ENVIRONMENTAL IMPACT ASSESSMENT

FIRST ADDENDUM

For the Development of an Airport on Maamigili Island, South Ari Atoll

Proposed by

Villa Shipping and Trading Company Pvt. Ltd.

Prepared by

CDE Consulting

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EXECUTIVE SUMMARY

This Addendum to the Environmental Impact Assessment (EIA) is an evaluation of the potential environmental, socio-economic and natural impacts of the proposed changes to the airstrip development project in Maamigili, South Ari Atoll.

Introduction and Key Features of the Project

Project Background

Maamigili is situated in one of the key tourism dominant resorts in Maldives. The ongoing development of an airstrip in Maamigili addresses the need for improved transport infrastructure to complement the thriving tourism industry in the atoll. A commercial harbour has also been developed on the eastern side of the island. However, commercial harbour operations are interfering with passenger travel both physically and aesthetically. A key objective of the Maamigili Airport is to transport tourists from Surrounding islands and atoll to Male' International Airport. Hence, the present situation in the commercial harbour is not suitable for passenger movement particularly for tourism related activities. The proposed changes to the project will address this issue, by constructing a separate jetty on the western side of the island. The proposed additional components of the airport development project also include coastal protection of the western coastline, as well as an access road between the jetty and the airport terminal, and a waiting area for passengers.

Project Objectives

The major objectives of the proposed project activities are to:

1) Improve airport services offered to the tourism industry
2) Mitigate coastal erosion

Project Scope and work methodology

The proposed project involves dredging and backfilling, and construction of a revetment, jetty, jetty head, access road and waiting area. Details of the proposed project components are outlined below.

1) Dredging and Backfilling

The existing harbour basin will be dredged to obtain material for backfilling of an area of 25 Ha on the western side of the island. Approximately, 37,500m^3 of sand will be dredged from the harbour basin, which will be stockpiled at the site demarcated for future construction of the fuel pump, before transportation to the site by large trucks. A cutter suction dredger will be used for dredging. All equipment needed for these activities are already mobilised on the site for previous activities of the project.

2) Profiling and Coastal Protection

The backfilled area will be profiled and a revetment will be constructed using boulders available on the island. This revetment will provide coastal protection to the backfilled area on the western side of the island.

3) Jetty Construction and Placement of a Jetty Head

The primary activity of this project is the construction of the jetty. Sheet piles will be used to construct the jetty. A jetty head constructed using armour rocks will be placed to prevent scouring and damage to the jetty, and control wave action and erosion in the area.

4) Construction of Access Road and Waiting Area

A dirt road will be cleared on the backfilled area between the jetty and the airport terminal, to facilitate easy access to the airport. A waiting area will also be constructed on the backfilled area, near the jetty, for the convenience of passengers.

Project Schedule and Life Span

Mobilisation for the project will begin after the EIA is approved. It is anticipated that the completion of the whole project will take approximately 8 months.

Existing Environment

The existing environment is heavily modified with extensive reclamation and dredging activities. This document refers heavily to the first EIA addendum for baseline conditions but provides additional assessments where required by the ToR. These include marine water quality, marine environment status, beach conditions and bathymetry.

Environmental Impacts

The potential significant impacts from the project are summarized below:

Potential Adverse Impacts during Sand Pumping/Dredging:

1) Damage to coral reef, lagoon benthos and fish population due to turbidity and sedimentation during dredging
2) Changes to coastal processes, possibly leading to erosion
3) Potential marine water contamination from accidental oil spills
4) Noise and air pollution
5) Vibrations

Potential positive Impacts from the overall project

1) Improved access, leading to increased convenience for tourist and locals
2) Job opportunities during construction phase
3) Coastal protection

Alternatives

The key alternatives considered for this project are as follows:

1) "No-project" Alternative
2) Dredging alternatives
3) Alternative borrow area
4) Sedimentation control measures
5) Alternative sheet piling technologies
6) Revetment alternatives

Environmental Monitoring Program

Monitoring program is based on the information requirements of the project.

The key areas highlighted in the program are:

1) Sedimentation – Ensure that silt screens or bundwalls are in place during sand pumping works and check for murkiness of water by visual observation on a daily basis. In addition the water quality of the dredging site shall be monitored on completion, two months after completion and thereafter annually by checking the levels of turbidity, total suspended solids (TDS) and dissolved oxygen (DO) levels by laboratory analysis. In addition, the weather conditions and sea conditions (tidal mode and currents) shall be recorded so that dredging works can be avoided during harsh weather and sea conditions.
2) Marine Water Contamination – All machinery that will be used for the proposed works/activities shall be properly tuned and maintained on a daily basis to avoid any leakage or accidental oil spillage.
3) Erosion and coastal changes
    a. Beach profiles at given locations immediately after dredging works and there after annually.
    b. Beachline at high tide and low tide and eroding areas marked using GPS
    c. Longshore currents at beach profile locations and in selected points around the lagoon

The proponent is committed to undertake the monitoring programme.

Conclusion

In conclusion, this assessment has comprehensively evaluated the components of the project, the exiting environment and the predicted impacts on the marine environment. Specific mitigation measures have been provided to control and mitigate impacts. The project will have some significant short-term impacts but they can be mitigated with the proper procedures and measures highlighted in this report. The monitoring programme will ensure that any unanticipated impacts arising in the long-term are addressed as they appear.

1 INTRODUCTION

1.1 Purpose of the EIA

1. The purpose of this document is to assess the potential environmental impacts and mitigation measures for the proposed changes to the airport development concept plan of Maamigili. This document has been produced with reference to the original Environmental Impact Assessment (EIA) and the First Addendum of the proposed Airstrip development at Maamigili.
2. The baseline conditions of the island are largely based on the original EIA documents. Additional information on some major changes to the environment is provided where appropriate and as specified by the ToR.
3. This report covers the new changes proposed for the concept, its potential negative and positive impacts on the environment, potential mitigation measures required to minimize or manage these impacts and a detailed monitoring programme.
4. This report is produced in accordance to the technical guidelines and EIA regulations prepared by the Environment Protection Authority.

This addendum is developed for Villa Shipping and Trading Company Private Limited by CDE Consulting.

1.2 Background and Overview

Maamigili is an inhabited island located in South Ari Atoll. Several tourist resorts have been developed within the atoll, under the first 10-year Tourism Master Plan, making the area as a densely developed zone in the country. The rapid growth in the tourism industry has necessitated the improvement of national communication and transport infrastructure. The need for an airport to in the atoll was recognised by the government, and the 1991 National Development Plan states the government's aim to construct an aerodrome in Ari atoll.

The proponent, Villa Shipping and Trading Company Pvt Ltd is a leader on the tourism industry of the country, and manages two tourist resorts in the vicinity of Maamigili. The proponent initiated the ongoing development of an airstrip in Maamigili, along with the development of a harbour on the island. This addendum to the EIA report focuses on the proposed additional components to the airport development project, which includes construction of an access jetty for speedboats and coastal protection of the western coastline, as well as an access road between the jetty and the airport terminal and a waiting area for passengers.

1.3 Project Need, Justification and Objectives

1.3.1 Improve airport services offered to the tourism industry

Ari atoll is an important hub for tourism in the Maldives, with several tourist resorts operating in the vicinity of Maamigili. The airstrip being developed in Maamigili would provide a convenient solution to the problem of inter-island transport at night and during rough weather.

The harbour on the eastern side of Maamigili currently provides access to the island and the airstrip. However, it has become apparent that the operation of the harbour hinders access to small passenger vessels like speedboats. Hence, it will not be practical or aesthetically acceptable to use the harbour as a hub for tourist passenger operations.

A separate jetty for speedboats would provide convenient access to the airstrip for tourists and other passengers. The access road proposed to be cleared between the jetty and the terminal would provide direct access from the jetty to the airport terminal.

1.3.2 Mitigate Coastal Erosion

The proposed jetty head will control wave action within the project site and prevent scouring and damage to the sheet-piled jetty. It will also help to prevent erosion of island beach on the northern side. The revetment proposed to be constructed along the western shoreline will protect the shoreline and infrastructure built on backfilled areas from wave erosion. Coastal flooding in the backfilled area will also be mitigated by profiling the shoreline.

1.4 Scope and Terms of Reference of EIA

The scope of this EIA is broadly based on the Environmental Impact Assessment Regulations 2007. The assessment more specifically adheres to the Terms of Reference (ToR) issued by the Environmental Protection Agency on 16th June 2010. The ToR is based on scoping meeting held between the stakeholders on 31 May 2010. A copy of the ToR is attached in Appendix A. The EIA report contains the following main aspects.

A description of the project including the need for the project, how the project will be undertaken, full description of the relevant parts of the project, implementation schedules, site plans and summary of project inputs and outputs *(Chapter 1&2).*

Information about the exiting baseline environmental conditions of the site. These include coastal and marine environment of the site. *(Chapter 3)*

An assessment of the potential impacts (environmental, social, and economic) during both construction and operational stages of the project as well as identification and cost of the potential mitigation measures to prevent or reduce significant negative impacts during both construction and operation stages of the project *(Chapter 4).*

Assessment of alternatives for the proposed project activities *(Chapter 5)*

Details of the environmental monitoring plan *(Chapter 6).*

Outcomes of consultation with relevant stakeholders *(Chapter 7)*

1.5 Assessment Methodology

The process followed in the preparation of this EIA report consists of five parts. These are: scoping consultations; literature review; field surveys; analysis of results; and compilation of the assessment in the form of a report.

The first step of the process covered consultations with client and government agencies to determine the scope of the impact assessment. During this stage the client clearly outlined their development needs and assessment was geared to match the development plan and environmental assessment needs. The environmental assessment needs was determined based on the EIA Regulations 2007 and the issues brought forward by the Environmental Protection Agency in the scoping meeting.

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 similar developments in island settings. In this context, the EIA Regulations 2007, best practices from similar development activities, scientific studies undertaken in similar settings around Maldives and previous documents/historical publications was considered.

The third stage involved field assessment on the island and areas covered by the EIA scope. Conditions of the existing environment were analysed using established scientific methods. 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 consultants' findings.

1.6 EIA Team Members

The team members of this EIA are:

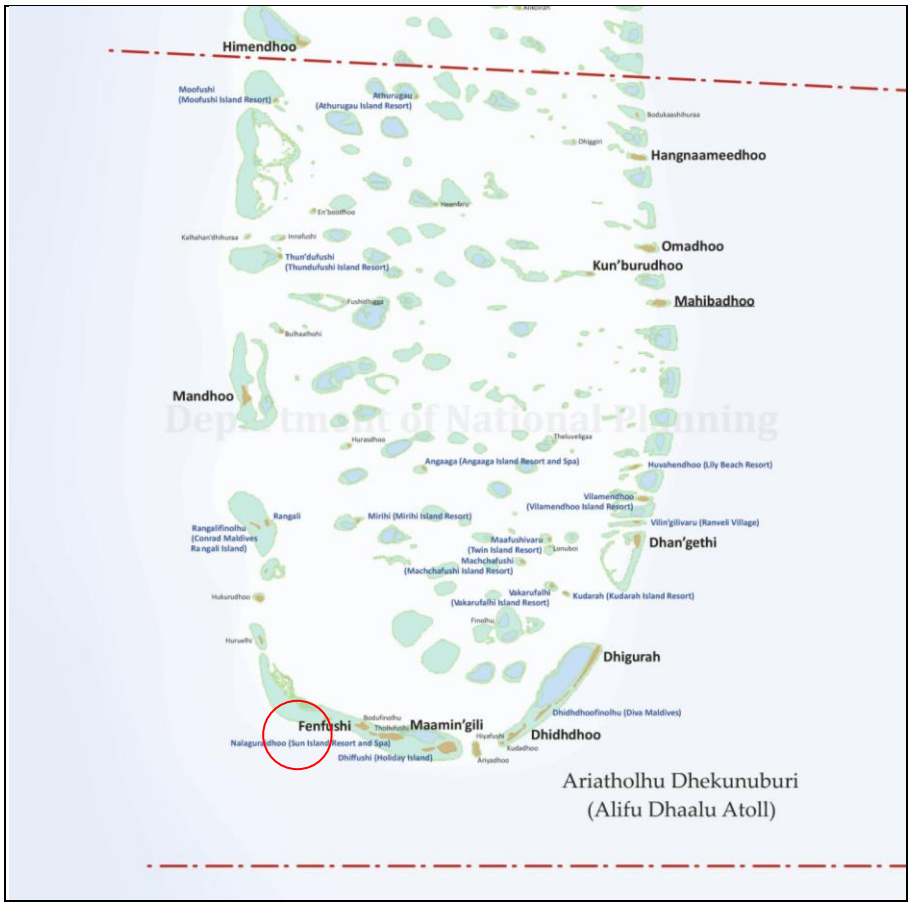
- Dr. Simad Saeed (Environmental Management and Planning Consultant, Team leader)
- Hafeeza Abdulla (Environmental Management Consultant)
- Aminath Afrah Rasheed (Environmental Management Consultant)
- Ahmed Haiman (Field Assistant - marine)
- Ali Moosa Didi (Surveyor)

The curriculum vitae's of the EIA consultants are attached in Appendix D of this report.

2 PROJECT DESCRIPTION

2.1 Project Location

Maamigili is the southernmost island on the South Ari Atoll, located at 72° 50′ east and 3° 28′ north. Resorts such as Sun Island and Holiday Island and Ari Beach are in close proximity (see figure 2.1 Below).



Source: Department of National Planning

Figure 2.1: Location map of Maamigili

2.2 Project Site Plan

The proposed conceptual and site plan for the project is presented in Appendix B. A Reduced version of the site plan is provided in Figure 2.2 below.

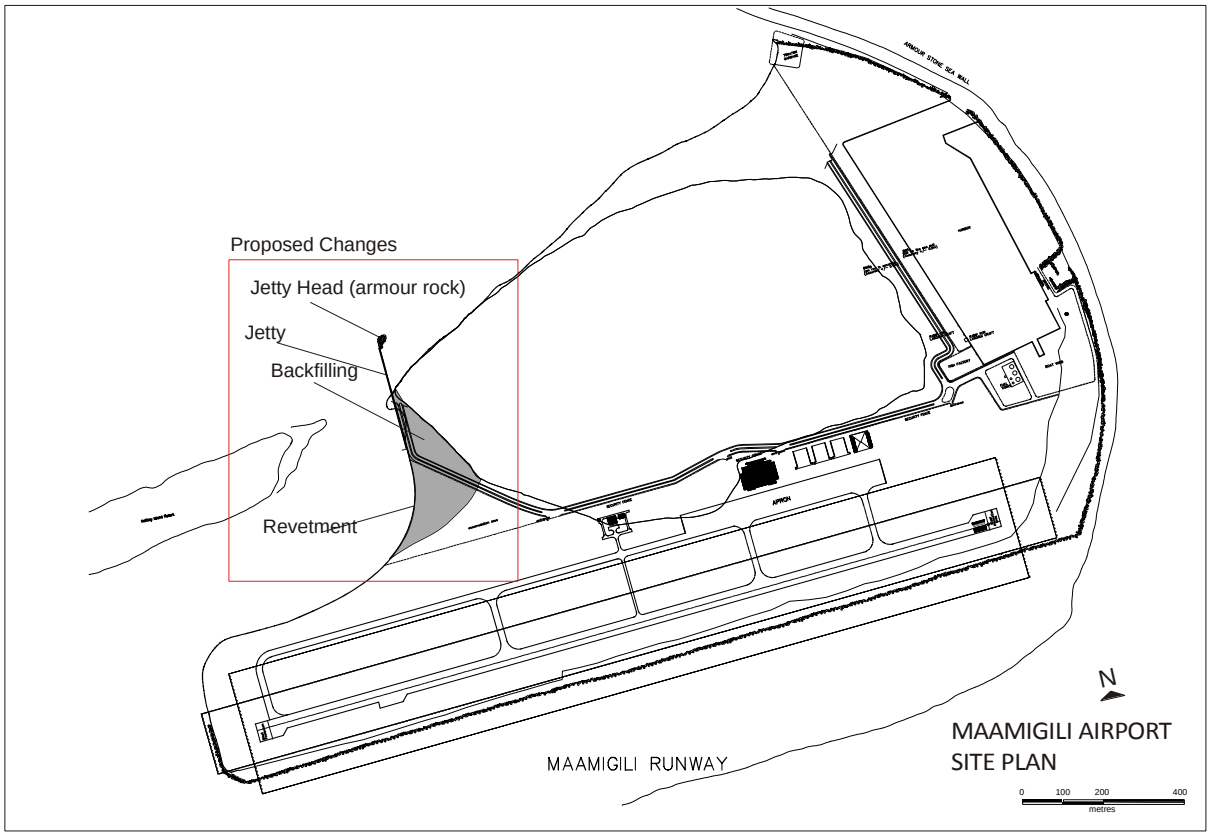


Figure 2.2: Conceptual plan for the additional components of the project

2.3 Existing Site Conditions

- The proposed site has been significantly modified over the last few years. Key modifications include land reclamation and dredging activities which has considerably modified the original shape and size of the island.
- Other modifications include major coastal protection around the island, from the northern tip to the south western corner of the island.
- The eastern areas of the islands have been dredged heavily for the development of a harbour.
- Dredging has also been undertaken on the northwestern side, between Maamigili and Holiday Island.
- A wooden jetty on the northwestern corner (near proposed site jetty construction under this project) is currently used by the island residents
- Modifications have also been undertaken in the neighbouring Holiday Island making the area around the two islands a significantly artificial region.
- The natural processes of the island are in the process of stabilising and are observed to be adjusting to the modifications.

2.4 Project Outline and Work Methodology

The proposed project involves:

- Dredging and backfilling
- Profiling and coastal protection
- Jetty construction
- Construction of a jetty head
- Development of an access road
- Construction of a waiting area

Details of the proposed project components are outlined below. Figure 2.2 provides the site plan for the proposed developments.

2.4.1 Dredging and Backfilling

Source of fill material

Fill material will be obtained from within the existing harbour area.

Type and method of dredger

A Cutter Section Dredger (CSD) is proposed for use in this project. A CSD is a stationary piece of equipment, which excavates material with a rotating cutter-head mounted on a ladder. The cutter head is equipped with cutting teeth. The loosened material is sucked into the suction mouth located in the cutter head, by means of a centrifugal pump, which is installed on the dredge pontoon or on the ladder of the dredger. Some loosened material will remain on the seabed. Most of this material will be dredged in the next cut. Only small particles will be suspended and will be distributed by local currents. Material is brought into suspension continuously during dredging. The majority of the re-suspended sediments will stay within the created basin. As the cut material will be disposed by a discharge pipeline to the stockpiling site, no additional turbidity will be created at the dredging site.

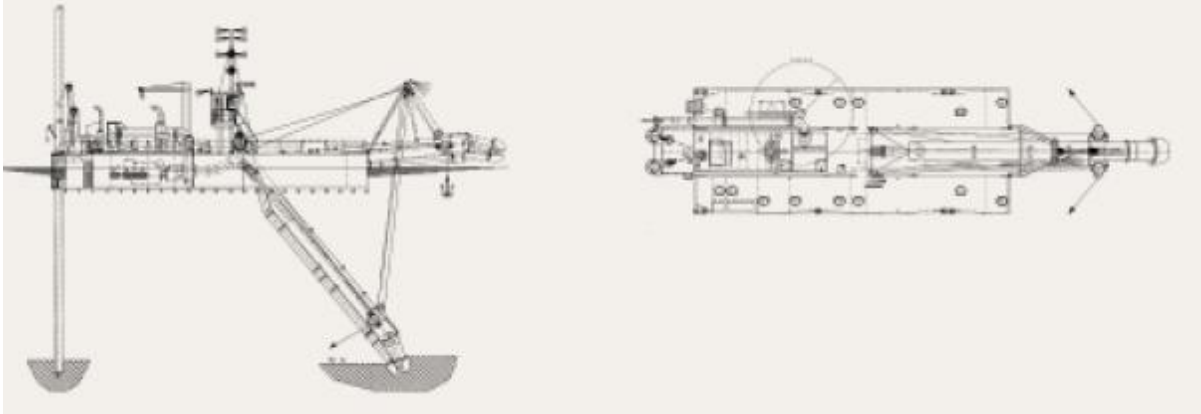


Figure 2.3: Sketch of the proposed cutter suction dredger

Dredge method

The CSD will be positioned in the harbour basin. The dredger will be connected to the stockpiling site via a floating pipeline and a shore-based pipeline. The dredger will dislodge the loose top layer of sand of the borrow area, mix this material with water and then pump the mixture via the pipeline into the stockpiling area. The water will flow back to the sea and the coral will remain behind. The return flow will be controlled using a bund constructed along the shoreline.

Backfilling

Backfilling along the western coastline of the island, up to the site proposed for jetty construction, is required to smoothen the coastline for the construction of the jetty, and to level the land in order to develop an access road. The stockpiled fill material will be transported to the reclamation area via large trucks, using one specified road. **Error! Reference source not found.**4 shows the dredging, stockpiling and backfilling areas.

Reclamation area and fill volumes

A total area of approximately 2.5 Ha on the western side of the island will be reclaimed. The total volume of sand to be sourced from the existing harbour basin for backfilling activities is 37,500 m^3.

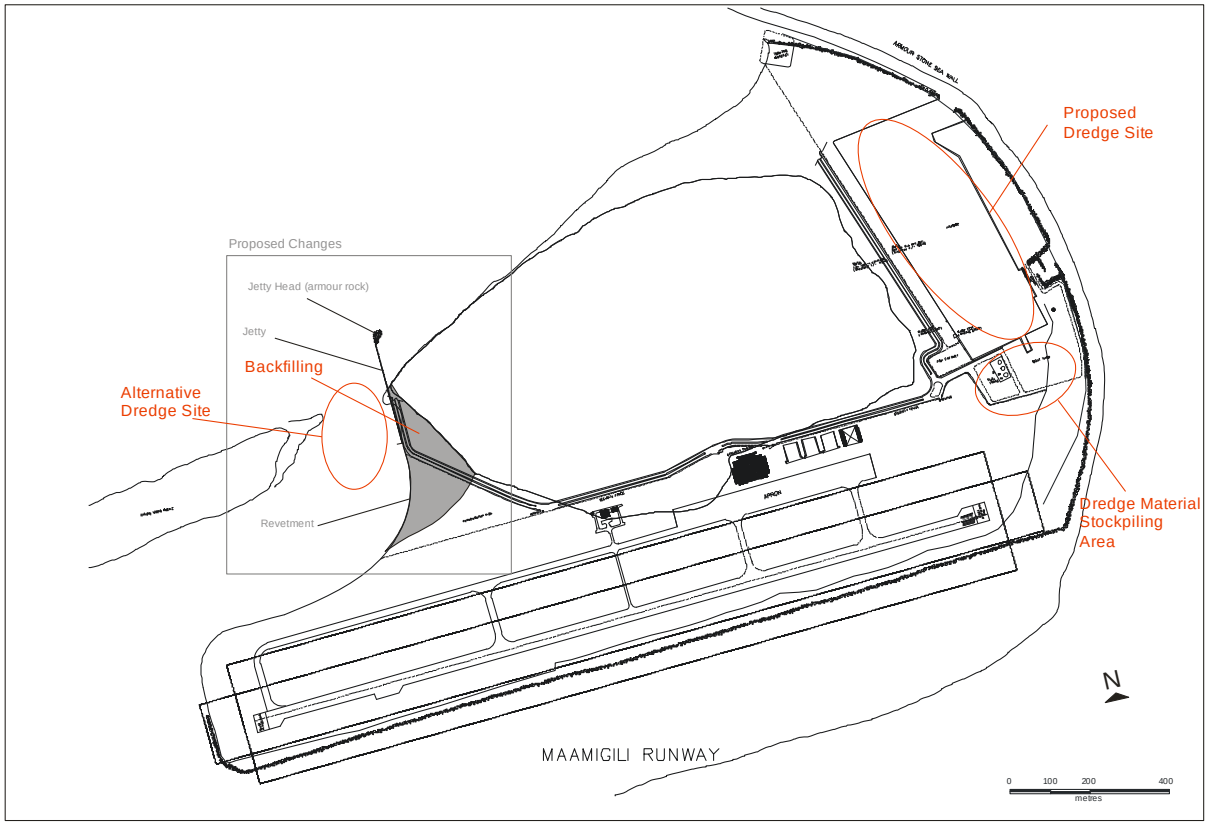


Figure 2.4: Dredging, stockpiling and backfilling areas

2.4.2 Profiling and coastal protection

The slope of the western shoreline of Maamigili in front of the backfilled area will be profiled during the hydraulic fill of the backfilling area by using dry fill equipment. This shoreline will also be protected using a concrete revetment.

2.4.3 Jetty construction

The jetty will be constructed on sheet piles. Sheet piling will consist of steel panels with interlocking connections. Piles will be approximately 8-9m long. The steel piles required will be drilled using vibratory hammers attached to a crane. The steel piles will be interlocked to form an impermeable barrier. Water will not be able to pass into or out of the island water lens through this barrier.

2.4.4 Placement of jetty head

A jetty head is required to control wave activity in the area and prevent scouring and damage to sheet piles. It will also control erosion of the island coastline. The jetty head will be composed of amour rock boulders. The boulders will be placed using cranes.

2.4.5 Development of an access road

A dirt road will be cleared between the airport terminal and the jetty, to provide easy access for passengers. Existing road levelling vehicles and loaders will be used for road clearing and levelling. The road may be paved in the future, if necessary.

2.4.6 Construction of a waiting area

A waiting area will be constructed in the backfilled area, near the access jetty, for the convenience of passengers. The waiting area, constructed using concrete and wood, will consist of concrete pillars, roofing and seating arrangements.

2.5 Project Schedule and Life Span

Mobilisation for the project will begin after the EIA is approved. It is anticipated that the completion of the whole project will take approximately 8 months.

The first stage of the project will involve dredging and backfilling activities. The second stage will concentrate on coastal protection and sheet piling. The third stage will involve the placement of amour rocks for jetty head. The last stage will be the construction of the access road between the jetty and the terminal, and construction of a waiting area on the backfilled area.

2.6 Labour Requirements and Availability

This project will utilise existing staff from the Airport development project. It is projected that the total number of employees during the construction stage will be between 20 and 25. They will be based in the current project staff accommodation on Maamigili. Their daily requirements for food, water and other necessities will be provided within the existing staff services framework.

2.7 Waste Management, Logistics and Safety Measures

2.7.1 Construction Waste Management and Disposal

All the dredge material will be used for backfilling activities, so dredge material is not expected to contribute to construction waste.

Small amounts of waste oil may be generated from the operation and maintenance of vehicles and equipment. All waste oil will be disposed as per the standards approved by the Environment Ministry.

Disposal of all other wastes, including packaging wastes such as cement bags and sand bags will be accommodated in the existing waste management system of Maamigili.

2.7.2 Pollution and Emission 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.
- All paints, lubricants, and other chemicals used on site will be stored in secure and bunded location to minimize risk of spill.

2.7.3 Sediment Containment and Turbidity Control Measures

The proponent is committed to prevent any sedimentation of the reef system from this proposed project. The following specific measures will be undertaken during the project.

- Establish silt-screens around the dredging area to control sediment disbursing. Silt screens will be removed after the sediment has been adequately settled within the lagoon.
- Undertake work during calm weather conditions.

2.7.4 Health and Safety Measures

All reasonable precautions will be taken for the safety of employees and equipment will be operated by competent persons. Construction activities would be carried out under the supervision of a suitably experienced person. Warning signs, barricades or warning devices will be provided and used. Necessary safety gear will be worn at all times.

2.8 Summary of Project Inputs and Outputs

The types of materials that will go into the development and from where and how this will be obtained are given in Table 2.1: Major Project Inputs

and the type of outputs (products and waste streams) and what is expected to happen to the outputs are given in **Error! Reference source not found.**

Table 2.1: Major Project Inputs

Input resource(s)	Source/Type	How to obtain resources
Construction workers	Local and foreign, mainly foreign	**Recruiting agencies, etc.**
Engineers and Site supervisors	Mainly Maldivians	**Advertise in local papers, social networks, etc.**
Construction material	electrical cables and wires, PVC pipes, light weight concrete blocks, reinforcement steel bars, sand, cement, aggregates, boulders 800-1000kg, steel sheet piles, etc	**Import and purchase where locally available at competitive prices – Main Contractor's responsibility.**

Maintenance material	Similar to above	**Import or purchase locally where available**
Water supply (during construction)	Desalinated water	**100 m^3/day desalination plant existing on the island**
Electricity/Energy (during construction)	Diesel	**450 kVA generator existing on the island**
Machinery	Barges, Excavators, cranes, loaders, trucks, concrete mixers	**Import or hire locally where available**
Food and Beverage	Mainly imported sources except a few locally available products.	**Import and purchase locally**
Fire fighting equipment	Fire Pumps, Fire Protection System, Smoke Detectors, Carbon Dioxide and Foam Fire Extinguishers, etc.	**Local suppliers**
Fuel, Kerosene and LPG	**Light Diesel, LPG Gas, Petrol, Lubricants**	**Local suppliers**

Table 2.2: Major Project Outputs

Products and waste materials	Anticipated quantities	Method of disposal
Green waste from site clearance	Small quantity	**Burnt or mulched on site and used for nursery and landscaping needs.**
Construction waste (general)	Small quantities	**Combustibles: Burnt/incinerated** **Others: Sent to designated landfill**
Dredge material	Large quantity	**Backfilling**
Waste oil	Small quantities	**Incinerated**
Hazardous waste (diesel)	**Small quantities**	**Barrelled and sent to designated landfill as part of overall hazardous waste management programme of the island**

2.9 Demobilization

Demobilization plan will be within the original airport development project demobilization activities.

3 EXISTING ENVIRONMENT

3.1 Introduction

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

I. Study Methodologies
II. Physical Environment
    a) Water quality
    b) Bathymetry
II. Biological Environment
    a) Marine environment
    b) Coastal environment
    c) Sensitive habitats

3.2 Study Methodologies

The environmental components of the study area were divided into marine and coastal environment. The marine environment covered the lagoon habitats and coral reef system including coral patches, fish communities, marine water quality, seagrass patches and bathymetry of the site. The coastal environment covered the beaches and coastal processes including longshore sediment transport patterns and coastal erosion of the site. Terrestrial environment was not studied as the project is mainly coastal and marine and these components are likely to involve the most significant environmental impacts. The study area boundary and survey locations are identified in Figure 3.1 and GPS locations of the survey sites are provided in Table 3.1

Results of water quality tests undertaken near Holiday Island for Villa Annual Monitoring is used to assess the water quality at the project site. To assess the coastal environment of the site, 6 beach profiles were taken using standard levelling techniques. These profile locations are marked in Figure 3.1 below. The measurement of beach profiles involved standard practice of surveying with a staff and a dumpy level.

The assessment of baseline conditions for the purposes of this EIA concentrated on areas which are specifically affected by the new developments. This addendum forms part of the original EIA and the first Addendum and should be viewed together for a comprehensive understanding of the environmental baseline conditions.

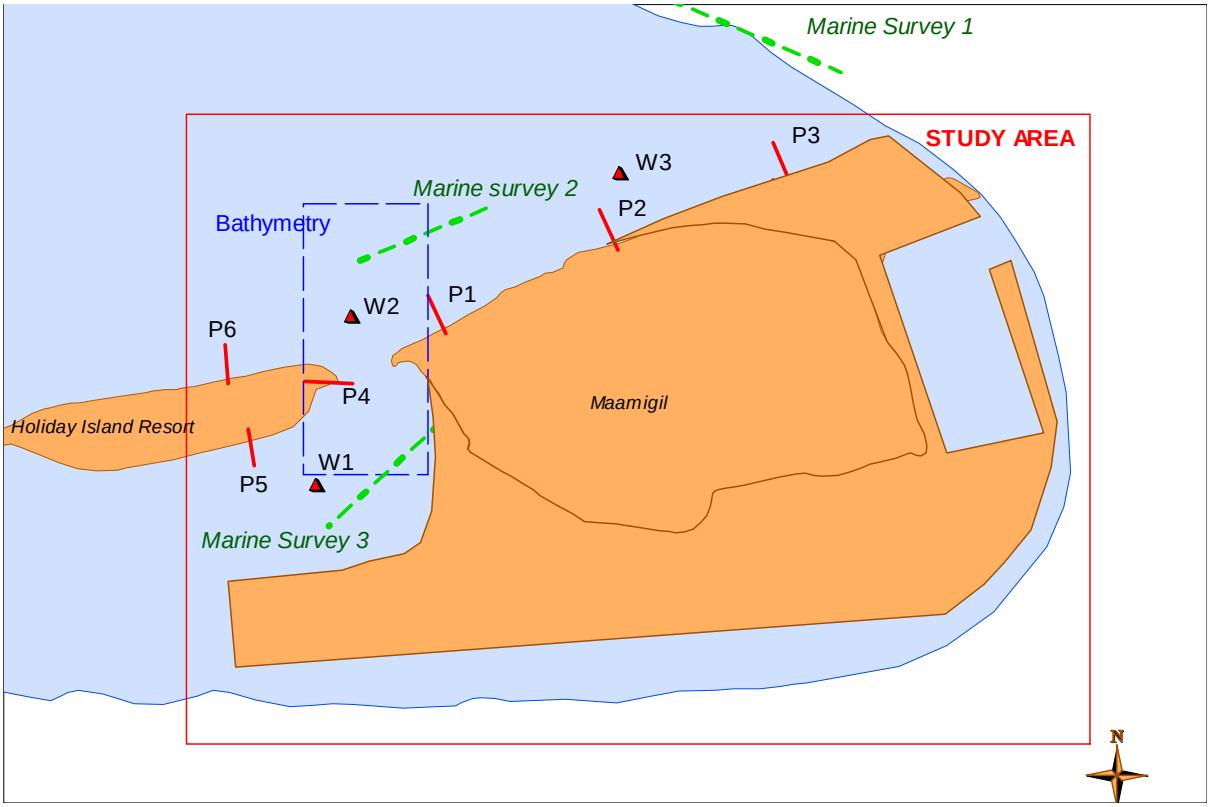


Figure 3.1: Detailed Survey Locations

Table 3.1: GPS co-ordinates of survey sites

Site Code	Longitude	Latitude	Survey Type
M1	72.8386	3.48411	Marine Survey
M2	72.8308	3.47949	Marine Survey
M3	72.8299	3.47387	Marine Survey
P1	72.8311	3.47761	Beach Profile
P2	72.8351	3.4796	Beach Profile
P3	72.8392	3.48103	Beach Profile
P4	72.8286	3.47603	Beach Profile
P5	72.8268	3.47451	Beach Profile
P6	72.8262	3.47646	Beach Profile
W1	72.8283	3.47366	Water samples
W2	72.8291	3.47759	Water samples
W3	72.8354	3.48092	Water samples

3.3 Physical Environment

3.3.1 Marine Water Quality

The main objective of the marine water sampling and testing was to determine baseline water quality conditions. The data is used to establish "action levels" for determination of whether the proposed development may have an adverse effect on marine water quality of the site.

Seawater samples collected from the lagoon between Holiday Island and Maamigili under the resort environmental monitoring programme is used to assess the water quality of the site. **Error! Reference source not found.** below provides details of the water quality parameters.

Table 3.2: Water quality at the project site

Parameter	SITE W2	SITE W1	ANZECC Water Quality Guidelines – Recreational Waters
Physical appearance	Clear	Clear	6.5-8.5
pH	8.5	8.5	
Electrical Conductivity (µs/cm)	52,800	51,300	
Suspended Solids (mg/L)	0.00	0.00	
Total Dissolved Solids (mg/L)	26,400	27,700	1000
Chemical Oxygen Demand (mg/L)	310	380	
Lead (mg/L)			
Iron (Total) (mg/L)	0.00	0.00	
Chlorine (Total) (mg/l)	0.00	0.00	
Fluoride (mg/l)			
Turbidity (NTU)			
Dissolved Oxygen (mg/l)	6.5	6.9	
Nitrate (mg/l)	0.00	0.00	10
Phosphorous, Reactive (Ortho Phosphate) (mg/l)	0.04	0.04	
Total Organic Carbon (mg/l)	725	728	

In general, the site is already contaminated to some extent with suspended sediments. Visibility is known to be poor in SW monsoon due to strong water flow between the two islands. However, comparison of monitoring data from Holiday Island Resort shows a gradual improvement in water quality since the dredging activities were stopped in Maamigili.

3.3.2 Bathymetry

A detailed bathymetric survey of the project site was undertaken for this study. The scope of the study area was limited to the area between the two islands, as shown in Figure 3.1 above.

The surveyed area has already been dredged (see figure 3.1 below). The maximum depth of the area is -10.0 m MSL. The average depth of the reef flat is around -1.5m MSL. Dredging activities has been undertaken as part of the Maamigili reclamation project. No additional dredging is required to make the area accessible to vessels.

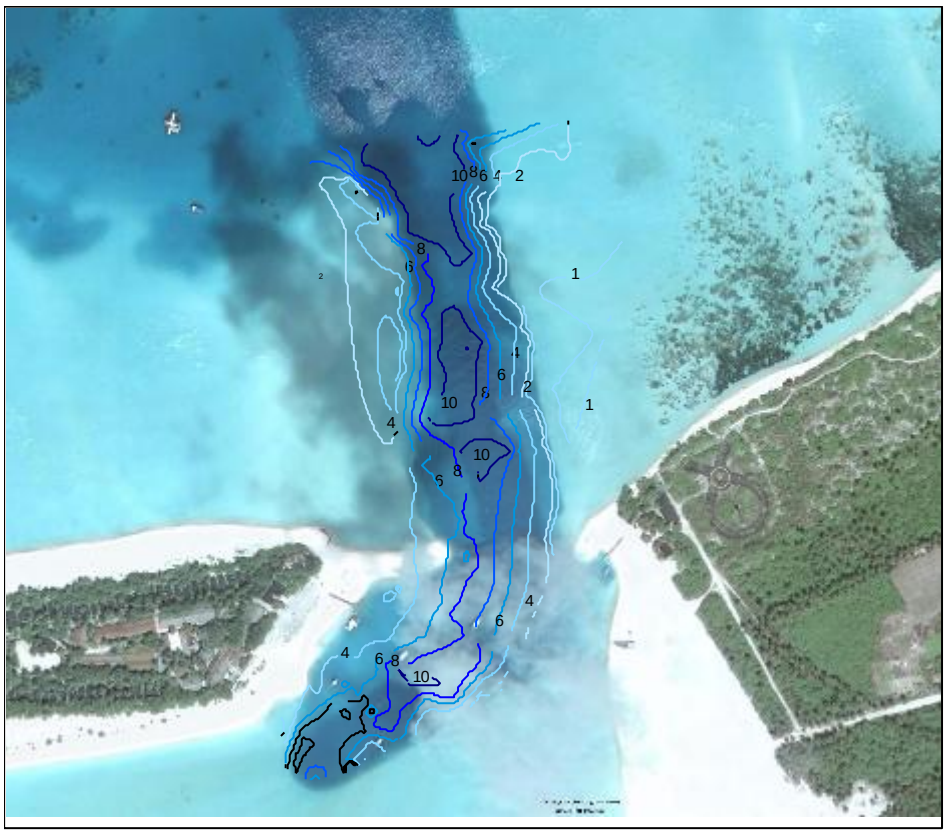


Figure 3.2: Bathymetry of the Project Site

3.3.3 Coastal Environment

3.3.3.1 Longshore Sediment Transportation Patterns

According to a study on current flow within the Hulhule Reef flat, waves and tides generate currents across the reef platforms that can also transport sediments (Binnie Black & Veatch, 2000). Similar to waves, currents are also modified by reef morphology. Under low-input wave conditions i.e. 0.5m wave height, strong lagoonward surge currents >60cm/sec are created by waves breaking at the crest. Long-period oscillations in water level cause transportation of fine-grained sediments out of the reef-lagoon system. In contrast, strong short duration surge currents <5 cm/sec transport coarse sediments from the breaker zone to seaward margin of the backreef lagoon. Sediment always accumulates at the lee of high-speed current zones. Generally zones of high current speed for example, jets or rips 50-80cm/sec are systematically located around islands.

Maamgili Island has undergone substantial changes to coastal environment which has altered the water flow patterns sediment transport patterns around both Maamigili and Holiday Island Resort. The narrowing down of the gap between the two islands has caused seasonal concentration of water flow into the area. The entire coastal system appears to be adjusting to these major modifications and is yet to stabilise. Severe erosion was recorded in Holiday Island and sections of the reclaimed Maamigili Island. These areas had to be restored through additional replenishment. Current speeds were relatively low at 0.16 m/s during the survey but are reported to reach around 0.8 m/s during flood tide.

It is unlikely that sediment will be transported from the southern oceanward reef edge to the northern coastline in future due to the dredged areas between the two islands. Similarly seasonal shifting of sediment from one side to the other, a feature prominent prior to reclamation, is now non-existent. Extensive human intervention will be required to restore beach areas of the two islands, particularly Maamigil, in the near future.

3.3.3.2 Coastal Zones

The coastal environment of Maamigili has been categorised into four zones as shown in Figure 3.2

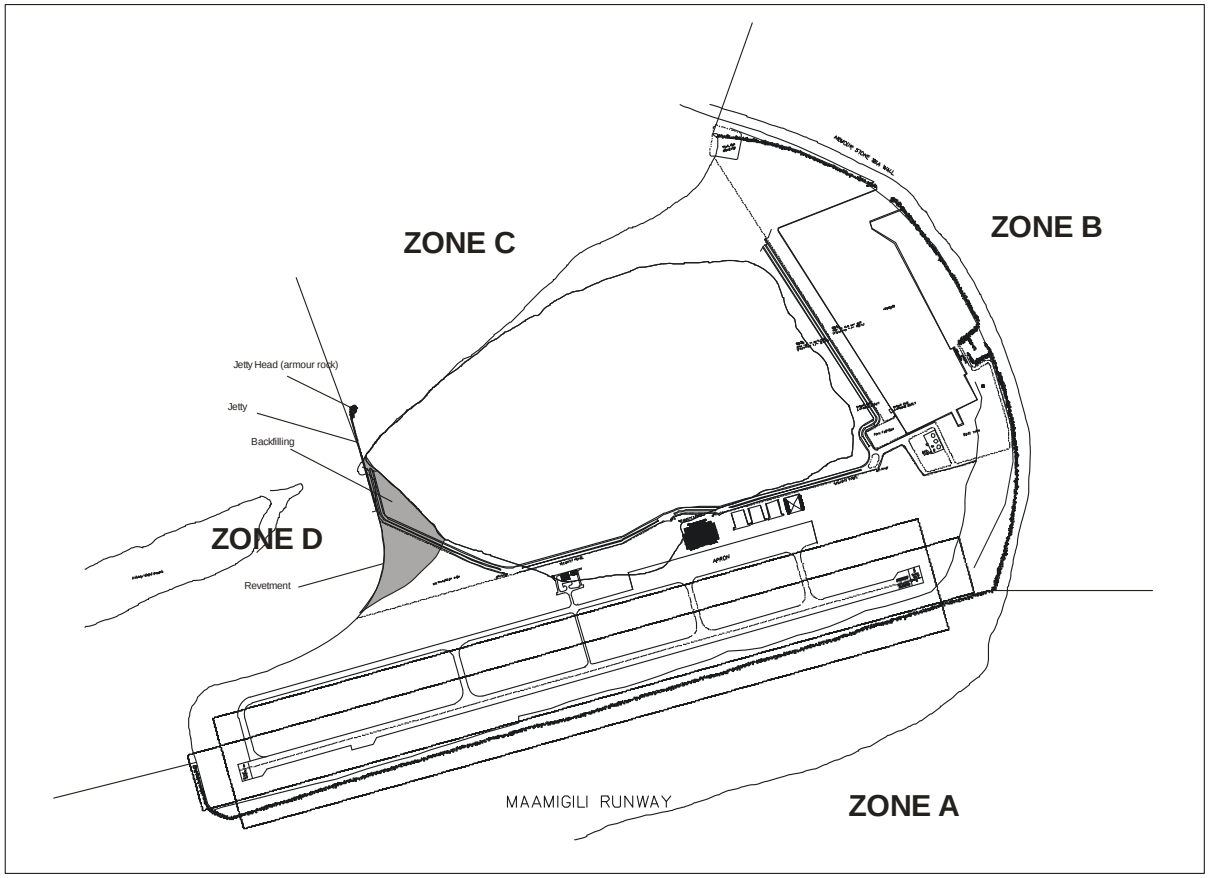


Figure 3.3: Coastal Zones in Maamigili

ZONE A

Zone A does not have a beach system as the whole area is protected by sea walls constructed using rock boulders. The coastal process in now controlled using the breakwaters. New beach appears to be forming outside the breakwater from material eroded from unprotected areas on the west.

ZONE B

Similar to Zone A, Zone B does not have a beach system. Coastal developments on this area comprise a harbour, and a series of breakwaters.

ZONE C

Zone C contains the only natural beach area on the island. However, much of the beach has been reclaimed at the request of the locals to provide additional land for economic use and social activities. There are no coastal developments in this area. Over the last two years the area has been adjusting to the reclamation activities.

ZONE D

Zone D has also been severely modified through land reclamation. The coastline in this zone is proposed to be smoothened using sediment dredged from the harbour basin. Revetments will be constructed using boulders to protect the coastline.

Beach profile surveys have been undertaken on the island as part of the baseline survey. Beach profiles at three locations on Maamigili and three locations on Holiday Island are provided in Appendix C. These data provide useful benchmarks against which shoreline changes may be evaluated in the future.

3.4 Biological Environment

3.4.1 Marine Environment

3.4.1.1 Lagoon and reef system

Maamigili Island is located on the largest reef system in Ari atoll. The reef extends over 15 km. There are 6 islands along the reef system and Maamigili, lying on the eastern edge of the reef system, is the largest among them. The average width of the reef system is 1 – 1.5 km. It is estimated to have an average depth of around – 1.5 m MSL.

3.4.1.2 Biotic Marine Environment

Biotic marine environment of study area can be categorized into two significant components. They are: the lagoon system surrounding the island and the seagrass bed in the lagoon. Biotic marine environment was assessed by adopting semi-quantitative visual observation, and quantitative LIT method in the lagoon, semi-quantitative method of Time-Swim and quantitative method of LIT on the reef-flat areas.

Lagoon System

Much of the surveyed areas are could not be analysed effectively due to poor visibility. In general the lagoon conditions are poor with extensive sedimentation. Live coral cover was observed at 3% and much of the lagoon bottom comprised of sandy and dead coral areas. The live coral cover in selected sites of the lagoon was observed to have declined from 8% (as reported in the baseline conditions of the initial EIA) to 2-3%.

Live coral cover was dominated by new growth of Acropora sp. and massive corals.

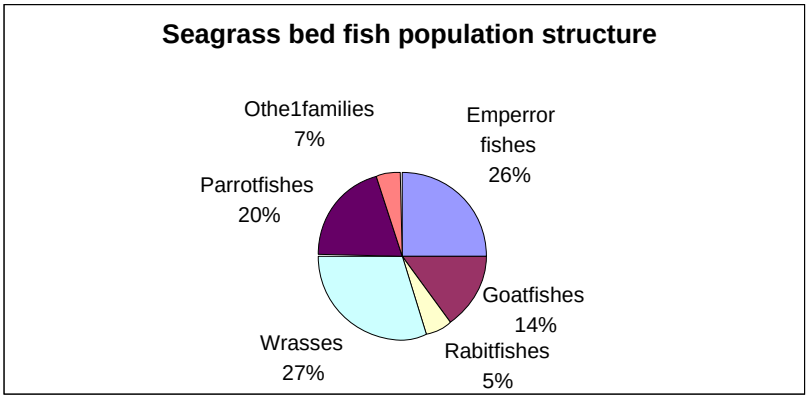
Fish census also could not be undertaken due to poor visibility. Bottom dwellers appear to have returned to the affected sites although their numbers were quite low at the time of the survey.

Figure 3.4: Lagoon conditions in surveyed sites – most areas appeared dead and live coral was found only among new recruits.

Seagrass bed

Benthic cover of segrass bed in northern side of the island was assessed by visual observation. This visual observation survey covered 500m² by swimming along a belt transects. The survey showed that it is a mono-specific seagrass bed consisting of *Thallasia hempreichii* species. Shoot density of this seagrass bed was found to be relatively sparse and varied significantly depending on location. Most densely covered seagrass was found in central areas of the seagrass bed. Other benthos observed in this survey was sea urchins, sea cucumber and algae epiphytes on seagrass.

Underwater visual fish census conducted in the seagrass bed showed that it is a habitat for juveniles. Abundance and diversity of fishes were found to be very low as the seagrass bed is not well developed. Figure 3.5 shows the fish population structure in the seagrass bed.



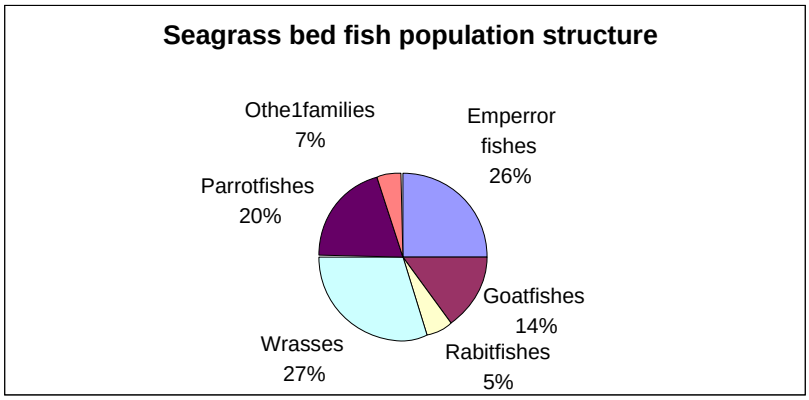


Figure 3.5: Fish population structure in the seagrass bed

Fishes in the seagrass bed were dominated by juvenile wrasses accounting approximately 27% of all the fishes found. Next dominant family was juvenile emperor fishes accounting 26% of all fishes. Other families observed were juveniles of parrot fishes having 20%, goatfishes having 14%, rabbit fishes having 5% and other families also having 7% of all fishes found in this seagrass bed.

In general, visibilities in the seagrass beds were low at the time of the survey.

4 POTENTIAL IMPACTS AND MITIGATION MEASURES

4.1 Introduction

This Chapter will discuss all the potential impacts (positive and negative) associated with the proposed development activities and suggest mitigation measures for all potential negative impacts. Impact identification and mitigation measures were primarily based on stakeholder consultations, literature reviews, professional judgment and past experience from similar projects.

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

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

In addition, the significance of impacts was determined based on the following characteristics:

- Nature of impact (direct/ indirect/cumulative)
- Spatial distribution of impact
- Duration of impact
- Reversibility of impact
- Magnitude of impact
    - Negligible: No significant impact
    - Minor: The impact is only short term and reversible on the long run
    - Moderate: The impact maybe irreversible and cause long term concerns but most likely short term and reversible.
    - Major: the impact is long term and irreversible

Table 4.1 shows a summary of the characteristics of the potential impacts identified and the significance of each impact. It should be noted that impacts correspond to the worst-case scenario in absence of any mitigation measures.

Table 4.1: Summary characteristics of the potential identified impacts

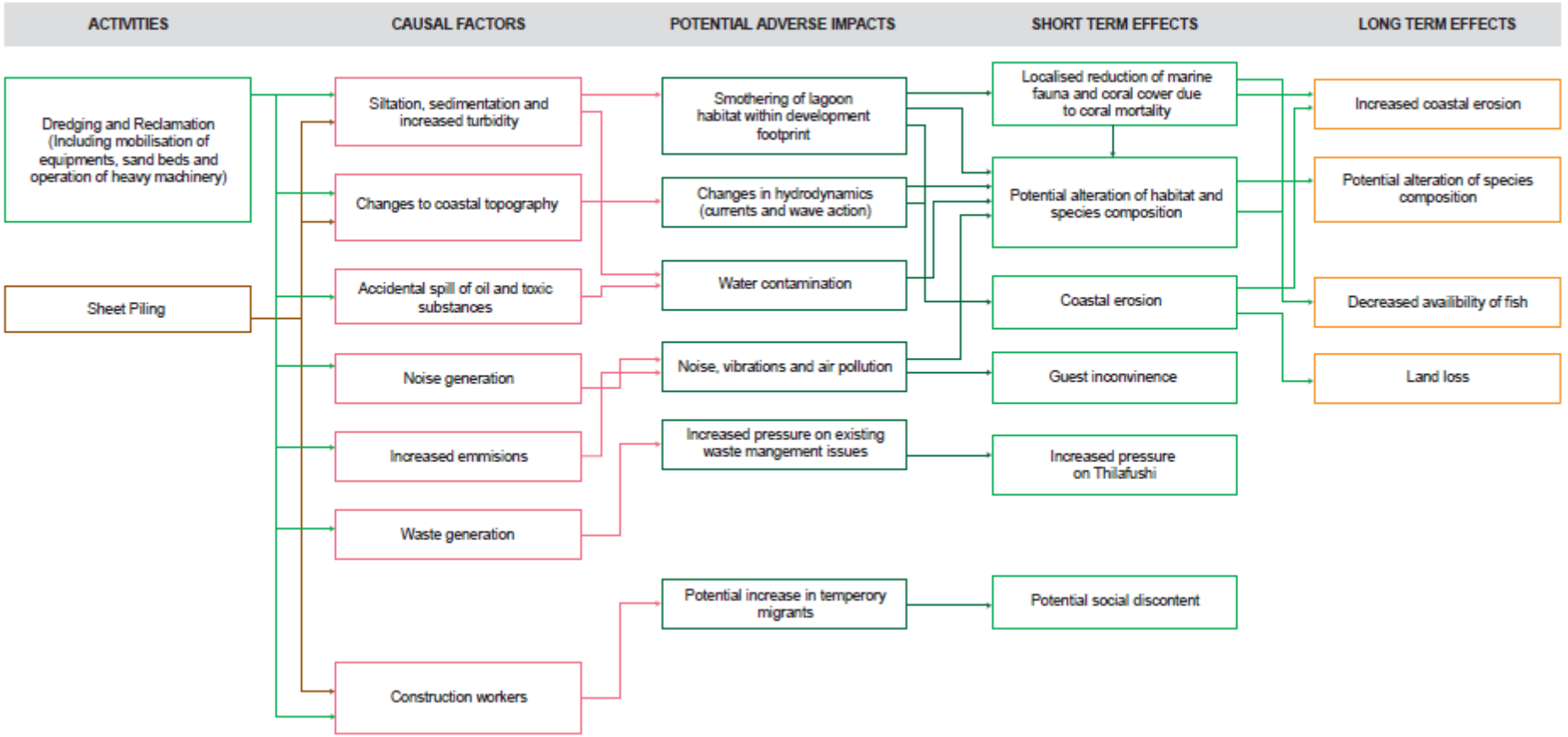
Impact	Nature	Spatial Distribution	Duration	Reversibility	Magnitude	Significance
Smothering of lagoon habitats	Direct	50 Ha	Short term	Yes	Major	Significant
Increased Coastal Erosion	Direct	(i) Maamigili north western coastline, (ii) Holiday Island eastern coastline	Long-term	No	Moderate	Significant
Marine water contamination from accidental oil spills	Direct	1-500m^2	Short term	Maybe	Moderate	Insignificant
Pollution (air/noise)	Direct	1-300 m^2	Short term (only during the project)	Yes	Minor	Insignificant
Generation of waste	Direct	Thilafushi waste site	Short and Long-term	No		Insignificant
Improved airport and tourism product	Direct & indirect	Maamigili, Holiday, Sun Island and other nearby resorts.	Long term	No	Major	Significant
Reduced Disaster risk	Direct & indirect	Western part of Maamigili	Long term	-	Moderate	Significant

4.2 Brief Description of Potential Impacts and Suggested Mitigation Measures

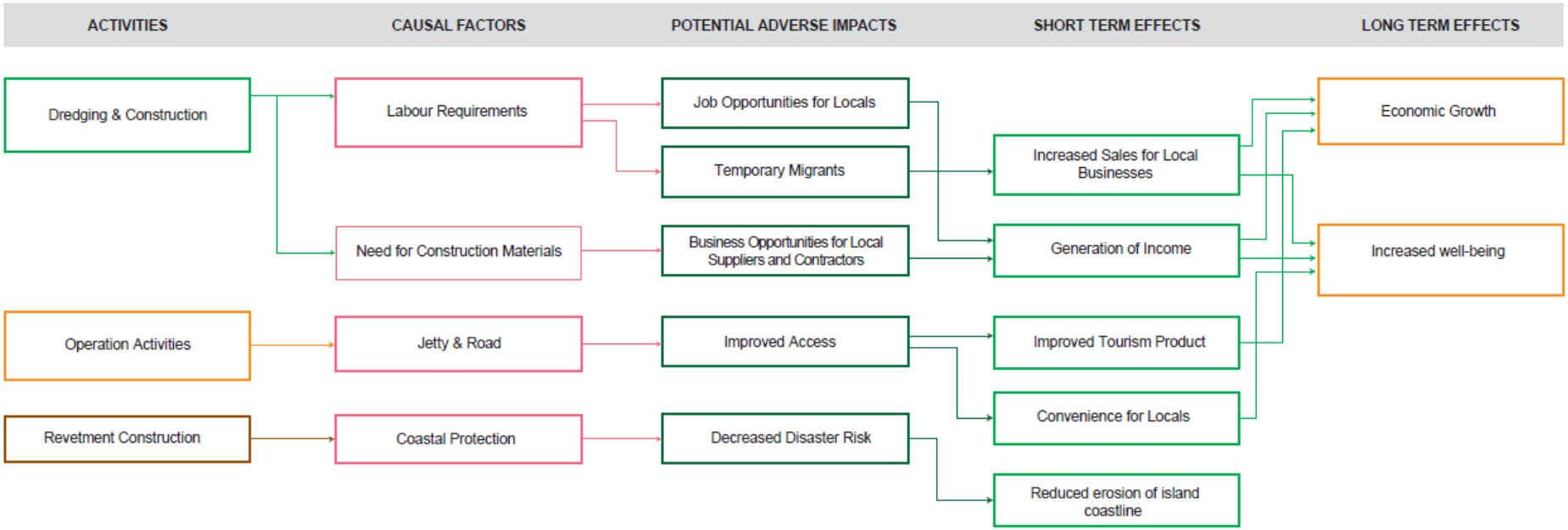
This section will provide a brief description of each of the potential impacts illustrated in the flowcharts and suggest appropriate mitigation measures for all potential adverse impacts.

A summary of the potential negative and positive impacts during construction and operation stage of the report is provided in the diagrams in the next four pages. Details of the key impacts provided in the following subsections.

POTENTIAL NEGATIVE IMPACTS FROM DREDGING, RECLAMATION & SHEET PILING



POTENTIAL BENEFICIAL IMPACTS OF CONSTRUCTION AND OPERATION PHASES



4.2.1 Potential Adverse Impacts during Construction Phase

4.2.1.1 Smothering of corals and reduced light to marine organisms

Project activities such as dredging, construction of jetty and reclamation are likely to cause a significant amount of siltation and sedimentation of the lagoon waters. Increased turbidity of the lagoon water column is expected.

These factors would result in smothering of corals and reduced light penetration to the coral and other organisms in benthic waters.

Corals have a self-cleaning mechanism, which allow them to withstand a certain rate of sedimentation. Therefore, reduced coral growth and recruitment rate resulting from sedimentation may be short term effects.

However, if sedimentation rates excess the rate at which corals can self-clean, serious detrimental impacts such as coral mortality and alteration of habitat and species composition may occur.

It is therefore important to take proper mitigation measures to avoid siltation, sedimentation and turbidity as much as possible.

Potential Mitigation Measures:

- Silt-screens or bund-walls will be established around the project site to control sediment disbursing.
- All construction works will be undertaken during calm weather conditions particularly when wave activity will be resticted.

4.2.1.2 Loss of flora and fauna

Dredging and reclamation can cause the loss of flora and fauna directly and indirectly.

Lagoon bottom is a habitat for certain organisms such as worms, mollusks, amphipod etc. which are important food sources for bottom feeders such as certain species of fishes. The displacement of sand would disturb habitats of these organisms.

However, it has been found elsewhere that lagoon bottom dwelling organisms re-establish within few months after such disturbances.

Direct removal of corals and hard bottom substrate for dredging can result in loss of habitats for fish, and reef benthos in addition to loss of coral colonies. The harbour basin has already been dredged, so direct loss of flora and fauna due to dredging is not likely to be significant.

4.2.1.3 Changes in hydrodynamics

Dredging works as well as construction of the jetty and reclamation might result in abrupt changes to coastal hydrodynamics. This may lead to temporary erosion and changes to coral growth.

Potential Mitigation Measures:

- Dredging activities should be undertaken during low tide and during the calm weather conditions

4.2.1.4 Water Quality Effects

Contamination of marine water can result from accidental spillage, mishandling of solid and hazardous waste and sedimentation. Various components of the proposed project activities have the potential to result in accidental spillage of construction waste, oil and fuel, etc. into the marine environment.

Significant quantities of waste will be generated from all construction related activities where any mishandling of solid (non-biodegradable) waste and hazardous waste will contaminate the marine and/or groundwater. Sewage and solid waste generated by the workforce also needs to be treated properly to avoid water contamination.

Sedimentation and high turbidity caused by dredging, reclamation and construction activities are likely to cause temporary degradation of water quality. Suspended solids can be abrasive or clog gill mechanisms, causing organisms such as fish to avoid highly turbid areas temporarily.

Contamination of groundwater caused by spillage and improper waste disposal is irreversible in the Maldivian islands, as the freshwater lens does no separate into independent reservoirs due to the absence of impermeable layers in the soil. Any point source of pollution would therefore contaminate the entire island groundwater resource.

Potential Mitigation Measures:

- All machinery will be properly tuned and maintained
- All paints, lubricants, and other chemicals used on site will be stored in secure and bunded location.
- Oil, solid waste and hazardous waste will be handled carefully and transported in sealed containers in properly bunded vehicles/vessels
- Construction activities will be carried out under the supervision of a suitably experienced person.

4.2.1.5 Air pollution

Site preparation and construction activities are likely to generate significant amounts of dust and emissions. Dust and emissions from vehicles and construction equipment will degrade the air quality and affect the health of construction workers, as well as the local flora and fauna.

Potential Mitigation Measures:

- All vehicles and machinery will be tuned and well maintained to minimise air pollution
- To minimise dust from construction works, ground/soil will be kept damp.

4.2.1.6 Noise and Vibrations

Noise resulting from project activities such as site clearance, mobilisation of equipment, operation of heavy machinery is likely to be significant. The noise and the resulting vibrations may cause disturbances to the local community and fauna such as bats, which use auditory stimuli for navigation.

Pile driving in particular can produce significant noise and vibrations at localised levels, possibly resulting in alteration of species behaviour. Pile driving too close to reefs may cause young reef areas to become dislodged.

Potential Mitigation Measures:

- All construction works will be carried out during day time to minimise nuisance to the resort and disturbances caused to nocturnal fauna such as birds and fruit bats that uses auditory communication.

4.2.1.7 Increased pressure on existing waste management facilities

Construction waste produced by the construction activities and municipal waste generated by the workforce will put extra pressure on the existing waste management facilities. Mishandling of the solid (non-biodegradable) waste and hazardous waste may lead to pollution and contamination of water, causing adverse health impacts on humans, as well as other terrestrial and aquatic life.

Potential Mitigation Measures:

- Designate specific vessels to transport waste generated by construction activities to Thilafushi
- Develop mechanisms to incorporate project activities into the existing waste management system

4.2.2 Potential Adverse Impacts during Operation Phase

4.2.2.1 Alteration of species behaviour

Lagoon is a habitat for certain organisms such as worms, mollusks, amphipod etc. which are important food sources for bottom feeders such as certain species of fishes. The reclamation activities would disturb habitats of these organisms and cause them to die or move out of the replenishing area. However, it is found that lagoon bottom dwelling organisms re-establish within few months after such disturbances.

Increased light during construction and from the operation of the access jetty may alter species behaviour. However, the project activities discussed in this addendum to the EIA are a small component of all the activities that are part of the airport development project. The impact from these activities is not likely to be significant in relation to the entire airport development project.

Potential Mitigation Measures:

- Installation of energy efficient and wildlife friendly lights.
- Request all vessels that utilise the access jetty and associated harbour to do routine checks and regular maintenance works on the vessels.

4.2.2.2 Changes to hydrodynamics and coastal geomorphology

As in the construction stage, it is highly likely that there will be considerable changes to hydrodynamics during the operation stage. Creation of a dredged basin deeper than the surrounding reef flat will cause sediment to settle in the dredged basin. This may result in the loss of beach material from the island.

The modification of the coastline will have implications for longshore sediment transport patterns and coastal erosion. The coastline of the only remaining natural beach area (Zone B) will search for a new equilibrium against the changed condition and may result in rapid short term readjustment leading to erosion.

Sheet piling can lead to flooding even at low levels of rainfall, as it obstructs surface and subsurface runoff. Reclamation can also lead to coastal flooding if the reclaimed area is higher than the existing level.

No specific mitigation measures can be undertaken to prevent the changes once the development has been undertaken. However, environmental monitoring should be undertaken to monitor the changes to environment especially to the marine environment and island shoreline. Particular attention should be given to erosion patterns.

Potential Mitigation Measures:

- Continuous monitoring to identify abnormal activity and implementing mitigation measures when needed.

4.2.2.3 Water quality

During the operation of the access jetty and associated infrastructure, any accidental spill or leakage of oil, fuel, sewage and mishandling of solid (non-biodegradable) waste and hazardous waste will contaminate the marine and/or groundwater.

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. Therefore, special care should be taken when handling oil, fuel, solid waste and hazardous waste to entirely avoid any accidental spills and leakage.

Potential Mitigation Measures:

- Fuel handling will be done under careful supervision and all vehicles and vessels will be properly maintained by doing routine checks.
- All paints, lubricants, and other chemicals used for maintenance works will be stored in a secure and bunded location.
- All waste oil, solid waste and hazardous waste will be handled carefully and transported in sealed containers to designated areas in properly bunded vehicles/vessels
- Bins will be kept at the access jetty and waiting area along with information and warning signs to reduce littering and dumping waste into the harbour and lounge area. In addition, regular monitoring will be done to give early warning in case of any accidental spills or littering of hazardous waste

4.2.3 Potential Beneficial Impacts during Construction and Operation Phases

- Employment opportunities for construction workers
- Employment opportunities for local contractors
- Business opportunity for local suppliers
- Improved sales for local businesses (cafés, shops, etc.)
- Easy access for speedboats (and sea planes, in the future)
- Improved tourism product
- Decreased natural disaster risk

4.2.4 Mitigation Costs

Table 4.2: Cost of mitigation measures for impacts during construction phase

Impact	Mitigation Measures	Costs
Smothering of Corals	- Silt-screens or bund-walls will be established at around the project site to control sediment disbursing. - All construction works will be undertaken when wave activity will be calmer.	US$ 10,000 NA
Water Contamination (Marine and/or Ground water)	- All machinery will be properly tuned and maintained - All paints, lubricants, and other chemicals used on site will be stored in secure and bunded location. - Oil, solid waste and hazardous waste will be handled carefully and transported in sealed containers in properly bunded vehicles - Construction activities will be carried out under the supervision of a suitably experienced person.	US$3000 US$2000 US$1500 US$2000
Noise, Vibrations and Air Pollution	- All construction works will be carried out during day time - All vehicles and machinery will be tuned and well maintained to minimise air pollution	NA US$5000
Increased pressures on waste management facilities	- Designate specific vessels and equipment to transport and handle waste.	US$20,000

5 ALTERNATIVES

5.1 Introduction

This Chapter reports on the alternatives for the proposed project. The alternatives were mainly considered for different dredging methods, alternative burrowing areas and for alternative technologies for sheet piling and sediment containment.

5.2 "No-project" Alternative

The following no project options have been considered.

- No jetty and jetty head
- No backfilling activities and coastal protection
- No access road
- No waiting area

Although the 'No Project' alternative would avoid the environmental impacts resulting from the project, this option is not preferred as the socio-economic benefits of the project would not be achieved if the project does not take place. Also, the adverse environmental impacts of the project are not expected to be significant, as much of the coastal, marine and terrestrial environment of Maamigili is already heavily modified.

5.3 Dredging Alternatives

Table 5.1 indicates the alternative methods for dredging of the harbour basin.

Table 5.1: Summary of dredging alternatives

Dredging Method	Advantages	Disadvantages
Sand pumping	• Least impact option. • Very cost effective. • No additional dredging or bundwall creation required	• May not be possible to operate barges at low depths. • Cannot pump long distances.
Excavator on temporary sand bed	• Most common method practiced by contractors for small scale projects • Does not require specialized skill • Very cost-effective	

Excavator on barge	• Environmentally friendly due to less siltation and avoidance of unnecessary dredging	• Difficult to operate in limited work space • Extra costs associated with additional equipments such as a tug to haul the barge
Cutter Suction Dredger	• Dredging works can be completed within a short time frame • Already available on site?	• Requires highly skilled operators • Not suitable for small scale dredging works • High costs

The preferred option is to use a cutter suction dredger

5.4 Alternative Borrow Area

The proposed area for obtaining sand for reclamation is the existing harbour basin. An alternative site for obtaining the sand could be the dredged area between Maamigili and Holiday Island which lies to the east of Maamigili (shown in Figure 2.4)

The harbour area is already heavily modified. Construction and operation of the harbour would have altered the natural composition of species in the area, so additional environmental impacts resulting from the proposed dredging activities are likely to be minimal. Furthermore, the effects of sedimentation and turbidity are likely to be contained within the harbour basin.

The alternative site considered for dredging is relatively less disturbed and the area has a natural beach, so the environmental consequences of dredging are likely to be more significant, especially as effects of sedimentation cannot be controlled without using additional sediment control measures. However, the site is closer to the areas proposed for backfilling, making it more convenient for transportation purposes.

The current proposal of dredging within the existing harbour basin is preferred, as that alternative would have the least negative environmental consequences.

5.5 Sedimentation Control Measures

Table 5.2 indicates the alternative technologies for the sediment containment.

Table 5.2: Summary of sediment containment measures

Type of Measure	Advantages	Disadvantages
Bund Wall	Environmentally friendly Durable Cost effective	High impact on marine environment. Cheap option
Silt screen	Durable Easy to handle Environmentally friendly	Large quantities not locally available Costly.

The preferred option due to cost concerns is the bund wall.

5.6 Alternative Sheet Piling Technologies

Percussive pilling could be used instead of vibratory piling for construction of the jetty. Percussive pile driving usually involves repeated striking of the head of a steel pile by a double-acting hydraulic hammer. However, percussive piling is also predicted to have the similar impact from vibration. The vibration and noise impact is generally stronger in percussive pile driving. Hence the present option of a vibratory hammer attached to a crane is the most appropriate amongst technology available in Maldives.

5.7 Revetment Alternatives

Table 5.3: Summary of revetment alternatives

3 indicates the alternative methods for construction of the revetment.

Table 5.3: Summary of revetment alternatives

Type of Revetment	**Main Advantages**	**Disadvantages**
Geotextile bags filled with locally sourced sand	• Environmentally friendly • Durable • Cost effective	• Requires specialized equipments and machinery to fill the bags, sew the bags and for installation • Bags are not locally available
Sheet Pile	• Durable	• Requires specialized design • Costly • Requires specialized equipments,

		machinery as well as skilled staff
Concrete structures	• Durable	• Requires specialized design • Costly • Requires specialized equipments and machinery
Boulders	• Durable • Stockpile already available	• Requires specialized equipments and machinery

The preferred option is boulders, as the material is already available on-site.

6 ENVIRONMENTAL MONITORING PLAN

6.1 Introduction

This Chapter will outline the monitoring plan for the proposed project. Environmental monitoring is essential because, although with proper mitigation measures, the overall environmental damage can be significantly minimized, an unforeseen impact may still occur. Furthermore, some of the impacts predicted may turn out to be far greater than predicted, making mitigation measures ineffective. Therefore, in order to avoid or reduce the chances of such events, regular and frequent environmental monitoring is vital.

6.2 Objectives of the Monitoring Plan

The main objectives of the monitoring plan are to:

- Identify whether the predicted impacts are accurate and mitigation measures taken are effective
- Identify any unforeseen impacts so that appropriate mitigation measures can be taken at the earliest
- Identify whether the community reaps the predicted employment opportunities and socio-economic benefits
- Identify and resolve any issues of social unrest at the earliest
- Eliminate or reduce environmental costs

6.3 Aspects of the Monitoring Plan

Table 6.1 below summarizes the key aspects of the monitoring plan. The Table indicates the methodology, frequency and estimated cost for each monitoring attribute that will be required for the proposed project.

Table 6.1 Aspects of the monitoring plan

Monitoring Attribute	**Indicator**	**Methodology**	**Frequency**	**Estimated Cost**
Water Contamination (Marine)	Water quality	Laboratory analysis	Upon completion of the project, two months after completion and thereafter annually	US$50 per survey
Waste monitoring	Waste generation levels	Waste census	Once during the construction and annually during operation	US$150 per survey

Marine Water Contamination	Oil spills	Visual observation	Daily for the duration of the project	NA
	Oil leakage from machinery or vessels	maintenance and tuning of all machinery & vessels	Weekly during the construction phase	US$50 per week
Coral reef health	Percent of live coral cover Fish abundance	Line transect or photoqudrat surveys; manta tows	Monthly during construction and quarterly thereafter.	US$200 per survey
Erosion and Coastal Changes	Beach profiles	Surveying using level, staff, compass & D-GPS	Two months after completion of the project and thereafter annually.	US$100 per survey
	beach line (at high tide & low tide)	D-GPS tracks along the beach		
	Longshore currents	Drogue method		
Water Depth	Water Depth	Sonarmite or handheld echosounder	Two months after completion of the project and thereafter annually.	US$100 per survey

6.4 Monitoring Report

Based on the data collected, a detailed monitoring report will be compiled annually and submitted to the relevant government authorities for compliance. The report will include methodologies and protocols followed for data collection and analysis, quality control measures and indicate the uncertainties.

6.5 Commitment for Monitoring

The proponent is fully committed to undertake the monitoring program outlined in this Chapter (refer Appendix E of this report).

7 STAKEHOLDER CONSULTATION

7.1.1 Introduction

Stakeholder consultations are a crucial process in any development project as it reveals invaluable information and empowers the public in decision making processes. Accordingly, key stakeholders for the proposed project were identified during the EIA scoping meeting held on 31st May 2009. Consultations were carried out by conducting random interviews where questions/discussions were mainly focused on environmental, social and economic aspects of the proposed project.

7.1.2 Ministry of Housing, Transport and Environment (Planning Section)

Mr Zuhurulla Siyad- Director, from the Planning Section of the Ministry of Housing, Transport and Environment was consulted on 16th June 2010.

An official letter notifying the ministry of the proposed plan, specifically the backfilling component, was requested.

The general view of the ministry regarding the proposed activities was positive. The replacement of the existing jetty with another of better quality was regarded as a positive improvement, as it contributes to the social development of the island. No objections to the proposed changes were raised.

7.1.3 Ministry of Civil Aviation and Communication

Ms Fathimath Ramiza, from the Ministry of Civil Aviation and Communication was contacted for comments regarding the proposed changes to the project.

There were no objections from the Ministry of Civil Aviation and Communication regarding the proposed changes.

7.1.4 Holiday Island Resort

Mr. Abdulla Zamir, the General Manager of Holiday Island was interviewed via telephone on 6th June 2010. The general attitude towards the proposed airport development was very positive.

Mr. Zamir noted the potential for noise-related disturbances. Currently, about 20 seaplanes carrying passengers to Sun Island and Holiday Island arrive in the vicinity of the project site. Operation of the proposed airport is expected to reduce the frequency of flights. Therefore, the disturbance caused by noise is expected to be less. The potential for development of the atoll and benefits to nearby resorts was also noted. No specific issues were raised regarding the project in general, or the proposed changes addressed in this report.

7.1.5 Maamigili community

Individuals contacted from Maamigili Island include:

- Mr Junaid — Island Office
- Mrs Nasreena Mohamed — President, Women's Development Committee
- Mrs Nazima Yahya — Vice President, Women's Development Committee

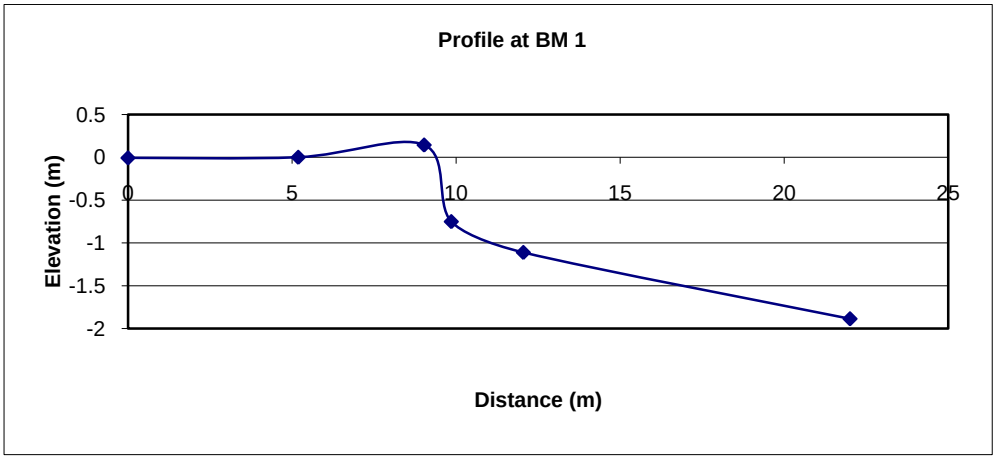
The general opinion is that the project will bring progress to Maamigili and other islands of the atoll. Generation of employment opportunities is highly anticipated. The residents of Maamigili anticipate development opportunities from having an airport on their island. The opportunity to work on the island, near family is one advantage looked forward to. Development of the tourism industry in the atoll, leading to economic growth, is also a benefit expected to arise from the project.

The individuals interviewed were not very well-informed about the details of the project or the proposed changes to the project. However, they were very much in favour of the construction of the jetty using sheet piles due to safety and aesthetic reasons. The current jetty poses a safety hazard to the community who use the jetty.

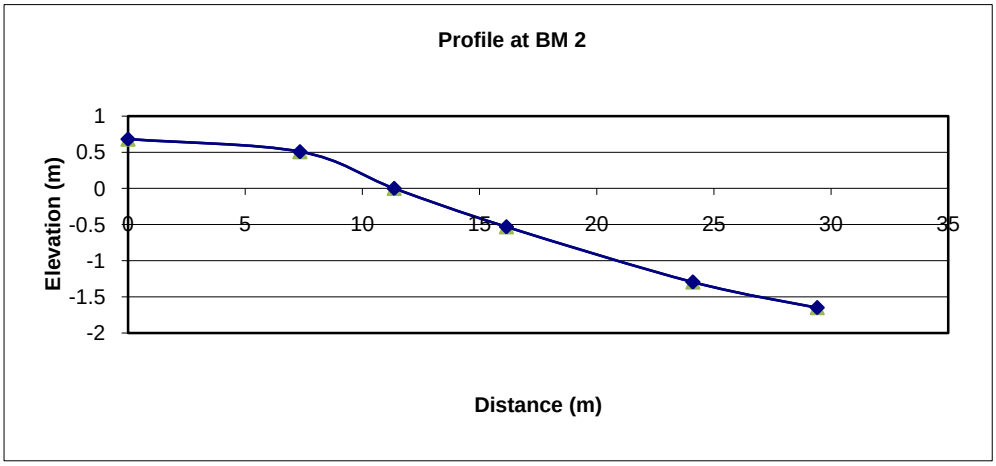
APPENDIX A – Terms of Reference

APPENDIX B – Site Plan

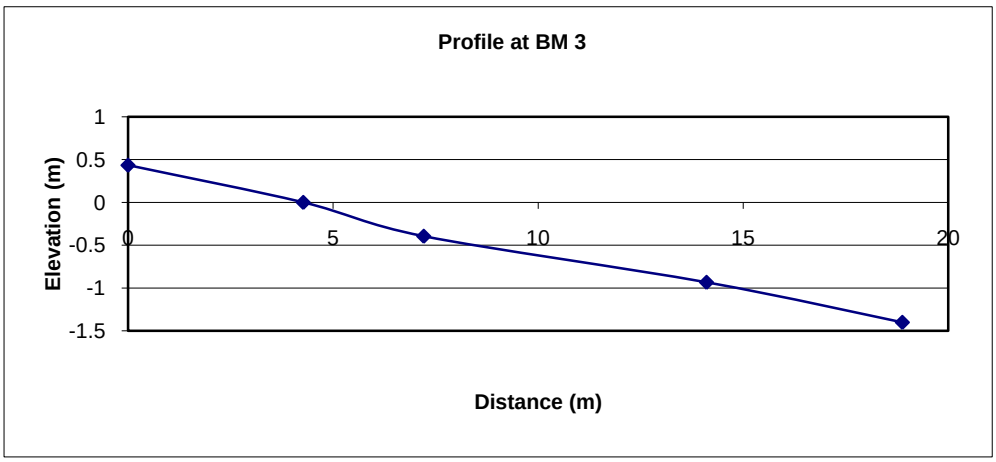
APPENDIX C – Beach Profiles



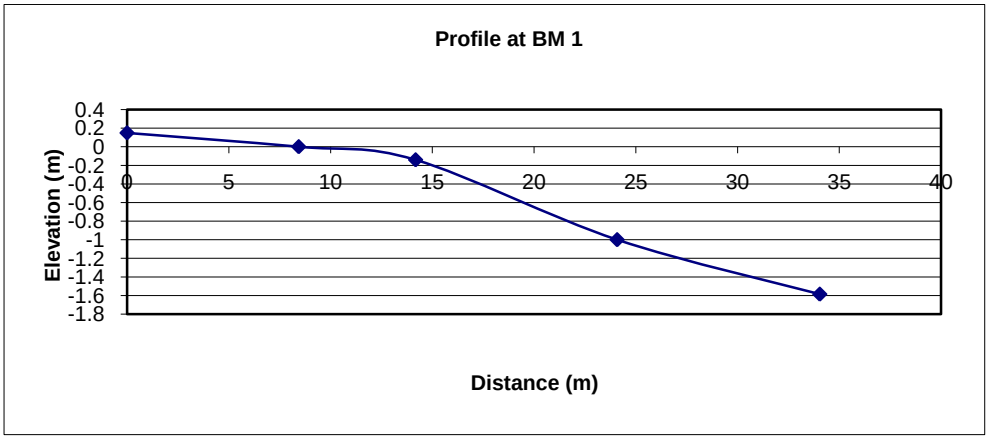
Beach Profile at BM1 in Maamigili



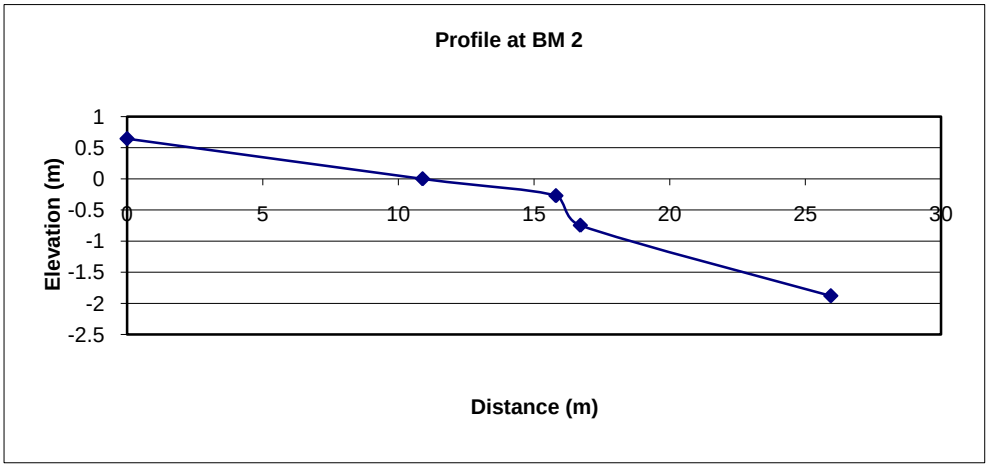
Beach Profile at BM2 in Maamigili



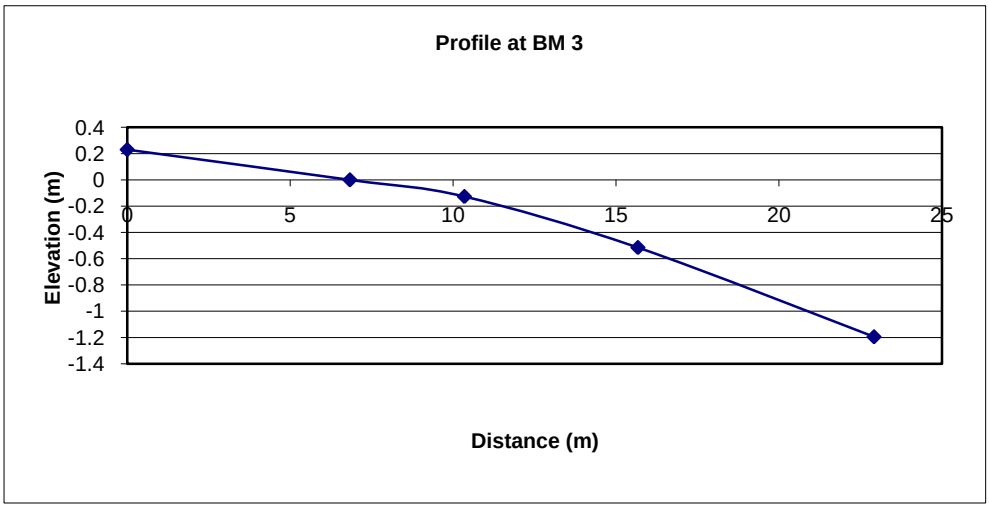
Beach Profile at BM3 in Maamigili



Beach Profile at BM1 in Holiday Island



Beach Profile at BM2 in Holiday Island



Beach Profile at BM3 in Holiday Island

APPENDIX D – CV's of Consultants

APPENDIX E – Commitment to Monitoring