Chapter 6: Environmental Management Strategy

The project may generate both permanent and temporary impacts at construction and operational phases of work proposed. These impacts are identified and assessed below. Suitable mitigating measures are also proposed to minimize, if not eliminate the negative environmental consequences associated with the negative impacts.

6.1 Site Preparation Phase

This phase involves:

- Demolition of any existing buildings within the site boundaries.
- Earthworks to level the site as required.
- Clearing of vegetation

6.2 Demolition Works

6.2.1 Generation of Demolition Waste

Most of the solid waste will come from the demolition of the existing basketball/tennis court and the small kindergarten building and will consist mainly of:

- Concrete and masonry debris
- Steelwork and iron fence
- Cables, wires and unused electrical appliances
- Pipe work

6.2.1.1 Nature of Impact

Piles of solid waste from demolition will create a negative visual impact in the North Tourism Zone and cannot be tolerated by the existing hotel nearby and the future hotel. Furthermore, this may become a habitat for rodent animals like rats and cannot be allowed.

6.2.1.2 Mitigating Measures

- Steel waste, iron fence, cables and electrical appliances shall be sold to scrap dealers for use elsewhere or for recycling.
- Concrete/masonry waste shall be broken in appropriate sizes so that they can be used in the backfilling operation during site leveling
- Other minor waste that cannot be reused or recycled shall be carted away to a landfill site.

6.2.2 Generation of Biological Wastes

6.2.2.1 Origin of Impact

Biological wastes will come from the existing toilets and sewerage system in the kinder garden building. Details are not available presently but it will basically consist of a network of collector pipes and septic tank.

The nature of the biological waste will depend on the date of cessation of operation of the kindergarten and septic tank may be fully loaded with waste water and sludge.

6.2.2.2 Mitigating Measures

Prior to any massive demolition of existing structures, the existing sewerage network need to be flushed and the septic tank emptied into a wastewater carrier by an accredited operator who shall dispose of the waste in an agreed sewerage treatment system. To ensure a better disinfection of the system before demolition, final flushing with sodium hypochlorite solution (NaOCl) will be done.

6.2.3 Earthmoving

6.2.3.1 Origin of Impact

The level contours of the topographical map and site visits suggest that some cut-and-fill operations will be of utmost importance to bring the site to workable levels. As a result of this operation, earth and rock will be dislodged from initial formations using excavators, rock hammers and heavy-duty vehicles.

During the earthmoving operations there may be circulation of heavy-duty vehicles when backfill material is brought on site. There may also be considerable noise and fugitive dust emissions on the work site

The intensity of the impact will depend on the duration of operation, the size and extent of the backfilling operation, wind speed and direction and absence of rain.

6.2.3.2 Mitigating Measures

- The equipment on site shall be operated strictly during normal working hours and all engines shall be equipped with silencers to limit noise levels.
- Truck drivers shall take extra care, such as tarpaulin covers, to prevent spillage of backfill material on the route to the worksite.
- Geotextile screens of at least 2m high shall be erected around the work site to limit wind born dust emission to the neighbourhood, especially to the adjacent Bluemarine Hotel.
- Earth stockpiles for backfilling shall be covered by geotextile membrane during windy seasons.

6.3 The Construction Phase: Negative Impacts

6.3.1 Impacts of Solid Wastes

6.3.1.1 Origin of Wastes

Solid wastes generated during the construction phase may comprise of the following basically inorganic wastes:

- rock and boulder fragments as well as top soil resulting from Site Earthworks
- timber and wood cuttings
- thatching straw

- paper & plastic wrappings
- solidified concrete spills and masonry debris
- electrical cables, pipes and ducts cuttings
- floor and wall tiles, glass debris
- metal or plastic paint tins or containers

Organic wastes will also be generated as food leftovers at Site Staff mess.

6.3.1.2 The Nature of the Impact

The impact resulting from the generation of inorganic wastes could be:

- a source of physical pollution in case(improbable) they are dumped into the sea or lighter materials are blown off by the wind to the sea
- a visual impact, should such wastes be stockpiled and left unattended

Besides, pests like rats, as well as stray domestic animals may avoidably be attracted by the food leftovers at the Site Staff mess.

6.3.1.3 Impact Receptors

The main impact receptor would the local landscape, and in particular, that of the Project Site, and of the Northern Tourist Zone as a whole.

6.3.1.4 Mitigation Measures

Mitigation will involve the loading, carting away by authorised waste lorries, and disposal of the solid waste to an agreed landfill site, which will be specified as part of the tasks to be executed by the Contractor on Site.

Excavation spoils may have to be used on Site, in a “cut & fill” exercise to build up the ground level for the purpose of setting out the Hotel buildings at the appropriate level. Thus low parts may be filled with the rock/boulder fragments, together with the fragmented concrete-work and masonry from demolition, and soil and compacted as per Engineer’s instructions.

Mess leftovers will be stored in appropriate bins fitted with tight lids, which will be carted away to disposal.

The impact will therefore be satisfactorily mitigated and eliminated.

6.3.2 Generation of Biological Pollution

6.3.2.1 By Contractor Staff on Site

During construction of Works, hundreds of Site workers will be present on Site and generation of sewerage must be expected. The daily rate of sewerage production will evidently depend upon the number of workers present any day on Site, but from past observations, an average of 5 to 10m^3/d can be expected.

6.3.2.1.1 Nature of the Impact

There is a risk that the raw sewerage, which they are likely to contain, reaches the lagoon:

- by infiltration via fissures in the rock formations
- or by leaching when surface runoff occurs under heavy enough rainfall

Sewerage contained in the septic tanks being demolished may considerably add to the contaminating load, besides generating foul smells.

6.3.2.1.2 The Impact Receptors

The major impact receptors will be:

- the marine environment, as the lagoon waters are ultimately contaminated in turn by the contaminated water table; the coral fields will be affected by the accelerated growth of algae
- the human environment, because of health hazards, and in particular the future residents of the hotel

6.3.2.1.3 Mitigation measures

Mitigation measures will involve the provision and maintenance, by the Contractor, of appropriate mobile toilet facilities on Site during the whole duration of the Works.

6.3.3 Spillage of Hydrocarbon

6.3.3.1 Nature of the Impact and receptors

This may occur if the vehicles and equipment are in poor working order, with leaking fuel tanks, sumps, pipes, and if they are carelessly refuelled and serviced anywhere on Site. The spillage will percolate through to the water table and eventually to the lagoon.

6.3.3.2 Mitigation measures

The Contractor will ensure that:

- no servicing and maintenance of vehicles and plant will be carried out on Site
- all emergency repairs will be carried out diligently in a way safe to Environment by eliminating all risks of hydrocarbon spills
- all plant and vehicle to be used on Site for demolition and Construction Works will be in perfect condition and fully operational
- refuelling of equipment will be carried out from a mobile hydrocarbon carrier trailed on Site whenever necessary and no *in situ* storage shall be tolerated.

The Promoter shall ensure that the above mitigation measures form part of the Contractual Obligations on Site, via the appropriate Engineer's Specification and Bill of Quantity items.

6.4 The Operation Phase: Negative Impacts

Potential impacts could be associated with:

- the generation of organic and inorganic solid wastes
- the generation of biological pollution
- the generation of odour from kitchen
- risks of hydrocarbon spillage from diesel storage to stand-by units
- atmospheric pollution by stand-by stack gases
- noise generated by stand-by diesel plants

6.4.1 Generation of Solid Wastes

Solid waste will be generated every day, in amounts depending basically upon the occupancy rates, and they will consist of:

- organic wastes, *i.e.* food leftovers from restaurants, kitchen wastes (grease and oils)
- non-organic wastes, *i.e.* glass ware, metal cans, plastic bottles and packages, paper

6.4.1.1 Mitigation measures

The non organic as well as organic solid wastes (food wastes) from restaurants, bars and kitchens, will be collected into plastic bins which will be stored in a cold room (4ºC), to be collected everyday by a licensed solid waste hauler.

Storing solid wastes in this fashion is recommended as the low temperature prevents fermentation which would have otherwise rapidly taken place, with the generation of leachate and foul smells, the attraction of flies, vermin, etc.

Selective solid waste storing is envisaged, upstream of a General Waste Selection Policy, particularly if it becomes necessary to participate in the global solution of the Solid Waste Problem in Mauritius.

The mitigating measures proposed by the Client are therefore judged satisfactory.

6.4.2 Generation of Biological Pollution

Sewerage will be produced at a maximum daily rate of 150kg and depending of course, upon:

- completion of the project to its capacity of 100 rooms
- seasonally fluctuating accommodation rate

6.4.2.1 Mitigation measures

As exposed in the detailed project description of the Project internal infrastructure, a Moving Bed Bio Reactor (MBBR) type sewer treatment plant of capacity 60m3 shall be proposed to treat all the wastewater generated by the daily activities of the complex and re-use for irrigation and general cleaning purposes.

6.4.3 Generation of Odour from Kitchen

Odour may emanate from the kitchen during working hours.

6.4.3.1 Mitigating measures

The Kitchen will be fully aerated and air-conditioned and air extractors will be connected to an odour scrubber unit.

6.4.4 Risks of Hydrocarbon spillage at Stand-by Storage Tank

6.4.4.1 Nature of the Impact

The spillage of diesel in permeable/fissured formation will contaminate the water table and eventually the lagoon waters. In view of the considerable distance from the lagoon, the intensity of the impact may not be catastrophic but considering the touristic value of the Site, such an event must be prevented from happening by adopting the appropriate mitigating measures.

6.4.4.2 Mitigating measures proposed by the Proponent

The storage tank will be internally coated steel tanks, designed to supplier Standards, and constructed to withhold efficiently all pressures associated with "full conditions". It will have a level monitor allowing continuous check of fuel tank status, cross-checked by records of daily drawings and periodic refills by the supplier.

The tank will be erected on a leak proof reinforced concrete trough, supplier Standards, where any leaking diesel will collect and flow to a sump where it will be recuperated.

6.4.5 Risks of accidental spillage from LPG Storage

LPG gas for cooking will be stored in bulk storage tanks in the outside back area of the kitchen.

Becuase of its low boiling point compared to the ambient temperatures, spilled LPG quickly vaporises to gaseous form when released to the environment. It is the ripe of combustion by fire, or when further mixed to air, possibly explosion.

6.4.5.1 Mitigation measures

A LPG Prevention & Contigency plan shall be set up by installer. Safety devices shall consist of the following: Safety fence/fire protection wall, Water sprinkler systems, shutoff valves, Emergency shut off valves, Safety signs & Internal gas pipe work.

6.4.6 SUMMARY OF ENERGY EFFICIENT AND ECO-FRIENDLY PRACTICES

The design of the mechanical and electrical installations shall be in accordance to the “Maurice Ile Durable” policy and Energy Efficiency Act under the New Control Act 2012. A series of green and energy efficient solutions shall been implemented as summarised below:

6.4.6.1 Solar water heating

Hot water production for the guest rooms shall exclusively be with solar water panels and storage vessels equipped with electric boosters for back-up. We are thus eliminating the need for installing gas water heaters hereby reducing fossil fuel consumption and CO_2 emissions. It is estimated that the proposed solar system will

reduce energy consumption for water heating by more than 70% compared to conventional boiler installation.

6.4.6.2 Sewer Treatment Plant

A sewer treatment plant shall be proposed to treat all the wastewater generated by the daily activities of the complex and re-use for irrigation and general cleaning purposes. Stages of the proposed STP plant:

(i) Primary anaerobic treatment: wastewater shall be retained for 24 hours in a primary settling tank to allow solid particles to settle down. The water then flows to the aerobic tank.

(ii) Secondary aerobic treatment: living organisms and bacteria feed on residual organic materials in the wastewater. The organisms/bacteria are allowed to grow on immerged polypropylene support made of recycled PP. The shape of the support considerably increases the area available for the organisms to grow, thereby increasing the efficiency of the process. Air blowers located in the technical room of the STP diffuses air at the bottom of the tank to sustain the organisms.

(iii) Clarifier: matters in suspension in the treated water are allowed to settle down at the bottom of the clarifier in conical shape. The clarified water is directed towards a pre-filtration tank and the sludge is pumped to the primary settling tank.

(iv) Tertiary treatment: the treated water is filtered and chlorinated to further eliminate bacteria and make it suitable for storage. The water is now disinfected and treated to irrigation quality.

The treated water shall be used for irrigation and general cleaning. On-site treatment of wastewater helps to reduce fresh water demand and cost/space requirements for wastewater disposal through leaching fields. Proper maintenance of the sewer treatment plant shall ensure that the system generate no noise and odour.

6.4.6.3 Inverter Drives on Air-Conditioning units

All air-conditioning units will be equipped with inverter drives. Inverter drives improve the efficiency of the air-conditioning unit at partial load. The Coefficient of Performance (COP) of the system is improved and an energy saving of 20% to 30% is possible compared to traditional AC split units.

6.4.6.4 Efficient Lighting System

The functional lighting system will be designed for optimal illumination levels (Lumens) as per the requirements of Chartered Institute of Building Services Engineers (CIBSE). As for decorative lights shall either be with compact fluorescent fittings or LED lights as they have lower power consumption and have longer life span. Additionally, bollards and spike lights with solar collectors will be implemented, depending on landscaping concept and shading factors. Light fittings fitted with LED lamps shall be extensively used for external and decorative lighting. A combination of photocells and automatic detectors shall be installed for switching of lights in corridors and office spaces to minimise wastage during vacancy.

6.4.6.5 Variable Speed Drives on Pumps

All frequently used pumps (desalination, domestic water pumps, pool pumps) shall be equipped with variable speed drive. The variable speed drive allows the pump to work at reduced capacity when demand in low by varying the frequency of the electrical input. The use of variable speed drives results in lower starting and operating current of the domestic pump set, thereby reducing energy consumption.

6.4.6.6 Stand-by Generator

The stand by generator shall be fitted with a weatherproof and sound attenuated canopy to limit the noise generated (compliant with Environmental Protection Act-EPA 2002). A bund wall shall also be provided around the generator and diesel tank to prevent spillage.

6.4.6.7 Desalination Plant

An on-site desalination plant is also proposed to meet 100% water demand of the hotel complex. The system will eliminate the need of fresh water from the CWA network.

6.5 Socio-Economic Impacts

6.5.1 At Conceptual Stage

6.5.1.1 Commitment for Training by Promoter

Promoter during the numerous meetings has agreed to organise a 'Job Fair' to recruit youngsters and middle aged people alike in the region and provide them training.

The Promoter will launch as soon as the EIA has been cleared, a programme for the training of the interested locals towards employability in the hospitality sector. The trainees will eventually be employed at the hotel.

This is in line with the policy to empower academically unsuccessful youngsters towards earning a decent living and to evade from the prevailing social evils encountered in the area.

6.5.2 Construction Stage

At Construction Stage, the Project will:

- provide work, for at least 8 to 10 months, to hundreds of artisans of the Building Industry, masons, carpenters, tile layers, plumbers, electricians, painters, etc;
- will boost up the production and sales of building materials, namely basalt products

The consequence is a distribution of wealth over all those sectors of activity, with an impact on the GDP.

6.5.3 At Operation Phase

6.5.3.1 National Economy

The best way to illustrate the economic impact is probably by studying the relative importance in the National Economy, of the major revenue earners, namely:

- *Mauritius Export Processing Zone* (EPZ)
- *Mauritius Tourism Industry* (MTI)

Their historical contributions to the National Economy as sector contributions to gross foreign currency earnings are shown in Table 6.6.3.1.1 detailed hereunder.

Table 6.5.3.1.1: Sector Contributions to Gross Foreign Currency Earnings (MRs)

	2001	**2002**	**2003**	**2004**	**2005**
EPZ	16555	15774	15865	14851	13436
Tourism	18166	18328	19415	23448	25704

The constantly increasing positive contributions of the Mauritius Tourism Industry to the National Economy, is undeniable whereas the EPZ Sector has been in decline since the early 2000.

Since the turn of the 21st Century, Tourism has overtaken both the EPZ Sector as the Net Foreign Currency earning.

6.5.3.2 Impact on Employment

The project at operation phase will provide employment to about 300 persons.

The Tourism Industry appears to be the only sector that can absorb 'massed' labour with a low level of skills when compared to other emerging sectors (Information technology, etc.).

Table 6.5.3.2.1 shows the past sector contribution to Employment.

	2001	**2002**	**2003**	**2004**	**2005**	**2006**
EPZ	87 607	87204	77623	68022	65159	64362
Tourism	19522	20729	21860	22613	25377	

From the above Table, it is observed that:

- Employment in the EPZ sectors have been decreasing continuously over the years due to the closure of foreign owned textile factories in the latter.
- Employment opportunities have increased continuously in the Tourism Sector and should continue this trend on account of the stated policies of the Government with regard to tourism development.

6.5.3.3 Peripheral Economic Impacts

The economic impact of the project is positive, from the point of view of direct Foreign
Currency Earnings to the Island, and also from those of peripheral activities such as:

- car hiring and taxi services