamation Impacts

The various land reclamation activities that will be carried out relate to the ‘elevation’ of the proposed expansion areas, the ‘elevation of the area for much of the West Beach reclamation phase, North Island development, much of the East Side expansion and South Island development.

The cumulative impacts relating immediately to the reclamation process of the different expansion areas 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 (adapted from the first EIA) 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 expansion 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. 2.3 (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 marina 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 Fig. 2.3 (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 XI), 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, all-be-it 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 are no extractive processes associated with the sourcing of potable water for the proposed development. The main source of potable water for direct human consumption is from rain-fed cisterns supplemented by supplies obtained from water desalinization and some potable water ferried from the mainland. In relation to the rainwater source, the roofs of the various buildings is to be fitted with gutters to 'harvest' the water. The plumbing associated with the water delivery system, is detailed in Fig. 3.1.

There are, in effect, no deleterious impacts associated with the potable water infrastructure and/or use. Although there is some brine associated with the 'desalination' plants to be installed, this is to be deployed only as a 'stand by' response, and the limited volumes of effluents exhausted will be discharged into a deep well.

5.3.5 Solid Waste Impacts

The proposed management scheme for solid waste on the caye will be the same as the plan present in the first EIA which involves the collection of the waste from the different sites and

sorting to separate the organic from the inorganic, and the combustibles from the non-combustibles. The inorganic components are to be ferried into Belize City on a regular basis where it is to be subsequently transported to the municipal landfill. 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 the pestilence and 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 raccoons, rats and opossums, 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 has 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

Based on the presently implemented system of hybrid energy generation, the proposed expansion project plans to expand this hybrid concept to meet the development energy needs. 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 marina servicing. Another impact related to the energy generation is the operation of the wind turbines and its associated influence on the surrounding environment and on bird population.

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.

In comparing the benefits of renewable energy against fossil fuel, one would think that the decision was clear cut. The operation of the wind turbine will impact some of the residents in the area and the birding population of the caye. Presently, the development has a wind turbine on the West Side that has been in operation for about two years and there has not been a single incident involving birds nor have there been any complaints on the part of the guests.

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 includes the clearing of land where required, the placement of construction material and the actual construction phase itself.

Considering that some of the expansion areas have already been cleared (See Fig. 1.3, 2.11), the predicted impacts are considered to be 'low'. This however, changes when considering the South Island development which will involve the construction of some 72 units. In this expansion area, it is expected that some vegetation removal will take place and is considered as moderate. Other associated impacts related to the construction phase include 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 expanded 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 Boardwalk Impacts

The impacts of the boardwalk are similar to those stated for the Causeway Impacts in the first impact assessment for Hugh Parkey's Belize Adventure Island and arise mainly from the construction phase of the related infrastructure. The designing and routing of the board walk would result in some short-term sedimentation impacts and to a lesser extent mud and sight pollution impact (See Table 5.1).

The construction of the boardwalk entails the construction of a wooden platform supported by either wooden or concrete stilts interconnected by various small 'islands' that will serve as roundabouts for the path. As described previously, these 'islands', similar to those stated in the first EIA, will be made up of dredged spoils that will be contained by pimento stakes (See Plate 3.1 and 3.2 in Section 3.6.2). It is anticipated that the impact related to the construction of this boardwalk be minimal as little to no mangrove will be removed. However, it is considered that the creation of the intermittent 'islands' may pose some 'aesthetic or sight pollution' in the short to medium term.

In general the proposed boardwalk (causeway) far outweighs the alternative of road construction in terms of impacts. Essentially, the proposed board walk will not interfere with the tidal flushing of the proposed route. In addition, the sedimentation and turbidity impacts have been assessed as 'low' given the remoteness of the area from the open sea. These impacts have been dealt with more exhaustively under the dredging impacts in Section 5.3.1.

The construction of the boardwalks and nature trail (to facilitate snorkeling in the near-shore areas off the mid-western portion of the Caye) are not expected to cause any discernible ecological impacts. This is as a result of the miniscule scale of the operation relative to the size of the caye and the abundant extent of the mangrove resources.

5.3.9 Heliport

The anticipated impacts related to the operation of the heliport involves the generation of noise on approach and departure. It is anticipated that these impacts are considered ‘minor’ in the realm of the proposed expansion project. Nevertheless, these must be identified especially considering the combined effect (noise and turbulence) it might have in relation to the operation of the wind turbines.

5.3.10 Impacts of Kayak Trail and Kayaking Activities

The construction phase impacts associated with the kayak trail is relevant only to the Kayak Canal (See Fig. 1.6) that will be linked to the South Island Development. The activities slated for this canal were never carried out as part of the first EIA. The impact is related to sedimentation and turbidity associated with the dredging activities.

The ‘low’ categorization of these impacts (See Table 5.1), are related to the relatively small volumes of sediments to be excavated and the remote location of this channel relative to the open sea and in general sensitive ecologies. The impacts associated with this phase have been dealt with previously in Section 4.

5.3.11 Boating and Marina Impacts

The marina 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 associated with the marina would be accorded a ‘low adverse’ categorization, given the relatively 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 in the marina. Another potential source of petroleum pollution is from the unauthorized and inappropriate discharge of ‘bilges’ in the marina. 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 marina basin from the open sea (See Fig. 3.7).

5.3.12 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.

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. Increase 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 island by its current owners). 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 new owners 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 area 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.

5.4 Indirect Impacts

It is anticipated that the proposed expansion 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 Spanish Caye. It is important to note that the caye falls within an area that is fairly 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 Snapper, the Yellowtail and the Hog Fish.

The fishermen fishing in the areas immediately surrounding the Caye are: Mr. Victor Foreman, Mr. John Castro, Mr. George Carr, Mr. Walter Brown and Mr. Melvin Young. These fishermen are lobster trappers and conch divers. There is also a limited amount of spear-fishing for fin-fishes and as well as traditional ‘drop line’ or ‘hand line’ fishing. The near-shore waters around the Caye, as well as the ‘internal’ waters on the southern reaches of the Caye are used for bait fishing, or ‘catching sprats’.

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 aerial extent of the actually physical excavation site or ‘burrow pit’.

5.4.2 Impacts on Tourism Activities

In analyzing the tourism related impacts, it has been determined that there are virtually no existing impacts on the pre-existing tourism activities in the area. The nearest known permanent tourism infrastructure is on Water Caye and Bannister Caye. St. Georges Caye is the most popular and lies 6 miles to the north of the development. Although Goff’s Caye, which lies 4.5 miles to the south of the project site, has become a popular tourism site associated with the cruise ship industry. The area will also be influenced by the construction and operation of the Stake Bank and by Grand Ocean View (North Drowned Caye Development). It is anticipated that these projects will impact the site minimally.

In addition, there has been no known previous use of the areas surrounding the caye for tourism purposes prior to establishing of scuba diving operations by the project proponents. This activity is expected to expand. There are currently between 40 – 60 divers on a daily basis when the cruise ships are servicing Belize. This is expected to expand to 80 – 120 divers per day when the project is fully developed on cruise ship days and 20 to 30 on other days.

Apart from the diving activities, kayaking, bird watching, dolphin interaction and other tourism activities are available at the project site. It is anticipated that this activity will increase as the expansion phase develops.

5.4.3 Other Related Impacts

The most notable impact not dealt with above is that relating to the encounter of different cultures. The major clientele for Hugh Parkey’s Belize Adventure Island 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 fishing, diseases, ‘culture conflicts’, tourism related activities (reef visits, kayaking, bird watching 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 Hugh Parkey’s Belize Adventure Island 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 bait fishing are the various channels and lagoons that are the internal waters of the caye. The activities that could pose an issue are canoeing, snorkeling, manatee observation and bird watching.

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 with certain activities such as the use of the nature trails, canoeing and the use of the beach 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 tourists that are to be the clientele of the Hugh Parkey's Belize Adventure Island operation are 'white' or 'near-white' tourists 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 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 in general and which is a cornerstone of the Hugh Parkey's Belize Adventure Island diving operations.

The issue of 'injury and physical trauma' relates specifically to accidents and incidents that could occur on the caye either to a guest, visitor or member of staff. These include diving incidences

both on the reef visitation and while during the dolphin encounter. 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 the fuel driven electricity generator and wind turbine operation. The generators could be a nuisance, especially at nights. The assignment of a rating of 'minimal' in the EIA Matrix in recognition of the fact that the use of the generator during the late night will only be on a standby basis since the primary source of electricity will be from wind mills and solar cells.

The operation of the wind turbines will impact the surrounding environment. This issue has been rated as 'low' as described previously. Nevertheless, the immediate vicinity will experience some noise pollution, especially those transiting the South Island boardwalk.