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Environmental Impact Assessment for the Proposed Development of a Golf Course at Shangri-La's Villingili Resort & Spa, Addu Atoll, Maldives

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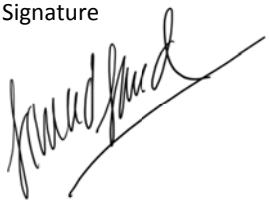
Consultant's Declaration

I certify that statements made in this Environment Impact Assessment are true, complete and correct to the best of my knowledge and available information.

Name:

Simad Saeed (EIA 06/2007)

Signature



EXECUTIVE SUMMARY

This EIA is an evaluation of potential environmental and socio-economic impacts of the proposed golf course at Shangri-La's Villingili Resort & Spa, Addu atoll. This EIA fulfils the requirements under the EPPA (Law no.4/93) of Ministry of Housing, Transport and Environment.

Introduction and key feature of the project

Project Background

Villingili Island in Addu atoll was leased for the development of a tourist resort under the Third Tourism Master Plan. Shangri-La's Villingili is the first luxury resort in the Maldives to be located south of the equator.

With the set up of a golf course on the resort, guest experience is expeted to be further enhanced.

Project Objectives

- Develop a golf course that will add to the guest experience and uphold the standard of the resort.
- Locate, design and operate a golf course that results in minimal impact to the natural environment of the island; and
- Comply with all Maldivian regulations and International obligations during both construction and operation phase of the project.

Project Scope

The proposed project involves the development of a nine-hole golf course at the southern tip of the island.

Project Features

The key features of this project are:

- Site preparation
- Installation of the irrigation system
- Construction of the artificial pond
- Soil conditioning
- Grassing and landscaping
- Construction of the Clubhouse and Storage building

Project Schedule

The project is expected to take approximately 12 months for construction.

Conformance to laws and regulations of Maldives and international conventions

The proposed developments require it to conform to a number of laws and regulations in the Maldives and other international protocols and conventions.

The Existing Environment

The existing environment of the project are described as follows.

1. Physical Environment
    a. Climate including rainfall, wind, wave and tides
    b. Topography of the project site
    c. Groundwater quality
2. Biological Environment
    a. Description of the wetland
    b. Marine water quality
    c. Existing vegetation and removal of vegetation

Environmental Impacts

The potential significant impacts from the project are summarized below:

Potential Adverse Impacts during the Construction Stage

- Loss of flora and fauna
- Groundwater and marine water contamination
- Noise and air pollution
- Greenhouse gas emissions
- Impacts from waste

Potential Adverse Impacts during the Operations Stage

- Introduced species
- Groundwater contamination
- Wetland and marine water contamination
- Soil quality degradation
- Noise pollution
- Air quality degradation
- Poor waste management

Alternatives

1. No Development

    Despite the environmental disadvantages of the no project option, the socio-economic benefits are too numerous for this project to be undertaken.

2. Reduced Scale of development

    The scale of development could be reduced but as the area of the golf course is quite small at present, any smaller than the area proposed may not make it attractive as a recreation.

3. Alternative Location

    The option available for an alternative location is to establish the golf course in another island of Addu atoll.

4. Alternative Design

The alternative design proposes one artificial pond at the southern end and located away from the wetland.

Environmental Monitoring Program

For the purpose of this project, monitoring should be done on all aspects of the golf course construction and operation that have the potential to influence the environment. Such areas where monitoring is required include changes to terrestrial environment including vegetation, groundwater and wetlands and, marine water quality.

It must be noted that Villingili undertakes annual environmental monitoring to meet the requirements of WBG/IFC standards. Therefore monitoring aspects discussed here will be incorporated to the annual monitoring plan of the resort.

The proponent is committed to undertake the monitoring programme.

Stakeholder Consultations

Consultations were held with the following

1. Ministry of Tourism, Arts and Culture

   The Ministry is in support of the project as the project will diversify the tourism product and provide an advantage for tourism in the south of Maldives.

2. Ministry of Fisheries and Agriculture

   The Ministry is concerned about the source of import for the grass to be used in the project and advises to follow formal procedures in importing grass.

3. Southern Province Office

   The Office is of the view that the project is beneficial however, benefits should be weighed against the environmental costs and environmental impacts should be given due consideration.

4. Atoll Office

   The Office is of the view that the project will provide job opportunities and that the Corporate Social Responsibility of the resort should expand to include environmental protection of Addu atoll as a whole.

Conclusions

The construction and operation of a golf course is justified based on economic grounds. The proposed development activities do have significant environmental impacts, particularly related to introduced species and potential contamination of groundwater, marine water and wetland water. These impacts are not specific to Villingili alone except where the wetland is concerned and are reminiscent of the impacts that would exist in the construction of a golf coursein any island of the Maldives. To strike a balance between development needs and environmental preservation it is recommended that the mitigation measures proposed in this report be strictly enforced both by the developer and the regulatory authorities.

1 INTRODUCTION

This EIA is an evaluation of potential environmental and socio-economic impacts of the proposed golf course at Shangri-La's Villingili Resort & Spa, Addu atoll. This EIA fulfils the requirements under the EPPA (Law no.4/93) of Ministry of Housing, Transport and Environment.

The main components of the project include site preparation, installation of an irrigation system, construction of artificial pond, soil conditioning grassing and landscaping and the construction of a clubhouse. The golf course is to be set at the southern end of the island on approximately 3.28hectares of land. The course will consist of nine (9) holes, including Fairways, Greens and Tees, with intermittent water features. All utilities including power and water supply will be sourced from the existing facilities of the resort.

The construction of the golf course is expected to take 12 months to complete.

This EIA has been developed based on the Term of Reference (ToR) issued by the Ministry of Transport, Housing and Environment (MTHE) of the Maldives on 7 November 2010. This document is submitted by the proponent to the Ministry of Tourism, Arts and Culture and MHTE to fulfil the requirements for an EIA under Article 5 of the Environment Protection and Preservation Act (4/93). The EIA Regulations 2007 have been used as the basis for developing this document.

The project is proposed by Shangri-La's Villingili Resort & Spa and the consultant for the EIA is CDE Pvt Ltd.

1.1 REPORT OUTLINE

This EIA is organised into the following sections. They are:

1. Executive Summary
2. Introduction
3. Project Description
4. Policy and Legal Framework
5. Existing Baseline Environment
6. Potential Impacts and Mitigation Measures
7. Assessment of Alternatives
8. Environmental Monitoring Program
9. Stakeholder Consultations
10. Appendices

1.2 PROJECT BACKGROUND

Villingili Island in Addu atoll was leased for the development of a tourist resort under the Third Tourism Master Plan. Shangri-La's Villingili is the first luxury resort in the Maldives to be located south of the equator. The resort has 142 rooms including private ocean retreats and tropical tree house villas – unique to the Maldives making it a premiere Maldives luxury resort. The resort is in operation since July 2009.

Guests can enjoy a tempting selection of dining and entertainment facilities, innovative treatments at CHI, The Spa at Shangri-La, and a variety of aquatic leisure activities, or explore by bicycle the five neighbouring islands connected by a 17-kilometre road. Those seeking an experience with a difference can enjoy a cruise on a luxury

yacht with lunch on the equator. The resort is a 70-minute flight from Malé and an eight-minute boat ride from Gan Airport on Addu Atoll.

With the set up of a golf course on the resort, guest experience is expeted to be further enhanced.

1.3 PROJECT OBJECTIVES

The main objectives of the project are to:

- Develop a golf course that will add to the guest experience and uphold the standard of the resort.
- Locate, design and operate a golf course that results in minimal impact to the natural environment of the island; and
- Comply with all Maldivian regulations and International obligations during both construction and operation phase of the project.

1.4 PROJECT SCOPE

The proposed project involves the development of a nine-hole golf course at the southern tip of the island. Details of the project description will be discussed in Chapter Two.

1.5 TERMS OF REFERENCE

This EIA has been prepared to the requirements established by the Term of Reference (ToR) issued for this project on 7 November 2010 (See Appendix 1 for the ToR).

1.6 EIA METHODOLOGY

The process followed in the preparation of this environmental impact statement consists of five components: scoping consultations; literature review; field surveys; analysis of results; and output.

The first step of the process covered consultations with client and government agencies to determine the scope of the impact assessment. The scope was decided and the ToR was finalised on 7 November 2010 based on the information contained in the EIA Regulations 2007. During this stage the client clearly outlined their development needs and assessment was geared to match the development plan and environmental assessment needs.

During the second stage, a literature review was conducted to acquire background information on the site and its environment as well as to identify possible environmental impacts of the proposed developments in similar island settings. In this context, the Draft Environmental Guidelines for Tourist Resort Development and Operation issued by the MTCA, the EIA Regulations 2007 and best practices from other resorts and golf course activities were considered.

The third stage involved field assessment in areas covered by the EIA scope. Conditions of the existing environment were analysed using established appropriate scientific methods. Coastal conditions were studied through field surveys which involved using GPS and echo-sound meters. Data from regional studies, particularly climate and wave data were used to assess environmental impacts.

Groundwater and marine water quality was assessed by laboratory analysis from the National Health Laboratory after collecting samples from different locations. Samples were collected in clean 500ml PET bottles after washing them with water to be sampled for non-bacterial parameters and in sterilized glass bottles for bacterial parameters.

The fourth stage involved in-house analysis using scientific analysis methods. These methods will be explained in detail in later sections.

The final stage involved compilation of individual consultant findings and consultations with the developer to adjust certain elements of the designs which were deemed to have significant affects on the operation of the islands and the resorts.

1.7 THE EIA STUDY TEAM

The team members of environment consultant team and their areas of contributions are listed in Table 1.2 below. Their CV's of are attached in Appendix 2.

Table 1.2: EIA study team and their areas of contribution

Consultant	Areas of Contribution
Dr. Simad Saeed	Team Leader, Social Scientist and Environmental Management
Ahmed Shaig	Coastal and Terrestrial Environment
Lubna Moosa	Environmental Management
Ali Moosa	Surveyor

2 PROJECT DESCRIPTION

2.1 PROJECT LOCATION

Villingili is located on the eastern rim of Seenu atoll at approximately 0°40'34.51"S latitude and 73°11'42.11"E longitude (see Figure 2.1). The width of the island is about 0.48 km and the length of the island is roughly 2.22 km. The total land area is approximately 46.94 ha. Vllingili is in close proximity to Gan International Airport at the southern tip of Seenu atoll.

Similar to other islands of the Maldives, Shangri-La's Villingili experiences a warm and humid monsoonal climate with two distinct seasons; dry season (northeast monsoon) and wet season (southwest monsoon). The dry season usually occurs from December to February and the wet season usually lasts from May to September. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November. The annual average rainfall recorded at Gan, the nearest weather station is 2277.8mm. Temperature remains almost same throughout the year although daily temperature ranges from around 31 degrees Celsius in daytime to 23 degrees Celsius in night-time. The relative humidity ranges from 73 per cent to 85 per cent. Winds are generally mild although, storms and line squalls can occur, usually in the period May to July.

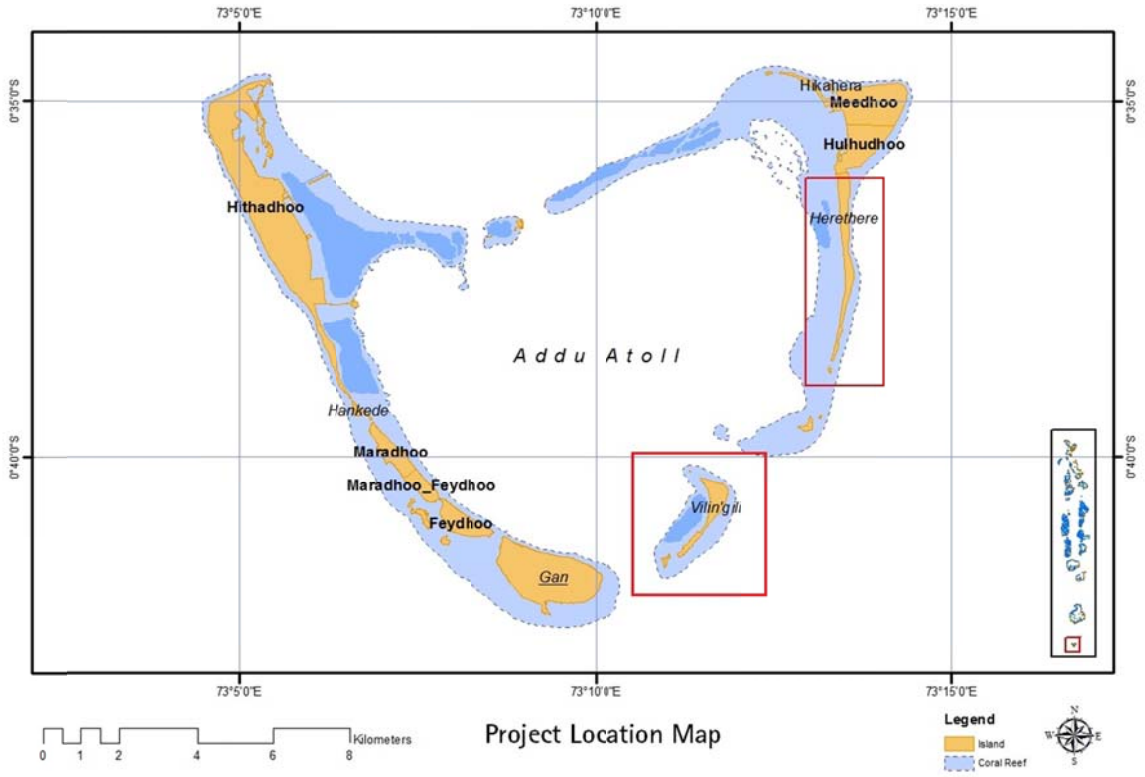


Figure 2-1 Location of Villingili (Circled in Red)

Source: Malways 2006

2.2 PROJECT NEED AND JUSTIFICATION

The project justification is two-fold:

1. Shangri-La at Villigili is located in the southern most atoll of Maldives making it costlier to access for tourists. The products offered in Shangrila-La therefore needs to expand to offer unique and more attractive activities to compete with the resorts in central Maldives. Hence, a Golf course is a unique product which will enhance the experience of high end clients who are looking for some extra activities, apart from water sports and standard land based sports activities like badmington and tennis.
2. With the introduction of land based rent system for resort islands, any land left unutilized will become a financial burden on the investment. The southern end of the resort is currently left unutilized and adds to the rent of the island. Hence, this piece of land needs to be developed to provide the maximum benefit to the resort but without compromising the environment.

2.3 SITE CONDITIONS

The existing environment of the proposed site has been heavily modified during the resort construction stage. This site was used as the temporary accommodation area for the workforce and as one of the temporary locations for material storage .Figure 2-2 below provides a comparison of the site before, during and after construction. Figure 2-3 shows the existing site plan.

The key modifications to the site can be summarized as follows:

1) Reclamation or back-filling

   Backfilling was undertaken on the demolished temporary accommodation zone and in the swampy wetland south of the mangrove area. About 75% of the area was filled. Material for backfill was dredge waste from the sea grass removal and neru dredging activity during construction. The low lying areas in this region were leveled and raised during the process. The mangrove vegetation and its brackish waters were left untouched, although the quality of the area is reported to have declined dramatically during the construction stage.

2) Vegetation clearing of the same area, including critical coastal vegetation.

   Backfilling also require vegetation removal. At least 60% of the total vegetation cover was removed. Much of the original vegetation comprised of strong salt resistant *Ironwood (Kuredhi)* species. Care was taken not to remove the mangrove vegetation.

3) Storage of backfill material in a mound about 2 m high.

   A large portion of the dredge waste was stored in a mound for potential future use. However, its use has been limited to-date and material is too coarse for general maintenance needs of the resort.

4) Construction of a staff training centre

   A staff team building area was constructed in the area during operation (see Fig 2 below).

5) About 15% of the area in consideration is also being used for waste management.

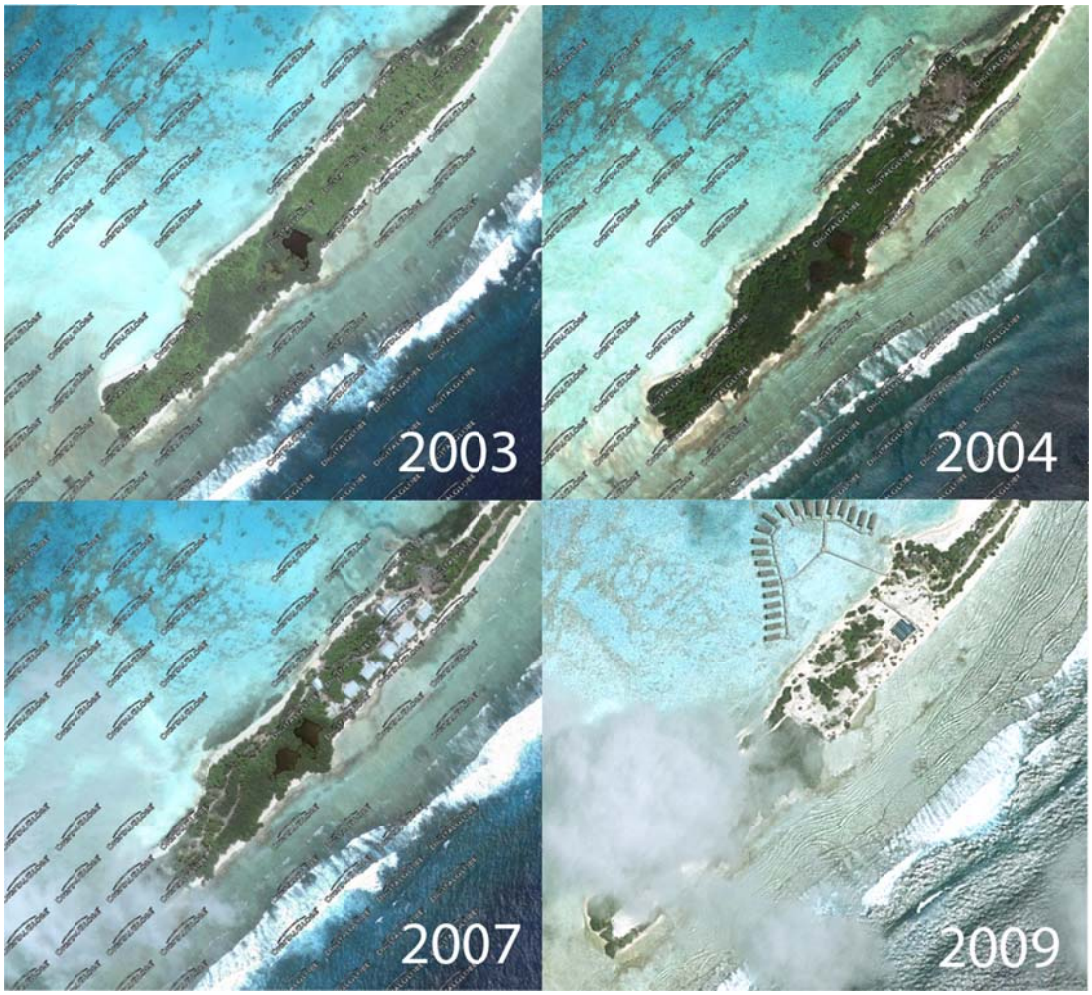


Figure 2-2 ***Temporal changes to the site before, during and after construction***

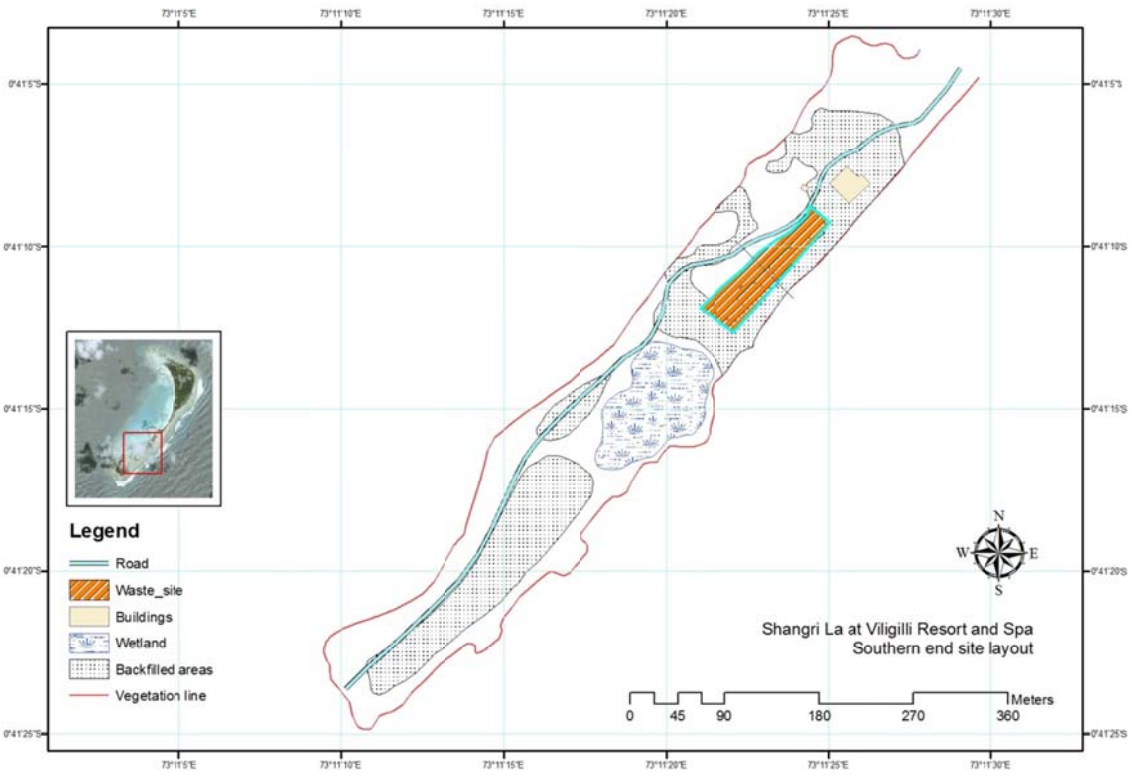


Figure 2-3 ***Existing site plan***

2.4 GENERAL DESCRIPTION OF THE PROJECT

The golf course will be constructed on approximately 7.5 hectares of land. The foot print of the of the golf course elements is 3.28 Ha . The course will consist of nine (9) holes, including Fairways, Greens, Tees and intermittent water features.

Appendix 3 provides the site plan of the golf course and Figure 2-4 shows a reduced version of the site plan.

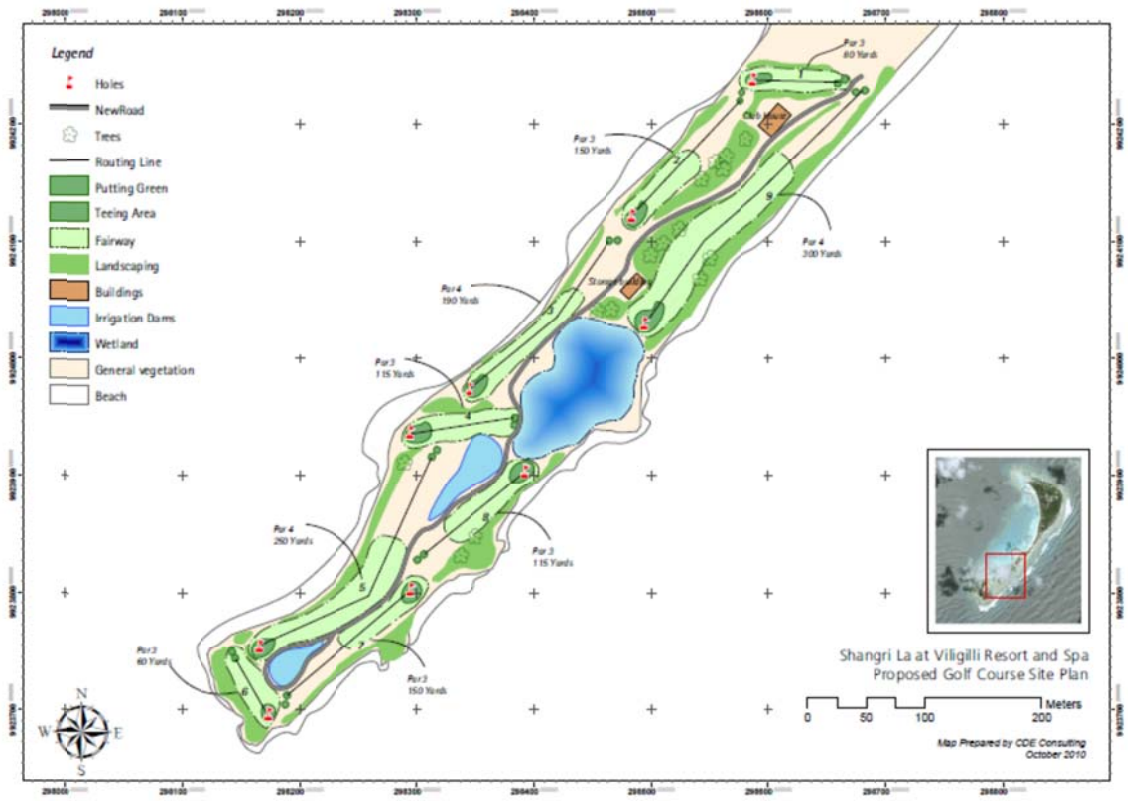


Figure 2-4 Site plan of the golf course

Table 2-1 shows the land use area for each component of the golf course.

Table 2-1 Land use area for each component of the golf course

Component	Area (sq m)	Area (Ha)
Tees	133	0.01
Fairways	26,360	2.64
Greens	2,015	0.20
Artificial lake	4,283	0.43
Sub-total of golf course	**32,791**	3.28
Club house	381	0.04
Storage building	212	0.02
Wetland	8,464	0.85

2.5 DETAILED DESCRIPTIONS

The major components of the project are:

- Site preparation
- Installation of the irrigation system
- Construction of the artificial pond
- Soil conditioning
- Grassing and landscaping
- Construction of the Clubhouse and Storage building

2.5.1 SITE PREPARATION

The golf course will consist of nine holes with intermittent water features and sand bunkers. The preparation for the area includes the steps outlined below.

Removal of Vegetation

The establishment of the golf course will involve clearing of vegetation approximately 15 m inland from the coastal area. There is a coastal vegetation belt of approximately 15 m on the oceanward side and 20 m on the lagoonward side. A minimum of 15 m in width of the existing coastal vegetation belt will be left intact.

The most significant vegetation in the area is the mangrove species, which has a national significance in terms of the ecosystem. These trees appear to be in a healthy condition and thriving. The integrity of the wetland will be maintained throughout the project and therefore none of the mangrove species will be cleared.

Grading, Excavation and Filling

Topography in the area will be modified to some extent to suit the elevations in the golf course concept. However, the changes to topography will be subtle and minimal and therefore extensive excavation and filling will be unnecessary. Sand will be sourced from the 2m high sand mound that was created from the previous backfilling activities during the construction of the resort.

In addition, excavation will be carried out to create the artificial pond which will act as the water dam for irrigation purposes. Excavation will be carried out on the 2 m high mound to a depth of 2.5 so that the excavation below actual ground level.

2.5.2 INSTALLATION OF THE IRRIGATION SYSTEM

The irrigation system will be installed during the preparation of the golf course. Water to the turf and other areas will be administered from the artificial pond using a drip irrigation system. Drip irrigation is also known as micro-irrigation or trickle irrigation and is used worldwide in agricultural, nursery, greenhouse, landscape and a variety of industrial applications. Below is a description of the components and the advantages of a drip irrigation system (The Toro Company 2007).

Components

Drip irrigation systems consist of emission devices serviced by a water distribution network that ideally includes control zone equipment. At the water source, water is controlled with automatic valves, sometimes amended with nutrients or chemicals, filtered and regulated at levels suitable for the emission devices chosen and plants being grown. From there, water is delivered to each of the emission devices through a network of PVC and PE pipes. The emission device, whether it is drip tape, a drip emitter, jet or micro-sprinkler, then delivers water and

nutrients to the soil where plant roots may nourish the plant. Figure 2-5 shows the layout of a typical drip irrigation system.

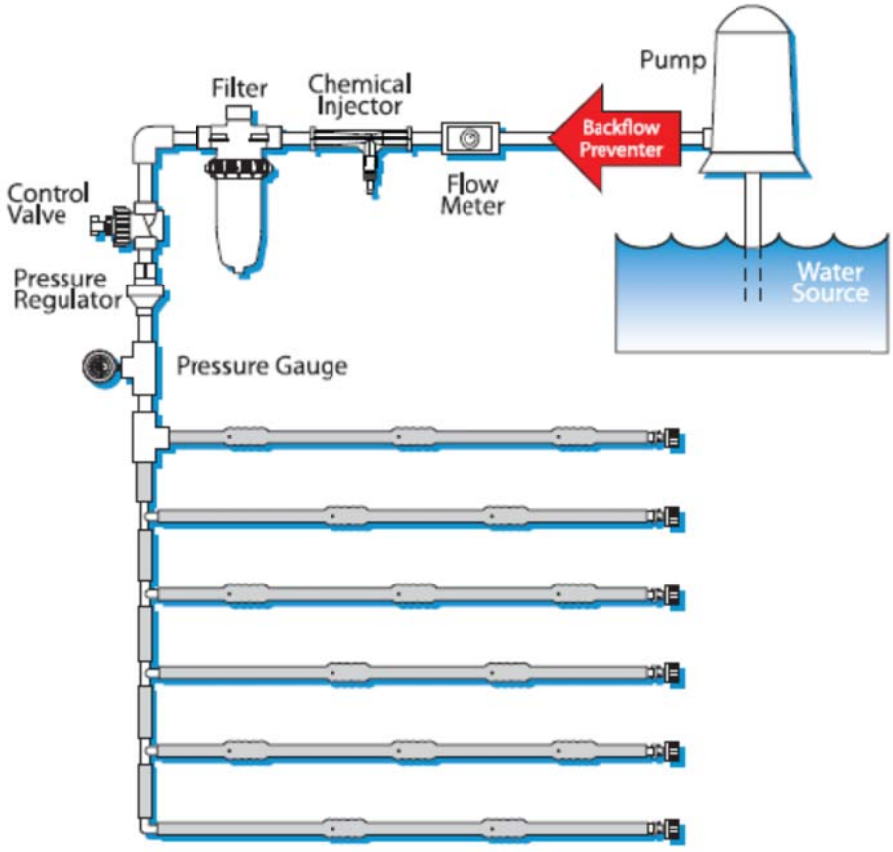


Figure 2-5 Layout of a typical drip irrigation system

Advantages

- Drip irrigation allows for targeted water applications, where runoff, leaching and wetting of non-targeted areas is avoided or completely eliminated.
- Drip systems are durable and are designed to withstand and perform in outdoor conditions.
- Drip emission devices are designed to deliver the same amount of water from each outlet, ensuring even distribution and high uniformity.
- Drip application rates can be tailored to fit the soil and plant type, allowing for flexible water applications above or below the soil surface.
- In addition to water, drip irrigation systems may be designed to efficiently deliver fertilizers and/or protective chemicals directly to the plant's root zone.
- Drip irrigation systems can be fully automated, offering an unprecedented degree of control over water and power costs, and over the crop's growing conditions.
- Drip irrigation provides superior uniformity, reduced evaporation, and less disease than other irrigation methods.

2.5.3 CONSTRUCTION OF THE ARTIFICIAL POND

An artificial pond will be constructed at the southwestern tip of golf course as part of the irrigation system. The pond will be 30 X 30 m in average with a depth of 2.5 m.

Golf Course Pond Lining

Pond Liners are a simple and cost effective way to prevent ponds from leaking. They are manufactured as soft flexible sheets of PVC plastic and can be joined together by heat welding the seams as needed to cover the determined area. These sheets are laid inside the dam/pond before filling it with water. The liner not only prevents water seepage from the dam, it also prevents osmotic water movement between ground water and the water in the dam/pond. This is of vital importance where dams/ponds have been filled with potable/clean water and are constructed near brackish or coastal regions as in the case of the Golf Course Project at Villingili Island.

Manufacturing Description

Polyvinyl chloride commonly abbreviated PVC.

Poly Vinyl Chloride or PVC is a thermoplastic made of 57% chlorine (derived from industrial grade salt) and 43% carbon (derived predominantly from oil / gas via ethylene). It is less dependent than other polymers on crude oil or natural gas, which are nonrenewable, and hence can be regarded as a natural resource saving plastic, in contrast to plastics such as PE, PP, PET and PS, which are totally dependent on oil or gas. Polyvinyl chloride is the third most widely produced plastic and in this form it is used in a variety of applications as indicated in Figure 2-6.

		PVC
		plain
Applications	Tank Linings	✓
	Pond & Lake Lining	✓
	Reservoir Lining	✓
	Reservoir Covers & Curtains	✓
	Groundsheets	✓
	Self Supporting Bags	✗
	Roofing & Decking	✓
	Contaminated Land Covers	✗
	Lorry Curtains & Tarpaulins	✓
Resistances	Water	✓
	Oils	✓
	Fuels	✗
	Acids	✗
	Alkalies	✓
	Gases	✗
	Standard Available Thickness	2mm

Figure 2-6 Characteristics of PVC pond liner

Figure 2-7 General Pond Liner Layout

2.5.4 SOIL CONDITIONING

The project involves conditioning of the soil in the areas where turf is to be planted. It is proposed to use a material known as zeolite for soil conditioning.

What is zeolite?

"Zeolite" is the name of a Group of safe, naturally occurring, environmentally friendly minerals that are aluminiosilicates with similar composition and characteristics. There are some 46 different minerals in the Group and only 4 of them have the absorption characteristics that render them of commercial value. The 4 useful minerals are clinoptilolite, mordenite, chabazite and phillipsite. Of these minerals clinoptilolite and mordenite are by far the most effective. **Castle Mountain Zeolites®** have the best of both Worlds with a mixture of both clinoptilolite and mordenite.

Natural Zeolites have an open box work crystal structure, which is occupied by cations and water molecules. These ions and water molecules can move within the large cavities allowing ionic exchange and reversible rehydration plus they have a very high micro-porosity and as their action is physical absorption and ion exchange

rather than a chemical reaction, the process can proceed virtually to completion rather than reach equilibrium. These special features of zeolites mean that they are invaluable in solving many environmental problems.

Features of Castle Mountain Zeolites in horticulture

- Traps, stores and slow releases applied fertilizers on demand, increasing the fertilisers efficiency.
- Reduced fertiliser loss through leaching or passing off as vapour.
- Reduces watering frequency.
- Friendlier environments for essential soil enhancing micro-organisms.
- Holds and stores water which remains available awaiting plant demand.
- Minimum deterioration in the soil and the zeolite remains available for future plantings.
- Results in healthier plants, increased growth and increased yields with vegetables.
- Recharging and slow release of both macro and micronutrients.
- Increased soil cation exchange capacity "CEC."

Castle Mountain Zeolites are particularly beneficial in acid sandy or loamy soils that have naturally poor nutrient and water retention abilities and where water is not reliably available. Further, a move towards ecologically sustainable technologies has increased the importance of Zeolites, a natural mineral with no known environmental downside.

It is important to place the zeolite within the root zone, rather than broadcast it. In this way, the zeolite is placed where it is most needed for the particular application. The rate should be 250 grams per square meter in garden beds and 10% of the mix in pots and tubs.

It is also important to recognize some of the other features of Zeolites. Zeolites are not in themselves a nutrient; they are simply a nutrient carrier or facilitator. The aluminium silicate structures of the Zeolites are insoluble, and therefore, once zeolites are applied to soils, they last literally for centuries. Zeolites should be considered as an asset, not a consumable.

Natural Zeolites have an open box work crystal structure, which is occupied by cations and water molecules. These ions and water molecules can move within the large cavities allowing ionic exchange and reversible rehydration plus they have a very high micro-porosity. These special features enables Castle Mountain Zeolites the ability to attract and absorb cationic materials such as plant nutrients for slow release.

2.5.5 GRASSING AND LANDSCAPING

Taking into account the advantages to the environment and the relatively low maintenance, the major turf grass proposed to be used on the Fairways, Greens and Tees is Seashore Paspalum (*Paspalum vaginatum*). Seashore Paspalum is a warm season perennial grass that is native to tropical and subtropical regions of North and South America. Native trees and shrubs will be used on the 'Rough' areas of the golf course.

2.5.5.1 CHARACTERISTICS OF SEASHORE PASPALUM

Seashore Paspalum is used on golf courses worldwide and is said be the most environment-friendly among the types of grass used for golf courses.

Paspalum was cultivated by the University of Georgia and released in 2001. Paspalum turf has the following advantages.

- **Drought Resistance -** Seashore Paspalum is highly drought resistant and can survive in an area that receives less than two hundred and fifty (250) days of rainfall per year. This is due to its extensive and deep root system. This will reduce the amount of water needed to meet the irrigation requirement for the golf course.
- **Adaptability to Coastal Environments** - One of the most outstanding characteristics of Seashore Paspalum (Paspalum vaginatum) is its ability to tolerate the physical conditions associated with coastal environments. This species is a native to sand dunes and therefore thrives in coastal areas. This species displays the highest salt tolerance of all turf grasses and is highly tolerant to saline soil conditions and salt spray.
- **Tolerance to Reclaimed Water** - Seashore Paspalum (*Paspalum vaginatum*) is also very tolerant to recycled, gray, and effluent wastewater. Therefore treated effluent from the sewage treatment facilities located on property may be used to irrigate the golf course without causing damage to the turf.
- **Herbicide Requirements** - This species has a high shoot density and is therefore more competitive against weeds and other grasses. This will reduce the amounts of herbicides that will be needed to maintain the golf course.
- **Pesticide Requirements** - Seashore Paspalum is less susceptible to insects and diseases as compared to other turf grasses, therefore reducing the amount of pesticides that has to be used during the maintenance of the turf.
- **Fertilizer Requirements** - Seashore Paspalum has nutrient uptake and utilization mechanisms which provide functional growth and development under very low nutrient imbalance situations. As compared to other turf grasses such as Bermuda grass, this species has a lower nutrient requirement and a higher and more efficient uptake system. This will reduce the amount of fertilizer that will be needed as compared to other species, to maintain a healthy turf.
- **Soil Versatility** - Seashore Paspalum is adaptable to a wide range of soil types. This species can survive in heavy to poorly drained soils. Therefore extensive soil conditioning at Villingili will be unnecessary.
- **Aesthetics** - Seashore Paspalum is soft with a cushioning texture that can help prevent skin abrasions, ankle and knee problems and 'turf toe' which are common ailments in golfing. It holds mowing stripe patterns and is much prettier than improved Bermuda grass.

2.5.5.2 TURF PREPARATION PROCESS

This project does not involve the establishment of a turf nursery at Villingili. Paspalum will be imported in the form of stolon. Below is a general description of planting, harvesting and packing for import of stolon.

Nursery Pre Plant Preparation

Before planting Methyl Bromide is applied at the rate of 500 pounds per acre. Once the field has been fumigated the ground is irrigated and monitored for seven days to make sure there are no visible signs of weeds or insects. A pre plant fertilizer and other site specific soil amendments are applied to the soil to create optimum growing conditions.

Nursery Planting

All varieties sold are certified by the Georgia Crop Improvement Association. Planting stock for newly planted varieties comes from a foundation plot that is typically located at a University or a government agricultural facility.

Newly planted farms are typically planted at a rate of six hundred bushels per acre and are typically ready to harvest in ninety to one hundred days. During the maturation of a newly planted farm it is inspected on a weekly basis by an independent inspector from the Georgia Crop Improvement Association. The goal of the inspections is to make sure that the crop is growing unencumbered from weeds, insects, disease and other foreign grasses.

Harvesting

Stolons for international shipping are harvested mechanically using a machine that pulls and shreds the stolons out of the ground. The machine digs the sprigs at a depth of one inch. Each variety has its own dedicated harvesting machine.

The harvester feeds the stolons into a dedicated dump truck that transports the stolons to the Turf International Processing Center.

Washing of Stolons

Most countries require that turf stolons imported into their country be washed free of soil. The International processing Center is a state of the art facility dedicated specifically for the sanitizing of turf grass for export purposes.

Once the stolons arrive at the processing facility they are manually loaded into the washing machine. As the machine rotates the stolons feed down the drum by gravity. The first section of the machine shakes loose soil from the plant matter while the section o the machine washes the grass completely free of soil and other debris.

Figure2-8 Stolon being wached and a sample of washed stolon just out of the washing machine

Sanitation

The stolons fall into large plastic bins from the washing machine. The stolons are then sprayed post washing with an Insecticide and fungicide mixture. Applications of pesticides are performed to the manufacturers label and requirements of State and Federal guide lines. Below is a list common pest and diseases and legal labeled pesticides for use on turfgrass in the State of Georgia in the United States. Please note that Nemacur is no longer produced in the United States. If nematodes are a concern please list the scientific name of the nematode and the USDA will perform a nematode assay on that particular pest.

Refrigeration

When the stolons are removed from the sanitation tanks they are immediately taken to a drive in refrigeration unit and allowed to hydro cool at a temperature of three degrees Celsius. Once the stolons reach a satisfactory moisture level they are moved into an indoor staging area for packaging. The staging area has a concrete floor and is swept clean everyday for sanitation purposes.

Packaging

The stolons are packaged in wax corrugated boxes that are sleeved with plastic liners. The stolons are manually placed into the boxes and are inspected a final time for foreign matter, insects, weeds, and disease. Once the boxes are full the plastic bag is vacuum sealed to pull out as much oxygen as possible.

Once the boxes are sealed they are labeled an placed back into the refrigeration unit. A temperature recording device is placed in every fourth box to track the temperature during the transit and to its final destination

Phytosanitary Certificates and Import Permits

Once the Turf Farm receives an import permit from the importing country it is immediately handed over to the state plant protection office located in Tifton, Georgia. The plant protection office will assess the permit and follow its requirements. If the importing country requires that the shipment be free of any particular insect, disease, or nematodes an officer will be dispatched to the farm and samples will be taken and placed in a sealed bag and sent to a laboratory for testing. If no pests are found then the plant protection office will notify the Turf Farm to proceed with the harvesting. An officer will be dispatched again during the washing process to inspect the stolons as they are being washed and sanitized. Finally the officer will return again during the packaging process. Random samples are taken from the packaged stolons for one more verification. Once the officer is confident that the shipment completely meets the importing countries requirements a Federal Phytosanitary Certificate is issued.

Certification

Turf Farms grow turfgrass certified by the Georgia Crop Improvement Association. For a turfgrass to become certified it must meet strict requirements for genetic purity. Inspectors from the Georgia Crop Improvement Association inspect our farms on a monthly basis. The inspectors look for weeds, disease, off type grasses and insects. If variety being inspected fails to meet the standards the field will be required to be taken out of production until the problem areas are addressed.

2.5.6 CLUBHOUSE AND MAINTENANCE AREA

The clubhouse and maintenance area will consist of an office, a storage, two toilets and a Pro Shop. Figure 2-9 shows the layout of the clubhouse and maintenance area.

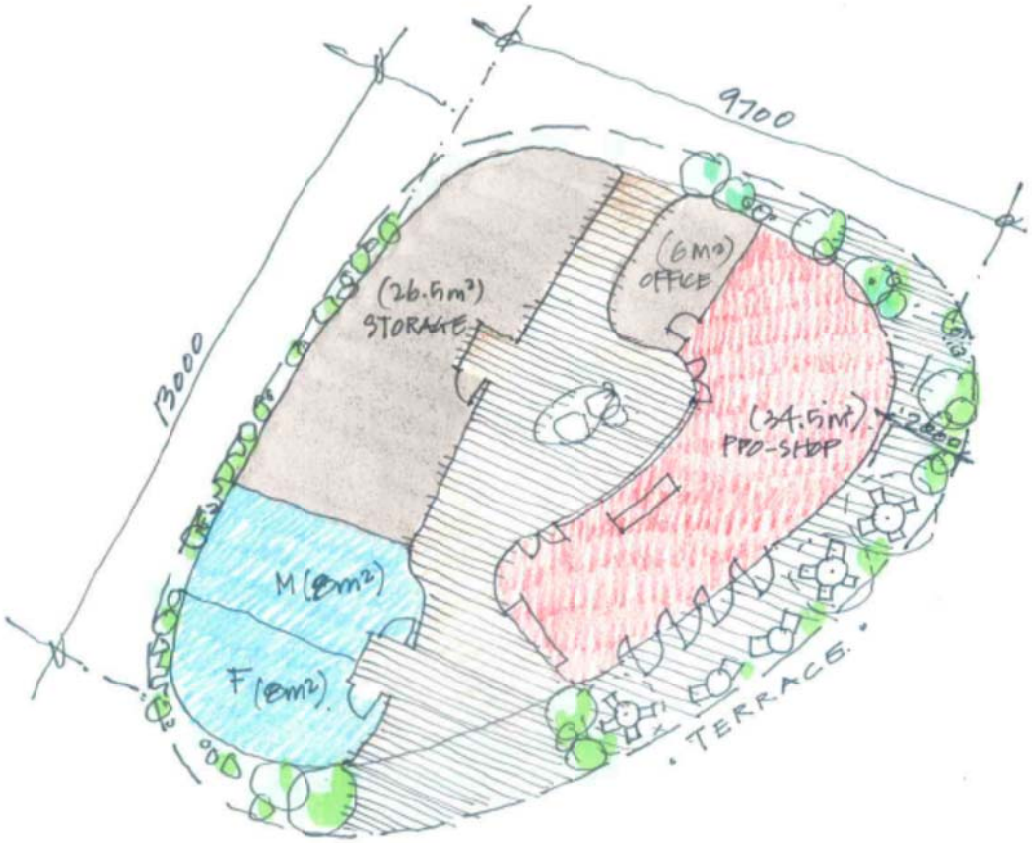


Figure 2-9 Layout of the clubhouse and maintenance area

2.5.7 OPERATION OF THE GOLF COURSE

2.5.7.1 OPENING HOURS

The golf course including the clubhouse will be open between the hours of 6:00 a.m. and 8:00 p.m. daily, seven (7) days per week.

2.5.7.2 STAFF REQUIREMENTS

The estimated number of staff required during operation is five with one golf course superintendent and four staff members.

2.5.7.3 MAINTENANCE

2.5.7.3.1 RECOMMENDED NUTRIENT MANAGEMENT

One of the advantages of Seashore Paspalum is that once the grass is established fertilization required id minimal. Brosnan and Deputy (2008) suggests the following nutrient management considerations.

- Optimum annual nitrogen fertilizer rates range between 5 and 8 lb per 1000 sq ft for golf course fairways, tees, athletic fields, and other landscape areas.
- Golf course putting greens should receive 3–6 lb N per 1000 sq ft annually.
- Soil tests should be conducted annually to determine other nutrient needs. Phosphorus fertilizer should be applied based solely on soil test recommendations. If deficiencies are not detected, phosphorus fertilization is not needed.
- Potassium fertilization affects seashore paspalum quality. Seashore paspalum is often grown in soils high in sodium that receive applications of calcium and magnesium to ameliorate soil chemical properties. In these instances, potassium can be thoroughly leached out of the rootzone. Potassium can also be deficient in soils that receive extra irrigation to leach salts through the rootzone.
- It is recommended that 3–8 percent of the soil CEC sites contain potassium. Fertilizers delivering a 1–1.5 : 1 ratio of nitrogen to potassium are recommended.

2.5.7.3.2 INSECT DAMAGE CONTROL

Damage to turf grass from insects such as crickets, sod webworms, spittlebugs, white grubs, billbugs, cut worms and fall army worms has been reported in different countries (Brosnan and Deputy 2008). Insecticides will need to be applied with regular observation to control damage from insects.

2.5.7.3.3 DISEASE CONTROL

Seashore paspalum is known to be affected by various turfgrass pathogens such as leaf spot diseases (*Helminthosporium* spp., *Bipolaris* spp., *Drechslera* spp.) fairy ring, fusarium blight (*Fusarium* sp.) and takeall patch (*Gaeumannomyces graminis*) (Brosnan and Deputy 2008). Following recommendations are made to minimize pathogen invasion (Brosnan and Deputy 2008):

- Avoid excessive nitrogen fertilization.
- Avoid late-afternoon or evening irrigation.
- Mow appropriately: do not scalp the turf and always keep mower blades sharp.
- Maintain adequate aeration and drainage throughout the rootzone.
- Manage thatch accumulation.

Chemicals appropriate to treat such invasions will be used regularly based on management observations.

2.5.7.3.4 WATER REQUIREMENTS

Following recommendations are made on the watering of Seashore paspalum (Brosnan and Deputy 2008):

- Irrigate early in the morning to minimize wind distortion.
- Deep, infrequent irrigation (no more than twice a week) is recommended for mature seashore paspalum stands to promote root development.
- Try to moisten the soil to a 6-inch depth with each irrigation event.
- Watering during the early morning hours will also limit the amount of time leaf tissue remains moist, reducing the likelihood of disease development.

2.6 PROJECT IMPLEMENTATION

2.6.1 TIMING AND COORDINATION

In general, the works are expected to be completed within 12 months.

2.6.2 MOBILISATION OF EQUIPMENT AND MATERIALS

Site mobilisation involves the mobilisation of construction equipment, materials and workforce to the island and providing necessary storage for materials and site access and services for the workforce.

2.6.3 WORKFORCE AND SERVICES

About five additional workers will be required during construction stage including one construction manager and four labourers. The workers will be accommodated at Villingili and therefore all workforce related services will be provided on the island.

2.6.4 UTILITIES

Existing utilities at Shangri-La's Villingili will provide water, electricity and sanitation facilities. Therefore set up of additional utilities will not be required.

2.6.5 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

Construction waste is expected to be minimal since major buildings are not included in the project. However, green waste is expected during site mobilization and most vegetation will be replanted in the area and the remaining will be composted at the existing waste management facility of the resort..

Other wastes would be general domestic waste arising from material consumption by construction workforce. These will be managed according to existing waste management plan of the resort. It would be the Contractor's responsibility to dispose of all construction-related waste during demobilisation along with any other waste. The Contractor will be required to clear all areas of work.

See chapter 6 on the proposed construction stage waste disposal plan

2.6.6 POLLUTION CONTROL MEASURES

The following measures will be taken to ensure minimal pollution during construction stage.

- Machinery will be properly tuned and maintained to reduce emissions and minimize risk of spills/leaks.
- Spill kits will be maintained around the islets to handle any liquid spills.
- All paints, lubricants, and other chemicals used on site will be stored in secure and bunded location to minimize risk of spill.

2.6.7 HEALTH AND SAFETY MEASURES

The contractor would ensure that Health and Safety procedures are complied with at all times.

- Construction activities would be carried out under the supervision of a suitably experienced person.

- All reasonable precautions will be taken for the safety of employees, and equipment will be operated by competent persons.
- Warning signs, barricades or warning devices will be provided and used.
- Necessary safety gear will be worn at all times.

2.6.8 FIRE PREVENTION

Fire extinguishing equipment would be readily available and employees will be trained in its use. In general, water-based fire extinguishers would be used.

Oxygen, acetylene or LPG bottles will not be left free-standing. All welding and cutting will be done in accordance to high safety regulations by experienced personnel.

2.7 PROJECT INPUTS AND OUTPUTS

The types of materials that will go into the development of the golf course, and from where and how this will be obtained are given in Table 2-2. It includes the type of outputs (products and waste streams) and what is expected to happen to the outputs.

Table 2-2 Inputs and outputs for the construction and operation stage of the golf course

Input resource(s)	Source/Type	How to obtain resources
	Construction Stage	
Construction workers	Local and foreign, mainly foreign	Recruiting agencies, etc.
Operational Staff	Mainly	Advertise in local papers, social networks, etc.
Construction material	Timber; Thatch for roof, electrical cables and wires, DBs and MCBs, PVC pipes, light weight concrete blocks, reinforcement steel bars, sand, cement, aggregates, telephone cable CAT 5, PVC conduits, floor and wall tiles, gypsum boards, calcium silicate boards, zinc coated corrugated metal roof, paint, varnish, lacquer, thinner, PVC lining, zeolite, water pump, turf etc	Import and purchase where locally available at competitive prices – Main Contractor's responsibility.
Water supply (during construction)	Desalinated water	Existing desalination plant
Electricity/Energy (during construction)	Diesel	Existing powerhouse
Electrical appliances/machinery	Energy efficient machinery and lighting; ozone-friendly refrigerators	Local suppliers

Telecommunications	Hotel Phone Systems, Fax Machines, E-mail and internet facilities	Local telecom company to provide telecom service
	Inputs during Operation	
Food and Beverage	Mainly imported sources except a few locally available products. Preference will be given to locally produced food items	Import and purchase locally
Paper Products	Tissue Roll, Tissue Boxes, Hand Tissues, Guest In-room Paper Amenities/ Brochures Office Use Paper Products	Local suppliers
Insecticides, pesticides, etc.	Imported pesticides	Local suppliers
Fire fighting equipment	Fire Pumps, Fire Protection System, Smoke Detectors, Carbon Dioxide and Foam Fire Extinguishers, etc.	Local suppliers
Golf gear	Golf clubs, balls, etc	Import
Water supply (during operation)	Desalinated water	Existing sewage treatment plant and existing desalination plant as an alternative
Electricity/Energy (during operation)	Diesel	Existing powerhouse
Maintenance material	Water, turf, fertilizer, pesticide, fungicide,	Import or purchase locally where available
Outputs during construction stage		
Construction waste (general)	Small quantities	Combustibles: Burnt/incinerated Others: Sent to designated landfill
Outputs during operational stage		
Chemicals	Minute quantities	Disposed at designated waste site
Garden wastes	Minute quantities	Composted on site and used as fertilizer

3 POLICY, PLANNING AND LEGAL FRAMEWORK

3.1 INTRODUCTION

This Chapter will provide a summary of the legal instruments applicable to the project and demonstrate how the project conforms to these aspects.

The main legal instruments of concern are the Environmental Protection and Preservation Act (EPPA) 1993, the Environmental Impact Assessment Regulations 2007, the Maldives Tourism Act 1999 and the Regulation on the Protection and Conservation of Environment in the Tourism Industry under the Maldives Tourism Act 1999.

3.2 RELEVANT LAWS

3.2.1 THE ENVIRONMENTAL PROTECTION AND PRESERVATION ACT (EPPA) 1993

The Environmental Protection and Preservation Act (EPPA) of the Maldives (Law No. 4/93) is an umbrella law that provides wide statutory powers to the Environment Ministry regarding environmental regulation and enforcement.

The EPP Act 1993 states that the natural environment and its resources are a national heritage that needs to be protected and preserved for the benefit of future generations and that the protection and preservation of the country's land and water resources, flora and fauna as well as the beaches, reefs, lagoons and all natural habitats are important for the sustainable development of the country.

The primary components of the EPP Act 1993 are:

Environmental Guidance

Guidelines and advice on environmental protection shall be provided by the concerned government authorities in accordance with the prevailing conditions and needs of the country. Hence, all concerned parties shall take due consideration of the guidelines provided by the government authorities.

Environmental Protection and Conservation

Formulating policies, rules and regulations for protection and conservation of the environment in areas that do not already have a designated government authority already carrying out such functions shall be carried out by the Environment Ministry.

Protected Areas and Natural Reserves

The Environment Ministry shall be responsible for identifying and registering protected areas and natural reserves and drawing up of rules and regulations for their protection and preservation.

Environmental Impact Assessment

An EIA shall be submitted to the Environment Ministry before implementing any developing project that may have a potential impact on the environment.

Termination of Projects

Projects that have any undesirable impact on the environment can be terminated without compensation.

Waste Disposal Oil and Poisonous Substances

Disposal of waste, oil, poisonous substances and other harmful substances within the territory of the Maldives is prohibited. Waste shall be disposed only in the areas designated for the purpose by the government. If such waste is to be incinerated, appropriate precaution should be undertaken to avoid any harm to the health of the population.

Hazardous/Toxic or Nuclear Waste

Hazardous / Toxic or Nuclear Wastes shall not be disposed anywhere within the territory of the country. Permission should be obtained for any trans-boundary movement of such wastes through the territory of Maldives.

The Penalty for Breaking the Law and Damaging the Environment

The penalty for minor offenses in breach of the EPP Act 1993 or any regulations made under this Act, shall be a fine ranging between Rf. 5.00 (Five Rufiyaa) and Rf. 500.00 (Five Hundred Rufiyaa) and for all major offences a fine not exceeding Rf. 100,000,000.00 (One Hundred Million Rufiyaa). The fine shall be levied by the Environment Ministry or by any other government authority designated by that ministry and shall depend on the seriousness of the offence.

Compensation

The government of the Maldives reserves the right to claim compensation for all damages that are caused by activities that are detrimental to the environment.

This EIA report will comply with the EPP Act 1993.

3.2.2 THE TOURISM ACT 1999

The Maldives Tourism Act 1999 encompasses the issues related to the development of tourism in the Maldives. This Act provides for the determination of zones and islands for the development of tourism in the Maldives including the leasing of islands for development as tourist resorts, the leasing of land for development as tourist hotels and tourist guesthouses, the leasing of places for development as marinas, the management of all such facilities and the regulation of persons providing such services.

The Act states that zones for the development of tourism in the Maldives, islands for development as tourist resorts and places for development as marinas shall be determined by the President.

The concept plan for the proposed project has been approved by the Ministry of Tourism (see Appendix 9 – concept letter from Tourism).

3.2.3 IMPORT EXPORT ACT 31/79

The Import Export Act of Maldives was adopted in 1979. The Act identifies the amount of duty to be paid by the party who import goods and services other than;

- Rice, sugar and flour,

- Holy Quran and parts thereof,
- Amount of duty exempted by the President from items brought by travellers,
- Amount of duty exempted by the President from items brought by private parties for minor use,
- Items imported into the Maldives for the business of re-export.

There are 97 chapters in the act which clearly identify the amount of duty that has to be paid. In chapter 28 (in organic chemicals), 29 (Organic chemicals) and 30 (plant fertilizers) have duty amount of 10%.

Exporting items naturally formed and produced in the Maldives, importing items into the Maldives, re-exporting, selling of imported goods, and operation of such activity shall be carried out with the permission of the Ministry of Trade, Industries and Labour, and in accordance with regulation made by that Ministry. Permission shall not be necessary for bringing items, amount of duty exempted by the President from items brought by travellers. And Items imported into the Maldives for the business of re-export.

The penalty for a person attempting to secretly import goods into the Maldives or secretly export goods from the Maldives shall be imprisonment, or banishment, or house arrest for a period between 4 months and 1 1/2 years, or a fine between the amounts Rf. 10,000/- and Rf. 100,000/-.

3.3 RELEVANT REGULATIONS

3.3.1 ENVIRONMENTAL IMPACT ASSESSMENT REGULATION 2007

The Environment Ministry issued the EIA Regulation in May 2007, which guides the process of undertaking the Environmental Impact Assessment in the Maldives. This Regulation provides a comprehensive outline of the EIA process, including the application to undertake an EIA, details on the contents, format of the IEE/EIA report, the roles and responsibilities of the consultants and the proponents as well as minimum requirements for consultants undertaking the EIA.

This EIA has been undertaken in accordance with the EIA Regulations 2007 of the Maldives.

Post EIA Monitoring, Auditing and Evaluation

The EIA Regulations 2007 provides a guideline of the environmental monitoring programme that should be included in EIA reports as monitoring is a crucial aspect of the EIA process.

Accordingly, the monitoring programme shall outline the objectives of monitoring, the specific information to be collected, the data collection program and managing the monitoring programme. Managing the monitoring programme requires assigning institutional responsibility, enforcement capability, requirements for reporting and ensuring that adequate resources are provided in terms of funds, skilled staff and the like.

The monitoring programme outlined in this report will comply with the EIA Regulations 2007.

3.3.2 REGULATION ON THE PROTECTION AND THE CONSERVATION OF ENVIRONMENT IN THE TOURISM INDUSTRY

The purpose of this Regulation is to protect the environment in the tourism industry and to encourage and facilitate sustainable tourism development in the Maldives. This Regulation has provisions for Protection of

Environment during Construction; Protected Species; Planting of Trees, Use of Fertilizers and Keeping Living Species; Waste Management; Storage of Water and Sewage and Waste Water Treatment.

In addition, the penalties for breaching any provision under this Regulation are specified. The Regulation states that depending on the seriousness of the non-compliance, a fine of between MRF 1000.00 and MRF 10,000.00 would be charged in the first instance. Parties repeatedly in non-compliance should be liable to a fine between MRF 50,000.00 and MRF 100,000.00. Further, if non-compliance of a provision occurs more than once, the Tourism Ministry reserves the right to revoke the licence.

Following are the provisions under the Regulation:

- Protection of Environment during Construction
- The Regulation states that permission needs to be obtained from the Tourism Ministry prior to carrying out any of the activities specified below;
- Dredging of lagoon and reclamation of land
- Construction on beach and lagoon
- Beach enhancement by pumping sand
- Construction of breakwater
- Construction of sea wall, revetment or groyne
- Dredging of lagoon or reef for safe access
- Dredging of reef
- Felling of trees
- Importing and exporting living species
- Conducting research of land, sea and lagoon
- Demolition of a building or a facility
- Any activity that may adversely affect the vegetation or fresh water lens of the island
- Any activity that may cause damage or adversely affect the environment.

In making an application to obtain permission to carry out any of the above activities, the applicant must submit the details of the activity together with a site plan of the island or designated area. The site plan must be of reasonable scale and must include the beach toe, vegetation line, high tide line, low tide line, reef crest line and the deep lagoon line. Furthermore, an EIA report prepared in accordance with the EPP Act 1993 shall be submitted to the Tourism Ministry before the commencement of any of the above activities or any construction project.

Accordingly, this EIA fulfills the requirements of the Tourism Ministry and the proposed project activities will commence in accordance with the Decision Statement.

Protected Species and Areas

In an island or land leased for tourism development in the Maldives, protected birds or marine living species are prohibited to be caught or kept in cages or other enclosed space. Also it is prohibited to carry out any activity that would harm the protected living species such as shifting their habitat.

Furthermore, in taking tourists to diving areas, no harm should be caused to the marine flora or fauna of the Maldives and extraction or removal of any item from such places is strictly prohibited. While diving with tourists, if any item or place of historic or cultural significance is found, it should be reported to the Tourism Ministry without causing damage to such item or place.

The proposed project is not carried out in a protected area and it will not have any effect on any protected areas. In addition, the proponent of this proposed project is fully aware of the legal aspects of protected species and areas, hence is committed to comply with the regulation.

Planting of Trees, Use of Fertilizers and Keeping Living Species

Prior to importing soils and chemicals for the use of pesticides and fertilizers for use in an island or land leased for tourism development, a written permission must be obtained from the relevant government authorities. Furthermore, a written permission must be obtained from the Tourism Ministry before planting or using any plant imported for use in an island or land leased for tourism development. Particulars of trees so planted must be informed to the Tourism Ministry.

In case any disease or fungus is found in any plants, it must be reported to the relevant government authorities and measures to remedy the problem must be carried out in accordance with advice and instructions from such authorities. In addition, written permission and instructions should be obtained from the Tourism Ministry prior to importing or exporting of any living species in an island or land leased for tourism purpose.

The proponent of this proposed project is aware of these legal aspects and is committed to comply with the regulation.

Waste Management

In all resorts, marinas, picnic islands or such places leased for tourism purposes, bins to collect waste should be kept in various locations in an easily accessible manner. Such bins should be in a clean and sanitary state, with the lid closed. Also, food and beverages, putrefying items, plastics, glass, paper, iron and items such as cans and toxic or hazardous waste should be kept in separate labeled bins for each type.

Waste disposal in resorts, marinas, picnic islands or such places leased for tourism purposes shall be carried out in a manner that would have the minimal negative impact on the environment and in accordance with the laws and regulations as well as in accordance with the following rules prescribed by the Tourism Ministry;

Incinerators, compactors and bottle crushers should be kept and used in all tourist resorts operating in the Maldives.

Waste should be disposed to the designated area if there is such an area in the region. In the absence of a designated area, waste should be disposed in a manner that is least harmful to the environment.

In the absence of a designated area for waste disposal in the region, only food waste and biodegradable waste may be dumped into the ocean. Accordingly, any such waste dumped must be dumped to the sea outside of the atoll, taking into account wind and ocean currents so that it would not land on the shores of islands.

It is prohibited to burn waste generated from the operation of the resort in the open areas of the resort. Incinerators should be used to dispose such waste. Items that would cause emission of noxious gases into the atmosphere when burned (e.g plastics) should not be burnt and should be collected and delivered to a designated waste management area.

Information relating to particulars of vessels, including the capacity and proper logs on trips made for waste disposal in an island or land leased for tourism purpose should be submitted to the Tourism Ministry.

It is prohibited to pump any sewer or waste into lagoons or into any protected area of the ocean from any tourist vessel.

Every tourist vessel should have a system for collection and keeping of waste generated in the vessel until such waste is taken to a designated place for deposition of waste.

The proponent of this proposed project is aware of these legal aspects and is committed to comply with the regulation.

Storage of Water

Every tourist resort should have a desalination plant for the purpose of provision of clean and safe water sufficient for use in the resort. Accordingly, the plant should be registered with Maldives Water and Sanitation Authority in accordance with the 'Regulation on Desalination Plants' and should comply with such regulation in the operation of the plant. Hence, the quality of water generated from the desalination plant should not be lower than that set by the relevant government authority and daily logs relating to the quality of water should be recorded and maintained.

At every resort, marina, Picnic Island or other place made for tourists, for use of tourists, staff and for all its purposes, clean and safe water that would be sufficient for five days should be stored.

Ground water taken from any resort, picnic island or marina should not be used for drinking by tourists or staff and should not be supplied to guest rooms or toilets of guest rooms or for use by staff. It is prohibited to conduct any activity that would contaminate the water table of the island. Furthermore, any type of oil or any other chemical which may damage the environment should not be drained to the ground.

The proponent of this proposed project is aware of these legal aspects and is committed to comply with the regulation.

Sewage and Waste Water Treatment

Sewage should be disposed in a manner that is least harmful to the environment. Accordingly, in establishing a system for sewage treatment, the following should be taken into consideration;

The sewage system should be established in a manner that would not reach food or living species

The sewage system should be established away from the face of the island

There should be no leak from the sewage system

It must be ensured that unpleasant smells or other nuisance are not caused. Hence, a pipe for allowing the smell out should be kept where septic tanks are used and all septic tanks should be properly covered

Sewage water from the toilets should not be drained into the ground. Also, treated sewage water should not be pumped into the lagoon after treatment.

If sewage water is pumped into the sea, it should only be carried out at night and should be pumped out of the reef of the island

Sewage water from toilets in tourist vessels should be deposited into a tank suitable for that vessel instead of pumping directly into the sea. The tank should be emptied at mid ocean.

The proponent of this proposed project is aware of these legal aspects and is committed to comply with the regulation.

3.3.3 BY LAW ON CUTTING DOWN, UPROOTING, DIGGING OUT AND EXPORT OF TREES AND PALMS FROM ONE ISLAND TO ANOTHER

In pursuant to the Environment Protection and Preservation Act of Maldives 1993, the Environment Ministry made a bylaw with the purpose of educating developers about the importance of trees including best management practices for maintaining trees and provide standards for preservation of trees in the Maldives and set down rules and regulations to be adhered to prior to commencing felling, uprooting, digging out and exporting of trees and palms from one island to another in Maldives.

The by law states that the cutting down, uprooting, digging out and export of trees and palms from one island to another can only be done if it is absolutely necessary and there is no other alternative. It further states that for every tree or palm removed in the Maldives two more should be planted and grown in the island.

The by law prohibits the removal of the following tree types;

- The coastal vegetation growing around the islands extending to about 15 meters into the island
- All the trees and palms growing in mangrove and wetlands spreading to 15 meters of land area;
- All the trees that are in a Government protected areas;
- Trees that are being protected by the Government in order to protect species of
- Animal/organisms that live in such trees; and
- Trees/palms that are abnormal in structure.

The proponent of this proposed project is aware of these legal aspects and is committed to comply with the regulation when bringing plants for landscaping the site.

3.4 REGULATION ON CONSERVATION OF OLD TREES

This regulation provides guidance on protecting and conserving the old trees that are found in the Maldives. The regulation came into force on 05th June 2007.

Deforestation and cutting down of significant number of old trees a have being observed in the Maldives, some of these trees are unique in their own way, which makes them a must to be protected and preserve for the future generation.

There are different types of the old trees that are being protected and preserved under this regulation

- The age of trees
- Number of endangered trees specific to the islands
- Significant trees in the environment
- Trees protect or preserved on communities will.

The project does not involve felling of any mature trees.

3.5 PLANT QUARANTINE REGULATION

This regulation has been made to control the importing and exporting of plants, plant products, timber and anything that may adversely affect plants.

The main objetive of this regulation is to control the importing to the Maldives of origins of plan disease and plant pests. Further to protect Maldivian plants from the said types that may be imported to the Maldives with plants and parts of plants. Further to work towards exporting plants and parts of plants from the Maldives in accordance with international sanitary and phytosanitary standards.

The regulation states the condition and characteristics of the ornamental plants, consumption plants, medicinal and herbal, plants not commonly found in the Maldives for importing, meanwhile sating that it as mandatory to submit a phytosanitary certificate during the collection of consignment.

The regulation also specifies about the prohibited import of plants, insects, micro-organisms, bacteria and other organisms to the Maldives, unless they are being imported for an economic value.

The proponent will seek permission of Ministry of Fisheries and Agriculture in importing the grass as required.

3.6 RELEVANT POLICIES

3.6.1 WASTE MANAGEMENT POLICY

The aim of the waste management policy is to formulate and implement guidelines and means for solid waste management in order to maintain a healthy environment. Accordingly, the key elements of the policy include:

Ensure safe disposal of solid waste and encourage recycling and reduction of waste generated;

Develop guidelines on waste management and disposal and advocate to enforce such guidelines through inter-sectoral collaboration;

Ensure safe disposal of chemical, hazardous and industrial waste.

3.7 RELEVANT ACTION PLANS

3.7.1 NATIONAL ENVIRONMENTAL ACTION PLAN III (NEAP III)

The Third National Environment Action Plan (NEAP III) of the Government of Maldives sets out the agenda for environmental protection and management for the period 2009 till 2013. NEAP III provides the basis for environmental planning, budgeting, performance measurement and accountability. The key target of NEAP III is to achieve measurable environmental results that matter to the people of the Maldives.

NEAP III provides the following principles to be adhered to in environment protection and environmental management.

1. **Environmental protection is the responsibility of every individual.** Protection of the natural environment and practicing environment friendly lifestyles is a responsibility of every Maldivian.

2. **Achieve results.** The actions, activities, regulations, supervision, reporting, incentives, information and advice for environmental management shall be directed and well co-ordinated to achieve the results the citizens want.

3. **Promote and practice sustainable development**. In environmental management the principle of sustainable development shall be followed. Conditions shall be created to give equal distribution of environmental goods and services both geographically and between generations including future generations. Special attention shall be given to address the concerns of the most vulnerable groups in the population.

4. **Ensure local democracy**. In environmental management the actions and decisions shall be taken and authority exercised at the most appropriate level.

5. **Inter-sectoral co-ordination and co-operation**. Co-ordination and co-operation is essential from all sectors. For environmental management all should work informatively and co-operatively toward the goal of integrating environmental aspects into the goals and actions of all sectors.

6. **Informed decision making**. Actions for environmental management should be based on documented facts to as great extent as possible and not to pursue self interest or short term gains.

7. **Precaution first**. Where there is threat of irreversible damage and when the factual basis is inadequate or uncertain, the precautionary principle shall apply.

8. **Continuous learning and improvement**. Favourable conditions shall be created for continuous learning and improvement in the work with environment management at the national, regional and local level

9. **Right to information and participation**. The citizens have a right to information about status of the environment as well as the right to participate in decisions affecting their environment. They also have the right to actively participate in protecting the environment.

10. **Environmental protection complements development**. Environmental protection efforts shall not be portrayed as competing with the development needs and aspirations of the present people. Healthy debate about values as they relate to ecological and social sustainability shall be encouraged.

More importantly, NEAP III consists of the following six strategic results that shall be attained during the period 2009-2013:

- Resilient islands,
- Rich ecosystems,
- Healthy communities,
- Safe Water,
- Environmental Stewardship, and
- Carbon Neutral Nation

The proponent is aware of NEAP III and is committed to work with the 10 guiding policies and towards achieving the strategic results of NEAP III.

3.8 RELEVANT INTERNATIONAL CONVENTIONS, TREATIES AND PROTOCOLS

3.8.1 INTERNATIONAL PLANT PROTECTION CONVENTION

The Maldives has become a party to the International Plant Protection Convention (IPPC) as a step to protecting native plant species in the Maldives from the risk of diseases introduced by imported plant varieties. The Maldives adhered to the IPPC on 3 October 2006 and the Convention requires that certificates of phytosanitary

condition and origin of consignments of plants and plant products be used for import and export of plants and plant materials. Contracting parties have the full authority to regulate entry of plants and plant products and may prescribe restrictions on imports or prohibit importation of particular plants or plant products.

The proponent is aware of the convention and will follow formal procedures in importing the grass for the turf of the golf course.

3.8.2 UNITED NATIONS CONVENTION ON CLIMATE CHANGE (UNFCCC) AND THE KYOTO PROTOCOL

The UNFCCC is an "overall framework for the intergovernmental efforts to achieve stabilization of greenhouse gas concentrations in the atmosphere at a low level enough to prevent dangerous anthropogenic interference with the climate system, recognizing that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases."

The Proponent is aware of the UNFCCC and Kyoto Protocol and is committed to implement measures to reduce/avoid greenhouse gas emissions into the atmosphere by any of the proposed development activities.

3.8.3 UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY (UNCBD)

The objective of the UNCBD is "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies and by appropriate funding."

Maldives was one of the first nations to ratify the UNCBD. In 2002, Maldives developed the National Biodiversity Strategy and Action Plan (NBSAP) through wide consultation and extensive stakeholder participation.

The proponent is aware of the UNCBD. Hence while carrying out any of the proposed development activities, the proponent is committed to implement measures to achieve the goals of the convention

3.8.4 UNITED NATIONS CONFERENCE ON DESERTIFICATION (UNCCD)

The objective of UNCCD is "to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas."

The Convention calls for improved productivity of land and the rehabilitation, conservation and sustainable management of land and water resources in order to improve the living conditions particularly at the community level.

The proponent is aware of the UNCCD. Hence while carrying out any of the proposed development activities, the proponent is committed to implement measures to achieve the goals of the convention

4 EXISTING BASELINE CONDITIONS

4.1 INTRODUCTION

This section assembles, evaluates and presents baseline data on the relevant environmental characteristics of the study area and comprises of the following subsections based on the Terms of Reference:

1. Study Methodologies
2. Physical Environment
    a. Climate including rainfall, wind, wave and tides
    b. Topography of the project site
    c. Groundwater quality
3. Biological Environment
    a. Description of the wetland
    b. Marine water quality
    c. Existing vegetation and removal of vegetation

4.2 STUDY METHODOLOGIES

Baseline environment of the study area were analysed by using standard scientific methods. The environmental components of the study area were divided into physical, biological and socioeconomic environment. The physical environment covers existing modifications to the island, meteorology, hydrology, water quality, soils and hydrogeology. Biological environment assessment covered marine environment, terrestrial environment and wetland habitats. Marine environment particularly covers lagoon habitats and seagrass patches of the site. Terrestrial environment covered the existing vegetation and fauna of the site. Particular attention was placed in detailed surveys of vegetation, fauna and ground water, as these components are likely to involve the most significant environmental impacts.

4.3 STUDY AREA BOUNDARY

The study area covers the southern half of Villigili Island. Figure 4.1 below shoes the specific study area. Details of the survey locations are presented in Appendix 4.

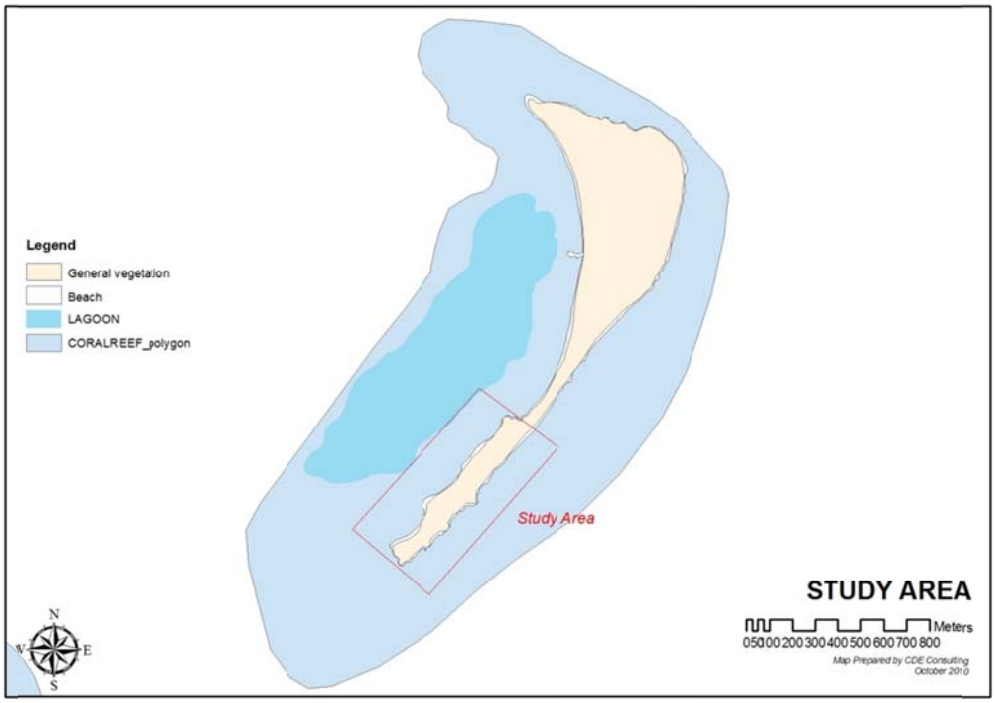


Figure 4-1 Study area

4.3.1 TERRESTRIAL FLORA AND FAUNA

The vegetation of the island was mainly studied using line transect method. Vegetation types along the lines were recorded for their abundance in that particular location. Coastal vegetation was surveyed by walking along the coastline.

In addition to the transect method, remote sensing technology was used to map and classify the main groups of vegetation. High resolution satellite images were used in the classification along with ground-truthing activities in the field.

Terrestrial fauna was studied by visual observation and community knowledge.

Additional Information on the flora and fauna was collected using the comprehensive vegetation survey undertaken on the island by Spicer and Newbery (Spice and Newbery, 1979).

4.3.2 AQUATIC RESOURCES

Groundwater quality of the site was assessed by taking samples from the well on the site. Samples were collected in clean 1500ml PET bottles after washing them with water to be sampled. Also to test for biological content (faecal coliform), samples were collected in sterilized 100ml glass bottles provided by the National Health Laboratory. Parameters tested were electrical conductivity, pH, Dissolved Oxygen (DO), nitrate, nitrite,

phosphate, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD) and feacal coliform. All parameters were analysed at the National Health Laboratory.

Wetland environment flora and fauna was assessed using visual observation and transect surveys.

4.4 PHYSICAL ENVIRONMENT

4.4.1 THE GEOLOGIC AND GEOMORPHOLOGIC SETTING

Based on studies conducted elsewhere in Maldives, it is estimated that the islands were formed between 3000 (Woodroffe, 1993) and 4000 (Kench et al., 2005) years B.P. (before present). Villigili Island, based on evidence from its lush vegetation system, is believed to be amongst one of the oldest islands in Maldives (Stoddart, 1966). The oldest part of the island may lie in the wider northern half of the island. The narrower southern half is believed to have been formed due to the natural merging of two smaller islands in the early Twentieth Century (Maniku, 1990). A survey done in 1836 showed that the southern half of the island had two separate sections. These areas were merged by 1900 (Gardiner 1903, 318). Much of the island remained fairly stable over the last 50 years but significant changes (erosion) occurred on the southern half of the island. The island had generally grown northward, which is evident from the wider northern section and the narrower southern section.

There are distinct morphological characteristics between the oceanward (eastern) and lagoonward (western) shoreline. The oceanward shoreline is characterized by coral rubble, very coarse beaches and solidified beach rocks. In addition, the lagoon is shallow and wave activity is constantly strong, except during low tide. The lagoonward side, on the other hand, comprises of fine to coarse sediments, and is relatively protected from strong wave activity. The present beach system on the western side has been created using beach replenishment, with sand imported from another reef system.

The area proposed for golf course development has a history of geomorphological instability as shown in Figure 4-2. The unstable areas are mainly along the southern and lagoonward shoreline, where considerable changes to coastline have occurred in last 40 years. Much of the region has remained stable, however. This aspect of the environment will have implications for coastal modifications in this area. In particular, the removal of coastal vegetation should be carefully considered as it is a major contributor in holding the shoreline together.

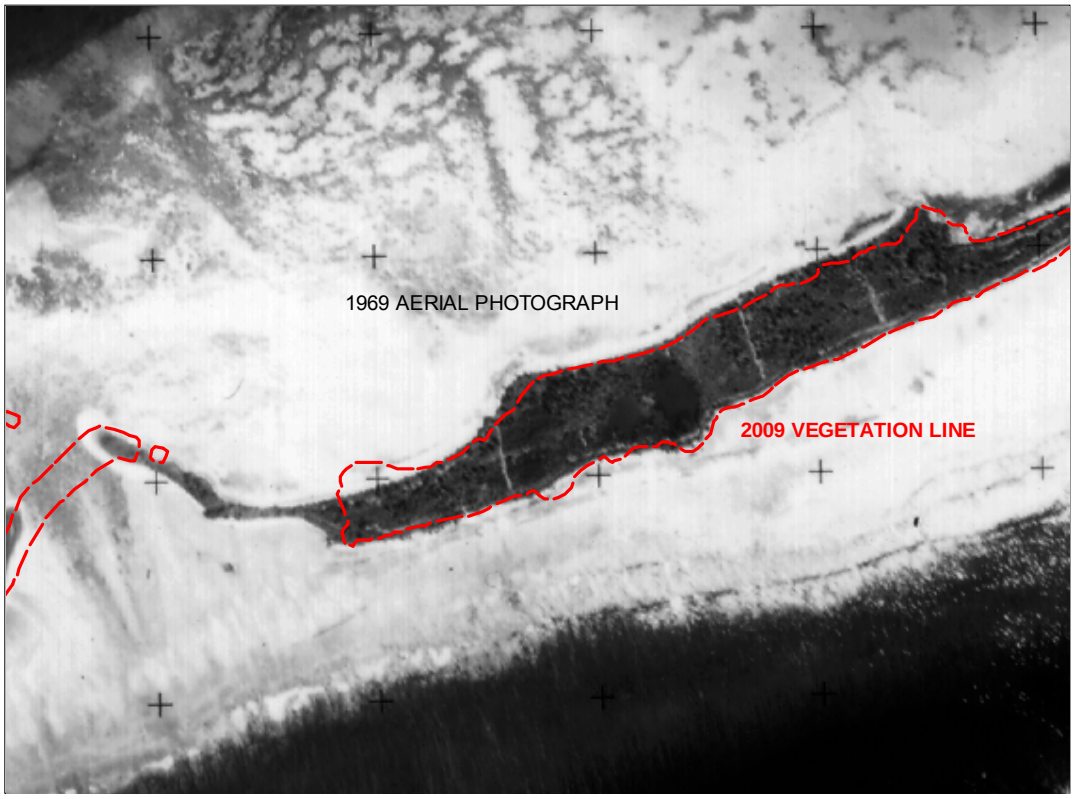


Figure 4-2 Comparison of an aerial photograph taken in 1969 with 2009 vegetation outline.

4.4.2 CLIMATIC SETTING

The climate of Villigili Island is generally affected by monsoons. The monsoons are usually characterized by rainfall and wind patterns. The north east monsoon (Iruvai) is regarded as the dry season with winds approaching predominantly from north to northeast. NE monsoon generally occurs between December and March. The Southwest monsoon (Hulhangu) is regarded as the rainy season with strong winds and rain approaching from Northwest to Southwest.

Temperatures variations are negligible throughout the year. The mean annual temperature is 28^{o}C and varies between 25^{o}C and 31^{o}C.

The average annual rainfall for the region is 2400 mm, which is the highest in the Maldives. Rainfall is highest between May and January, and lowest during February and March.

Figure 4-3 below summarizes the general climate characteristics of Villigili region.

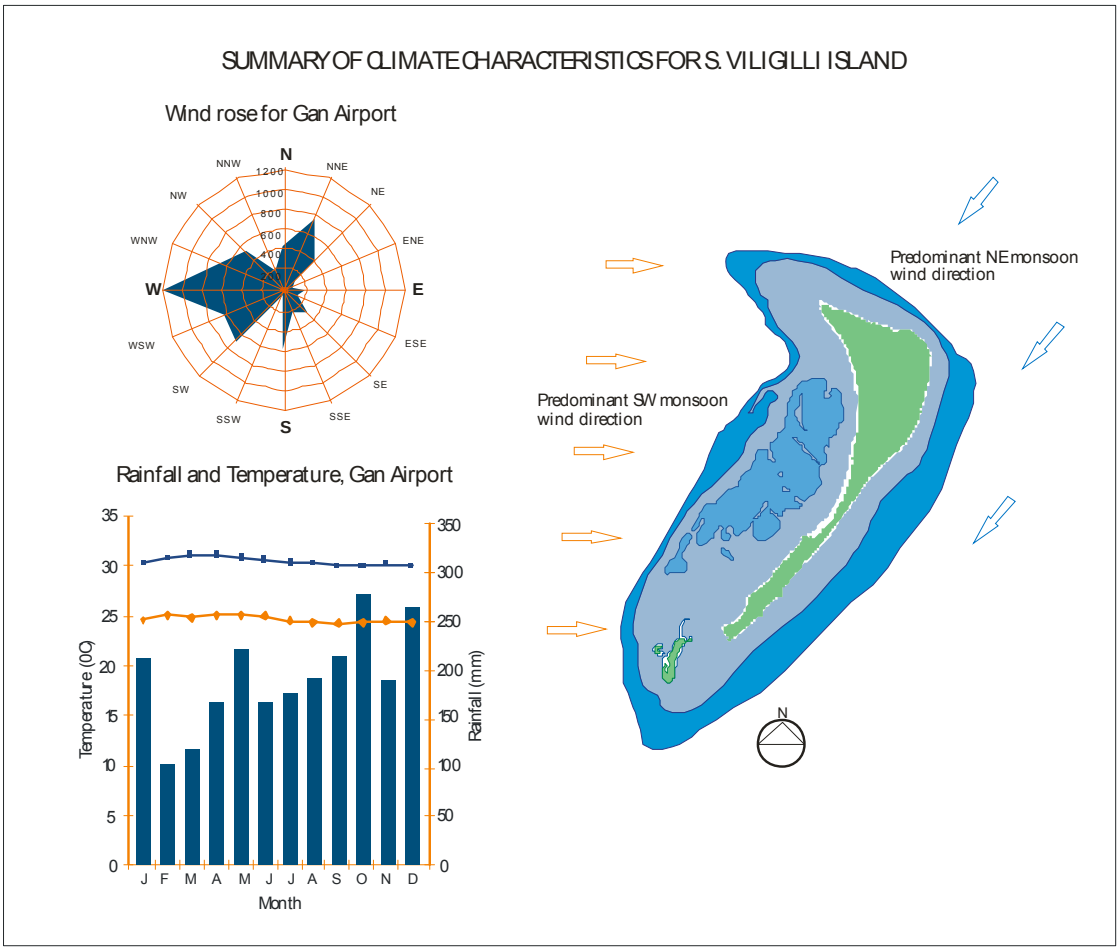


Figure 4-3 Summary of climate characteristics for Villigili Island.

The main impacts from the climate concerned with the development are rainfall, wind and temperature.

4.4.2.1 RAINFALL

Average annual rainfall for Gan (the nearest weather statio) is 2299.3 with a standard deviation of 364.8 mm. Gan has the highest average annual rainfall in the Maldives with 230 mm higher than the northern half of Maldives.

Year to year variation in Gan is very large and it varies from +38.5% in 1978 to –32.6% in 1999 as shown in Table 4-1.

Table 4-1 Rainfall with percentage departure from normal by station

Hanimaadhoo	**Gan**	
Years	Rainfall (mm)	%Dev
1975	-	-

1976	-	-
1977	-	-
1978	3185.7	38.5
1979	2251.3	-2.1
1980	1812.5	-21.2
1981	2012.9	-12.5
1982	1980.8	-13.9
1983	2401.9	4.5
1984	2286.2	-0.6
1985	2307.3	0.3
1986	2194.8	-4.5
1987	2375.4	3.3
1988	2251.6	-2.1
1989	2482.2	8.0
1990	2432.3	5.8
1991	2870.8	24.9
1992	2415.0	5.0
1993	2133.2	-7.2
1994	2837.4	23.4
1995	2402.5	4.5
1996	2031.6	-11.6
1997	2132.7	-7.2
1998	2384.0	3.7
1999	1548.8	-32.6
2000	2131.0	-7.3
2001	2066.7	-10.1
2002	3056.5	32.9
2003	1887.2	-17.9
2004	2209.5	-3.9

Source: Disaster Risk Profile of Maldives

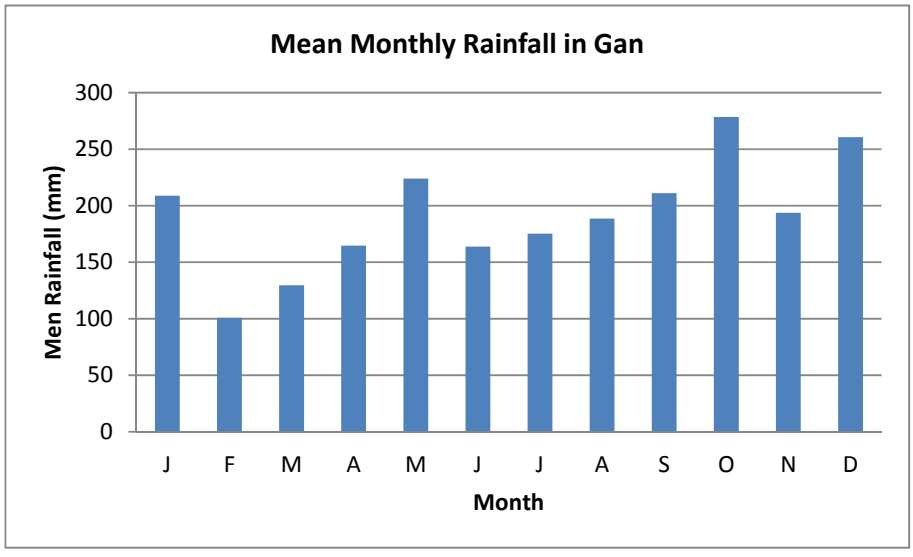


Figure 4-4 Mean monthly rainfall of 3 stations

Mean monthly rainfall is presented in Table 4-1 and Figure 4-4. Gan islands show bi-modal characteristics with primary peak in November (Hulhule) and October (Gan) and secondary peaks in May coinciding with onset of monsoon period, and retreating summer monsoon and beginning of northeast monsoons. Fluctuation of rainfall in Maldives mostly depends upon general monsoon conditions and movements of the Inter Tropical Convergence Zone (ITCZ) with embedded disturbances and frequency of thunderstorms (UNDP 2006).

4.4.2.1.1 FLOODS AND DROUGHTS

One of the criteria to decide excess (flood) and deficient (drought) years in a place is the standard deviation of rainfall. The Disaster Risk Profile of Maldives evaluates the flood and and drought years as follows:

If the percentage departure of rainfall from its long- term mean is greater than one standard deviation (SD) then it may be considered as excess rainfall (flood) year. If it is less than one SD then it may be considered as deficient (drought) year. Rainfall within one SD can be considered as normal year. From the available rainfall data of Maldives SD of rainfall works out to be about 16%. Following the above criteria, the number of excess, normal and deficient years for the above stations for the data period is calculated and are presented in Figure 4-5.

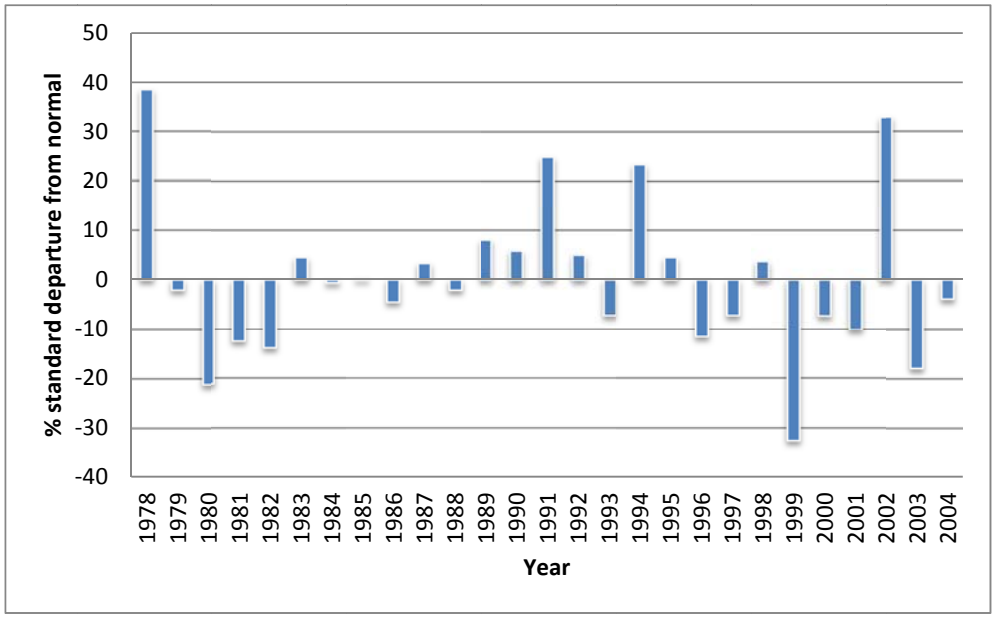


Figure 4-5 Excess, normal and deficient rainfall years of Gan

Table 4-2 Frequency of excess and deficient rainfall years (% departure in brackets)

Station Name	Number of drought years	Extreme drought years	Number of flood years	Extreme flood years
Gan (1978 to 2004)	3	1999 (-32.6)	4	1978 (38.5)

The above results in Table 4-2 indicate that southern parts of Maldives is less prone to drought and floods compared to northern part, though frequency of flood/drought years are small (about 15 to 16% of the years).

4.4.2.1.2 PROBABLE MAXIMUM PRECIPITATION (PMP)

Probable maximum precipitation, for 24 hours period, is an important parameter for designing drainage system, irrigation system and location of greens and putting area of the golf course. The design of drainage should consider PMP values, the catchment area of drains and characteristics of the catchment area to avoid flooding.

The Disaster Risk profile of Maldives assumes calculates the PMP values for Gan as follows:

A theoretical distribution is fitted to the extreme daily rainfall for three stations using Gumbel's type I extreme value distribution (EVD) function. The EVD is used to estimate the probabilities and the return period of rainfall for 50-, 100-, 200- and 500-years. The relevant data of PMP for different return periods for three stations in Maldives are given in Table 4-3.

Table 4-3Probable Maximum Precipitation for various Return periods

Station Name	Return Period			
	50 year	100 year	200 year	500 year
Gan	218.1	238.1	258.1	284.4

4.4.2.1.3 IMPLICATIONS ON GOLF COURSE DEVELOPMENT

1. The proposed site receives the highest rainfall for any area of Maldives. Hence, the numbers of rainy days are comparatively higher on the site, reducing the days requiring for operation of sprinklers. The recharge rate of the groundwater itself is higher on the site compared to other island sin the north. The total cost of watering therefore expected to be comparatively lower on the site.
2. The chances of heavy rainfall years are high on the site. Heavy rainfall will cause low level flooding on the site due to the presence of wetland and general lower topography towards the centre of the site.

4.4.2.2 WIND

The winds that occur across Maldives are mostly determined by the monsoon seasons. The two monsoons are considered mild given that Maldives is located close to the equator. As a result, strong winds and gales are infrequent although storms and line squalls can occur, usually in the period May to July. During stormy conditions gusts of up to 60 knots have been recorded at Male'.

Wind has been uniform in speed and direction over the past twenty-plus monsoon seasons in the Maldives (Naseer, 2003). Wind speed is usually higher in central region of Maldives during both monsoons, with a maximum wind speed recorded at 18 ms-1 for the period 1975 to 2001. Mean wind speed as highest during the

months May and October in the central region. Wind analysis indicates that the monsoon is considerably stronger in central and northern region of Maldives compared to the south (Naseer, 2003).

Winds recorded at Gan meteorological center indicates that heavy windy conditions occurred during south-west monsoons. Wind gusts of 35 mph to 45 mph were occasionally recorded when effects of cyclones from Arabian Sea were felt in the country. Direction of wind changes predominantly from north-east in the northeast monsoon to west and south-west in the southwest monsoon and variable direction of wind are experienced in the monsoon transition periods.

In terms of severe events, data from 1978 to 2001 reports a maximum of 63 km/h. The data also shows that there were four similar events - albeit of smaller intensity - over this period. The reports for the period 2001 to 2007 provide a different picture, however. During this period, individual events reaching 70km/h or more have been report for each of the 7 years (DoM, 2005).

Table 4-4 summarises the wind conditions in southern Maldives throughout a year. Medium term meteorological data from Gan meteorological center (see Figures 4.5 – 4.7) and findings from long-term Comprehensive Ocean-Atmosphere Data Set (COADS) are used in this analysis.

Table 4-4 Summary of General Wind Conditions from Gan Meteorological Center

Season	Month	Wind
NE - Monsoon	December	Predominantly from NW-NE.
	January	High Speeds from W
	February	
Transition Period 1	March	From all directions. Mainly W.
		High Speeds from W.
	April	
SW - Monsoon	May	Mainly from W.
	June	High Speeds from W.
	July	
	August	
	September	
Transition Period 2	October	Mainly from W.
	November	High Speeds from W

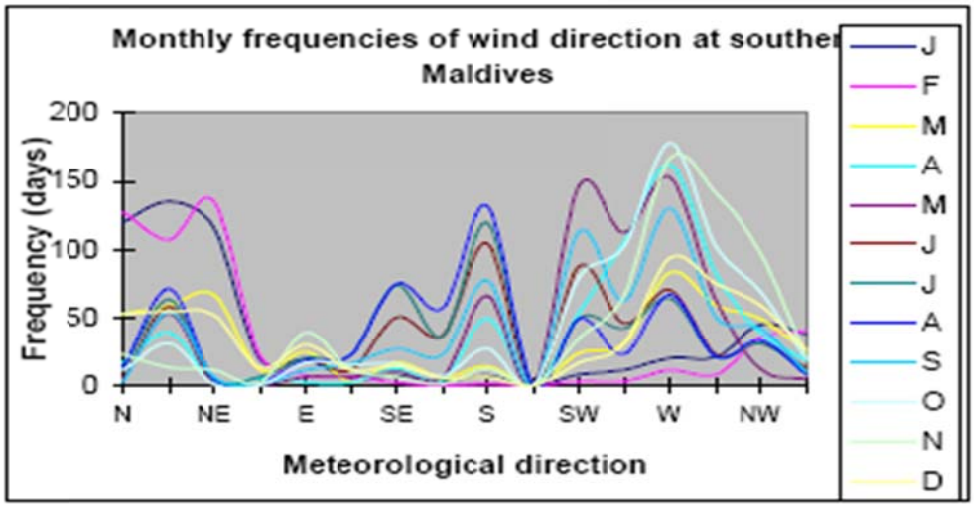


Figure 4-6Monthly Frequencies of Wind Direction in Southern Maldives based on Gan Meteorological Center 10 year Data (adapted from Naseer, 2003).

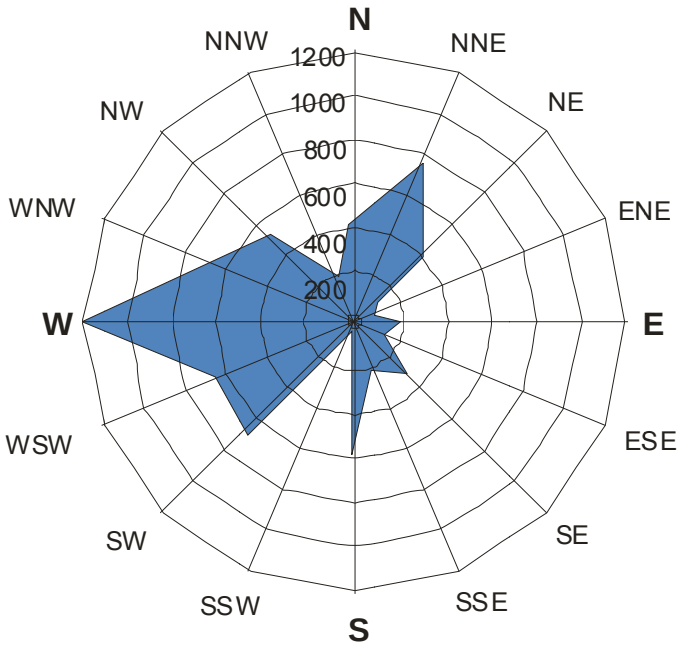


Figure 4-7:24 Year Wind Frequency Recorded at Gan Meteorological Center.

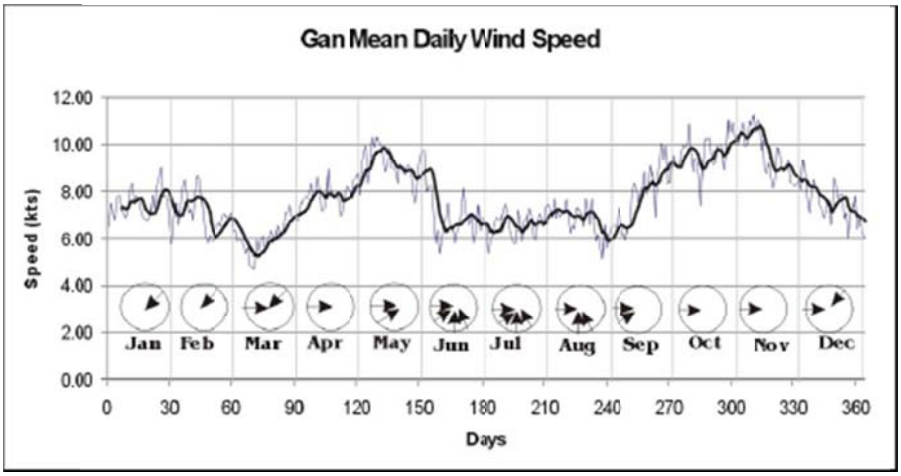


Figure 4-8 Mean Daily Wind Speed and Direction Recorded at Gan Meteorological Center. Arrows Indicate Dominant Wind Direction (Adapted from Naseer, 2003)

4.4.2.2.1 IMPLICATIONS ON GOLF COURSE DEVELOPMENT

1. The project site is expected to receive regular annual strong winds at the start and end of SW monsoons and peak of northeast monsoon. However, it is highly likely that wind may increase beyond normal northeast monsoon peaks at times of severe weather such as those resulting from localised storms. There reports of winds reaching 96 km/h in Gan during storm events.
2. The coastal vegetation of the island is very important to keeps the winds at bay at the golf course. There may be difficulties in playing gold during brief periods of both seasons and during storm events.
3. The regular high winds during SW monsoon and peak of NE monsoons will result in salt spray. The coastal vegetation will capture much of these and therefore their presence is crucial for the maintenance of non-native greens on the golf course.

4.4.3 HYDROLOGY

4.4.3.1 WAVES

There are two major types of waves reaching the coasts of Villigili. Long distance swells waves and monsoonal wind waves. Studies in undertaken in Fuvahmulah provides an insight into the wave regimes around the region (see Table 4-5).

Table 4-5 Wave regimes in neighbouring Fuvahmulah Atoll

Season	Total	Long Period	Short Period
NE - Monsoon	Predominantly from E-S. High Waves from W	From S-SW	Mainly E-NE. High waves from W
Transition Period 1	Mainly from SE-E	From S-SW	Mainly from NE-SE

SW - Monsoon	From SE-SW. Mainly from S. High Waves also from W	From S-SW	Mainly from SE-S. High waves from West
Transition Period 2	As SW monsoon	From S-SW	From SE-W. Higher waves from West

The local monsoon waves generated mainly during the NE monsoon affects the eastern coastline of the island. These waves are generally with a period of 3-8 seconds and some time at 1.5 m high in open ocean. The estimated wave propagation pattern is plotted in Figure 4-9.

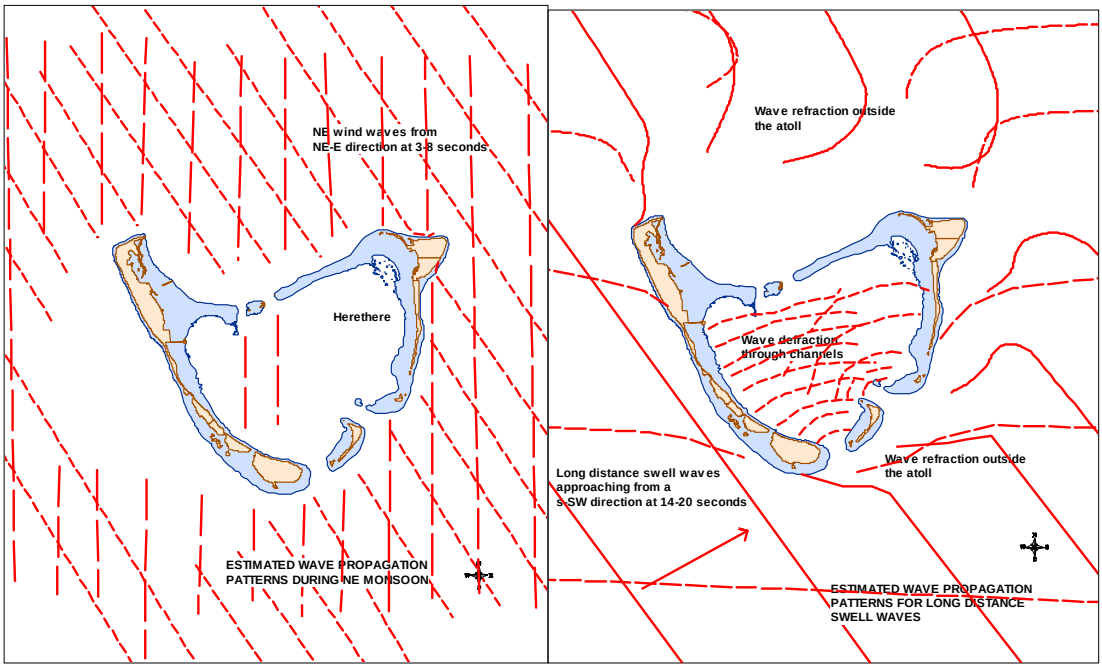


Figure 4-9 Estimated wave propagation patterns during NE and SW monsoon

The long distance swell waves approach mainly from a S-SW direction and is dominant throughout the year. These waves come with a wave period of 14-20 seconds with a maximum height of 3.0 m in open ocean. The estimated wave propagation pattern for swell waves are plotted in figure below.

During the SW monsoon winds generated within the atoll can create wind waves within addu atoll with a wave period of 2-5 seconds and with wave heights at 0.5 m.

Hence, Villigili site is affected by wind waves from the east during the NE monsoon and wind waves form within the atoll during SW monsoon. The long distance swell waves refract around the atoll but reach the eastern

shoreline. Moreover, the residual waves diffract through Gan channel and may reach the eastern shoreline of the island. All three wave types play an important role in the shoreline stabilization and island development in Villigili.

Wave activity may be strongest on the eastern side during the peak NE and SW monsoon in May, October and November. In addition, storm events are likely to cause significant run-up onto the coastline, perhaps, leading to sediment loss.

4.4.3.2 CURRENTS

Long term monitoring of currents are required to establish a meaningful pattern for coastal change analysis. In the meantime, the following general characteristics could be derived from studies elsewhere in Maldives.

Currents that affect the reef system of the proposed site can be caused by tidal currents, wind-induced currents and wave-induced currents.

It is presumed that generally current flow through the country is defined by the two-monsoon season winds. Westward flowing currents are dominant from January to March with the change in current flow pattern taking place in April and December.

In April the westward currents become weak while the eastward currents start to take over.

In December the eastward currents are weak with the westward currents becoming more prominent.

Currents at the time of survey were highest on the southern end and on the northern tip of the island. Currents in the central parts of the lagoon were slow moving and generally in a northerly direction during high tide and in a westerly direction during low tide. Long-term monitoring will be used to determine the exact nature of currents.

4.4.4 TOPOGRAPHY

The proposed site is generally low lying with an average elevation of +1.1 m MSL apart from an artificial mound. Topographic variations were analyzed from a sample transect and topographic surveys.

Figure 4-10 shows the general topographic variations in the site. The map was created form low resolution level surveys and should be treated as indicative levels. A larger version of the map is provided in Appendix 5. As noted before, the site has been previously been modified with backfilling activities. The southern end contains a large mound of dredge debris. The main wetland area remains intact with no modifications. However, large areas of previous wetlands have been backfilled in the past.

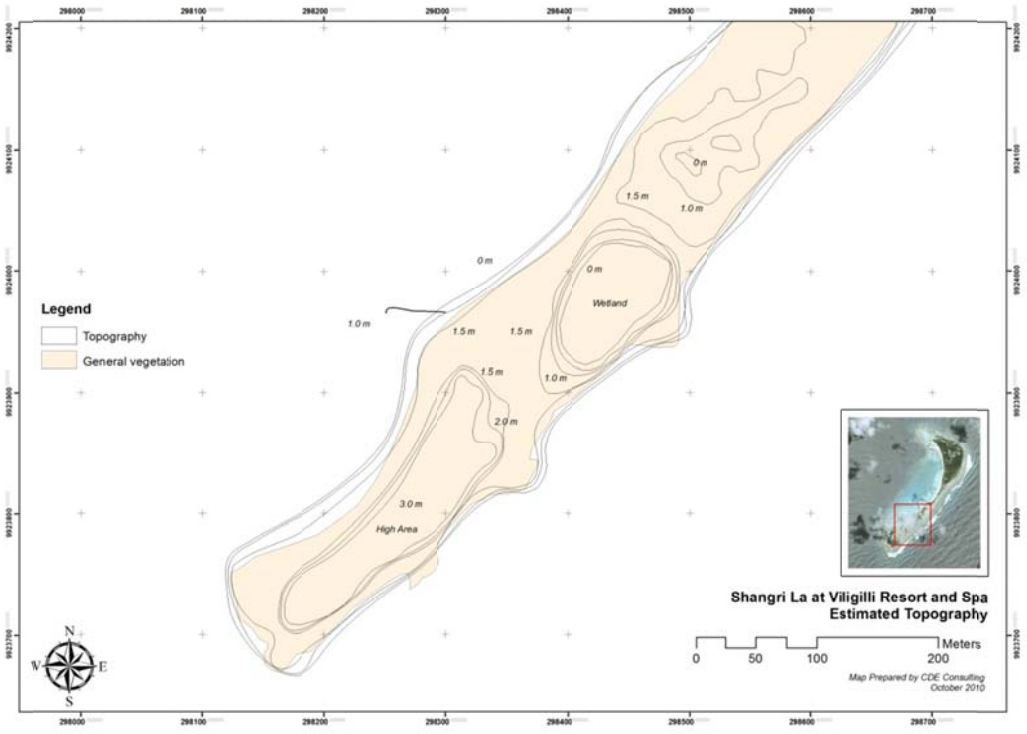


Figure 4-10 Topography of the project site

Figure 4-11 below shows the topographic profile of the large mound area. The top of the mound is approximately 4.0 m above mean sea level

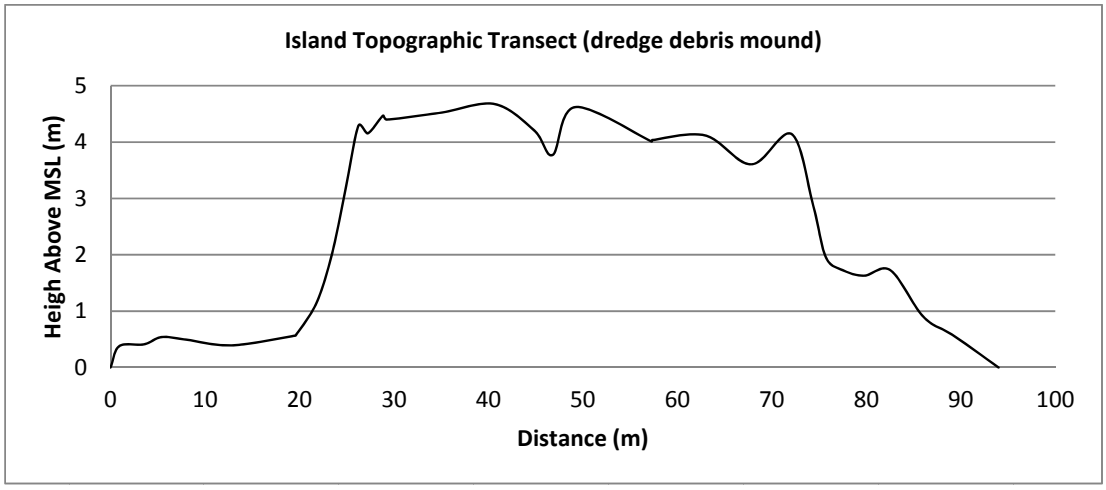


Figure 4-11 Topography of the sand mound

The coastal ridge on the eastern shoreline is generally high reaching 1.5m MSL. This higher ridge is the result of strong wave activity on the oceanward side and wind activity during NE monsoon.

These features will have major implications for the project.

1. The high mound is a hindrance to the development of the resort. However, its removal is not an option as there is no other site for its disposal. Disposal in the lagoon is not an option. Hence, the design has been modified to use the elevations as a design element. In addition the proposed water storage area will be constructed on this site, thereby reducing the effects on the water table due to excavation.
2. The low areas on the northern half of the site will also affect the layout of the golf course. Again the natural variations will be used to the advantage of the golf course design.

4.4.5 GROUNDWATER QUALITY

Groundwater assessment was conducted to assess the ambient conditions of groundwater. The water table stands approximately 0.8 to 1.1 m below ground level at MSL, but varies with changing tide. Table X shows the parameters tested and the results found. Measurements for nitrates, phosphates and Chemical Oxygen Demand could not be undertaken due to limitations with the sample and laboratory (see Appendix 6).

In the absence of national standards for groundwater quality, WHO standards for drinking water is used as a guideline. It must be noted that the groundwater in Villingili is not used for drinking purposes. As illustrated in Table 4.6, the investigations of groundwater revealed that the groundwater of Villingiliis fairly normal.

Table 4-6 Groundwater quality at the proposed site

Parameter	Results	WHO Standards for Drinking Water
Physical appearance	Grey with suspended particles	Clear & colourless
pH	7.7	6.5-8.5
Electrical conductivity	1609 µS/com	<1500
Biological Oxygen Demand	14 mg/L	-
Ammonia, Nitrogen	1.48 mg/L	<1.5 mg/L
Total coliform	-	0
Faecal coliform	0	0

4.5 BIOLOGICAL ENVIRONMENT

4.5.1 DESCRIPTION OF THE WETLAND

Villingilli has three wetlands (also known *kulhi*). They are located towards the centre of the island; one in north and the third towards south. The wetland in the south is located within the golf course site. The southern wetland is the smallest of the three wetlands with an area of 477 square meters.

4.5.1.1 FLORA AND FAUNA

The wetland located within the proposed site for the golf course consists mainly of the flora listed in Table 4-7 and some of these species are shown in Figure 4-12

Table 4-7 Main species of vegetation found at the wetland

Dhivehi name	Common name	Scientific name
Kan'doo	Small-leafed orange mangrove	Bruguiera cylindrical Bl.
Ran'doo		Rhizophora macrorrhiza
Bodu kandoo, Bodavaki	Large-leafed mangrove, oriental mangrove	Bruguiera gymnorrhiza (L.) Lam
Kuredhi	Ironwood	Pemphis acidula
Magoo	Sea lettuce	Scaevola taccada

Figure 4-12 Vegetation observed around the wetland

Among the fauna found near the wetland shellfish was seen in abundance as shown in Figure 4-13.

Figure 4-13 Shellfish observed around the wetland

A number of mud or mangrove crabs and several crab holes were seen in the marshy and mangrove area. Mangrove crabs are a vital part of mangrove ecology and flow of water through their holes influence nutrient cycling. It is also believed that the holes of the mud/mangrove crabs absorb power of destructive waves such as tsunamis. Further, aquatic species in the wetland was also observed during the surveying. Figure 4-14 shows upside-down jellyfish (*Cassiopea* xamachana) found in the wetland.

Figure 4-14 Upside down jellyfish observed in the wetland

4.5.1.2 WATER QUALITY

Wetland water quality was tested from two locations. The samples were tested at the National Health Laboratory between 9 – 21 November 2010. Results are provided in 4-8 and Appendix 7.

Table 4-8 Water quality of the wetland

Parameter	W1	W2
Physical appearance	Grey with suspended particles	Grey with suspended particles
pH	8.2	7.2
Total Dissolved Solids (mg/L)	32,700 mg/L	8980 mg/L
Biological Oxygen Demand (mg/L)	20 mg/L	22 mg/L
Suspended Solids	6 mg/L	*NT
Ammonia, Nitrogen	0.71 mg/L	1.02 mg/L

*NT – Not Tested

4.5.2 MARINE WATER QUALITY

The primary objective of the lagoon water quality sampling was to establish a baseline condition specific to potential impacts from the operation of the golf course. Samples were taken from one location and analysed at the National Health Laboratory between 9 – 21 November 2010. Results are shown in Table 4-8 and provided in Appendix 7.

Table 4-9 Results of the seawater sample tested

Parameter	Seawater
Physical appearance	Clear with suspended particles
pH	8.5
Total Dissolved Solids (mg/L)	9190
Electrical conductivity (µs/cm)	16,280
Turbidity (NTU)	5
Iron (Total) (mg/L)	0.01
Biological Oxygen Demand (mg/L)	6
Dissolved Oxygen	NT*
Salinity	NT
Total Suspended Solids	NT
Nitrate	NT
Nitrite	NT
Phosphate	NT

*NT – Not Tested

4.5.3 EXISTING VEGETATION AND REMOVAL OF VEGETATION

4.5.4 FLORA

4.5.4.1 GENERAL CHARACTERISTICS

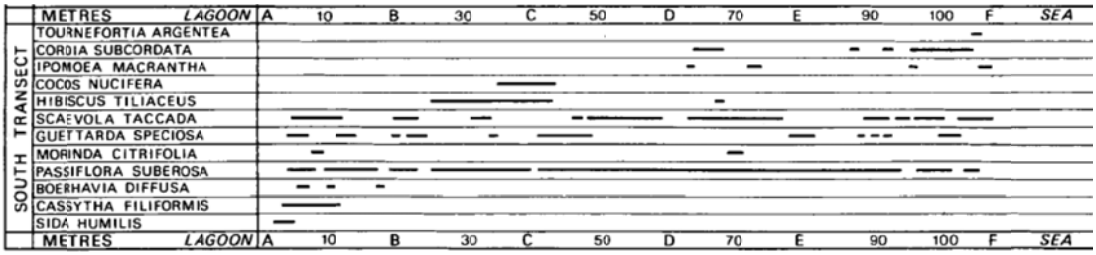
Viligilli Island is renowned for the floral variety and intensity, and is somewhat regarded a as a unique island in the southern hemisphere of Maldives. Agassiz (1903) described the vegetation of Viligilli as "luxuriant as that of any island in the Maldives". Sigee (1966) also commented on the luxurious nature of vegetation on Viligilli Island but did not get to survey the island in details due to political restrictions.

Spicer and Newbery (1979) perhaps provide the most comprehensive assessment of Viligilli Island flora. Their assessment catalogued the plants on Viligilli Island and conducted assessments on exposure and edaphic factors and the possible effects of these on vegetation pattern. In the process they recorded eight confirmed new species in the Maldives.

Spicer and Newbery's (1979) assessment show that the characteristics of the northern half of the island is quite different from that of the southern end (the proposed site). The vegetation in the north was diverse with increased heights and abundant woody vegetation, particularly *Pisonia Grandis.*

The southern end (project site) however were described by Spicer and Newbery as limited in diversity and stunted in growth particularly among the coconut trees. The dominant species on the southern most areas were identified as *Scaevola taccada, Tournefortia argentea, Guettarda speciosa, and Pemphis acidula.* They identified a narrow stretch of coconut grove but with stunted growth. The southernmost end was generally described as having sparse vegetation. The ground cover was dominated by *Thuarea involuta* and *Lepturus repens.*

Spicer and Newbery's transect analysis is reproduced below in Figure 4-15. Their vegetation classification is presented in Figure 4-20.



Source: Spicer and Newberry (1979)

Figure 4-15 Vegetation transect analysis by Spicer and Newberry (1979)

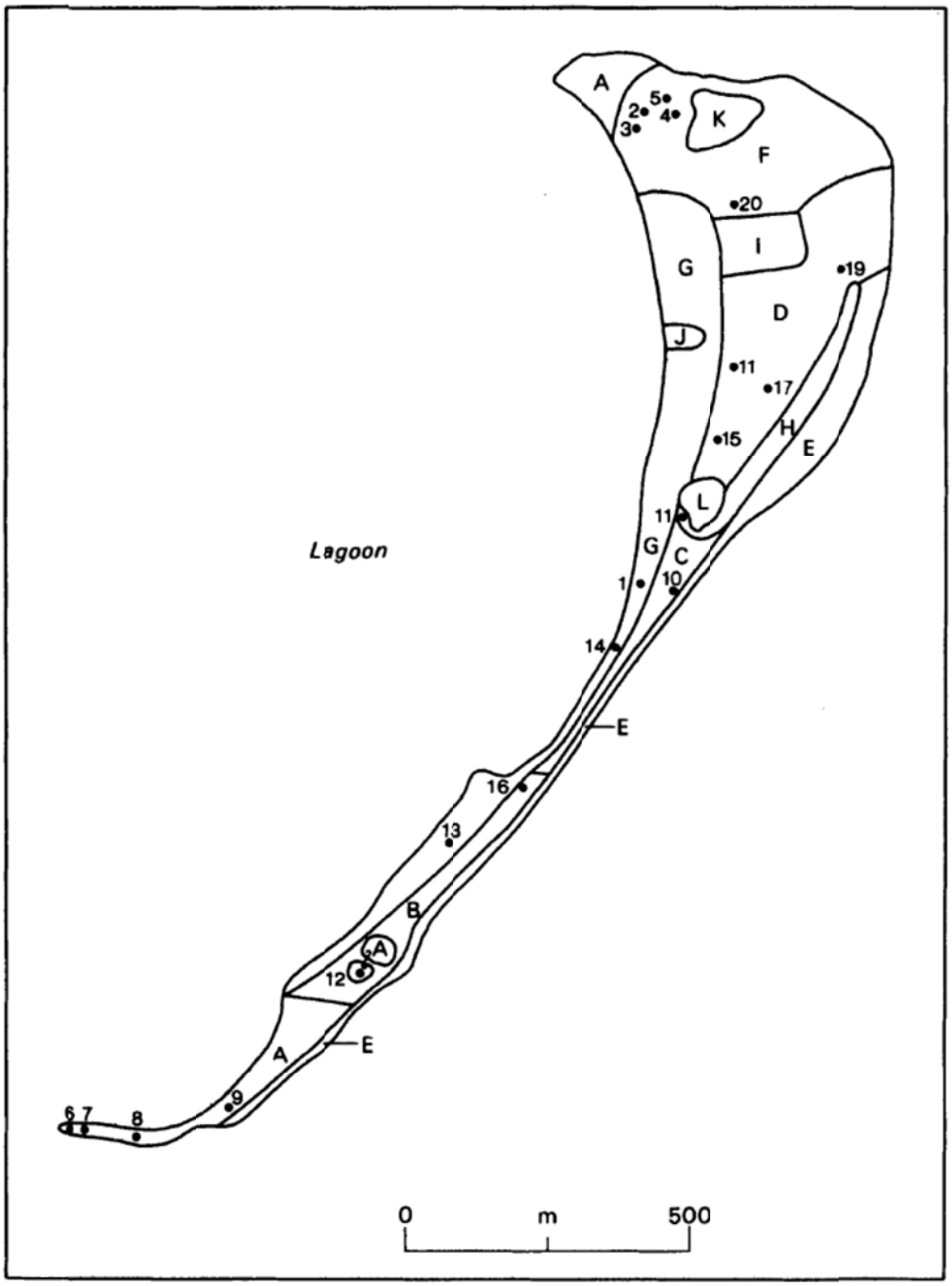


Fig. 1. Map of Wilingili indicating the positions of the stand sites with respect to island geography and general vegetation types. A, Sparse vegetation, *Pemphis acidula* and *Scaevola taccada*; B, Bush vegetation; C, small trees and shrubs; D, central *Pisonia grandis* hardwood forest; E, Strand *Pemphis acidula*; F, Northern *Pandanus*-coconut forest; G, *Cocos nucifera* groves; H, mangrove swamp; I, 'semi-cultivated' area; J, native huts; K, sea-water pond; L, brackish water pond; M, dried out ponds.

Figure 4-16 Vegetation classification by Spicer and Newberry (1979)

Human activities have dramatically changed the landscape of the project site since the pioneering works Agassiz, Spicer and Newbery. Approximately 41% of the area has been backfilled and these areas have not recovered yet due to the introduction of highly alkaline soil. Vegetation has been removed considerably, particularly coastal strand vegetation *Pemphis acidula.* Some area remain exposed to wave activity and erosion, and there is evidence of wave over wash 100 m inland from the oceanward side. Most of the previous marshlands have been backfilled but the main wetland with mangrove vegetation still remains intact. There is a 4 m high mound of dredge waste covering a 1.2 ha area. This mound is not conducive for vegetation growth, apart from grass species, due to its deep ground water access and highly alkaline soil. All in all the area is in a 'bad shape' apart from the mangrove wetland.

The next section describes the status of the flora as it existed at the time of the survey in November 2010.

4.5.4.2 VEGETATION SPECIES AND FREQUENCY OF THEIR OCCURRENCE

The vegetation types and frequency of their occurrence were assessed by conducting three line transects as shown in Appendix 4 – survey locations. The vegetation types on either side (north and south) of the line transect was recorded at about 5 m interval. The GPS position was also recorded at each interval.

The results of the line transect shows that the proposed project area was dominated by large sparsely vegetated areas with patches of woody and bush trees namely; Dhiggaa (*Hibiscus tiliaceus*), Kuredhi (*Pemphis acidula*) and Magoo (*Scaevola taccada*) were found in abundance while frequent occurrence of Kan'doo (*Bruguiera cylindrical*) and Ran'doo was found. Species that were found occasionally include Ruh (*Cocos nucifera*), Kaani (*Cordia subcordata*), Uni (*Guettarda speciosa*), Burevi (*Lumnitzera racemosa*) and Boakashikeyo (*Pandanus tectoras*).

Figure 4-17 provides a list of the types of vegetation and the frequency of their occurrence found along the line transect.

Transect 1

Lagoon	10	20	30	40	50	60	70	80	90	100	110	Sea
Cocos nucifera (Ruh)												
Hibiscus tiliaceus (Dhigga)												
Pemphis acidula (Kuredhi)												
Scaevola taccada(Magoo)												
Cordia subcordata (Kaani)												
Open area / waste site												

Transect 2

Lagoon	10	20	30	40	50	60	70	80	90	100	110	Sea
Pemphis acidula (Kuredhi)												
Scaevola taccada(Magoo)												
Bruguiera cylindrica(Kandoo)												
Pandanus tectorus(Boakashikeyo)												
Guettarda speciosa(Uni)												
Cassytha filiformis												
Lumnitzera racemosa (Burevi)												
Rhizophora mucronata - Ran'doo												
Open Area / surface water												

Transect 3

Lagoon	10	20	30	40	50	60	70	80	90	100	110	Sea
Cocos nucifera (Ruh)												
Hibiscus tiliaceus (Dhigga)												
Pemphis acidula (Kuredhi)												
Scaevola taccada(Magoo)												
Cordia subcordata (Kaani)												
Pandanus tectorus(Boakashikeyo)												
Guettarda speciosa(Uni)												
Open Area												

Figure 4-17 List of the types of vegetation and the frequency of their occurrence found along the line transect.

4.5.4.3 VEGETATION CLASSIFICATION AND ABUNDANCE

High resolution satellite imagery was used to map and classify vegetation cover. A GIS application was used to classify vegetation based on colour variations. Samples of classified zones were verified using ground-truthing data and line transect surveys. Due to the sheer size of the island and density of vegetation it would impossible to map the vegetation system without remote sensing technology. This method has well-established procedures and is a recommended method for terrestrial surveys.

Vegetation was classified into seven main groups as shown in Figure X, namely; Bush Vegetation, Mangrove Vegetation, Mixed Woody Vegetation, Sparse Strand Vegetation, Strand Vegetation , Wetland and Wetland Bush Vegetation. Bush vegetation mainly consisted of Magoo. Mangrove vegetation mainly consisted of Kandoo and Randoo. Main species in the mixed woody vegetation was Coconut, Dhigga and Kaani. Sparse strand vegetation and strand vegetation mainly consisted of Magoo. Wetland vegetation mainly consisted of Kandoo and Randoo while Wetland bush vegetation mainly consisted of Bodu Kandoo.

The results of the vegetation classification are presented in Appendix 8 and a reduced version is shown in Figure 4-18.

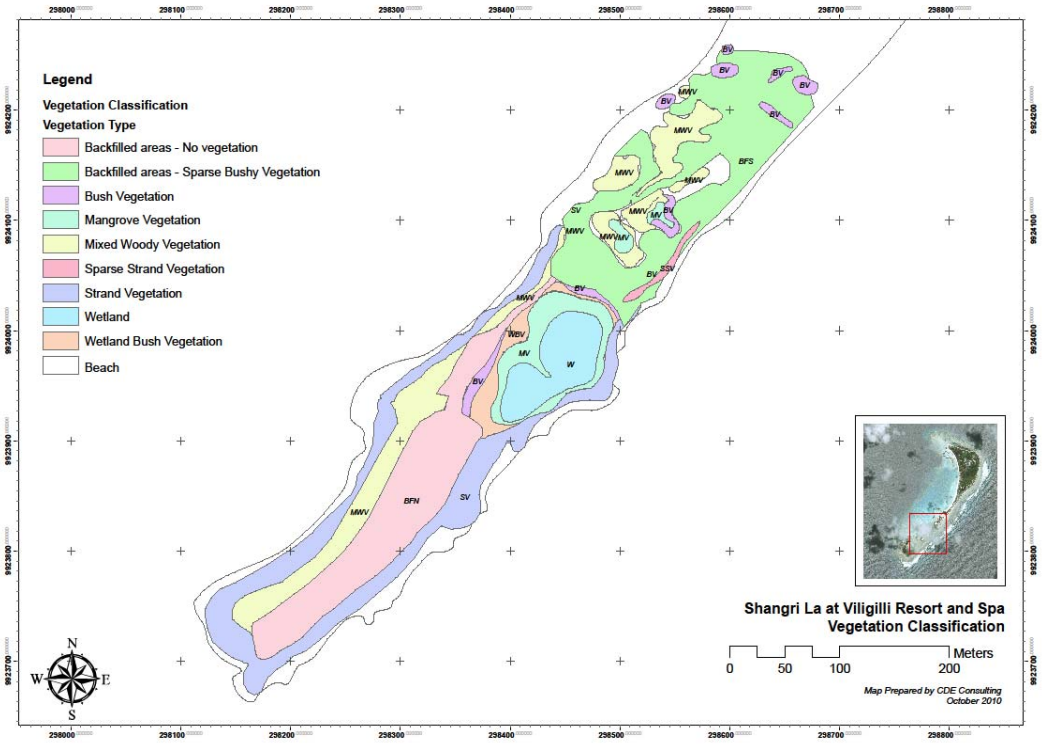


Figure 4-18 Vegetation classification of the project area

4.5.4.4 LARGE TREES

An inventory of large trees was undertaken during the survey. The plotted map of large trees is provided in Appendix 9 and a reduced version is given in Figure 4-19.

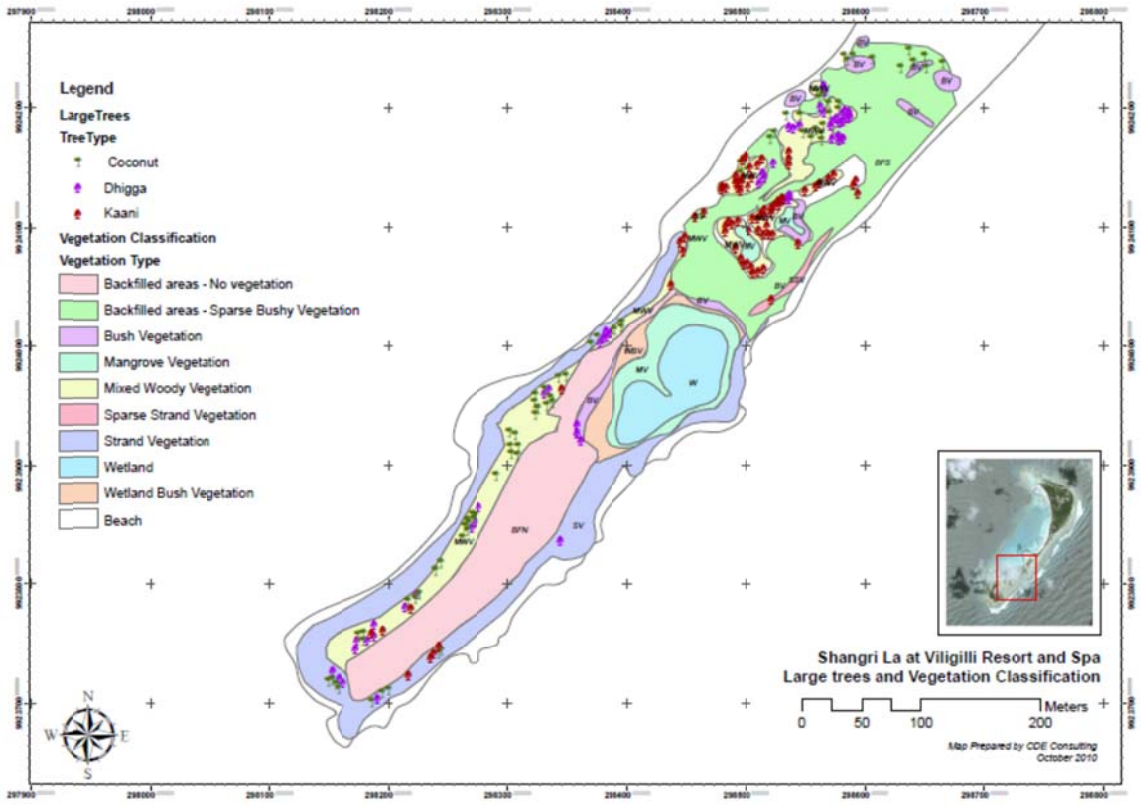


Figure 4-19 Distribution of large trees in the project site

The types and number of mature trees on the site are provided in the Table 4-10.

Table 4-10 Type and number of large trees in the project site

Tree Type	Number of trees
Coconut	78
Dhigga	55
Kaani	75

Large tree removal required is indicated in Table 4-11 based on Figure 4-20 (large version in Appendix 10. The number of trees to be removed is estimated based on the line of sight for each hole. It must be noted that this is an estimate of the number of trees that needs to be removed. At the time of construction removal of trees will be minimized as much as possible.

Table 4-11 An estimate of the number of large trees to be removed based on line of sight

Line of sight	Type & estimated no. of trees to be removed
1	Coconut x 2

2	Dhigga x 2 Kaani x 3
3	None
4	Coconut x 2 Dhigga x 3
5	Coconut x 1
6	Kaani x 1
7	None
8	None
9	None

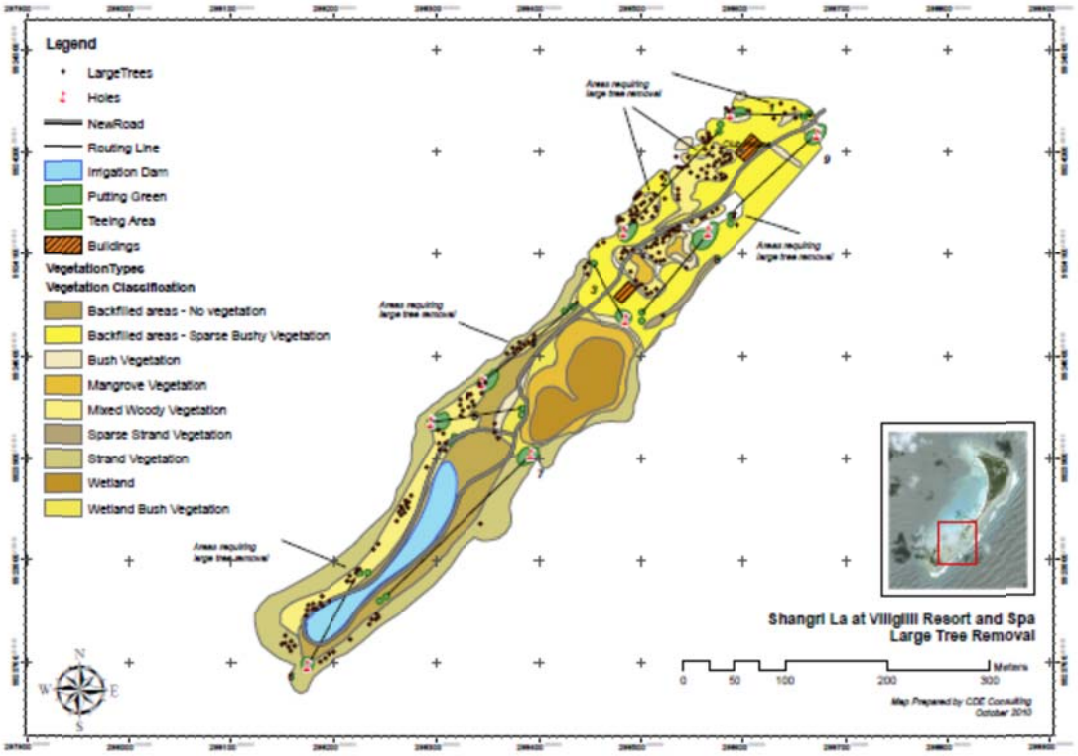


Figure 4-20 An indication of large trees located in the line of sight of the holes

5 POTENTIAL IMPACTS AND MITIGATION MEASURES

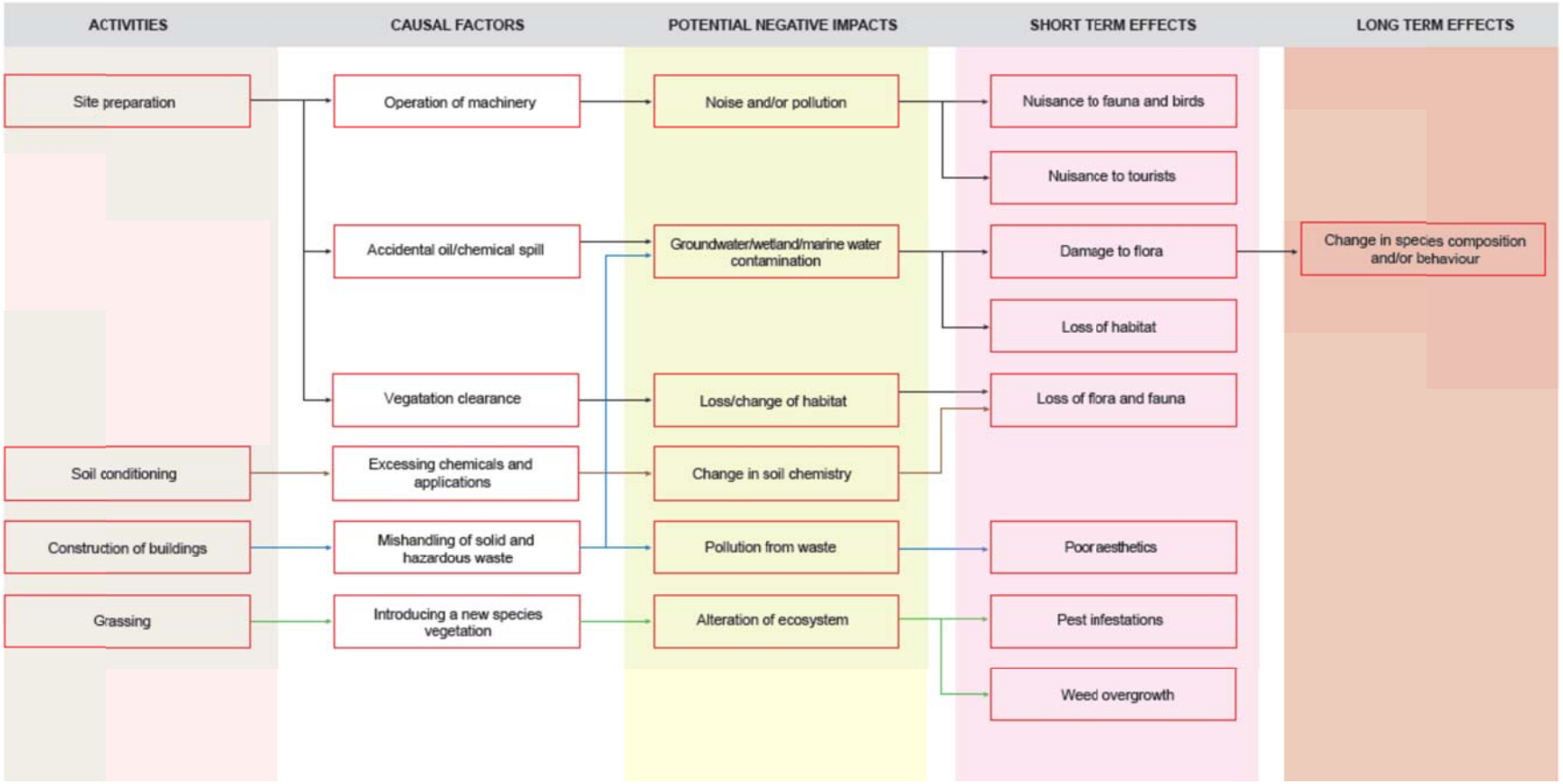
5.1 INTRODUCTION

The proposed development of a golf course at Shangri-La's Villingili is anticipated to cause significant detrimental as well as beneficial impacts. Impact identification (environmental/social/economic impacts) and mitigation measures were primarily based on literature reviews, professional judgment and past experience from similar projects.

For the purpose of this EIA, the chain of events linking activities to specific impacts and knock-on effects are represented in flowcharts to allow for easier interpretation. This is because the cause-effect relationship between a specific activity and its potential impacts are rarely linear and in most cases, a series of casual factors linked to different activities create the conditions that cause an impact. Three separate flowcharts were developed and organized to display logically the following sequence of events:

Activity → Casual Factor → Potential Impacts → Short Term Effects → Long Term Effects

Accordingly, Figure 5.1 below illustrates the flowcharts. The first chart will show the potential negative impacts of the proposed development activities during the construction stage and the second chart will show the potential negative impacts of the proposed development activities during the operation stage. Finally the third chart will show the potential positive impacts expected to arise once the project is in operation.


ACTIVITIES
CAUSAL FACTORS
POTENTIAL NEGATIVE IMPACTS
SHORT TERM EFFECTS
LONG TERM EFFECTS
Site preparation
Operation of machinery
Noise and/or pollution
Nuisance to fauna and birds
Nuisance to tourists
Accidental oil/chemical spill
Groundwater/wetland/marine water contamination
Damage to flora
Loss of habitat
Change in species composition and/or behaviour
Vegatation clearance
Loss/change of habitat
Loss of flora and fauna
Soil conditioning
Excessing chemicals and applications
Change in soil chemistry
Construction of buildings
Mishandling of solid and hazardous waste
Pollution from waste
Poor aesthetics
Grassing
Introducing a new species vegetation
Alteration of ecosystem
Pest infestations
Weed overgrowth

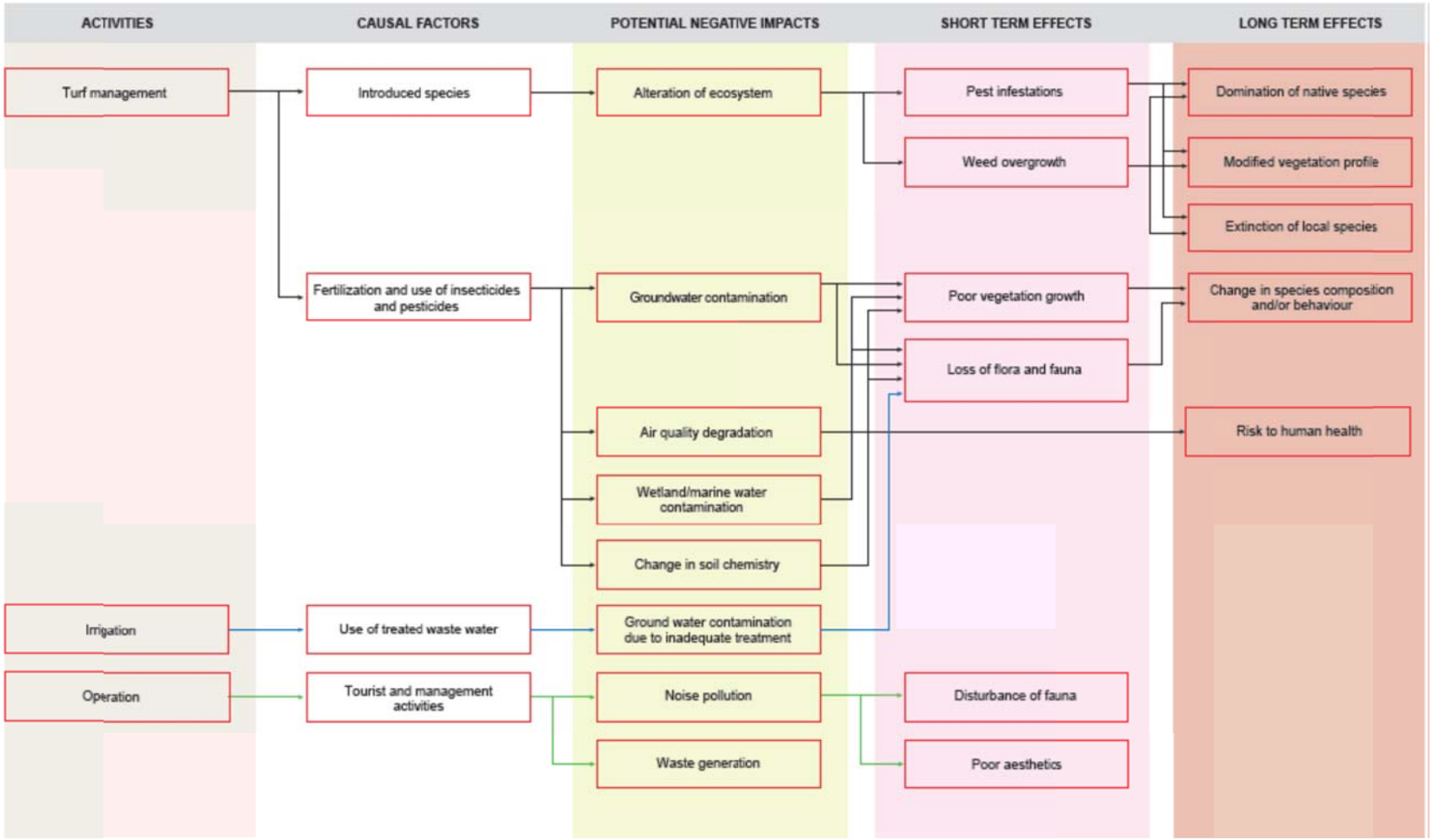


Figure 5-1 Potential positive and negative impacts

5.2 UNCERTAINTIES IN IMPACT PREDICTION

In the EIA process of the Maldives, uncertainties in impact prediction generally arise due to the lack of long term data, limited timeframes to complete EIAs and lack of standard procedures to collect data leading to inconsistent methodologies used by the various EIA consultants. Such issues are mainly linked to the lack of importance given to the EIA process in strategic planning and initial stages of development projects. Typically in the Maldives, EIAs for major development projects are only done after development activities and project locations are finalised. This gives the EIA consultants limited time frames to conduct a comprehensive impact assessment.

Accordingly, the uncertainties in impact prediction for this particular EIA are due to the time constraints in data collection and due to the limited amount and type of data available for measuring or predicting impacts.

5.3 BRIEF DESCRIPTION OF POTENTIAL IMPACTS AND SUGGESTED MITIGATION MEASURES FOR ALL ADVERSE IMPACTS

This section will provide a brief description of each of the potential impacts illustrated in the flowcharts of Figure 5.1 and suggest appropriate mitigation measures for all potential adverse impacts. Similar to the flowcharts, firstly potential negative impacts and mitigation measures during the construction stage will be described. This will be followed by descriptions of the potential negative impacts during the operation stage. Finally all potential positive impacts will be discussed.

The potential significant impacts from the project are summarized below:

Potential Adverse Impacts during the Construction Stage

- Loss of flora and fauna and, alteration of species behavior due to vegetation clearance.
- Alteration of habitat due to clearance of vegetation and/or introduction of a new species of grass.
- Noise and air pollution from the operation of machinery during site preparation and construction.
- Groundwater contamination from accidental spill of oil and other toxic substances and, mishandling of waste.
- Emission of greenhouse gases during site preparation and construction.

Potential Adverse Impacts during the Operations Stage

- Introduced Species
- Groundwater contamination
- Wetland and marine water contamination
- Soil quality degradation
- Noise pollution
- Air quality degradation
- Waste management

5.4 POTENTIAL ADVERSE IMPACT DURING THE CONSTRUCTION STAGE AND SUGGESTED MITIGATION MEASURES

5.4.1 LOSS OF FLORA AND FAUNA

As described in Chapter 4 Existing Environment, vegetation in the area has been largely cleared and new growth has been slow. The dominant species in the area is the salt tolerant *Ironwood* species and mix of coastal vegetation species. The coastal vegetation belt has been retained to some extent (approximately 15 m on the oceanward side and 20 m on the lagoon ward side).

The most significant vegetation in the area is the mangrove species, which has a national significance in terms of the ecosystem. These trees appear to be in a healthy condition and thriving.

The proposed project involves clearance of vegetation in the area about 15m inland from the existing coastal vegetation. Vegetation clearance will be carried out during site preparation. Wetland vegetation will preserved.

Mitigation Measures

- Mangrove vegetation will not be cleared for any purpose to preserve the integrity of the wetland.
- All mature trees will be retained and incorporated in the design of the golf course.
- Only vegetation that is absolutely necessary to be removed will be cleared minimizing any changes to habitat and therefore species behaviour.
- A buffer zone of at least 15m will be retained along the coast to ensure the natural defense against erosion is sustained.
- Any vegetation that is removed will be re-planted in the area or elsewhere in the island.

5.4.2 GROUNDWATER AND MARINE WATER CONTAMINATION

During construction, groundwater and marine quality may be deteriorated from activities such as storage and handling of hazardous substances and the storage of raw materials for the construction of the buildings. The clearing of the vegetation within the development area may also have a synergistic negative long term impact on the groundwater quality in the area.

In the Maldives, groundwater contamination is an irreversible impact due to the absence of impermeable layers to separate the freshwater lens in independent reservoirs. Accordingly, any point sources of pollution would cause the contamination of the entire island groundwater resources.

Any effect on human health from contaminated groundwater is unlikely as groundwater is not used for human consumption at Villingili. Any adverse impact on groundwater may lead to loss of vegetation or change in vegetation composition in the area. Therefore, special care should be taken when handling oil, solid waste and hazardous waste to entirely avoid any accidental spills and leakage.

Mitigation Measures

- Oil and toxic substances will be properly contained in a bunded area with a capacity to contain 1.5 times the amount of the stored substance.
- All raw materials will be stored away from the vicinity of the coastal areas to avoid contamination in these areas.

- General refuse generated during these phases of the development will be stockpiled in one central area of the development site for easier management and monitoring.
- All construction waste will be collected, transported and disposed of appropriately at a designated disposal site.
- Clearance of vegetation must be avoided in periods of heavy rainfall to reduce the impact of runoff on marine waters.
- Construction activities will be carried out under the supervision of a suitably experienced person.

5.4.3 NOISE AND AIR POLLUTION

During the mobilisation of equipments and operation of heavy machinery for site preparation and construction of buildings, it is anticipated that significant noise will be generated. Furthermore, noise vibrations may alter species behaviour. In addition, dust and emissions from vehicle and machinery exhausts will degrade the air quality. However, these adverse impacts will be short term and can be mitigated to avoid nuisance to fauna. Local communities are not anticipated to be disturbed by the noise given the level of noise that will be generated and the distance to the communities. With proper mitigation measures, it is unlikely that noise and air pollution impacts will cause long term effects such as human health risks leading to increased public and private health costs.

Mitigation measures

- All construction works will be carried out during day time to minimise disturbances caused to nocturnal fauna such as birds and fruit bats that uses auditory communication.
- All vehicles and machinery will be tuned and well maintained to minimise air pollution.
- To minimise dust from construction works, ground will be kept damp.
- Construction material such as sand and aggregate will be covered or damp when stockpiled to reduce the effects of wind whipping.
- Care will be taken in delivery and unloading of construction material particularly aggregate, sand and cement to prevent spillage. If any spill occurs, it will be cleaned up immediately.
- Retain a buffer area of trees and other vegetation around the perimeter of the development site which will serve as a natural windbreak which may reduce the level of dispersion of dust particles generated during this phases of the development.
- All staff employed at the construction site will be provided with dust masks and be asked to use them.
- All waste must be transported off-site for processing, not burnt or stored for any longer than is absolutely necessary.

5.4.4 GREENHOUSE GAS EMISSIONS

Vegetated areas are known to act as carbon sinks for greenhouse gases particularly carbondioxide. The proposed golf course involves clearing of vegetation during site preparation. However, the amount of vegetation to be cleared is planned to be minimal and any vegetation that are removed will be re-planted in the area or elsewhere in the island.

Further, inappropriate landfilling of waste can lead to emission of greenhouse gases particularly methane. Construction waste is expected to be generated from the development of the project.

Mitigation Measures

- All mature trees will be retained and incorporated in the design of the golf course.
- Only vegetation that is absolutely necessary to be removed will be cleared.
- Any vegetation that is removed will be re-planted in the area or elsewhere in the island.
- Waste will be properly stockpiled temporarily on site and disposed at a designated disposal site.

5.4.5 IMPACTS FROM WASTE

The project is expected to generate green waste from site preparation and construction waste from other activities particularly building. Green waste is expected to be minimal as any trees that are cleared will be replanted. Amount of construction waste is anticipated to be insignificant as building activities are limited to one clubhouse. There may be minor amounts of waste from installation of irrigation system and the construction of the artificial pond.

Mitigation Measures

- Compost any green waste that is generated to use in soil conditioning.
- Stockpile waste at a designated site for easier management and possible reuse of the material.
- Transfer waste to a designated disposal site as and when necessary.
- Store any hazardous waste in properly bunded areas to prevent pollution of the immediate environment.

5.5 POTENTIAL ADVERSE IMPACT DURING THE OPERATION STAGE AND SUGGESTED MITIGATION MEASURES

5.5.1 ALTERATION OF ECOSYSTEM

The project proposes to introduce an exotic grass species known as Seashore Paspalum to the natural environment of the area as the turf grass for the golf course. Exotic or invasive species are non-native plants or animals that have been introduced to areas where they do not naturally occur, mostly by human actions either intentionally or accidentally (Wyatt, Skinner and Higley. 2003).

Seashore paspalum (*Paspalum vaginatum*) can alter ecosystems in a number of ways. It can form dense monospecific groundcover in brackish marshes and estuaries, and alter the composition of native species. This can lead to changes in invertebrate communities - in the Galapagos it is associated with a move from aquatic to more terrestrial communities (Siemens, 2005 in IUCN Invasive Species Specialist Group 2008), and this in turn can impact on foraging habitat and food resources for waterbirds. In addition, invasion of *P. vaginatum* is associated with an increase in sediment accumulation, changing hydrology in New Zealand estuaries (Shaw and Allen, 2003; Graeme, 2005a, b in IUCN Invasive Species Specialist Group 2008). Seashore Paspalum has the potential to cause significant ecological damage such as alteration of native species composition in the short term and local extinction of native species in the long term if proper mitigations measures are not taken.

In addition, with the introduction of a new species use of chemical fertilizers, pesticides and insecticides to maintain the turf will be inevitable. Impacts associated with chemicals and appropriate mitigation measures are described in detail in the following sections.

Mitigation Measures

- Turf Management Plan will be developed which will include regular monitoring of the planted areas to ensure that growth is limited to these areas.
- Seashore Paspalum will be removed from areas other than the planned spots should there be any spreading of the grass.

5.5.2 GROUNDWATER CONTAMINATION

The project proposes to use treated wastewater from the existing sewage treatment plant of the resort for water supply in the irrigation system of the golf course. The artificial pond will act as a dam in the water supply system. Irrigation using treated wastewater has the potential to contaminate groundwater from inadequate treatment. At present the sewage treatment plant of Villingili is operated and monitored by NALCO, India to meet World Bank Group/International Finance Cooperation standards.

Application of pesticides may also have major longterm negative impact on groundwater through impact on pH and by a process called volatilization. Pesticides with high vapour pressure tend to undergo volatilization to convert to a gaseous state and then become diluted with water droplets which are susceptible to transport from application site and return back to soil which may then penetrate to the groundwater aquifer.

As described earlier, in the Maldives, groundwater contamination is an irreversible impact due to the absence of impermeable layers to separate the freshwater lens in independent reservoirs. Accordingly, any point sources of pollution would cause the contamination of the entire island groundwater resources.

Mitigation Measures

- Adequate treatment of wastewater will be ensured through regular monitoring to meet WBG/IFC and national standards.
- All chemicals used during the operation of the golf course will be stored in secure and bunded locations.
- Staff will be informed and trained on the application areas and quantities and, use of chemicals will be done with proper supervision.
- Groundwater will be monitored regularly for any signs of deterioration related to treated wastewater and chemicals.
- Fertilizer application will be based on regular soil testing to avoid over-application.
- The area will be irrigated after the application of chemicals to reduce volatilization.
- Use of fertilizer will be adjusted based on available natural sources of fertilizer, for example, nitrogen from grass clippings.
- Practices and products that reduce the potential for contamination of water will be implemented as much as possible including physical removal of weeds, slow-release fertilizers and environment-friendly products.

5.5.3 WETLAND AND MARINE WATER CONTAMINATION

Nutrient loading from the application of chemicals may have a negative impact which may be irrivesible and longterm. While most of the nutrients are expected to be absorbed due to proper soil conditioning, some nutrient loading will occur in the wetland and marine waters due to leaching and surface runoff. These nutrients can affect the pH, temperature and deoxygenation of water bodies resulting in

eutrophiation and enhanced growth of plant and algae. This will lead to increased turbidity and hence light attenuation further exacerbating deoxygenation.

In addition, wetland and marine waters may also be affected by the application of pesticides through volatilization as described in the above section.

Mitigation Measures

- All chemicals used during the operation of the golf course will be stored in secure and bunded locations.
- Excessive application of chemicals will be avoided through soil monitoring and proper training of staff.
- All staff will be made aware of sensitive areas such as the wetland in the application of chemicals.
- Marine water and wetland will be monitored regularly to ensure any sign of contamination is addressed immediately.
- A vegetation buffer will be maintained around the wetland and around the golf course to reduce nutrient loading to wetland and marine waters.
- Irrigation will be monitored properly especially during rainfall to ensure leaching and runoff is not further increased from excessive irrigation.
- Slow-release fertilizers will be used as much as possible to reduce leaching and runoff.
- Practices and products that reduce the potential for contamination of water will be implemented as much as possible including physical removal of weeds, slow-release fertilizers and environment-friendly products.

5.5.4 CHANGE IN SOIL CHEMISTRY

Soil quality may be affected by the application of chemicals and the use of treated wastewater for irrigation. These activities may lead to change in soil chemistry from changed to pH of the soil. This impact may be major, long-term and irreversible.

Mitigation Measures

- All chemicals used during the operation of the golf course will be stored in secure and bunded locations.
- Slow-release fertilizers will be used as much as possible to reduce leaching and runoff.
- Practices and products that reduce the potential for contamination of water will be implemented as much as possible including physical removal of weeds, slow-release fertilizers and environment-friendly products.
- Excessive application of chemicals will be avoided through soil monitoring and proper training of staff.
- All staff will be trained in nutrient management and chemical application.

5.5.5 NOISE POLLUTION

The operation phase of the golf course is not expected to cause high levels of noise. Golf course will be using battery operated buggies for visiting tourists as well as management purposes. Possible sources of noise are the pump stations, tourist activities and management activities. Hence, some disturbance may be caused to fauna and especially birds in the wetland area during opening hours.

Mitigation Measures

- Ensure that the golf course adheres to its opening hours which are between 6:00 a.m. and 8:00 p.m. daily.
- Ensure that deliveries to the golf course are made between 8:00 a.m. and 5:00 p.m. daily.
- Ensure that maintenance works on the golf course occurs between the hours of 8:00 a.m. and 5:00 p.m. daily.
- Use proper signage around the wetland area to make tourists aware that there may be birds in the area.
- Install noise reduction measures such as building bund walls around the pump stations, installing sound proofing attenuators and silencers.
- Retain all vegetation around the wetland area as a buffer against noise.
- Ensure all golf buggies are properly maintained and tuned.

5.5.6 AIR QUALITY DEGRADATION

Vehicular emissions are not expected around the golf course as the only vehicles in use will be battery operated golf buggies for both visits by tourists as well as management purposes. A potential source of emissions is the chemicals such as fertilizers and pesticides that will be used during the maintenance of the course. These emissions occur owing to a process known as volatilization where a liquid or solid evaporates into the atmosphere as a gas. Climatic conditions such as high temperature low relative humidity and air movement affect the extent of volatilization. This impact is expected to be minor as humidity in Maldives is high and with vegetation buffer zone air movement will be limited. Therefore pesticides become diluted in water droplets and return to soil surface.

Mitigation Measures

- Most 'environmentally friendly pesticides' will be used as much as possible. Also, low vapour pressure and high water solubility pesticides will be preferred.
- Turf will be irrigated after the application of pesticides to reduce the level of volatilization.

5.5.7 WASTE MANAGEMENT

Operation of the golf course is not expected to produce high quantity of waste. Maintenance of the golf course will generate green waste and to some extent chemicals. Packaging waste may be produced from material procured for maintenance and clubhouse. Some food waste is expected from guest activities. A small amount of waste oil is expected from the maintenance of the pump stations.

As the resort has an existing waste management facility and system, waste management of the golf course will be incorporated into the current practices.

Mitigation Measures

- All waste will be properly sorted and transferred to the waste management facility on a daily basis.
- Any hazardous waste will be temporarily stored on site until transfer in suitable containers.
- All staff will be trained on the handling of waste.

5.6 POTENTIAL POSITIVE IMPACTS FROM THE PROPOSED DEVELOPMENT PROJECT

The proposed project has several potential positive impacts as follows.

- Income opportunity to the resort – Under the Second Amendment to the Tourist Act (Law no. 2/99) lease rent is now based on land area. The proposed project area of Villingili is at present unused however the resort is required to pay lease rent for this area under the Second Amendment. Therefore it is in the best interest of the developer to propose a project that will increase income from tourist activities.
- Aesthetic improvement – the area is currently in an abandoned state after the completion of the construction of the resort. The project will improve the aesthetics of the area and enhance the wetland ecosystem creating a further attraction for tourists.
- Enhanced tourist experience – The proposed project will provide an additional activity for tourists to enjoy enhancing the tourist experience during their stay at Villingili.
- Management of the wetland area – The proposed golf course does not involve bringing about changes to the wetland and is incorporated to the design of the golf course as a preserved area. Further as the area has been unused since opening of the resort there has not been much management of the environment of the area. This project will monitor the wetland conditions and manage the area as a tourist attraction.
- Employment opportunities – The project will create employment opportunities for the community of Addu atoll as well as other Maldivians.
- Basis for product diversification for tourism in Maldives – Given that golf as a tourism product is new to the Maldives this project can in future relay experience and results in diversifying tourism to include golf and other such high class sports that attract high end tourists.

5.7 COST OF MITIGATION MEASURES

Table 5.2 Cost of Mitigation Measures for Impacts during Construction Phase

Impact	Mitigation Measures	Costs
Loss of Flora and Fauna	Mangrove vegetation will not be cleared for any purpose to preserve the integrity of the wetland.	NA
	All mature trees will be retained and incorporated in the design of the golf course.	NA
	Only vegetation that is absolutely necessary to be removed will be cleared minimizing any changes to habitat and therefore species behaviour.	NA
	A buffer zone of at least 15m will be retained along the coast to ensure the natural defense against erosion is sustained.	NA
	Any vegetation that is removed will be re-planted in the area or elsewhere in the island.	USD5000
Groundwater and Marine Water	Oil and toxic substances will be properly contained in a bunded area with a capacity to contain 1.5 times the	USD5000

Contamination	amount of the stored substance. All raw materials will be stored away from the vicinity of the coastal areas to avoid contamination in these areas. General refuse generated during these phases of the development will be stockpiled in one central area of the development site for easier management and monitoring. All construction waste will be collected, transported and disposed of appropriately at a designated disposal site. Clearance of vegetation must be avoided in periods of heavy rainfall to reduce the impact of runoff on marine waters. Construction activities will be carried out under the supervision of a suitably experienced person.	 NA USD1000 USD1000 NA USD2000
Noise and Air Pollution	All construction works will be carried out during day time to minimise disturbances caused to nocturnal fauna such as birds and fruit bats that uses auditory communication. All vehicles and machinery will be tuned and well maintained to minimise air pollution. To minimise dust from construction works, ground will be kept damp. Construction material such as sand and aggregate will be covered or damp when stockpiled to reduce the effects of wind whipping. Care will be taken in delivery and unloading of construction material particularly aggregate, sand and cement to prevent spillage. If any spill occurs, it will be cleaned up immediately. Retain a buffer area of trees and other vegetation around the perimeter of the development site which will serve as a natural windbreak which may reduce the level of dispersion of dust particles generated during this phases of the development. All staff employed at the construction site will be provided with dust masks and be asked to use them. All waste must be transported off-site for processing, not burnt or stored for any longer than is absolutely necessary.	NA USD2000 USD1000 USD1000 NA NA USD2000 USD1000
Greenhouse Gas Emissions	All mature trees will be retained and incorporated in the design of the golf course. Only vegetation that is absolutely necessary to be removed will be cleared.	NA NA

	Any vegetation that is removed will be re-planted in the area or elsewhere in the island. Waste will be properly stockpiled temporarily on site and disposed at a designated disposal site.	USD2000 USD1000
Impacts from waste	Compost any green waste that is generated to use in soil conditioning. Stockpile waste at a designated site for easier management and possible reuse of the material. Transfer waste to a designated disposal site as and when necessary. Store any hazardous waste in properly bunded areas to prevent pollution of the immediate environment.	USD1000 USD1000 USD1000 USD2000

Table 5.3: Cost of Mitigation Measures for Impacts during Operation Phase

Impact	Mitigation Measures	Costs
Introduced Species	Turf Management Plan will be developed which will include regular monitoring of the planted areas to ensure that growth is limited to these areas. Seashore Paspalum will be removed from areas other than the planned spots should there be any spreading of the grass.	US$5000 USD5000
Groundwater Contamination	Adequate treatment of wastewater will be ensured through regular monitoring to meet WBG/IFC and national standards. All chemicals used during the operation of the golf course will be stored in secure and bunded locations. Staff will be informed and trained on the application areas and quantities and, use of chemicals will be done with proper supervision. Groundwater will be monitored regularly for any signs of deterioration related to treated wastewater and chemicals. Fertilizer application will be based on regular soil testing to avoid over-application. The area will be irrigated after the application of chemicals to reduce volatilization. Use of fertilizer will be adjusted based on available natural sources of fertilizer, for example, nitrogen from grass clippings. Practices and products that reduce the potential for	NA USD2000 USD1000 USD500 USD1000 NA NA

	contamination of water will be implemented as much as possible including physical removal of weeds, slow-release fertilizers and environment-friendly products.	USD2000
Wetland and Marine Water Contamination	All chemicals used during the operation of the golf course will be stored in secure and bunded locations. Excessive application of chemicals will be avoided through soil monitoring and proper training of staff. All staff will be made aware of sensitive areas such as the wetland in the application of chemicals. Marine water and wetland will be monitored regularly to ensure any sign of contamination is addressed immediately. A vegetation buffer will be maintained around the wetland and around the golf course to reduce nutrient loading to wetland and marine waters. Irrigation will be monitored properly especially during rainfall to ensure leaching and runoff is not further increased from excessive irrigation. Slow-release fertilizers will be used as much as possible to reduce leaching and runoff. Practices and products that reduce the potential for contamination of water will be implemented as much as possible including physical removal of weeds, slow-release fertilizers and environment-friendly products.	US$2000 USD1000 NA US$500 NA NA USD500 USD2000
Soil Quality Degradation	All chemicals used during the operation of the golf course will be stored in secure and bunded locations. Slow-release fertilizers will be used as much as possible to reduce leaching and runoff. Practices and products that reduce the potential for contamination of water will be implemented as much as possible including physical removal of weeds, slow-release fertilizers and environment-friendly products. Excessive application of chemicals will be avoided through soil monitoring and proper training of staff. All staff will be trained in nutrient management and chemical application.	US$1000 NA USD2000 NA USD1000
Noise Pollution	Ensure that the golf course adheres to its opening hours which are between 6:00 a.m. and 8:00 p.m. daily. Ensure that deliveries to the golf course are made between 8:00 a.m. and 5:00 p.m. daily. Ensure that maintenance works on the golf course occurs between the hours of 8:00 a.m. and 5:00 p.m. daily.	NA NA NA

	Use proper signage around the wetland area to make tourists aware that there may be birds in the area. Install noise reduction measures such as building bund walls around the pump stations, installing sound proofing attenuators and silencers. Retain all vegetation around the wetland area as a buffer against noise. Ensure all golf buggies are properly maintained and tuned.	USD500 USD15000 NA USD500
Air Quality Degradation	Most 'environmentally friendly pesticides' will be used as much as possible. Also, low vapour pressure and high water solubility pesticides will be preferred. Turf will be irrigated after the application of pesticides to reduce the level of volatilization.	USD2000 NA
Waste management	All waste will be properly sorted and transferred to the waste management facility on a daily basis. Any hazardous waste will be temporarily stored on site until transfer in suitable containers. All staff will be trained on the handling of waste.	NA USD1000 USD500

6 ALTERNATIVES

6.1 INTRODUCTION

This section looks at alternative ways of undertaking the proposed project. Firstly, at the broad level there are two main options to undertake the project: (1) undertake the project or (2) not undertake the project. The environmental assessment above has been conducted in view of the former and this section will explore the no project option.

6.2 NO PROJECT OPTION

The no project option takes the following into account.

- The area proposed for the golf course will be left in its present state.
- The developer will not be able to maximize value of the land against payment of lease rent based on land area according to the Second Amendment to Tourism Act.
- Jobs related to this project will not be created.

The advantages and disadvantages of the no project option are discussed in Table 6.1 below.

Table 6-1 Advantages and Disadvantages of the No Project Option

Advantages	Disadvantages
Vegetation in the area will be left intact. No environmental impacts from the proposed project. No development costs to the Proponent.	Loss of income to the Proponent. Loss of employment opportunities for the atoll population Lack of diverse products offered to tourists at the resort. Success of such a project as a new product for tourism sector will be unexplored.

Despite the environmental disadvantages of the no project option, the socio-economic benefits are too numerous for this project to be undertaken. The modern day mitigation technologies if followed properly as prescribed in this document will ensure negative impacts are managed efficiently, when implemented properly.

6.3 REDUCED SCALE OF DEVELOPMENT

The scale of development could be reduced but as the area of the golf course is quite small at present, any smaller than the area proposed may not make it attractive as a recreation. Main advantages and disadvantages of this option is listed in Table 6-2.

Table 6-2 Advantages and disadvantages of the reduced scale option

Advantages	Disadvantages

Environmental footprint could be smaller.	Investment cost may be too high compared to the scale of the project. Unattractive to tourists due to the small size. Required jobs will be less reducing employment opportunities.

6.4 ALTERNATIVE LOCATION

As the resort is fully developed it is not favourable to locate the golf course elsewhere in the resort. Relocation of the golf course within the resort itself may not be suitable to the concept and design of the resort. Therefore the option available for an alternative location is to establish the golf course in another island of Addu atoll which may be one of the inhabited islands, uninhabited islands or Gan International Airport. The advantages and disadvantages of this option is listed in Table 6-3.

Table 6-3 Advantages and disadvantages of alternative location option

Advantages	Disadvantages
Income opportunity for the community. A larger golf course may be developed. Employment opportunities to the community.	Loss of revenue to the proponent. Investment cost may be too high compared to the scale of the project. Higher management and maintenance costs for the proponent. Social conflicts in selecting a site. Social issues in frequent visits of tourists to a inhabited area. Greater responsibility to the resort in ensuring safety of tourists.

The main concern in locating the golf course outside of the resort is the loss of revenue to the proponent in the light of the Second Amendment to the Tourism Act. The Second Amendment requires the payment of lease rent based on land area. The proponent will be at a disadvantage from locating the golf course outside of the resort in that the proposed golf course site will be left unused and therefore a feasible amount of revenue may not be generated from the land area. In addition, relocating the golf course outside the resort will involve management costs to the resort. Therefore relocating the golf course creates disincentive for the proponent and is not a favourable alternative.

6.5 ALTERNATIVE DESIGN

Figure 6-1 shows the alternative design for the golf course taking into account that the scale of the golf course cannot be reduced to less than nine holes and that the wetland needs to be protected as much as possible.

The alternative design proposes one artificial pond at the southern end and located away from the wetland.

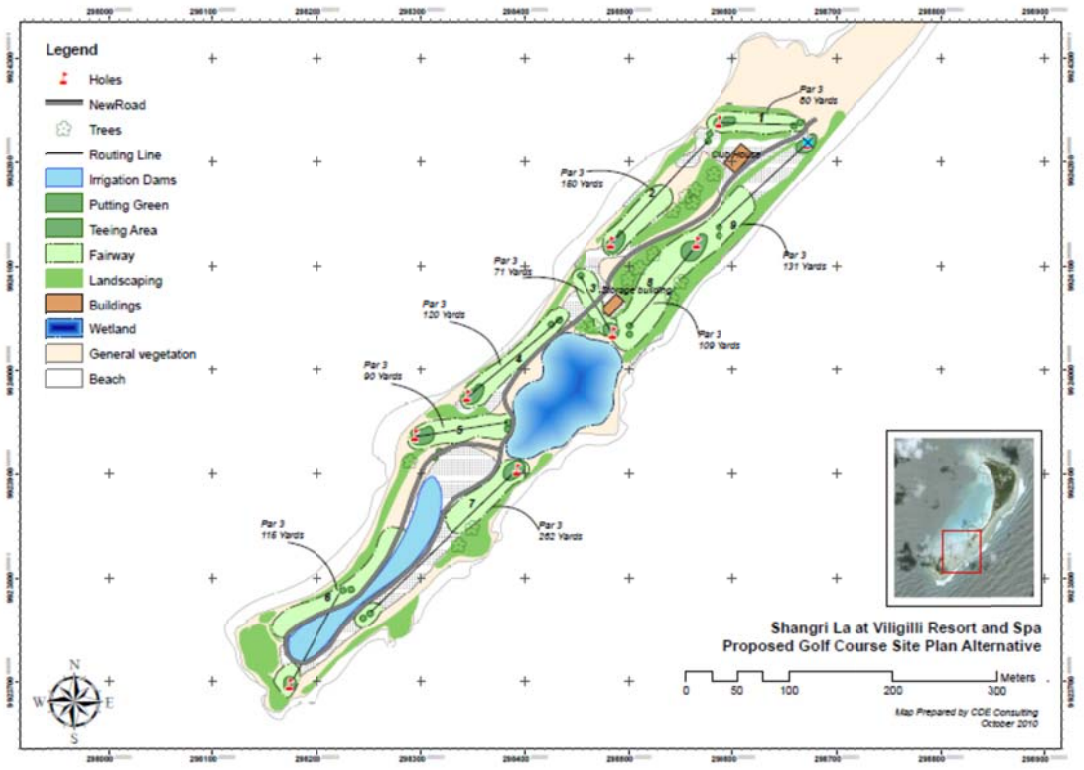


Figure 6-1 Alternative design of golf course

Larger version of the map is provided in Appendix 11.

Advantages	Disadvantages
Wetland is more protected with potential adverse impacts related to the artificial pond during construction and operation.	A larger area is required for the pond

6.6 CHOSEN ALTERNATIVE

Based on the advantages and disadvantages considered in the alternatives described above, the chosen alternative for the proposed golf course is the alternative site plan.

7 ENVIRONMENTAL MONITORING PROGRAM

7.1 INTRODUCTION

Environmental monitoring and auditing is an essential component of any project. Under the EIA regulations of Maldives, a detailed monitoring plan is a mandatory component of any EIA. Major areas that will impact the environment should be included in the monitoring programme. In this regard, the project components should specify the location of monitoring points, the parameters to be analysed, and the frequency of such analyses. An appropriate time interval can be planned for monitoring activities that will address the major areas of concern.

For the purpose of this project, monitoring should be done on all aspects of the golf course construction and operation that have the potential to influence the environment. Such areas where monitoring is required include changes to terrestrial environment including vegetation, groundwater and wetlands and, marine water quality.

It must be noted that Villingili undertakes annual environmental monitoring to meet the requirements of WBG/IFC standards. Therefore monitoring aspects discussed here will be incorporated to the annual monitoring plan of the resort.

7.2 MONITORING DURING CONSTRUCTION PHASE

Monitoring aspects specific to this particular project are:

- Landscaping and Vegetation growth:
- Percentage of trees reused
- Percentage of exotic species brought from overseas
- Survival rates of re-planted and newly planted trees
- Groundwater quality – Salinity, pH, conductivity, faecal coliform and TDS
- Sea Water quality – Oil films, Total Suspended Solids, Dissolved Oxygen (% saturation), Dissolved Oxygen (mg/l), turbidity (NTU), temperature and water depth.
- Wetland water quality
- Noise levels
- Air quality

The proponent is committed to undertake the monitoring programme.

Outlined here are project specific monitoring requirements for the construction phase. This monitoring programme for the proposed project includes at least monthly monitoring and covers the three stages of the project implementation.

7.2.1 CONSTRUCTION PHASE MONITORING TIMETABLE

The following Table 8.1 shows the frequency at which the different parameters may be monitored. Each bar represents one month. This monitoring programme may be continued during the operational phase.

Table 7-1 Monitoring frequency of each parameter

	Setup stage	Construction phase																
Vegetation replantation	♦							♦										
Marine water quality	♦	♦						♦						♦				
Groundwater quality	♦	♦						♦						♦				
Wetland water quality	♦	♦						♦						♦				
Noise	♦	♦						♦						♦				
Air quality	♦	♦						♦						♦				

7.2.2 OTHER MONITORING NEEDS

The following aspects will be monitored during the construction stage:

- Daily monitoring to ensure that the construction processes are not creating any significant dust nuisance for the local environment.
- Regular water quality monitoring to ensure that the construction works are not negatively impacting the groundwater and wetland environment.
- Undertake daily assessment of the quantity of solid waste generated and keep records of its ultimate disposal.
- Monitor re-vegetation activities to ensure minimal damage to trees during handling and whether the correct vegetation profiling is used.

7.3 MONITORING DURING OPERATIONAL PHASE

7.3.1 TERRESTRIAL ENVIRONMENT

With the completion of the construction, monitoring will be undertaken for terrestrial environment in conjunction with a more comprehensive program of monitoring for the whole island. Performance indicators that would apply to the terrestrial environment include indicators for:

- The extent of the remaining vegetation cover in the area.
- The number of trees successfully replanted and the number of trees that fails to survive.
- Noise levels from the operation of the golf course.
- Changes in air quality by level of NOx and SOx as relevant
- Evidence of soil contamination.

- Changes in selected bird colonies and other selected faunal species.
- Changes to groundwater quality.
- Changes to wetland water particularly nutrient loading.
- Alterations to the marine environment including marine water quality and signs of eutrophication.

Table 7-2 Implementation schedule for the terrestrial environment monitoring

Type	Frequency of monitoring	Main Concerns to address	What to monitor
Introduced plant species	Three monthly	Spread of the grass to unintended areas	Signs of growth of the grass in other areas especially sensitive areas such as the wetland and coastal vegetation buffer zone
Flora	Six monthly	Vegetation regrowth of replanted trees.	Presence, loss or damage
Flora	Annually	Vegetation loss or increase indicates either damage or improvement to the flora.	Number of trees surviving re-planting
Fauna – Birds and bird nesting grounds	Six monthly	Assess whether bird numbers are decreasing or increasing. Identification of bird nesting grounds within the island	Bird species and numbers Number of bird nests
Soil	Six monthly	Alteration of soil chemistry from the application of chemicals and introduction of new plant species. Soil contamination from accidental spill of chemicals.	Selected parameters of soil condition Evidence of soil contamination in high risk locations
Noise	Six monthly	Changes in noise levels	Ambient noise level
Air	Six monthly	Changes in air quality	PM_{10}, NO_2, SO_2

7.3.2 WATER QUALITY

Monitoring and auditing of ground, marine and wetland water quality is vital for environmental protection of Villingili. This monitoring programme would be required to ensure the implementation of the recommended water quality mitigation measures and to assess the effectiveness of these measures. If monitoring results indicate that the water quality is not improving after the implementation of the recommended mitigation measures, then appropriate alternatives need to be carefully considered.

Table 7.3 outlines the implementation schedule for water quality monitoring, both ground and marine water. Baseline data for groundwater was collected from one location. However, once the proposed developments go into operation, additional monitoring locations will be identified and selected for continuous monitoring. These locations will be preserved and marked for monitoring purpose.

Table 7-3 Implementation schedule for the water quality monitoring programme

Type of water and location	Frequency of monitoring	Main Concerns to address	Parameters to monitor
Ground water from selected locations	Every month for the first year and then three monthly	Assess groundwater quality to assess impact from recharge by treated wastewater	pH, faecal coliform, total coliform, Residual chlorine
Ground water from selected locations	Every month for the first year and then three monthly	Assess groundwater quality to assess impact from application of chemicals to the golf course.	pH, Nitrates, Phosphates, Potassium, BOD, DO, TSS, Turbidity, Electrical Conductivity
Seawater quality	Every three months	Water quality control in the immediate lagoon to ensure that water quality is not affected by chemical leaching and runoff.	pH, Temperature, Salinity, BOD, Turbidity, Nitrate, Phosphate, Potassium
Wetland	Every three months	Water quality of the wetland to ensure it is not affected by leaching and run off from chemical applications in the golf course.	pH, temperature, BOD, nitrate, phosphate, potassium, turbidity

7.3.3 WASTEWATER MONITORING

Quality of wastewater discharged into the environment plays a key role in contaminating the receiving water body. For the golf course, treated wastewater is proposed as the primary source of water supply. Therefore, the effluent quality of the sewage treatment plant in the resort will need to be monitored to determine the efficacy of the treatment system in terms of its claimed standards and to provide a means of accurately monitoring any changes in treated effluent. Wastewater will therefore need to be regularly monitored for selected parameters. Table 7.4 outlines the recommended effluent quality standards of the required parameters for wastewater monitoring and Table 7.5 outlines the implementation schedule for wastewater monitoring.

Table 7-4 Recommended effluent quality standards for wastewater monitoring

Parameter	Justification for monitoring	Standard
Temperature	An important determinant because of its effects on chemical reaction, reaction rates, aquatic life and suitability for beneficial uses.	40 o C
pH	Hydrogen ion concentration is an important quality parameter of both natural water and wastewater. Concentration range suitable for the existence of most biological life is quite narrow and critical.	5-9
BOD5	Most widely used parameter of organic pollution applied to both wastewater and surface water is the 5-day biochemical oxygen demand (BOD5). This determination involves measurement of dissolved oxygen used by microorganism with biochemical oxidation of organic matter. Treated effluents should usually meet this criteria.	20-60 mg/l
COD	Chemical oxygen demand (COD) test is used to measure the contents of organic matter of both wastewater and industrial water. Oxygen equivalent of organic matter that can be oxidized is measured by using strong oxidizing agent against an acidic medium. This test is also used to measure organic matter in wastewater that contains compounds that are toxic to biological life. COD of wastewater is in general higher than BOD, because more compounds can be chemically oxidized than can be biologically oxidized.	120 mg/l
Total Suspended Solid (TSS)	This is also one of the most important contaminant of concern in wastewater treatment. Suspended solids can lead to the development of sludge deposits and anaerobic conditions when untreated wastewater is discharged in to the environment.	150 mg/l

Table 7-5 Implementation schedule for wastewater monitoring

Type of water and	Frequency of	Main Concerns to address	Parameters to monitor

location	monitoring		
Wastewater effluent from the treatment plant.	Every three months	-Poor water quality of effluent has the potential to contaminate the groundwater aquifer.	BOD5, COD, Total suspended solids (TSS), E. coli, ammonia, total nitrogen, total phosphorus, pH and dissolved oxygen.

At present, Maldives does not have a water quality standard for effluents. Therefore, international guidelines should be used. Considering the above monitoring requirements and parameters, the effluent standards outlined in Table 7.4 will be followed as a guideline. These guideline values are adopted from the World Health Organizations (WHO) environmental quality standards.

7.3.4 SOCIO-ECONOMIC IMPACT MONITORING

Impacts on employment is the key socio-economic impact areas identified for this project. The following indicators are proposed to measure the employment impacts. This data can be obtained from the resort;s Human Resource Department.

Table 7-6 Monitoring socio-economic conditions

Impact Area	Data sought	Min. Frequency	Purpose
Employment	Percentage of employees from the atoll and island Number of female employees from the atoll and island Unemployment rate in the atoll and island Income poverty in the atoll and island	Once a year	To understand the impacts on employment and income levels from the project

7.4 MONITORING REPORT

A detailed environmental monitoring report is required to be compiled and submitted to the Ministry of Housing and Environment yearly based on the data collected for monitoring the parameters included in the monitoring programme given in this Chapter. This report may be submitted to the relevant Government agencies in order to demonstrate compliance. If required, however, a monitoring report for the proposed work phase may be prepared and submitted to the Ministry of Housing and Environment. The report will

include details of the site, strategy of data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed. In addition to this more frequent reporting of environmental monitoring will be communicated among the environmental consultant, project proponent, the contractors and supervisors to ensure possible negative impacts are mitigated appropriately during and after the project.

7.5 COST OF MONITORING

The cost of monitoring is estimated to be US$ 10,000 annually. Professional consultants will be hired to undertake the monitoring and the necessary equipment for monitoring will be procured.

7.6 COMMITMENT TO MONITORING

The proponent is fully committed to undertake the monitoring programme given in this Chapter.

8 STAKEHOLDER CONSULTATIONS

8.1 INTRODUCTION

This Chapter reports on the consultation undertaken on the proposed development activities in Shangri-La's Villingili. Stakeholder perceptions were identified through interviews during meetings and over the phone. Stakeholders were identified based on the Terms of Reference.

The views and concerns expressed during stakeholder consultations are described below.

8.2 MINISTRY OF TOURISM, ARTS AND CULTURE

Ministry of Tourism, Arts and Culture was consulted on 14 December 2010 during a meeting held at the Ministry with Mr. Ahmed Solih, Permanent Secretary. Views expressed regarding the project are as follows.

- The Ministry supports the project as the proposed golf course will be the first of its kind in Maldives and the project therefore will expand and diversify the tourism product of Maldives.
- The project is believed to create a new market for elites and therefore attract high end tourists to Maldives.
- As Shangri-La's Villingili is located in the south, the project will provide an advantage to tourism in the south over Male' region especially.
- In addition, the golf course will differentiate tourism products offered in south compared to the rest of the Maldives.
- The Ministry is in agreement with the project and direct the proponent to implement the project according to relevant legislation and guidelines of the Maldives.

8.3 MINISTRY OF FISHERIES AND AGRICULTURE

Consultation was held with Ministry of Fisheries and Agriculture on 14 December 2010. A meeting was held with Dr.Aminath Shafia, Minister of State for Fisheries and Agriculture at the Ministry. The main concerns expressed regarding the project are as follows.

- The wetland within the golf course must be preserved.
- The Ministry does not have reservations on the import of grass under the project given that the grass is sourced from a reliable supplier with stringent quarantine practices for export of plants. Improper quarantine may result in devastating impacts to the environment of Villingili.
- The preferred form for the import of grass is stolons rather than seeds in order to minimize import of microorganisms and other pests that may cause hard to the local environment.
- The project shall follow the procedure for the import of live plants.

8.4 SOUTHERN PROVINCE OFFICE

Southern Province Office was consulted by a phone interview on 14 December 2010. The person consulted was Mr. Mohamed Saudhi, Director. The interviewee was first briefed on the components of the project. Following the introduction the interview was undertaken based on the questions listed below. The views expressed are presented below.

1. Do you think this project will benefit the community of Southern Province?

The project may have benefits to the community however it is important to weigh the benefits from the project over the environmental costs.

2. Do you think this project will have any adverse impacts on the community of Southern Province and the environment?

   In order to understand adverse impacts the environmental costs and benefits have to be assessed.

3. Do you have any concerns regarding the project?

   Main concern is about any adverse impacts on the environment.

4. Is this project in line with the development goals of Southern Province?

   Not aware if there is a development master plan for Southern Province. A land use plan is in the drafting stage for Addu atoll. It is important that the project is in line with the land use plan of Addu atoll.

5. What kind of outcome from this project will benefit Southern Province in the long run?

   As the development goals for the Southern Province is unknown it is difficult to link outcomes of the project to any benefits to Southern Province.

In general, the project is seen as beneficial and the main concern expressed was that the project should look at whether the benefits outweigh the environmental costs of the project.

8.5 ADDU ATOLL OFFICE

Addu Atoll Office was consulted by a phone interview on 14 December 2010. The person consulted was Mr. Abdulla Sodiq, Atoll Councilor. The interviewee was first briefed on the components of the project. Following the introduction the interview was undertaken based on the questions listed below. The views expressed are presented below.

1. Do you think this project will benefit the community of Addu atoll?

   The main benefit expected from the project is job opportunities. However, there is dissatisfaction among the community on the job opportunities available from Shangri-La's Villingili.

2. Do you think this project will have any adverse impacts on the community of Addu atoll and the environment?

   Any adverse impacts on the community are not foreseen. With regard to the environment, vegetation clearance may be a major impact that has to be looked into.

3. Do you have any concerns regarding the project?

   Main concern is about any adverse impacts on the environment.

4. Is this project in line with the development goals of Addu atoll?

The atoll has a development plan known as Vision Addu and the project contributes to achieving the goals of Vision Addu, in that the project is expected to diversify tourism product of the atoll and also increase and expand job opportunities.

5. What kind of outcome from this project will benefit Addu atoll in the long run?

   The Councilor highlighted that the Corporate Social Responsibility policy of Shangri-La should expand to include contributing to the protection and preservation of Addu atoll environment by working with Non-Governmental Organizations within the atoll.

9 POTENTIAL GAPS IN EXISTING DATA AND LIMITATIONS IN THE ASSESSMENT

9.1 GAPS IN INFORMATION

The environment of Maldives is generally poorly understood. This may be due to the lack of detailed studies in the Maldives. Much of the literatures on coral islands are derived from studies done in the pacific, which unfortunately has very different climatic and geologic settings.

Detailed environmental analysis for an EIA is often required to be undertaken in a relatively short period of time. Given the seasonal climatic variations in Maldives and the differences in local geomorphologic and climate settings in individual islands, such a short time frame is often too little to assess selected aspects of the environment. This problem is compounded by the absence of long-term studies in other parts of Maldives. Hence, most EIA's end up being based on an environmental snapshot of specific point in time. However, experienced EIA specialists can deliver a close match to reality based on a number of similar assessments.

In this regard, the following gaps could be identified in information.

- Absence of long-term site specific or even regional data (at least 2 years).
- Absence of historical and long-term records on the conditions of the wetland.
- Lack of detailed data on geology and soil due to time limitation in EIA submission.
- Lack of consistent and longterm data on the groundwater quality at the site.
- These gaps are seriously considered in the assessment and care has been taken to address the issue in designing mitigation measures and the monitoring programme.

9.2 UNCERTAINTIES IN IMPACT PREDICTION

Environmental impact prediction involves a certain degree of uncertainty as the natural and anthropogenic impacts can vary from place to place due to even slight differences in ecological, geomorphological or social conditions in a particular place. As noted earlier, there is also no long term data and information regarding the particular site under consideration, which makes it difficult to predict impacts. However, the level of uncertainty is partially minimised due to the experience of golf course construction and operation in similar settings in the Maldives. Nevertheless, it is important to consider that there will be uncertainties and voluntary monitoring of natural processes as described in the monitoring programme is absolutely essential.

10 REFERENCES

Binnie Black & Veatch, 2000. Enviromental / Technical Study for Dredging / Reclamation Works under Hulhumale' Project - Final Report. Ministry of Construction and Public Works, Male'.

Choi, B. H., Pelinovsky, E., Kim, K. O. & Lee, J. S., 2003. 'Simulation of the Trans-Oceanic Tsunami Propagation Due to the 1883 Krakatau Volcanic Eruption'. Natural Hazards and Earth System Sciences, 3, 321-332.

Goda, Y., 1988. Causes of High Waves at Male' in April 1987. Department of Public Works and Labour, Male, Maldives.

Hoback, W.Wyatt, Kerri M. Skinner, and Leon G. Higley. 2003. Exotic Species Curriculum for Agricultural Problem-solving Education. Kearney, NE: University of Nebraska. Home Page: http://www.unk.edu/acad/biology/hoback/escape/home.html (Version 15DEC2003). Available from http://cgi.unk.edu/hoback/ESCAPE/whats_exotic.html. Accessed 13 December 2010

IUCN Invasive Species Specialist Group, 2008. Global Invasive Species Database - Paspalum Vaginatum. [Online]. Available from: http://www.invasivespecies.net/database/species/references.asp?si=1351&fr=1&sts=sss&lang=EN. Accessed on 13 December 2010.

Luthfy, M. I., 1994. Dhivehirajjeyge Geographeege Vanavaru [the Geography of Maldives], Novelty Printers and Publishers, Male'.

Maniku, H. A., 1990. Changes in the Topography of Maldives, Forum of Writers on Environment of Maldives, Male'.

MHAHE, 2001. Maldives State of the Environment 2001, Ministry of Home Affairs, Housing and Environment, Male'.

Ministry of Planning and National Development, 2006. Maldives Population and Housing Census 2006: Preliminary Results. Ministry of Planning and National Development,, Male', Maldives.

Ministry of Planning and National Development (MPND), 2006a. Maldives Population and Housing Census 2006: Preliminary Results. MPND, Male', Maldives.

Ministry of Planning and National Development (MPND), 2006b. Statistical Yearbook of Maldives 2005, Ministry of Planning and National Development, Male, Maldives.

Naseer, A., 2003. 'The Integrated Growth Response of Coral Reefs to Environmental Forcing: Morphometric Analysis of Coral Reefs of the Maldives.' Dalhousie University, Halifax, Nova Scotia.

Pernetta, J. & Sestini, G., 1989. The Maldives and the Impact of Expected Climatic Changes. UNEP, Nairobi.

Severe weather events in 2002 2003 and 2004, 2005. [Online] Department of Meteorology, Male', Maldives, Available from: Date Accessed:

Shaig, A., 2005. 'Population and Development Consolidation as a Strategy to Reduce Risk of Natural Disasters and Global Climate Change: A Case Study on Maldives', Unpublished Thesis, James Cook University, Townsville.

The Toro Company 2007. 'Irrigation Solutions: what is drip irrigation?' [Online} The Toro Company, California. Available from: http://www.dripirrigation.org/images/ALT142_What%20Is%20Drip%20article_WEB.pdf. Date accessed 6 December 2010.

UNEP, 2005. Maldives: Post-Tsunami Environmental Assessment. United Nations Environment Programme.

United Nations Development Programme (UNDP), 2005. Disaster Risk Profile for Maldives., UNDP and Government of Maldives, Male'.

Woodroffe, C. D., 1989. Maldives and Sea Level Rise: An Environmental Perspective. Ministry of Planning and Environment, Male'.

APPENDIX 1 TERMS OF REFERENCE

APPENDIX 2 CVS OF CONSULTANTS

APPENDIX 3 SITE PLAN

APPENDIX 4 SURVEY LOCATIONS

APPENDIX 5 TOPOGRAPHY

APPENDIX 6LETTER FROM NATIONAL HEALTH LABORATORY

APPENDIX 7 RESULTS OF WATER TESTS

APPENDIX 8VEGETATION CLASSIFICATION

APPENDIX 9 DISTRIBUTION OF LARGE TREES

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APPENDIX 11 ALTERNATIVE SITE PLAN

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