
SECTION SIX

ENVIRONMENTAL MANAGEMENT

6.1 Introduction

Environmental management is not, as the phrase could suggest the management of the *environment* as such, but rather the management of interaction by the modern human societies with, and impact upon the environment. The need for environmental management can be viewed from a variety of perspectives. A more common philosophy and impetus behind environmental management is portrayed in the application of an Environmental Management System that will address the environmental impacts and outline the mitigation measures along with their respective monitoring plan. In addition, a disaster or contingency management framework often accompanies such management systems.

6.2 EMS Outline

The proposed Environmental Management System (EMS) for the anticipated development will be a set of processes and practices that will reduce the environmental impact. This system will involve the continual cycle of planning, implementing, reviewing, and improving the processes and actions to meet both the business and environmental goals. The system will also reflect the project's emphasis on continuous improvement in operations by measuring and evaluating its environmental performance. In addition, this management system will be utilized as a tracking tool for all the environmental objectives and targets so that it can satisfy the Department's requirements. The organization's environmental management system must demonstrate the following key elements:

- Setting an environmental policy,
- Determining significant environmental impacts,
- Setting goals for compliance and environmental performance,
- Assigning responsibility,
- Implementing and documenting programs,
- Evaluating and measuring effectiveness by demonstrating performance

These outlines are essential in carrying out a successful management system that will benefit the project in all its environmental endeavors. This section will facilitate the necessary framework for the project to meet its environmental goals and in so doing, promote the existence and conservation of the natural surroundings in which the project site is to be located.

6.2.1 Benefits

There are a range of benefits associated with operating an effective Environmental Management Systems (EMS):

Financial

- ▶ Cost savings through the reduction of waste and more efficient use of natural resources (electricity, water, gas, and fuels).
- ▶ Avoiding fines and penalties from not meeting environmental legislation by identifying environmental risks and addressing weaknesses.
- ▶ Reduction in insurance costs by demonstrating better risk management

Operational and Internal

- ▶ Improved overall performance and efficiency.
- ▶ More efficient, less hazardous production processes
- ▶ Improved consistency by reducing waste and disruption of production.
- ▶ More clearly defined staff responsibilities
- ▶ Improved internal communications and morale, often leading to sound environmental solutions suggested by staff, proves seriousness of the company

External

- ▶ Better public perception of the organization, leading to improved sales
- ▶ Reduction of the impact (e.g. noises, smells, dust) of your activities on the local residents, leading to more community support

Benefits of third party verification

- ▶ Ensures that the EMS is consistent according to set protocols.
- ▶ Provides credibility and integrity in reporting and publishing environmental information.
- ▶ Demonstrates commitment to environmental transparency and accountability.

6.3 Impact Mitigation Measures

The proposed mitigation measures to be implemented are in relation to circumventing, ameliorating, or reducing those impacts that have been assessed as low to moderate within an acceptable level (See Table 5.1). These measures will also occur throughout the project cycle which would include both the construction and operation phase. In any event, the following sections summarize the main developmental issues that will require specific meditative

responses. This summary is by no means limited and other issues may be incorporated into the EMS as development progresses.

6.3.1 Mitigation Measures In Relation To Excavation Activities

No dredging activities will take place for the proposed development. Therefore there will be only land excavations in order to obtain fill material for land reclamation activities. It is anticipated that this action will be limited in scope and magnitude. Thus the main issue of concern for this type of action is land clearing, removal of habitat and ground water contamination. The latter specifically relates to the excessive excavation of fill material adequate enough to impact the natural drainage and change in topography.

The primary impacts related to the actual excavation are land clearing and removal of important habitats. Overall, it is anticipated that the excavation activities will be low with the mitigating measures relating to limiting this activity where possible and that no important habitat is within the project site (See Table 6.1). There are no known secondary effects other than the possible alteration of the movement of nutrients and water within the layers of soil, which for the most part is comprised of calcareous sand.

Possible responses to the impacts can include the rapid undertaking of the overall excavation operation the conceptually decrease the severity and range of impacts in space and time. The impacts from the excavating operations are expected to be localized and should be confined to the areas immediately associated with the excavated site. The following table summarizes the proposed mitigation measures that will be implemented by the anticipated project for all approved excavation operations.

Table 6.1: Mitigation Responses in relation to Excavation Impacts

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Actual excavation of project site and other excavation equipments (excavator, back hoe)	1a. Disturbance of vegetation and suspension of fine sediments (dust)	1a1. Direct physical destruction of habitat, and attenuation photosynthesis for other auto-trophs	1a1a. Demark area to be excavated, use selective clearing as a part of the demarcation process.
			1a1b. Applying velocity reduction measures where spoils are deposited such as baffles to precipitate solids and curtail turbid influences in effluent stream.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
			1a1c. Assist re-colonization of impacted areas where possible.
			1a1d. Monitoring the operation including the deposition of spoils with containment areas.
			1a1e. Decrease time frame over which excavation operation is to take place to avoid magnification of impacts.
			1a1f. Deposition of spoils from excavated pits in areas already cleared or otherwise denuded – Also deposition in smaller piles that are spread out to facilitate drying by sun and elimination of unpleasant odor.
			1a1g. Ensure that the excavation equipment is fully functional with spare parts readily available, especially involving hydraulic hoses.

6.3.2 Mitigation Measures in Relation to Land Reclamation Activities

The proposed project plans to partially reclaim some of the low lying portions of the project site. This reclamation scheme will be carried out in conjunction with the proposed excavation and ‘site leveling’ activities. In addition, this scheme will be important considering the overall surface runoff and drainage of the area. This activity is not expected to alter any major drainage area. Other impacts associated with the reclamation scheme involve the possible disturbance of the immediate soils, increased turbidity as a result of improper impoundment along with the possible deposition of anoxic sediments into the receiving environs.

Table 6.2: Mitigation Responses in relation to Land Reclamation Activities

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts
1. Land Reclamation and land filling	1a. Disturbance of soils and ground water as a result of spoil deposition	1a1. Reduce immediate habitat for existing wildlife and movement of these to other areas.
	1b. Increase turbidity to water body as a result of spoil runoffs if not mitigated	1b1. Disturbance to the circumventing vegetation as a result of spoil deposition
	1c. Introduction of ‘possible’ anoxic sediments to undisturbed areas.	1c1. Bioaccumulation of possible toxics in organisms thereby altering the food chain.

6.3.3 Mitigation Measures in Relation to Domestic Effluent Impacts

The primary environmental disturbance associated with the generation of liquid waste (human wastes and domestic effluents) is the possible nutrient enrichment from the injection of macro-nutrients and pathogens into the environment without the appropriate mitigation measures. These events can also occur with mitigation measures but are mostly subjected to inadvertent discharges, mismanagement, lack of environmental ethics, treatment plant malfunctions etc. These issues, however, will also require successful mitigation measures in order to reduce or ameliorate the impacts.

The situation of increased macro nutrients in the water column is generally referred to as eutrophication, a condition which is exacerbated in standing or slow moving waters. The nutrients in question generally refers to the concentrations of phosphates and nitrates which are generally derived from gray water effluents as well as sewage effluents from the general use of the toilets. The latter, which is also considered as human waste, is anticipated to be the largest contributor to eutrophication. Another source of macro-nutrients can also be derived from the use of detergents in the general cleansing regime. These detergents have been known to contain large concentrations of ‘nutrients’ regardless of their environmental friendly brand. Therefore it is anticipated that this impact has been assessed as high without the appropriate mitigation measures (See Table 5.1).

In terms of the microbiological pathogens, these will mainly be limited to fecal coliform and *E. coli*. As can be seen from the Water Quality results, the average pathogen concentration is zero. (See Section 2.1.2.6, Fig. 2.6 and Annex IX). The generation of *E. coli* becomes a significant consideration with the commissioning of the development. The primary impact from these features of the development has been characterized as short and high without mitigation (See Table 5.1).

Cumulatively, these impacts will be successfully mitigated by the installation of a tertiary treatment system to manage the liquid waste (See Section 3.3 and 5.3.3). The application of the treatment technology combined with the water conservation measures greatly diminishes the potential human health and macro-nutrient impacts. Therefore, with the reduction of nutrients to

acceptable levels along with the elimination of pathogens will bode well for the anticipated development. With this in mind, the following mitigation measures will be applied to the generation, treatment, and disposal of liquid waste.

Table 6.3 Summary of Impacts Associated with Human Wastes and Domestic Effluents

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Human Waste and Domestic Effluents	1a. Nutrient enrichment from the injection of macro-nutrients into the environment.	1a1. Stimulus to plant growth on land and in the water column, in the case of the latter this includes phytoplanktons, seagrass, and macroalgae including the possibility of the overgrowth of reefs by macroalgae.	1a1a. Installation of BESST Treatment technology to treat waste to ‘Tertiary’ Levels, where Total Nitrogen Loads are reduced to less than 10 mg/l and Phosphorus are reduced to 2-3mg/l.
			1a1b. Reduce effluents going into the environment by recycling effluents to flush toilets – effluents from BESST Plant will be disinfected through chlorination before it is reused for flushing.
			1a1c. Reduce further nutrients potentially going into the water column by using stored treated effluents from BESST Treatment Plant for irrigation purposes.
	1b. Human Health and Biosecurity risks	1b1. Infection of humans and animals with pathogenic viruses and bacteria.	1b1a. Thorough disinfection of effluents potentially going into water column or otherwise making contact with

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Human Waste and Domestic Effluents Contd.			humans by use of BESST Sewer Treatment Plant which incorporates chlorination of effluents.
			1b1b. Reduction of effluents going into the environment by use of BESST Treatment Plant. And incorporation of recycling and reuse of effluents for flushing of toilets and irrigation
	1c. Suspended Solids from un-dissolved components of human waste and domestic effluents.	1c1. Suspended solids would impede light penetration in the water column and photosynthesis.	1c1a. Employing primary treatment in the form of sieves traps and pumping stations prior to BESST Treatment to reduce TSS to less than 10 mg/l.
	1d. Sedimentation associated with settlement of flocculent fraction of human waste and domestic effluents.	1d1. Blanketing of seafloor and suffocation of slow-moving and sedentary invertebrates.	1d1a. Application of BESST Treatment technology reduces TSS to less than 10 mg/l, this in combination with effluent recycling and reuse regime reduces to insignificant levels suspended solids in the water column.
	1e. Increase in BOD substances and consequent reduction in dissolved oxygen.	1e1. Induction of physiological stress and in extreme circumstances death in relation to sessile and slow moving invertebrates.	1e1a. Application of BESST Treatment technology reduces BOD to less than 10 mg/l, this in combination with effluent recycling and

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Human Waste and Domestic Effluents Contd.			reuse regime reduces to BOD to insignificant levels in the water column.

6.3.4 Mitigation Measures in Relation to Solid Waste Management

Impacts relating to solid waste will be generally limited to the construction and post construction phases of the anticipated development. There is however, a small volume of solid waste that will come as a result of ‘beaching’ which is primarily transported to the site from passing ships etc. It is anticipated that the proposed development will separate its solid waste into organic and inorganic components (domestic/residential) as well as non-residential wastes (such as construction waste and some commercial wastes).

The organic component includes in large part discarded and unconsumed food from the restaurants and residents followed by the ‘green’ waste generated as a result of landscaping activities (pruning and trimming). The inorganic waste includes wastes that are either classified as combustible and non-combustible.

The construction phase of the anticipated development will have the capacity to generate substantial volumes of construction waste which normally involves some ‘green’ waste as a result of land clearing as well as discarded food. This waste varies from felled trees and shrubbery to wooden mouldings for the erection of buildings, styrofoam packaging, wooden planks, food scraps etc. Therefore, in considering the solid waste constituents, it is anticipated that the possible impacts related to this issue would be low to moderate considering the occupancy rate and remoteness of the project. This issue can be addressed considering the Present Island and regional infrastructure for solid waste.

Other impacts associated with the proposed undertaking would be the attraction of wildlife such as raccoons, rats, crocs, and birds to the area to scavenge. This attraction would possibly cause a shift in the ecological balance of the area in a way not induced by nature. In addition, this impact can possibly pose a threat to human interaction which can include risky encounters (rabies, injury etc.). Other impacts associated with the generation of solid waste are the possible outbreak of vector diseases (zoonosis).

The associated mitigating response to the generation of solid waste will fall on the judicious collection and segregation of the wastes into organic and inorganic components (See Table 6.4 below). These wastes are to be removed from the project site on a regular and recurrent basis (See Table 6.4). In addition, the anticipated development plans to incorporate a public education campaign aimed to educate and sensitize the visiting and residing population of the project site.

The only secondary impact of note would be in regards to the land-based ecosystems. These impacts relates to the fact that there is to be little or no discarded food lying around in a way that would be available to feral animals, given the regular collection, bagging, composting and disposal of this category of waste.

Table 6.4 Mitigation Measures in Relation to Solid Wastes

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. General Commissioning of the proposed project including the relevant amenities.	1a. Accumulation of solid waste that could impact the receiving environment. General discarding of cans, bottles and plastics in general from foods, general packing materials and other utilitarian inorganic functions.	1a1. Attraction of feral animals such as rats, raccoons, crocodiles, and birds to the area to scavenge and in effect shift the ecological balance in a way not induced by nature.	1a1a. Judicious separation of solid waste into organic and inorganic constituents. Organic waste will be collected and composted on site and used as nutrients for landscaping activities. The inorganic waste will be compacted and taken to the San Pedro Dumpsite for disposal.
			1a1b. Definition and implementation of education and sensitization program focused on tourists and visitors in general, in the form of interactive posters and brochures posted in strategic locations such as restaurants, and rest rooms.
			1a1c. Possible compilation of the inorganic waste with other stake holders of the area. Inorganic waste can be collected and transported to the dump site by a service provider.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Commissioning of the operational processes Contd.	1b. General discarding of cans, bottles and plastics in general from foods, general packing materials and other utilitarian functions.	1b1. Habitat for mosquitoes and other insect pests, as well as aesthetic pollution from odor and unsightly accumulation of solid waste.	1b1a. Separation of discard and refuse into organic and inorganic components where they will be secured in plastic garbage bags and stored in plastic bins – organic will be composted on site and used as nutrients for landscape activities whereas the inorganic will be transported to the San Pedro dump site when sufficient quantities have accumulated to justify removal.
		1b2. Entanglement and ingestion of plastics floating in the water column by sea turtles, birds and other fauna in the area.	1b2a. Judicious collection, confinement, and disposal of solid wastes as described above.

6.3.5 Mitigation Measures in Relation to Energy Generation

The primary impacts concerning the generation of energy for the anticipated project will be the noise factor associated with the wind turbine (See Section 5.3.6). This is primarily due to the primary source of energy for the project. It is anticipated that this source will be complemented by solar energy and standby generators (See Section 3.5).

The impacts from the wind turbine and solar energy are expected to be minimal as opposed to the impacts associated with the operation and maintenance of the standby generators. Other potential impacts related to the primary source include the clearing of vegetation for the installation of underground conduits for the energy (power lines) and to a larger extent the basic utility services.

In considering the impacts associated with the standby generators, the issue of petroleum pollution will be a concern. Nevertheless, in considering the mitigation measures, it is expected that these concerns will be adequately addressed (See Table 6.5). This method of energy

generation is also interlinked with the sourcing and transportation of the required fuel for its operation. In considering the custodial chain of petroleum management, the proponent will be required to implement mitigation measures in every phase of the fuel management program.

In addition, the very notion of having standby generators makes noise pollution a relevant issue especially considering the project environment. In this regard, the anticipated development plans to mitigate this impact by muffling of the generator noise and the use of sound-proof tiles at the generator stations, as well as their placement in areas far removed from the recreational activities of the project site and the movement of staff and guests.

Noise pollution can also be an issue for the primary source of energy as described earlier. In considering the amount of wind turbines required (if need be the case), the ‘net or cumulative’ effect as a single source would pose a problem to the surrounding dwellings. Nevertheless, mitigation measures will be in place to counteract this issues by simply purchasing low noise pollution turbines, locating the ‘bank’ away from any residential components and paths and by ‘turning’ on individual turbines as the requirement increases.

Secondary impacts associated with the energy generation component include the placement of the generators and the ‘effect’ the wind turbine would have on the caye’s bird population and flight patterns. The mitigation measures for these are discussed in the following table.

Table 6.5 Mitigation Measures in relation to Energy Generation

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Wind Turbine Operation	1a. ‘Net or cumulative’ noise pollution from the bank of turbines operating at the same time.	1a1. Increase in overall ambient noise, especially around the turbine areas.	1a1a. Turbine not expected to supersede the L _{MAX} 65 dB threshold. System is designed to shut off at wind speed exceeding 56 mph.
	1b. ‘Shadowing’ effects on the receiving environment during operation	1b1. Disorientation of some guests and staff	1b1a. Varying wind speed and direction reduces shadowing instances. Moreover, placement of wind turbines to follow installation guidelines for health and safety reasons. Residents with ‘shadowing’ problems should be identified.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Wind Turbine Operation	1c. Increase mortality of both birds and bats of the area.	1c1. Loss/reduction of bird diversity and visitation as a result of the wind turbine operation.	1c1a. Placement of the turbine unit in area not identified as 'primary migration routes' would mitigate against an increase in mortality rate for the bats and birds of the area.
			1c1b. Turbine tower design have changed, smoother cylindrical poles prevent roosting. Turbine rotor speeds have reduced, reducing injury to birds/bats.
			1c1c. In addition avian studies have shown that these new design have reduced the impact to bird migration pathways or habitats.
2. Operation of standby generators to complement existing sources.	2a. Excessive noise pollution to residents/staff and neighboring developments	2a1. Increase in ambient noise levels as a result of generator use	2a1a. Attenuate noise levels by enclosing generators with sound proof material and by the proper use of mufflers and other sound reduction devices designed to minimize the ambient impact.
			2a1b. Examine and develop a best siting scenario for the operation of such generators at full occupancy and generator capacity.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
	2b. Soil pollution due to hydrocarbon spills/leaks	2b1. Contamination of waterways and soil on direct contact	2b1a. Contain all fuel tanks in an enclosed concrete wall capable of storing 110% of the total stored volume
			2b1b. Develop a contingency plan to address any spills and leaks that can occur both on land and at sea during transportation.
	2c. Air pollution due to generation process	2c1. Air pollution can impact on the ambient residential air, especially during prevalent winds.	2c1a. Develop and implement a preventative maintenance manual to address all concerns related to repair and operation of the equipments

6.3.6 Mitigation Measures In Relation To Socio-Economic Concerns

Probably the most widespread impact relates to the socioeconomic concerns of the project and of the community. In other words, the evaluation of the intended and unintended consequences of the development must be analyzed and taken into consideration in order for the project to adequately mitigate and ameliorate the potential social impacts.

Relevant in this regard is the issue of tourism, especially considering the BCNP and MR. It is therefore anticipated that the potential impact to the reserve and national park will be very minimal considering the occupancy of the proposed development and its associated activities. Marine traffic in the area is very restrictive and limited and therefore the development will have no such impact on the 'sea lane'. It is anticipated that there will be no navigational hazards except for the placement of the pier and overwater structures.

Furthermore, the issue of employment, safety and other socioeconomic aspects are also of concern, especially considering that there is a need for both skilled and unskilled workers to cater for the ever growing tourism industry.

Table 6.6 Mitigations In Relation to Socio-Economic Concerns

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Construction Activities	1a. Temporary but potentially marked increase in amount of people moving into the area.	1a1. Increased demand on services in the area.	1a1a. Construction will be planned and strictly scheduled such that only the absolute amounts of people necessary are in the area at any given time.
			1a1b. The developer shall seek to employ as much people as possible from the immediate area. All workers save for the security personnel will be either shuttled between the project site and San Pedro on a daily basis during the construction phase or housed at the site during this period.
			1a1c. The project will make the appropriate arrangements for food for the construction crew by establishing an onsite kitchen
			1a1d. Because of the location of the project, all development activities will be scheduled so as not to conflict with existing and on-going activities in the area.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Construction Activities Contd.			1a1e. All and construction related activities, especially transportation will be coordinated with the BCNP/MR so as to avoid any breaching of the rules and regulations of that institution.
	1b. Movement of materials and supplies and heavy equipment into the area.	1b1. Human health and safety issues.	1b1a. Safe and secure mooring of boats when loading and offloading equipment and supplies.
			1b1b. Navigation of boats to and from San Pedro Town and other areas observing national and international and sea lane rules and navigational protocol, and ensuring that equipment and supplies are securely stored and fastened during transportation.
			1b1c. Access to the project site through channels in reef shall be suspended during periods of heavy seas and poor visibility conditions. The channel shall be adequately marked with large florescent buoys and beacons that shall be kept in operational readiness at all times.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Construction Activities Contd.			1b1d. Similarly, access to the site from the lagoon shall be conducted in a manner that is safe to navigation and adhering to the 'No Wake Zone' while transiting the lagoon portion.
		1b2Response to construction injury includes first aid kit on-site, and in severe case the deployment of boat to ferry injured party (ies) into Belize City.	1b1e. The developer will be responsible for the well being of the construction worker, resident and staff and in severe case the deployment of a helicopter to transport the injured party to either San Pedro or Belize City.
			1b1f. The Developer shall comply with all applicable building codes and performance standards in regards to all standing structures.
			1b1g. Proper alignment of the road reserve with emphasis on safety, lower maintenance costs, and minimal impacts to habitat through which the road reserve will be built.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
	1c. Employment of foreigners and persons not from immediate areas	1c1. Lack of economic opportunities to people in the overall region.	1c1a. Hiring people from San Pedro and immediate area where requisite skills and competencies are available at competitive costs.
2. Resource use conflicts	2a. Possible loss of habitat in nearshore seagrass beds at project site from physical destruction of seafloor biota, and sedimentation and turbidity effects placement of geotextile mats for bathing areas.	2a1. Potential decline in recruitment of lobsters and conch with consequent decrease in landings.	2a1a. Proper placement of geotextile mats on seafloor. Course sand will then be placed on the geotextile material. In addition method chosen is an alternative to dredging the site which could have significant impacts.
3. Operational Phase of Development.	3a. Employment of foreigners and persons not from San Pedro and immediate environs.	3a1. Lack of economic opportunities.	3a1a. Hiring people from San Pedro in circumstances where requisite skills and competencies are available.
	3b. Health and safety issues.	3b1. Fractures, broken bones and possible mortality from boating activities, the children play park.	3b1a. Access by boat to emergency services in San Pedro.
	3c. Lack of amenable infrastructure to accommodate workers on-site.	3c1. Rapid turn-over of staff, low productivity and worker satisfaction.	3c1a. Staff to be transported into San Pedro on a daily basis by shuttle provided by the development is applicable.
	3d. Increase in marine traffic.	3d1. Increase in potential for injury and trauma from navigational accidents and mishaps.	3d1a. Ensure that piers and docks are well lit with adequate berthing facilities, and that strict protocols are adhered to

6.3.7 Other related Impacts

There are other environmental impacts associated with the proposed development that are considered as minor. These impacts range from water management to safety and can have a cumulative effect if not successfully mitigated and addressed by the developer. These impacts can also occur during the different phases of operation. The mitigative responses to these impacts include the implementation of several plans to ameliorate and circumvent the negative effects associated with the development. Such plans will focus on specific objectives of each impact and coordinate the mitigation measures accordingly.

Table 6.7 Mitigation Measures in Relation to Other Impacts

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Water usage related issue	1a Loss of potable water	1a1. Reduce water availability and loss of profitability	1a1a. Implement a water conservation plan to address the water needs. 1a1b. Develop a contingency plan for water shortage (s) and water contamination if so is the case. 1a1c. Implement a water recycling plan (Section 3.3.2) aimed at utilizing wastewater for non potable uses.
2. Design Concepts	2a. Loss of land to development and building infrastructure	2a1 Loss of vegetation cover and habitat area	2a1a. Plan layout poses less environmental impact to construct and operate. 2a1b. Conservation of the natural contouring and aesthetics of the mangrove forests, lagoon and beaches.
3. Marine Traffic	3a. Increased number of users and marine vessels to the area	3a1 Impact on natural environment by increased boat usage	3a1a. The movement of marine vessels to the area should be scheduled according to BCNP/MR

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
		3b1. safety for traditional users and other users	3b1a. All watercraft activities be regulated and designated markers in places in special impact areas
			3b1b. Safe and secure mooring of craft, docking facility
			3b1c. All watercraft activities be monitored and regulated
			3b1d. Hazardous areas and areas of specific importance be demarcated
4.0 Environmental Disturbances	4.a. Noise pollution from the operation of construction equipment and machinery	4.a.1 Disturbance of wildlife and neighboring activities	4a1a. All installed equipment such as a power generator etc., be enclosed to minimize noise impacts
	4b. Noise from the landing and taking off of the helicopter	4b1. Human impact as well as wildlife	4a1b. Scheduling of flights as well as the placement of the helipad away from residences.
	4c. Airborne pollutants from proposed construction and operational activities	4c1. Same as above, incremental airborne pollutants to Air-shed	4c1a. Operation of heavy machinery (excavator, back hoe) and equipment operated during daylight hours.
			4b1b. Composting of organic materials will be encouraged during the construction and operational phases.
5.0 The clearance of mangroves and vegetation for construction of project	5a. The displacement of flora and fauna in the area.	5a1. Birds that migrate will need to find another area to rest.	5a1a: leave as much flora in place, and replant species that attract birds.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
	5b: The displacement of reptiles in the area	5b1: Removal of habitat	5b1b: Create a reserve or buffer zone to protect the remaining vegetation by curtaining around them.

6.4 Environmental Monitoring Plan

It is important to have an environmental monitoring plan for every development irrespective of the magnitude and scope of the project. These comprehensive monitoring tools can be used as an integral part of the Environmental Management System. Current EIA process considerations are focused on the use of monitoring in conjunction with the implementation of mitigation measures in order to address the pertinent potential impacts. In addition, the importance of the environmental monitoring plan include, but are not limited to, the establishment of baseline conditions, documenting and managing experienced impacts, evaluating the effectiveness of mitigating measures, and validating impact-prediction techniques (Canter, 1993).

6.4.1 Principle of Environmental Monitoring

The basic fundamental importance of the project's environmental monitoring plan is to observe the anticipated impacts over time that may be associated with the development and its activities. These impacts would in principle vary over time in both magnitude and direction. In the case of the latter it is important to understand that changes in environmental parameters and functions may be positive or negative. Thus in principle a monitoring plan does not necessarily focus on the perceived or anticipated negative changes precipitated by a given development, or indeed vice versa where the focus may be on the positive or beneficial changes only.

Therefore the proposed monitoring plan has been developed not only in relation to satisfying the statutory requirements of the EIA process, but also as a consequence of the proper implementation of the proposed development and its relationship to the integrity of the environment and stakeholders in the area.

With this in mind and considering the magnitude and scope of the proposed project, it is therefore important to conduct the necessary monitoring plans/programs in order to successfully mitigate the net or cumulative effects of the potential impacts. Therefore the anticipated development will integrate the following six general cases gleaned for the conduction of the post EIA monitoring:

1. The environmental monitoring will provide information for the documentation of the impacts that would result from proposed activities;
2. The monitoring system will warn the developer and relevant governmental agencies of unanticipated adverse impact or sudden change in impacts trends.

3. The monitoring system will provide an immediate warning whenever a preselected impact indicator approaches a predetermined critical level.
4. The environmental monitoring will facilitate information which will be used by agencies to control the timing, location, and level of impacts of a project. Control measures would involve preliminary regulation and enforcement measures.
5. The environmental monitoring will provide information which will be used in evaluating the effectiveness of the implemented mitigation measures.
6. The environmental monitoring will provide information which would be used to verify predicted impacts and thus validate impact prediction techniques. Based on these findings, the techniques, for example, mathematical models could be modified or adjusted, as appropriate or as required.

6.4.2 Specific Monitoring Plan

The proposed monitoring plan for the anticipated project will entail those parameters and ecosystem components that have been identified as being significant through the Impact Rating matrix and other mitigation factors. These components or plans include:

- Water Quality Monitoring (Marine and Effluent)
- Energy Generation
- Waste Management (Wastewater/Solid Waste)
- Biodiversity
- Socio-economic Influence
- Environmental health and safety (Disaster Management Plan)
- Engineering aspects
- Others

6.4.2.1 Water Quality Monitoring Program

The water quality monitoring program is an important plan, especially considering the project location. As with many projects within the BCMP/MR, the marine component plays an important role and it is therefore critical to conserve both the marine and lagoon environment and its resources. This action would promote a healthy and stable marine ecosystem around the project site and surrounding areas of the marine reserve.

It is with this intention that the anticipated development plans to incorporate a water monitoring program designed to collect, interpret and submit valuable data to the relative authorities including the Fisheries Department. This program, which will further be developed by the proponent and DOE, will eventually form part of the development's environmental management system.

In order to carry out this activity, several important parameters must be identified and corroborated with both the Fisheries Department and DOE in conjunction with other stakeholders of the area. With this in mind, water samples will be collected and analyzed on a monthly and quarterly basis using the recommended protocol required by the *Effluent Limitations Regulations* (this regulation recommends the use of the Standard Methods for the

Analysis of Water and Wastewater). Therefore, considering the importance, the following parameters will be analyzed on a monthly and quarterly basis (See Table 6.8)

a) In situ Measurements

- Salinity
- Temperature
- Dissolved Oxygen
- Ph
- Turbidity
- Total Dissolved Solids
- Conductivity

b) Laboratory Analysis

This will include the determination of

- Total Suspended Solids
- Total Nitrate
- Total Phosphate
- Total and Fecal Coliform
- E. Coli

Table 6.8: Monitoring Plan for Surface Waters

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
Nutrients (Phosphate and Nitrates)	Monthly	10 mg/l	3 sample points with the first immediately off the mid-latitudes of beach and reef, and the rest at the north and south extremities of the project site.	High Priority	DOE, Fisheries
			3 samples in the Laguna de Cantena directly in front of the project site similar to the windward points.		
TSS/TDS	Quarterly	100 mg/l	3 sample points with the first immediately off the mid-latitudes of beach and reef, and the rest at the north and south extremities of the project site. 3 samples in the Laguna de Cantena directly in front of the project site similar to the windward points.	High Priority	DOE, CZMAI

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
Turbidity	Monthly	Observing disappearance of secchi disc and comparing this over time at different locations.	3 sample points with the first immediately off the mid-latitudes of beach and reef, and the rest at the north and south extremities of the project site. 3 samples in the Laguna de Cantena directly in front of the project site similar to the windward points.	High Priority	DOE, CZMAI
BOD	Quarterly	200 mg/l (EPA/WHO)	3 sample points with the first immediately off the mid-latitudes of beach and reef, and the rest at the north and south extremities of the project site. 3 samples in the Laguna de Cantena directly in front of the project site similar to the windward points.	High Priority	DOE, CZMAI
Dissolved Oxygen	Monthly	< 4.0 mg/l (DOE)	3 sample points with the first immediately off the mid-latitudes of beach and reef, and the rest at the north and south extremities of the project site. 3 samples in the Laguna de Cantena directly in front of the project site similar to the windward points.	High Priority	DOE /Fisheries, CZMAI

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
- Total Coliform - E. coli - Fecal Coliform	Quarterly	0/100 ml of sample	3 sample points with the first immediately off the mid-latitudes of beach and reef, and the rest at the north and south extremities of the project site. 3 samples in the Laguna de Cantena directly in front of the project site similar to the windward points.	High Priority	Public Health, DOE, Fisheries

6.4.2.2 Energy Monitoring Program

The monitoring of the energy consumption is also an important issue, especially considering that the anticipated energy source will be derived from alternative energy mainly wind and solar sources. Therefore the anticipated development plans to integrate an energy monitoring plan to reduce the consumption of energy and reduce the use of electrical devices.

This plan is an attempt to merge the common household energy saving measures with the proposed development outline. In so doing, energy saving tips must be considered and abided by in order to reduce energy consumption whilst at the same time live in a convenient and modest manner.

6.4.2.3 Wastewater Monitoring Program

This monitoring program will ultimately be linked into the Water Quality Monitoring program (See Section 6.4.2.1). This respective section will deal with the specific monitoring of the treatment plants, particularly the quality and quantity of treated post chlorinated effluent. This monitoring program will also develop a maintenance plan which will encompass training of personnel, troubleshooting, inspections, monitoring of accessories (aerators, grease traps, separators etc.) and the installation of the appropriate signage.

Wastewater samples will be collected for both the influent and effluent of the respective treatment plant and sent to an approved DOE laboratory for analysis or tested inhouse if the resources are available. In any event, the developer will comply with all applicable laws relating to this matter. Table 6.9 shows a proposed monitoring template that will be reviewed by the project and DoE.

Table 6.9: Wastewater Monitoring Template

Date (day/month/year)	Dissolved Oxygen (mg/l)	Ph (Units)	Total Phosphate (mg/l)	Total Nitrate (mg/l)	TSS (mg/l)	BOD (mg/l)	F. Coliform (count)	E. Coli (count)
____/01/____								
____/02/____								
____/03/____								
____/04/____								
____/05/____								
____/06/____								
____/07/____								
____/08/____								
____/09/____								
____/10/____								
____/11/____								
____/12/____								
Annual Average								

6.4.2.4 Solid Waste Monitoring Plan

As part of the overall management structure, the anticipated project intends to carry out a thorough solid waste management plan in order to address all the relevant issues pertaining to the collection, storage, and disposal of garbage/refuse. Table 6.10 describes the outline for which the activity will be monitored.

Performance indicators will be developed to keep track of this activity and report any major incident/accident to the local authorities. Such examples include inadvertent spillage during barging, flying, or ‘blowing’ away of uncontained garbage etc. It is therefore anticipated that the project will carry out the respective plans in order to reduce the volume of solid waste generated.

Table 6.10 Parameters for Solid Waste Monitoring

Parameters	Frequency	Critical Levels	Area/ Locale	Priority	Agency Responsible
Solid Waste Management					
Collection	Daily	Same as above	Anywhere where available trash receptacles are located.	High	SWMA, DOE , Public Health

Parameters	Frequency	Critical Levels	Area/ Locale	Priority	Agency Responsible
Disposal	Weekly	Clean environment	Collected waste will be transported to the San Pedro for subsequent transportation to the San Pedro dump site	High	SWMA, DOE , Public Health
Storage	Daily	Same as above	At WTS on the project site	High	SWMA, DOE , Public Health
Management	Daily	Development, implementation and documentation	All aspects of the management plan	High	SWMA, DOE , Public Health

Management Issues

These management issues are generic in nature and therefore applicable to every project. It is important to remember that tourists typically generate up to twice as much solid waste per capita than local residents, resulting in increased stress on local waste management infrastructure. Waste generated by tourism facilities normally includes paper and cardboard items, glass and aluminum products, plastic items, organic waste, building materials and furniture, and used oils and fats. Hazardous wastes may include batteries, solvents, paints, antifouling agents, and some packaging wastes.

The following principles of waste reduction in tourism and hospitality facilities should also be considered as part of a formal Waste Management Plan:

- Buying in bulk quantities whenever possible;
- Use of refillable, bulk dispensers (e.g. toiletries) rather than individually packaged products; Working with suppliers to limit use of, and establish recycling for, product packaging;
- Avoiding use of polystyrene foam in all operations;
- Providing in-room recycling procedures and appropriate receptacles;
- Use of glass or durable plastic instead of disposable plastic items (e.g. straws, cups);
- Implementing organic-waste composting;
- Disposing of wastes only after all waste prevention and recycling strategies have been explored and maximized.

In considering these issues the anticipated project will carefully evaluate its practices and implement a waste minimization strategy to cope with the anticipated generated volume (See Section 3.4.3) Options however, are limited, especially considering the local infrastructure for the handling and disposal of solid waste (Mile 3 Dumpsite).

6.4.2.5 Biodiversity Monitoring Program

The biodiversity monitoring plan will include the monitoring of the bird abundance, feral animal population and some coral reef cover and diversity. The main objectives of this plan is to track the potential impacts on the wildlife and their habitat, and to mitigate (minimize and reduce) the detrimental effects on protected or endangered species. Therefore, the following monitoring measures for flora and fauna are as follows:

- A checklist will be developed in order to ensure data collection in terms of the abundance of local species. In the event of an important sighting e.g. manatees, crocodiles, nesting sea turtle or other important species, the siting will be recorded.
- Assist in any way possible by relocating animals if found within the construction sites, (this especially includes nesting sea turtles if necessary).
- Establish communications with relevant Government Departments or NGOs in the event for the need for relocation of wildlife (e.g. crocodiles).
- Forge and establish constant communication with staff of the BCNP/MR.
- Restrict land clearing only to areas required in order to minimize habitat destruction or reduce buffer zone area.
- Posting of warning signs throughout the property about wildlife, especially the crocodiles.
- Minimize effects on the receiving environment by minimizing the negative impacts that may hamper potential navigational interests.
- Confinement of the construction activities to as small an area as possible.
- Establish monitoring program for biological communities for a period of three years. This should focus on features of mangrove habitats, which are likely to reflect changes in environmental conditions (such as specie composition and distribution, changes in number of individuals, girth, height and litter, birds, fish and other animals).
- Report any illegal activity of concern respective of the different zones.

Table 6.11 Proposed Biodiversity Monitoring Plan

Parameters	Frequency	Critical Levels	Area/ Locale	Priority	Agency Responsible
Bird Abundance	Twice per year, during December and in June (i.e. winter and summer)	Population changes and diversity profile to be noted and compared with pre-development and existing data.	To be done on project site as well as over sea and in the Laguna de Cantena	Moderate Priority	Forest Dept.

Parameters	Frequency	Critical Levels	Area/ Locale	Priority	Agency Responsible
Feral Animal Population (Crocodiles, raccoons and rats)	Twice per year during June and December	Population changes to be observed over time.	Entire development site and surrounding areas	Moderate Priority	Forest Dept., Public Health
Finfish Populations	Twice per year during June and December, and coincident with coral reef survey	Population changes and shifts in diversity to be observed over time and compared with pre-development situation.	Back reef area and near shore seagrass beds, as well as near shore areas of Laguna de Cantena.	High Priority	Fish. Dept.
Coral Reef Cover and Diversity (where applicable)	Twice per year, during June and December	Population changes and diversity profiles to be compared over time.	- Corals in back reef areas as well as in mid-latitude of the barrier lagoon	High Priority	Fish. Dept.
Sea-grass biomass and density (where applicable)	Twice per year during June and December.	Sea-grass biomass and density to be observed over time for any discernible trend that may be associated with the proposed development.	- 4 transects 300 m in length, evenly distributed and proceeding from the beach, with sampling stations every 20 m	High Priority	Fish. Dept.

6.4.2.6 Social Monitoring

The socio-economic input into the project site will mostly be related to the demand for employment. Thus considering the orientation of the anticipated development, a number of new jobs will be created for both the skilled and unskilled workers who from time to time will be required to live on site. The development will therefore be required to provide adequate housing and sanitary infrastructures for the staff during the different phases. It is anticipated that employment will mainly come from San Pedro Town as well as from other parts of the country, particularly the northern districts.

Table 6.12 Social Monitoring Issues

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
Fisheries Landings	Quarterly	Determine any changes in the availability of fishes harvested in the immediate area.	Assess lobster and conch landings from area bounded by northern and southern latitudes of property from shoreline to reef crest.	High Priority	Fish. Dept.
Historical useage of area	Quarterly	Determine any changes in the area as a dive site.	Monitor use of seas within project area bounded by the northern southern latitudes of property from shoreline to reef crest.	Low Priority	Fish. Dept.
Employment	Annually	Ratio of locals to foreigners as well as migrant workers	Construction site and administration of proposed project	High Priority	Labour Department
Services	Annually	Acceptable/non acceptable	Project site and related services	High Priority	BTB, BTIA

6.4.2.7 Other Monitoring Plans

The proposed project will also implement complementary monitoring plans as part of their EMS program. These plans will be further expanded as the project develops and gradually comes to light. The following table summarizes the proposed monitoring plan that will aid in both the yearly environmental audit and reporting scheme.

Table 6.13: Complementary Plans for Bellcan Eco Resort

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
Beach Dynamics					
Beach erosion	Quarterly	Observable loss of beach material.	- North-east main development site	Moderate Priority	CZMAI, Fish. Dept.

6.4.3 Performance Indicators

The anticipated project will be required to develop performance indicators in order to measure the respective target goals and objectives of the different monitoring plans. These indicators will be required to incorporate all the necessary components in order to dictate whether the monitoring plan or the EMS in general are performing as stated by the regulatory bodies.

Therefore, its imperative that the development consider these tools which will ultimately transend to the project’s effectiveness in conducting its operations. These actions will result in huge savings for the proposed project and ultimately the environment if carried out sucessfully. Collectively these measures and actions can be beneficial towards sustainable development. On the whole, the performance indicators must be ultimately dictated by the critical levels of the aforementioned monitoring plan along with any other indicator that may be of importance.

6.5 Disaster and Contingency Management Framework

A Disaster and Contingency Management Framework will be also be developed by the project as part of the Environmental Management System. This framework is generic in nature and is aimed at identifying the different potential disasters that could impact the development in one way or the other. The term ‘disaster’ will be loosely used and will refer to any accident, incident or natural occurrence that could jeopardize fully or partially the project’s operation.

Considering the potential for disasters, the proposed proponent will focus on six types of possible disasters that could arise from several sources and impact the project. These disasters will be tentatively discussed below but will require a more detailed plan once in operation (See Table 6.14). Other contingency plans can also be added to the program as time progresses.

6.5.1 Administrative Framework

The proposed project will be required to establish an Emergency Committee that will be able to deal and address all of the potential disasters (See Table 6.13). In addition, the committee will responsible for electing an Emergency Coordinator to chair and oversee the preparation activities in relation to the potential disasters. The committee will also be task in assigning a subordinate coordinator to oversee the activities in the absence of the Emergency Coordinator.

Overall, the committee will be charged of conducting periodic meetings in order to address and update the important issues relating to the disaster plans. This effort will be vital in conducting the proper mitigation and monitoring measures in an effort to avert and minimize the disaster effects.

6.5.2 Disaster Classification

As mentioned previously, the proposed development plans to incorporate six potential disasters that could impact the project site and project’s operation. In considering such possibilities, the project proponent plans to develop and implement a Disaster Management Plan aimed at identifying the different potential disasters. The following table outlines some of the more likely disasters that could occur on site.

Table 6.14 Preparedness Plan for Bellcan Eco Resort

Disaster	Description	Response Plan	Stages
Hurricanes and tropical storms	High winds can significantly impact the resort’s infrastructure and operation should the hurricane strike the project site or area	Hurricane Preparedness Plan	Alert, Response, Recovery
Fire	This anthropogenic and to some extent natural, event poses a serious problem to the infrastructure and occupants of the resort.	Fire Prevention and Response Plan	Response
Fuel/oil Spills and leaks	This incident affects the soil and water on a whole if not properly addressed.	Spill Contingency Plan (Tier levels)	Response, Recovery
Climate Change	This slow natural occurrence can pose serious risks to the project if not adapted and monitored over time.	Tidal Rise Contingency Plan	Alert, Response
Medical	Medical emergencies can occur at any moment without giving notice and therefore requires a quick and coordinated effort to respond to this need.	Medical Emergency Plan (Transportation and Evacuation)	Response, Recovery
Environmental Health and Safety	Required training in the different disaster and contingency field.	Environmental Safety	Alert, Response, Recovery

6.5.3 Hurricane Preparedness Plan

The existing project presently has a hurricane preparedness plan currently in place. Therefore in considering this disaster, the project will be incorporated into the present plan. With this in mind, the plan will incorporate the following components.

6.5.3.1 Purpose of Plan

This hurricane preparedness plan is to:

- (i) Establish the coordinating mechanisms necessary for the development to prepare and implement measures to safeguard property and lives of all concerned during the threat of a storm or hurricane.
- (ii) Ensure that the coordinating mechanism that will ensure maximum safety of property or lives during an incoming storm, is put in place, and to make sure the developer and residents/guests are familiar with the mechanism.

6.5.3.2 Storm Information System

The ‘official alert’ system for the Hurricane Plan will entail the coordination between the management of Bellcan Eco Resort and the National Emergency Management Organization in conjunction with the Belize National Meteorological Service of Belize. Therefore the proposed project will follow the official hurricane categories and Warning Flag System as follows:

Tropical Depression	29 mph – 38 mph
Tropical Storm	39 mph – 73 mph
Hurricane Category 1	74 mph – 95 mph
Hurricane Category 2	96 mph – 110 mph
Hurricane Category 3	111 mph – 130 mph
Hurricane Category 4	131 mph – 155 mph
Hurricane Category 5	Above 155 mph

Flags	Phases
One Red Flag	Preliminary Alert Phase (Storm/Hurricane Watch)
One Red flag with Black Center	RED I Phase (storm or hurricane watch)
Two Red Flags with Black Centers	RED II (Warning Phase)
One Green Flag	Green Phase (ALL CLEAR)

6.5.3.3 Action Plan

The following is a generic implementation plan as outlined by the National Emergency Management Organization. The implementation plan has been modified to fit this project.

Preliminary Alert - Hurricane Watch

This is the First Phase, and means that a storm or hurricane may threaten within 72 hours. A storm or hurricane is within 21° N 80° W of Belize.

Actions to be taken:

- (i) The Emergency Committee should be prepared to convene and take action if the NEMO issues a warning.
- (ii) Stay informed by radio and television of the storm's progress.
- (iii) Obtain hurricane tracking charts for Committee members and interested parties,
- (iv) Obtain the contact number etc. from the management, including residents and guests with marine vessels, and inform vessel owners of the alert phase,
- (v) Ensure that contact is made with all guests and captains of vessels, whether by direct or indirect means to alert them of the phase and to make initial contact.
- (vi) Prepare a checklist (electronically) of items required in the event of a strike
- (vii) The Emergency Coordinator will identify and categorize items or equipment to be removed as follows: list of equipment to stay, and list of those to be removed to an approved shelter.
- (viii) Prepare a tentative list of all the guests and management staff on the project site.

Hurricane Warning – Red 1 Phase (Watch)

During this phase, a hurricane may threaten within (36) thirty-six hours. A hurricane or storm is located within 20° N 87° W.

Actions to be taken:

- (i) Advise all vessel Captains to leave the project site immediately and take their vessel to safe harbor.
- (ii) The Emergency Coordinator will advise all employees and available human resources to install the hurricane shutters on the buildings and other related infrastructures.
- (iii) Advise all occupants of the site including guests and employees to be prepared to evacuate the areas at once.
- (iv) Identify official shelter for guests, visitors and any other employee in need of such shelters.

Hurricane Warning – RED 2 Phase

Whenever Phase 2 (Red) is given, this means that a hurricane is likely to strike Belize within (24) twenty-four hours.

Actions to be taken:

- (i) Final hurricane preparations should be concluded for the project site.
- (ii) Evacuation of employees, guests and residents should be completed.

- (iii) There should be no one remaining within this time frame as winds and rain are expected to intensify making evacuation difficult.

Fourth Phase – Green (All Clear)

This is the ALL CLEAR, which will be declared by NEMO after the hurricane has passed and it is safe to return to review the effects of the hurricane.

Actions to be taken:

- (i) The Emergency Committee will attempt to return and survey the project site as soon as possible,
- (ii) The Emergency Committee will immediately make a brief report on all damages (supported with photographs), and prepare an estimate of damages, and submit the same to Management for their perusal.
- (ii) Employees of the project will report as previously advised.
- (iii) Clean-up phase will commence with the assistance of project employees, and all available human resources, where possible.

6.5.3.4 Safety Precautions

The following are some basic precautionary guidelines that should be followed in the event of a tropical depression or storm. In the event of a hurricane, a full evacuation should be executed at the earliest.

1. Pay no attention to rumors. Only rely on the official reports and weather advisories but under no circumstances telephone the Weather Services, nor any other national radio station or B.T.L. exchange as this will hamper the hurricane tracking and information service for everyone.
2. Close and secure all hurricane shutters properly.
3. Be sure that a window or door can be opened on the side of the house opposite to the one facing the wind.
4. Be sure that you have an adequate supply of drinking water as well as canned food or other food that needs no cooking or refrigeration. If you own a coal or kerosene stove get it into working order and procure a supply of kerosene and coal as it may come in handy after a hurricane.
5. Keep a good flashlight handy as well as candles and storm lanterns as the electricity supply will likely be cut off or knocked out during the storm.
6. Check on everything that may blow away or be torn loose during a storm and store them inside the buildings if possible. Remember that garbage cans, garden tools, signs, awnings and other objects may become weapons of destruction in hurricane winds.
7. If the center of the “eye” of the storm passes directly over you, there will be a lull in the wind lasting from a few minutes to half an hour or more depending on the speed of movement of the hurricane. Remain in a safe place. Make emergency repairs if necessary during the lull, but

remember that the wind may return suddenly from the opposite direction, frequently with even greater violence.

8. Never leave your shelter until the official “ALL CLEAR” has been given.

6.5.4 Fire Prevention and Response Plan

The outbreak of any fire is considered both dangerous and disastrous. In considering this possibility, the anticipated development will implement a fire prevention and response plan that will include the use of fire suppression equipment and hydrants. Since the project site is remotely located away from any development, the proposed project will be responsible of formulating their own service via the Environmental Committee and engineering controls (fire protection equipment, building design and materials).

6.5.4.1 Purpose of Plan

The primary objective of the project is to ensure that the coordinating mechanism that will ensure maximum safety of property or lives during a blaze, is put in place, and to make sure the developer or residents/guests are familiar with the mechanism. In addition the plan will:

- (i) Increase awareness to residents/guests, management and others of the need for a fire prevention and response plan,
- (ii) To establish the coordinating mechanisms necessary for Bellcan Eco Resort to prepare and implement measures to safeguard property and lives of all concerned should a fire occur in a building
- (iii) Indicate all possible evacuation routes for each residential room.

6.5.4.2 Fire Prevention

It is important to remember that prevention is better than cure in medicine; well that same principle applies to fire. While water may be plentiful, it’s immediate availability may not be a possibility. Therefore the proposed project plans to implement the following prevention schemes:

I. Use of fire retardant material - The use of nonflammable building material will be encouraged within the proposed project. This will include also the use of fire rated doors and fire resistant barriers.

II. Qualified personnel to install electrical system - Only certified wiring Technicians will be allowed to carry out any electrical work on the premises. This will need to be approved by the Belize Electricity Limited.

III. Building Codes - The project will call for the construction of casitas, villas, bungalows and other buildings, with heights above (1) one and (2) two stories high. A set of building codes will be developed by the engineers of the project. The engineering standards will also include provisions for adequate and safe wiring; plumbing, heating, and cooling systems are also in conformity with acceptable building codes.

6.5.4.3 Fire Protection Equipment/Systems

The proposed project plans to implement fire protection equipment and systems in order to protect their buildings and related infrastructure. This equipment will offer some sort of protection from a fire in one form or another. The following are fire detection, notification and suppression systems that can control a fire.

1) Fire alarm detection and notification systems.

- *Smoke and heat detectors:* The project will install fire detection equipment in the form of smoke detectors in each of the residential units and buildings. These detectors will activate a smoke alarm possibly signaling a fire or something burning.

2) Fire Suppression Systems.

- *Hydrants:* Fire hydrants will also be used on the project. These hydrants will be spaced out accordingly and pressurized. Water for these hydrants will be gotten from the recycled wastewater or from the lagoon if necessary. A portable water pump with hoses will be coupled to the hydrants and used to extinguish the fire.
- *Fire Extinguishers:* Bellcan Eco Resort will install multi-purpose dry chemical (Class ABC) fire extinguishers at all the key areas such as hallways, infrastructure buildings, maintenance areas etc. Dry chemical extinguishers will range in sizes of 7 lbs to 10 lbs.

6.5.4.4 Fire Response

It is difficult to consider an appropriate response plan for the project especially considering the different scenarios that can accompany a fire outbreak. Nevertheless, it is important to have a fire combating plan in place where trained workers would utilize the necessary equipment (See Fire Protection Equipment/System) to extinguish a small fire or smolder bigger flames.

An evacuation plan must also accompany the fire combating plan in the event of an occurrence. These plans must be schematically developed and placed at strategic locations determined by the emergency committee. The evacuation plan will also involve the use of evacuation cards to disseminate the procedures and conditions necessary for an evacuation. These cards must be handed out and made known to each member of staff and management as well as the guests on the resort.

6.5.4.5 Response Mechanisms

The following response mechanism will be implemented in case of small or large fires:

In the advent of a fire (small fires)

Fires first start small and then grow large as time progresses and if there is enough fuel, oxygen and heat for the fire.

Actions to be taken:

- (i) Sound the alarm or call out FIRE -FIRE
- (ii) Use an extinguishing media to fight the fire.
- (iii) Do not fight a large fire with a fire extinguisher.
- (iv) Check to see that the fire is completely extinguished.
- (v) Inspect the fire area and assess for damages.
- (vi) Close off the area for safety purposes.

At some point, the Emergency Coordinator needs to be notified of the situation. A report of the incident should be submitted to the Emergency Committee for assessment.

In the advent of a large fire

Utilize these procedures if a large fire occurs such as in a residential unit or otherwise:

Actions to be taken:

- (i) Sound the Alarm or call out FIRE-FIRE
- (ii) Use an extinguishing media such as a fire extinguisher and fire hydrant to fight the fire.
- (iii) If possible, remove any fuel (combustible material) that could be engulfed by the fire
- (iv) Use fire hoses and hydrant and full pressure aiming at the base of the fire
- (v) Evacuate any persons within the area or found in the area at the time of the incident
- (vi) Once contained, check if the fire has been completely extinguished
- (vii) Inspect the fire area and assess for damages

Similarly, the Emergency Coordinator needs to be notified of the situation and a report of the incident should be submitted.

6.5.5 Spill Contingency Plan

The proposed project will require a Spill Contingency Plan for the activities that will be undertaken. This plan will primarily apply to the handling of fuels of the project. Although it is expected that the volumes of fuels will be small, it is still necessary to provide an organizational structure and procedures for preparing and responding to hydrocarbon spills and leaks both on land and at sea. It is better to understand the purpose of the response plan in order to tackle every spill situation. Therefore, it will be important to train the adequate personnel in the response effort to determine the best practical approach.

6.5.5.1 Purpose of Plan

The purpose of the plan is to outline the procedures necessary to reduce and contain the effect of a spill by means of a well-coordinated response in conjunction with the following:

- To increase staff awareness on Spill Response procedures taking into consideration the different governmental tier response levels.
- To define the coordinating mechanisms necessary for management and staff to utilize their resources in Response Procedures.

6.5.5.2 Response Policy

The response policy will call for a timely and effective response to incidents which requires basic training in the response policies as well as the use of contingency equipments to contain and clean up a spill after it occurs. Because the approaches and methods for responding to oil spills are constantly evolving, and each spill provides an opportunity to learn how to better prepare for future incidents, contingency plans also are constantly improving and providing increased protection to human health and the environment from these accidents.

The following tables are DOE Tier levels as described by the National Emergency Preparedness Plan for Oil Spills (NEPPOS).

Table 6.15 Marine Spills Levels

Tier	Quantity (gals)	Location	Response
I	1,000-10,000	Coastal/ Marine	To be managed by polluter
II	10,000-100,000	Coastal/ Marine	Requires Government assistance for management
III	>100,000	Coastal/ Marine	Requires Government and/or external assistance

Table 6.16 Inland Spill Levels

Level	Quantity	Location	Response
A	<1,000	On land or Inland	To be managed by polluter
B	>1,000 or poses significant health hazard and requires evacuation	On land or Inland	Responsible party requires GoB assistance to manage the discharge.

For the purpose of this project both Tier I and Level A will be considered. This is especially so because of the fuel transportation from the mainland to the project site.

6.5.5.3 Fuel Management

Fuel management is a very critical safety issue considering the remoteness of the project site. It is however, not a difficult task to do considering the small volumes that will be handled by the

project during construction and operation. Fuel will be managed to prevent spills and leaks via the following:

- *Storage:* Fuel for the anticipated project (standby generators) will be stored inside a reinforced concrete containment wall which will be designed to contain 110% of the maximum tank volume. To protect against any accidental fire the tank will be sited away from all electrical installations.
- *Documentation:* It is important to keep in mind that the project must order the correct volume of fuel required for operation. For this reason, all the fuel consumed and received must be recorded.
- *Maintenance:* It is important to carry out periodic inspection of the containment walls and fuel containers as these can lead to unnecessary spills and leaks.

6.5.5.4 Waste Oil Management

This section is not required to be fully implemented considering the volumes of waste oil that will be generated by the project. It is important, however, to keep in mind the possibilities of spills and leaks, especially considering the project site. With this in mind, the following management plan will be undertaken:

- *Storage:* All waste oil will be stored in properly sealed containers and inside a containment wall.
- *Handling:* Used oils are a legal responsibility of Bellcan Luxury Eco-Resort and thus should be handled adequately and with care.
- *Disposal:* Although the volume may be very small, it is important to properly discard the accumulated waste oil. Once stored, the waste oil should be disposed by an approved or certified contractor.

6.5.5.5 Contingency Equipment

In complying with hydrocarbon spills and leaks, the proposed development will require spill response equipment in order to safely contain the spills and leaks. Therefore, in considering this issue, the following equipments will be required:

- Spill response Kits – these will be made available to the maintenance staff and installed at key locations such as generators, boats, etc.
- Containment Booms – these are mostly for marine spills and will be deployed if required.

6.5.6 Tidal Rise Contingency Plan

This natural phenomenon is a derivative of global warming. This process impacts a wide range of naturally occurring process on earth such as agriculture, sea rise, hurricane impacts etc. The

natural phenomenon is an extremely slow process taking several years to decades to materialize. Nevertheless, sea level rise can impact the project's shoreline. Such impact can include increased shoreline erosion, high storm surges, flooding, project inundation, changes in the surface water quality and ground water characteristics, increased flood risks and loss of tourism, recreation and transportation functions. Considering its importance from an economic long term investment, the following sections summarize the contingency plan for sea level rise at the project site.

6.5.6.1 Purpose of the Plan

The overall objective of the project is to mitigate the effects of this long term phenomenon by:

- Preventing erosion and protecting vulnerable areas prone to such activity
- Prepare a comprehensive plan to remediate the problem by formulating tidal charts, sea level maps, erosion patterns, sand transportation, beached seagrass/algae accumulation and the other necessary tools.

6.5.6.2 Adapting to Sea Level Rise

Adapting to this new phenomenon will be very interesting considering the different beach dynamics and global warming effects. The following points describe the importance of undertaking such a task.

- **Erecting walls to hold back the sea** - Most response strategies to future sea-level rise have concluded that coastal locations will merit protection with bulkheads, dikes, and pumping systems. Bulkheads, seawalls, and rock revetments already are being used to halt erosion to protect land that is well above sea level.
- **Elevating land surfaces and beaches** - The effects of rising sea level can be offset by elevating beaches, land surfaces, and structures as sea level rises. A key benefit of this approach is that the character of the shore is not altered.
- **Protecting natural shorelines by allowing shores to retreat** - Several planning measures have been proposed to enable some shorelines to remain in roughly their natural state as sea level rises, rather than be replaced with structures. For the most part, these measures apply to areas that are not yet developed.

There has been no documentation on the effects of sea level rise in Belize. Nevertheless, these adaptive responses should be carried out in order to estimate the economies of scale in considering the responses.

6.5.6.3 Climate Change Effects

It is anticipated that the changes in the hydrological cycle in Belize as a result of climate change, would be characterized by changes in sea levels, the intensity of hurricanes and its accompanying storm surge, and changes in rainfall patterns and temperature (Usher 2000). These changes may result in devastating impacts on the project such as:

- Coastal erosion and degradation with accompanying beach loss;
- Alteration or destruction of mangrove communities due to the alteration of the productivity of mangrove ecosystems;
- Increased inundation as a result of sea level rise, with consequences such as salt-water intrusion;
- Vulnerability to flooding and soil erosion of low lying areas within project site,
- Loss in net tourism economic activities as a result of the combined effects of climate change,

These issues are by no means limited in scope, nevertheless, the proposed development must consider the possibilities and implement the necessary measures in an effort to mitigate and minimize the damage.

6.5.7 Medical Emergency Plan

The proposed development plans to implement a medical emergency plan in the event of a medical emergency. This plan is a new concept that must be implemented based on the expanding growth of the tourism industry. In considering this, the proposed project plans to implement and develop a medical emergency plan to respond to such an incident. Any response to an emergency medical situation will depend strongly on the situation, the patient involved and availability of resources to help them.

This response plan will cater to basic first aid health care only and any emergency transportation to a recognized health institution such as a hospital or health center. A more comprehensive plan will be developed by the Emergency Committee. In any event, the plan will be required to be approved by a certified doctor, health institution or NEMO.

6.5.7.1 Purpose of the Plan

The primary objective of the plan is to respond to a medical emergency in a quick manner by:

- Establishing the coordinating mechanism necessary to respond to a medical emergency and to implement basic first aid treatment if applicable.
- Developing and implementing a coordinating mechanism necessary to secure appropriate emergency transportation to a recognized health institution.
- Registering all the visitors with medical histories and complications, especially the elderly.

6.5.7.2 Basic First Aid

First aid treatment is the provision of limited care for an illness or injury that has just been sustained. It generally consists of a series of simple, sometimes life saving, medical techniques, that an individual, either with or without formal medical training, can be trained to perform with minimal equipment. Most first aid kits contain bandages for controlling bleeding, personal protective equipment such as gloves and a breathing barrier for performing rescue breathing and CPR (cardiopulmonary resuscitation), and sometimes instructions on how to perform first aid.

Aims

The 3 main aims of first aid, commonly referred to as the “3 Ps” are:

- **Preserve life**
- **Prevent further injury**
- **Promote recovery**

6.5.7.3 Transportation (Evacuation) of Patient

When conventional first aid requires additional medical attention, the patient must be transported to a recognized health institution for further treatment as quickly as possible. For this reason it is important to establish relations with the health institutions and notify them on the project’s plan and determine whether the institution is able to assist in emergency cases. In any event, the Emergency Committee will be required to make transportation arrangements to the health institution in the event of a medical emergency.

Considering the aforementioned importance, all medical emergencies requiring further treatment will be transported to San Pedro Town where there are several clinics (See Table 6.17). More serious cases will be required to be transported to the Karl Heusner Memorial Hospital or to any approved tertiary health care facility (Universal Health Care Services Co. Ltd., or Belize Medical Associates) in Belize City. In any event, the proposed project will facilitate the appropriate transportation mechanism which could include boat and helicopter.

6.5.7.4 Contact Information

Contact information is an important factor in considering emergency situations. It can be used in cases of fire, medical and hurricane emergencies. The following table lists the possible contact information for emergencies. This table must be supplemented by the emergency committee listing the member’s contact information.

Table 6.17 Contact Numbers for Emergency Services

Institution/Department	Contact Number	Alternate Number
San Pedro Lions Clinic	226-4052	911
San Pedro Polyclinic II	226-2536	
Los Pinos Clinic	226-2686	
Medical Emergency (ACER)	226-3231	
Karl Heusner Memorial Hospital	223-1548	223-5686
Wings of Hope	223-3292	
Fire	226-2372	
Police	226-2022	

6.5.8 Environmental Safety

Environmental safety is a growing concept that must be developed, especially considering the growing number of tourists who visit the country. Moreover, this concept must be practiced on a daily basis by those who make up the tourism industry. With this in mind, the Emergency Committee of the proposed development will develop safety training programs for the resort. This program will not be required to divulge in general or in details about the many risks and hazards that exist or affect the project. Nevertheless, it's important to address these concerns, especially considering the location of the project.

Training

Training is the field concerned with workplace learning to improve performance. Such training can be generally categorized as *on-the-job* or *off-the-job*. On-the-job describes training that is given in a normal working situation, using the actual tools, equipment, documents or materials that they will use when fully trained. On-the-job training is usually most effective for vocational work. Off-the-job training takes place away from normal work situation which means that the employee is not regarded as a productive worker when training is taking place. An advantage of off-the-job training is that it allows people to get away from work and totally concentrate on the training being given. This is most effective for training concepts and ideas.

(a) Hurricane Preparedness Plan

Natural disasters such as hurricanes and storms can claim both lives and property, especially considering the project location. Considering these possibilities, the Emergency Committee will conduct annual updates and periodic orientation in the Hurricane Preparedness Plan. It is essential to educate and sensitize the staff and visitors of this important plan, especially in the hurricane season.

(b) Fire Prevention and Response Plan

The best possible training for firefighting is fire prevention, especially considering that fire outbreaks are dangerous and life threatening. In view of this importance, the Emergency Committee will train the necessary person in dealing with small and large fires. Training for these sorts of events can be conducted by the National Fire Service who will basically provide an overview of the different risks and factors associated with fires as well as hands on demonstration on how to use the fire equipment.

The training will be enhanced to include the usage of the project's fire hydrant system to extinguish large fires that might occur. Special attention will be paid to this section as it signifies the last line of defense for the proposed project. The training will also include the maintenance of both the fire extinguishers and fire hydrant systems.

(c) Spill Contingency Plan

Although the volumes of hydrocarbon will be limited, it is still important to provide training in this field. Precedence will be given to the small spills since the probability is much higher. Trainees in this area will be required to learn the basics in spill containment and remediation process. This contingency plan will involve the deployment of spill response kits to contain and clean up the hydrocarbon spills and leaks. Training in this field can be undertaken by the Department of the Environment, or private consultancies.

(d) Tidal Rise Contingency Plan

Training in this field is limited to only monitoring of the coastline and low lying areas of the project site. Impacts such as coastal erosion, sand accretion and transport, water quality and flooding are essential factors that should be accounted. Nevertheless, it's important to keep in mind the different scenarios that can arise when dealing with tidal rise, especially considering the project's life span.

(e) Medical Emergency

Much of first aid is common sense, and people are almost certain to learn some elements as they go through their life (such as knowing to apply an adhesive bandage to a small cut on a finger). However, effective life-saving first aid requires hands-on training by experts, especially where it relates to potentially fatal illnesses and injuries, such as those that require Cardiopulmonary Resuscitation (CPR), as the procedures may be invasive, and carry a risk of further injury to the patient - which the '3 aims' of first aid above, clearly try to avoid.

Training in first aid is often available through the Red Cross or through commercial providers, who will train the staff for a fee. This commercial training is most common for training of employees to perform first aid in their workplace.

As the key skill to first aid is preserving life, the single most important training a first aider can receive is in the primary diagnosis and care of an unconscious or unresponsive patient. The most common mnemonic used to remember the procedure for this is ABC, which stands for **Airway**, **Breathing** and **Circulation**.

(f) Others

There are many other on the job training that somehow involve the environment, for example solid waste collection, water quality sample collection, landscaping, life guard, etc. In the tourism field, there are many such instances that require some sort of qualification and training. Nevertheless, the proposed development plans to implement training exercises into the operation of the project.

6.6 Conclusion

Newton's Law provides that for every action there is an equal and opposite reaction.

The Council on Environmental Quality (CEQ) on the other hand provides that “Whenever a proposed project will result in potential significant adverse environmental impacts, measures must be taken which will limit or avoid that impact. These may include conditions of approval, revisions to the project, and, less frequently, approving an alternative project with fewer impacts. Where such measures are imposed, there must be a program for monitoring or reporting on the project’s compliance with those measures”.

As described from the conotation above, the proposed project will have its degree of impact on the receiving environment. Based on these assumptions, the different mitigation and monitoring programs plan to include as much activities that are related to the development and operation of the proposed subdivision. Once Environmental Clearance has been granted, the Environmental Compliance Plan will request a more formal and detailed monitoring program from the different activities. It is up to the Department of the Environment, along with other interested parties and stakeholders, to monitor the project site in both its construction and operation stage and to ensure that the monitoring program and mitigation measures presented in the tables above are properly put in place and functioning as planned.

In obtaining quick and decisive responses, the Emergency Committee of the proposed project should have regular meetings, training and drills to update their continued effort in disaster preparedness and management. It is in fact a coherent relationship between management and employees to display sound actions in the case of a disaster. This relationship extends far beyond the property boundary lines as members also take this experience at home. A quick and well-planned response is always an essential tool in dealing with any natural or man-made disasters.