ENVIRONMENTAL IMPACT ASSESSMENT

For the Proposed Beaching Area

HA. Dhidhdhoo

Maldives

Proponent: Ministry of Housing and Infrastructure

Sandcays

December 2015

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Consultants Declaration

This EIA has been prepared according to the EIA Regulations 2012. I certify that the statements in this Environmental Impact Assessment study are true, complete and correct to the best of my knowledge and abilities.

Hussain Fizah

Consultant Registration EIA 01/14

Proponent's Commitment and Declaration

This is in reference to the EJA report for the Proposed Beaching Area construction in Dhidhdhoo, Haa Alif Atoll, Maldives.

As the Proponent of the project, we guarantee that we have read the report thoroughly and that to the best of our knowledge all information provided here is accurate and complete.

Fathimath Shaana Farooq
Director General
Ministry of Housing and Infrastructure
26 January 2016

بسم الله الرحمن الرحيم

Ministry of Housing and Infrastructure
Male', Republic of Maldives.

ހިދުމަތްތެރި ގެދޮރު ހަދައި ދިރުއުފެދުމުގެ ތަރައްގީ ވަޒާރާ
ދަތުރު، ދިރުއުފެދުން.

Date: 06th January 2015

No: 138-PIS2/203/2016/7

Mr. Yazeed Ahmed
Director
Environmental Protection Agency
Ministry of Environment and Energy,
Ameenee Magu, Maafannu, Male', 20392,
Maldives.

Dear Sir,

Sub: EIA to the Proposed Beaching Area in HA.Dhidhdhoo:

As the proponent of the project, we confirm our commitment to finance and implement all mitigation and the monitoring program as specified in the report.

Thanking you.

Sincerely,

Fathimath Shaana Farooq
Director General

Ameenee Magu, Maafannu, Male', 20392, Republic of Maldives. ދަތުރު، ދިރުއުފެދުން، 20392، ދަތުރު، ދިރުއުފެދުން.
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Executive Summary

This report discusses the findings of an Environmental Impact Assessment for the proposed development of a beaching area in HA. Dhidhdhoo. The project is proposed by Ministry of Housing and Infrastructure.

At present, unavailability of space has forced boat owners to travel great distances to do small scale servicing to boats. In cases where boats are beached on Dhidhdhoo, being too close to residential areas has made these activities a public nuisance and a health hazard. The project aims at providing a suitable space for boat owners of Dhidhdhoo and nearby islands for vessel beaching and related work on the island away from residential areas. The proposed project entails dredging a 24m by 266m access channel, 110m by 76m manoeuvring area and reclamation of 0.54Ha at the southwest side of the island.

There are very few practical alternatives to the proposed project; alternatives to reclamation shape and location are assessed in the report.

Environmental impacts were assessed for both the construction and operation phase of the project. Most of the environmental impacts of the project have been identified as positive resulting mainly from improved socio-economic situation of Dhidhdhoo. The main negative environmental impact of the project is identified to be the possible movement of low to moderate levels of sediment on the reef during dredging and reclamation. Movement and settlement of fine sediments are expected to occur on the reef flat to a small degree. However, effects of this would not be severe as sediment plume is not expected to last longer and live coral cover at the location is minimal. Overall, the negative environmental impacts of the project are short-term and of moderate significance while long term socio-economic benefits are numerous. Hence the impact matrices done for the project indicates a net positive impact.

Impact mitigation measures are few. In order to mitigate movement of sediment plume onto the reef, bunds around reclamation area and creating settlement ponds during reclamation is suggested.

Regular environmental monitoring and reporting is an essential element of the EIA process. During the construction phase, in-situ monitoring of total suspended solids and turbidity is usually undertaken in dredging and reclamation projects to ensure that water quality criteria

are met and sedimentation on the reef does not occur. It is recommended to incorporate these into an island-wide monitoring programme, which is not within the scope of this EIA report.

In conclusion, it appears justified from a technical and environmental point of view to carry out the proposed project to develop a beaching area in Dhidhdhoo. However, before start of construction phase, the consultants recommend evaluating alternative reclamation shape proposed in this report; as to reduce potential impact of interrupting longshore sediment movement.

ސާރާ ހުލާސާ

މި ރިޕޯޓަކީ ހއ.ދިއްދޫ ހުޅަނގު ދެކުނު ފަރާތުގައި ހެދުމަށް ހުށަހަޅާފައިވާ ބީޗު އޭރިއާ ސަރަހައްދު ހެދުމުގެ މަޝްރޫއުގެ ސަބަބުން ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަޔާންކުރުމުގެ ގޮތުން ތައްޔާރުކުރެވިފައިވާ ރިޕޯޓެކެވެ. މި މަޝްރޫއުގެ އެދިއާރަކީ މިނިސްޓްރީ އޮފް ހައުސިންގް އެންޑް އިންފްރާސްޓްރަކްޗަރެވެ.

ދިއްދޫއަކީ ބިމުގެދަތިކަން ކުރިމަތިވެފައިވާ ރަށްތަކުގެ ތެރެއިން ރަށެކެވެ. އަދަދު ފިރިކަންކުރާ ރަށަށް ފުމާއި ބޮޑުވާ ގިނަ ވަސީލަތްތަކެއް ރަށުގައި ގާއިމް ކުރެވިފައިވުމުގެ ސަބަބުން ގިނަ އަތޮޅުތަކުގެ އާބާދީ ހިނގާފައިވާ ރަށަށް ޖީހާލައެވެ ކުރަމުން އާދެއެވެ. މީގެ އިތުރުން ދިއްދޫގައި ރަޖިސްޓަރީކޮށްފައިވާ އާބާދީއަށްވުރެ ނުހަނު ގިނައެވެ. އެހެންނަމަވެސް ރަށުގައި ދިރިއުޅޭ އާބާދީ ބޮޑުވުމާއި އާންމު ޖާގަތައް ކުޑަވުމާއެކު ކައިރިގައި އުނދަގޫވާ މަރާމާތު ކުރުމުގެ މަސައްކަތް ކުރަން ޖެހުމުން ދިއްދޫގެ ރައްޔިތުންނަށް އުނދަގޫތަކެއް ކުރިމަތިވެފައިވެއެވެ. ހުށަހެޅިފައިވާ މަޝްރޫއުގެ ސަބަބުން މިކަމަށް ހައްލެއް ލިބިގެން ދާނެއެވެ.

މި މަޝްރޫއުގެ ދަށުން 24މ ފުޅާ 266މ ދިގު ނެރަކާއި 110މ އަދި 76މ ދެ ބޯސިން އެއް ކޮށްލި 0.54ހެކްޓަރ ގެ ބިން ރަށުގެ ހުޅަނގު ދެކުނުފަރާތުގައި ހިއްކިގެން ދާނެވެ.

މަޝްރޫއުގެ ޖުމްލަ މާލީ އަގެއްބިޑްގެ ތަކެއް މި މަޝްރޫއަށް ނިސްބަތް ކުރަނީ ފާރާ ކުރަން ބޭނުވެ. ނަމަވެސް ހިންގުމަށް ހުށަހެޅިފައިވާ ބައިޓްސަރު ގޮތަށް ބަދަލުކޮށް މި ރިޕޯޓުގައި ބަޔާންކޮށްފައިވާނެވެ.

މަޝްރޫއުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ ކަމަށް ފާހަގަކުރެވޭ ނޭދެވޭ އަސަރުތައް ކުޑަކުރުމަށް އިޖުރާއާތު ފައިދާ ބޮޑުކަމަށް ފެންނަނެވެ. މިގޮތުން މި މަސައްކަތުގެ ސަބަބުން ދިއްދޫއާއި ކައިރި ރަށްރަށަށް ރައްޔިތުންނަށް ލިބޭފައިދާތައް ވެގެންދާނެވެ. ނަމަވެސް، ފުރަތަމަ ވެރިގެ އެންމެ މުހިއްމު އެއްބައި ކަމުގައިވާ ފަރުގެ ދިރުމަށް ކުރާނެ ގެއްލުންތައް ވަރަށްގެ ނޭދެވޭ އަސަރުތައް މަޝްރޫއުގެ ސަބަބުން ކުރާނެއެވެ. އެހެންނަމަވެސް، މަޝްރޫއުގެ މަސައްކަތް ކުރުމަށް ހުށަހެޅިފައިވާ ސަރަހައްދުގައި ދިރޭ މުރަކަ މަދުވުމުން މަސައްކަތުގެ ސަބަބުން ފަރުގެ ދިރުމަށް ކުރާ އަސަރު ވަރަށް ކުޑައެވެ.

މަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ ނޭދެވޭ އަސަރު ކުޑަކުރުމަށްޓަކައި ކުރެވިދާނެ ކަންކަމުގެ ތެރޭގައި، ހިއްކުމުންދާއިރު ހިލަނބު ފެތުރުން ކުޑަކުރުމަށްޓަކައި ހިއްކާ ހިސާބު ވަށައިގެން ބައްދާލުމާއި ސެޑިމެންޓް ކާޓަން ގެނުވުން ހިމެނިފައިވާނެވެ.

މަޝްރޫޢުގެ ސަބަބުން ވެށްޓަށް އަންނަމުންދާ ބަދަލުތައް ދެނެގަތުމުގެ ގޮތުން މޮނިޓަރކުރުމަށް ބިން ހިއްކުމުގެ މަޝްރޫޢުތަކުގެ މަރުޙަލާ ގޮތުގައި ބަލާނީ ކޮން ހިއްކާ ސަރަހައްދުން ފެންގެ ކޮލިޓީ (ހިލަނބުގެ އަސަރު - ޓާބިޑިޓީ ސަސްޕެންޑެޑް ސޮލިޑް އާއި ޓާބިޑިޓީ) އާއި އޮޅުވަރަށް އަންނަމުންދާ ބަދަލުތަކެވެ. މި މަޝްރޫޢުގެ ދަށުން ކުރާ މިފަދަ ދިރާސާތަކެއް މުޅި ރަށަށް ހާއްސަކޮށްގެން ހިންގާ މޮނިޓަރިންގެ ޕްރޮގްރާމެއްގެ ތެރޭގައި ހިމަނާފައި އޮތުމަށް އެންމެ ރަގަޅު ގޮތް ކަމުގައިވެސް ފާހަގަކުރެވެއެވެ.

މި ރިޕޯޓުގައި ހިމަނާފައިވާ ކަންކަމަކީ އެއީ ސަބަބުން ތިމާވެށްޓަށް ކުރާ ނޭދެވޭ އަސަރު ކުޑަ ނުވަތަ ނޭދެވޭ އަސަރެއް ކަމަށް ކަނޑައަޅާ ދެއްކުމަށްފަހު ވެސް ކަންކަމުގެ ނަމޫނާ މަޝްރޫޢު ސަބަބުން މައިގަނޑު ގޮތެއްގައި ތިބާ ފައިދާ ބޮޑުކަމުން ފެންނާނެ، މި މަޝްރޫޢު ހުށަހެޅުއްވި ގޮތަށް ކުރިއަށް ގެންދިއުން އެންމެ ރަނގަޅު ކަމަށް ފެނެއެވެ. އެހެންނަމަވެސް ހުށަހެޅުއްވި ގޮތަށް ބިންހިއްކުމުން ހުރިހާ ގޮތްތަކާ ދިމާއިތުރުވާގޮތަށް ދ ނޭދެވޭ އަސަރު ކުރުމުގެ ފުރުސަތު އެންމެ ރިޕޯޓުގައި ހުށަހެޅިފައިވާ އޮލްޓަނޭޓިވް ތަކަށް ރިއާޔަތް ކުރުމަށް މަސައްކަތް ކުރުމުގައި އެންމެ ރަނގަޅު ގޮތަކީ ފާހަގަކުރަމެވެ.

1 Introduction

1.1 Introduction

This Environmental Impact Assessment (EIA) report has been prepared in order to meet the requirements of Clause 5 of the Environmental Protection and Preservation Act of the Maldives (Law No. 4/93) to assess the impacts of proposed Beaching Area construction in HA. Dhidhdhoo. Environmental Impact Assessment Regulations 2012 provides a list of proposals requiring an EIA. As per the list, EIAs are mandatory for dredging and significant coastal modification projects. This report will identify the potential impacts (both positive and negative) of the proposed Beaching Area development.

This report will look at the justifications for undertaking the proposed project components. Alternatives to proposed components or activities in terms of location, design and environmental considerations would be suggested. A mitigation plan and monitoring programme during and after the works would also be included. Monitoring would ensure that the proposed activities are undertaken with caution and appropriative care so as to protect and preserve the built environment of the areas in proximity to the site or those areas and environmental aspects affected by the development.

The findings of this report are based on qualitative and quantitative assessments undertaken during a site visit in October 2015 as well as professional judgment. The impact assessment methodology has been restricted to field data collected, professional judgement and experience of similar settings and projects across the Maldives and elsewhere. Long term data relevant to this report on specific aspects such as meteorology and climate were gathered from secondary sources and published reports on the Maldives.

Experience of the Consultant in the implementation of similar projects has also been taken into consideration in understanding impacts and making professional judgements about the environmental impacts due to the project.

1.2 Background to the EIA

This EIA is prepared in accordance with the Terms of Reference (TOR) approved by the Environmental Protection Agency (EPA) on 8th November 2015. It is a legal requirement that

new projects having potential for environmental impacts gain environmental clearance or approval prior to construction and operation of such projects.

The principal environmental institution that implements EIA process in the country is Environmental Protection Agency. Additionally, the Ministry of Environment and Energy provides policy guidance before projects are implemented.

1.3 Scope of the EIA and Approach

The main scope of this EIA report as per the approved TOR is to broadly assess, identify, predict and document potential environmental impacts from the proposed construction of vessel beaching area in HA. Dhidhdhoo. This project involves construction of a mooring area, access channel and relocation of existing rock boulder revetment. Hence, importance is given to document the whole project proposal in detail, identify the main environmental impacts that are associated with the proposed development and address the legal requirements that need to be taken into consideration while implementing this project. This document also addresses the existing environmental condition of the island and foresees the ways in which potential environmental impacts will be managed, mitigated and reduced.

Hence the key aims of the report are to

- Describe in detail the proposed project;
- Identify the need and justification for the proposed development;
- Describe the biophysical status of the existing environmental condition of the island based on the findings undertaken during the site visits;
- Assess, identify and predict potential environmental impacts of the proposed development;
- Evaluate the significance and magnitude of impacts that will be generated; and identify and predict ways in which these environmental impacts will be prevented and removed through appropriate environmental management and mitigation measures;
- Develop a mechanism to closely monitor and understand the long-term effects and changes of the proposed development on the environment with respect to the available baseline information, mostly collected from field assessments and site visits;
- Provide legal protection with regards to the proposed development activities; and

- Review the predictions and assessments made on environmental impacts that are associated with the proposed development activities.

In general, the EIA report has been based upon the following sources of information:

- Review of available project documentation including previous EIA reports;
- Discussions with involved key personnel;
- Site visits to the project location;
- Baseline environmental assessments;
- Maldives Environmental Protection and Preservation Act No. 4/93;
- Environmental Impact Assessment (EIA) Regulation 2012
- Other Environmental Regulations
- Maldives National Development Framework
- Sandcays' previous experience of undertaking EIAs for projects in the Maldives; and
- Other EIAs for similar projects that have been carried out in the Maldives.

1.4 Relevant Studies and Experiences

Since several EIAs of this sort have been undertaken in the past, documents and experiences from these projects such as slipway development EIAs in ADh. Dhangethi and N. Velidhoo; harbour projects in N.Holhudhoo harbour rehabilitation, Lh. Naifaru harbour project, N. Magoodhoo Harbour project, R.Fainu harbour project, Hdh.Nellaidhoo harbour project, N.Kudafari harbour project Ihavandhoo harbour project, Velidhoo harbour project, Lh.Kurendhoo harbour project, Kurinbi harbour project, HDh. Kulhudhuffushi harbour rehabilitation project and the environmental monitoring carried out for 16 similar projects have been reviewed and taken into consideration.

1.5 EIA Implementation and Methodologies

This study was based mainly on data collected during a field investigation missions during October 2015 by a team from Sandcays Pvt. Ltd. and published literature on similar settings and projects. The EIA report was compiled by Hussain Fizah and reviewed by Ahmed Zahid. Zahid is a registered EIA consultant with over 18 years of experience and has been involved in numerous reclamation and harbour development projects in the Maldives and various other projects such as shore protection, resort development, sewerage and water projects. Fizah is a registered EIA consultant at Sandcays and has been involved in almost every EIA undertaken by Sandcays since he joined in 2012.

Established and widely accepted methods have been applied in this EIA study. Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. The field assessment methodologies are briefly described in Section 4 of this report.

The methods used to identify, predict and assess impacts are based on matrices that have been established by the Consultants over a long period. In the matrix, the consultants assign a likert-scale number to represent the magnitude, significance, duration and spatial extent of the potential impact for each project activity against the key environmental and socio-economic components that the specific project activity may have an impact on. The product of the magnitude, significance, duration and spatial extent for each activity and component is summed up to measure the exact nature of the impacts by each activity and the overall impact of the proposed project is the sum of all activities.

The Terms of Reference (TOR) for this EIA has been attached as Appendix 1. This EIA has been prepared based on this term of reference.

2 Project Description

2.1 General context of the study

HA. Dhidhdhoo is the capital of the administrative Haa Alif atoll. As such the island acts as a hub for nearby islands, providing trading, educational and health necessities to neighbouring communities. Numerous sea vessels use the island harbour and providing them with repairs and maintenance facilities have become a bit of an issue; there is no space available for this type of industrial work away from residential areas. The proponent proposed this project to provide a suitable space for beaching vessels in HA. Dhidhdhoo, targeted to vessels of the entire region.

This section will provide the details of the project including detailed methodologies of undertaking the proposed project with illustrations of areas using maps at appropriate scales.

2.2 The Proponent

The project proponent is the Ministry of Housing and Infrastructure.

2.3 Project Location and Study Area

Dhidhdhoo is located in the north-western side of the Haa Alif Atoll at 6° 53’ 14” N and 73° 06’ 51” E. The closest inhabited islands, Vashafaru is roughly 4.5km east while Utheemu is 5km south of Dhidhdhoo.

The proposed project is to be carried out on the southwestern side of the island. The maneuvering area and access channel will be dredged at this location while the excavated material will be used for backfilling. As such, study area used for this EIA is limited to southwestern marine and coastal environment. Specific locations and parameters to be surveyed were selected based on predicted impacts from project components.

Figure 2-1: location of proposed development

2.4 The Project

The components of the proposed project are construction of an access channel; 24m wide and 266m long and a manoeuvring area of 110m x 76m. These areas will be dredged to achieve an even depth of 3m at mean-tide with a suitable slope towards the shore. This makes a total area of 14 744m^2 proposed for dredging. Initially, existing depth of the proposed dredge area was thought to be -1m from MSL; giving a sand yield of 29 488m^3. However, field investigations revealed existing depths at the location to vary between -1.5m and -2m from MSL (with an average depth of 1.6m at Mean Tide). As such, consultants estimate the sand yield to be around 24 000m^3.

The existing rock boulder revetment will be removed using excavators to allow reclamation of 4680m^2 area to be used for vessel servicing and maintenance activities. The material from this revetment will be used to construct revetments on either side of the newly reclaimed area. An

area of 5430m^2 will be reclaimed for use in boat maintenance activities. With an average existing depth of 1.5m at proposed reclamation area, this will require a total volume of 16290m^3. Excess sand could be stockpiled near the harbour and used for beach nourishment of eroding areas on the western side of the island. During the initial phase of the project design, excess sand was not expected to be generated. Stockpiling and using for beach nourishment was briefly discussed in the scope meeting. However, the consultants recommend going for alternative shape proposed in Section 7.4 of this report.

2.5 Work Methods

2.5.1 Workforce and machinery

A total of 18 workers will be used by the contractor for this project. Temporary accommodation and other utilities will not be built for the workforce. Instead, existing buildings and facilities in Dhidhdhoo will be used.

Table 2-1: Workforce details

	Description	T. Qty
1	Site Manager	1
2	Supervisor	1
3	Excavator Operator	2
4	Loader Operator	1
5	Driver	2
6	Laborer	11
	TOTAL	**18**

Heavy machinery will be used for different components of the project including excavation and construction of shore protection measures and breakwater (Table 2-2).

Table 2-2: Equipment details

	Equipment	No. of Units
1	Excavator 330	2
2	Dump trucks	2
3	Loader	1
4	Winget Machine	1
5	Crane	1
6	Diesel Tank 5000L	3
7	Water Tank 5000L	2
8	Welding Genset 20kva	1

2.5.2 Excavation

Excavator, barge and general construction tools will be used for excavation. Trucks and excavators will be used to transport, spread and level material on roads. Sand will be transported to the project area using barges and dumped into the reclamation area.

2.5.3 Shore Protection Measures

Rock boulder revetments will be built on the eider side of the reclaimed area using material from existing revetment. Western side revetment will be 46m while the eastern side revetment will be 44m.

Figure 2-2: Proposed project components


HARBOUR LOCATION:
N
REVETMENT
46m [152ft]
140m [459ft]
REMOVE EXISTING REVETMENT
RECLAIMED AREA
76m [250ft]
100m [328ft]
39m [127ft]
44m [145ft]
REVETMENT
BASIN MSL -3m
110m [362ft]
24m [79ft]
ENTRANCE CHANNEL
266m [874ft]
24m [79ft]
PROJECT:
CONSTRUCTION OF
HA. DHIHDHOO
BEACHING AREA
CONTENTS:
BEACHING AREA LAYOUT
DATE:
16 JULY 2015
ENGINEERING DIVISION
MINISTRY OF HOUSING AND INFRASTRUCTURE
AMEENEE MAGU MALE' 20392
REPUBLIC OF MALDIVES
TEL: 300 4300, FAX: 300 4301

2.6 Project duration

The project is expected to start soon after the approval of this EIA report, which is expected to take less than 3 weeks from submission. The proposed beaching area development is expected to take about 5 months (Table 2-1) including mobilisation and demobilisation. A detailed work schedule is not available during the time of report compilation.

Table 2-3: Tentative work schedule

	Duration (wks)	Feb				March				April				May				June			
Mobilization	2	■	■																		
Removal of existing revetment	5			■	■	■	■	■													
Dredging and Reclamation	7						■	■	■	■	■	■	■								
Construction of new revetment	6										■	■	■	■	■	■					
Demobilisation	2																■	■			

2.7 Project Inputs and Outputs

The project has inputs in terms of human resources and natural resources such as water and fuel. The main output of the project is the beaching area itself and associated socio-economic benefits. These inputs and outputs are summarised in Table 2-4 and Table 2-5.

Table 2-4: Main inputs of the proposed project

Input resource(s)	How to obtain resources
Workers	Contractor's workforce (about 18)
Food, water and other resources	Provided on site for workforce
Machinery (excavator, barge, operational tools)	Contractor
Energy for machinery operation (e.g. fuel)	Diesel fuel provided by contractor
Sediment containment materials or sediment curtains (if necessary)	Imported/Contractor-owned
Sand for reclamation	Dredging access channel and mooring area

Table 2-5: Matrix of major outputs

Products and waste materials	Anticipated quantities	Method of disposal
Wastewater from workers	No. of workers x 95l/c/d	Through existing island sewerage system
Possible oil leak from excavator, etc	Trace amount	Take precautionary measures to avoid such leaks
Sediment plumes (during excavation)	Moderate to Minor	Natural dispersion over a short period

2.8 Need and Justification

The island of Dhidhdhoo is one of the economic hubs of northern Maldives; especially that of Haa Alif Atoll. In addition to numerous vessels registered on Dhidhdhoo, vessels from other islands use harbor of Dhidhdhoo to transfer goods and people to and from Dhidhdhoo. As such maintenance service for boats is carried on the island out of necessity. With lack of space on the island, these activities are carried out near residential areas, leading to increased public nuisance from noise and health hazards from fumes and dust released. Furthermore, enough space and facilities (even near residential areas) are not available on the island to cater for the demand. At times, vessels have to travel great distances just to do routine small maintenance, increasing cost exponentially. The proposed project aims to address the existing and growing need to provide a safe and suitable area for vessel beaching on HA. Dhidhdhoo.

3 Legislations and regulations

This section will identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. The proposed project is expected to conform to all of the policy and regulatory aspects outlined here. This section outlines and summarizes key policies, applicable laws and regulations and regulatory bodies regarding environmental protection in the Maldives. Also, it outlines some international and regional obligations that the country has to meet in terms of sustainable development, environmental management and protection.

The proposed project will be subject to the key legal tools including Environmental Protection and Preservation Act (No. 4/93), EIA Regulation and Dredging and Reclamation Regulation. Thus, it must satisfy the EIA process and get approval as well as conform to the requirements of the dredging and reclamation regulations.

3.1 Policy Guidance

The policy guidance on the development of the proposed project is taken from a number of policy documents prepared by the Government of Maldives on sectoral developments. Key documents outlined in this EIA are currently being implemented towards sustainable development of the country.

3.1.1 National Framework for Development 2009-2013

One of the most important environmental policy guidance is given in the Strategic Action Plan (SAP) of the National Development Framework for 2009-2013. Due to the fragile nature of the country's environment, all the development activities must ensure that appropriate care is taken to protect the environment. Environmental sustainability is the basis for socio-economic development, hence, the SAP outlines the key environmental policies that will be implemented in the country for environmental protection and sustainability, while one of the key environmental goals of the country is to protect and preserve the natural environment to ensure prosperous economic development. The environmental policies outlined in the SAP include;

Policy 1: Strengthen EIA process with an emphasis on EIA monitoring.

Policy 2: Conserve and sustainably use biological diversity and ensure maximum ecosystem benefits.

Policy 3: Develop resilient communities addressing impacts of climate change, disaster mitigation and coastal protection.

Policy 4: Strengthen adaptation and mitigation responses for beach erosion and develop a system to assist communities where livelihood and property are affected by beach erosion.

Policy 5: Ensure management of solid waste to prevent impact on human health and environment through approaches that are economically viable and locally appropriate.

Policy 6: Ensure protection of people and the environment from hazardous waste and chemicals.

Policy 7: Improve air quality to safeguard human health.

Policy 8: Enable a fully functional decentralized environmental governance system.

Policy 9: Develop a low carbon economy to achieve Carbon Neutrality by 2019.

Policy 10: Inculcate environmental values in the society and enable environmentally friendly lifestyle.

The Ministry of Environment and Environmental Protection Agency takes the lead role in implementing the above national policies through various strategies and regulatory measures.

3.1.2 Third National Environment Action Plan

NEAP 3 sets out the agenda for environmental protection and management in the Maldives for the five year period 2009-2013. This plan is targeted to achieve measurable environmental results that matter to the people of the Maldives.

The aim of developing NEAP 3 is to protect and preserve country's environment and properly manage natural resources for sustainable development of the country and encompasses ten principles, six strategic results with targeted goals to be achieved under each result.

The key principles of the NEAP 3 are:

Principle 1: Environmental protection is the responsibility of every individual

Principle 2: Achieve results

Principle 3: Promote and practice sustainable development

Principle 4: Ensure local democracy

Principle 5: Inter-sectoral co-ordination and co-operation

Principle 6: Informed decision making

Principle 7: Precaution first

Principle 8: Continuous learning and improvement

Principle 9: Right to information and participation

Principle 10: Environmental protection complements development

The six strategic results of NEAP3 are: resilient islands; rich ecosystems; healthy communities; safe water; environmental stewardship; and a carbon neutral nation with 30 result oriented environmental goals that will be achieved in the span of the NEAP 3.

3.1.3 Maldives National Strategy for Sustainable Development 2009-2013

The Maldives National Strategy for Sustainable Development (NSSD) outlines the key objectives, principles and goals that the country will embark toward achieving sustainable development. Hence, the overall direction of the NSSD is to build a nation which appreciates the true value of the natural environment, utilizes its natural resources in a sustainable manner for national development, conserves its limited natural resources, has built the capacity to learn about its natural environment and leaves a healthy natural environment for future generations.

The guiding principles outlined in the NSSD are:

Principle 1: Promotion and protection of fundamental human rights

Principle 2: Equity within and between generations

Principle 3: Democratic and open society

Principle 4: Full participation of businesses and civil society

Principle 5: Policy coherence and coordination

Principle 6: Use best available knowledge

Principle 7: Precaution first

Principle 8: Make polluters pay

While the country will be steered in accordance with the underlying principles of NSSD, the country aims to achieve very important environmental goals, including; adapting to climate change, protecting coral reefs, achieving carbon-neutrality in energy, ensuring food security, establishing a carbon neutral transport system, protecting public health and achieving full employment and ensuring social security.

3.1.4 National Biodiversity Strategy and Action Plan

The goals of the National Biodiversity Strategy and Action Plan are:

- Conserve biological diversity and sustainably utilize biological resources.
- Build capacity for biodiversity conservation through a strong governance framework, and improved knowledge and understanding.
- Foster community participation, ownership and support for biodiversity conservation.

In implementing the proposed project activities due to care has to be given to ensure that the national biodiversity strategies are adhered to.

3.1.5 Waste Management Policy

As waste management has been identified as a key environmental issue in the Maldives, a National Solid Waste Management Policy for the Republic of Maldives was developed in 2007 as an important step towards mainstreaming waste management in the country. The key strategic principles outlined in the document include; establishing polluter pay principles, integrated solid waste management, best practice environmental option (BPEO), best available technology not entailing excessive costs (BATNEEC), proximity principle and private sector participation. It is an important priority of the Government of Maldives as identified in the policy document to setup regional waste management facilities and island

waste management centres and decentralizing waste management administration. Hence, the key policies relevant to this project include;

Policy 1: Establish a governance structure for solid waste management which will distribute clearly delineated roles and responsibilities for solid waste management at island, regional and national levels

Policy 2: All waste producers have a duty to manage the waste they generate

Policy 3: Waste will be management and disposed as close as possible to the place of their generation

Policy 8: Private sector participation (PSP) will be facilitated where it is financially for both government and private sector.

Establishing a proper mechanism of waste management and disposal will be vital for the project and the waste management practices both during construction and operation of the project will closely adhere to the policies and principles taken as a priority of the government.

3.2 Regulatory Bodies

3.2.1 Ministry of Environment and Energy

The primary environmental institution in the Maldives is Ministry of Environment and Energy (MEE). It is mandated with formulating policies, strategies, laws and regulations concerning environmental management, protection, conservation and sustainable development. The Minister of Environment or a designate gives the environmental approval or clearance to EIA by an Environmental Decision Statement. Additionally, MEE is responsible for formulating relevant laws and regulations, policies and strategies concerning energy, water and sanitation, waste and infrastructure.

3.2.2 Environmental Protection Agency (EPA)

EPA is the key regulatory body on environment, which is an autonomous body formed under the umbrella of MHE. It is mandated with implementing the EIA process in the Maldives, implementing the Environment Act and subsequent regulations on behalf of MHE, regulating water and sanitation, biodiversity conservation, waste management and coastal zone

management. Also, it is responsible for developing environmental standards and guidelines in the country.

3.2.3 Ministry of Housing and Infrastructure

The Ministry of Housing and Infrastructure is the government agency responsible for the provision of housing and infrastructure such as harbours. It is under this mandate that the Ministry, as the Proponent, is undertaking this project.

3.2.4 Atoll/City Councils and Island Councils

Under the Maldives Decentralization Law, elected Atoll Councils, City Councils and Island Councils have been formed as regulatory bodies dealing directly with atoll, cities and island issues. In this regard, some of the development projects are subject to approval of these councils through a public consultation process. For the proposed project, EPA requires that a copy of the final draft of the EIA Report be submitted to HA. Atoll Council and receipt provided to EPA or attached to the EIA report.

3.3 Laws and Regulations

There are a number of laws and regulations relating to environment in the country. Only relevant laws and regulations have been outlined in this section.

3.3.1 Environmental Protection and Preservation Act

The Environmental Protection and Preservation Act of the Maldives, EPPA (Law No. 4/93) provides the basic framework for environmental management including Environmental Impact Assessment (EIA) process in the Maldives, which is currently being implemented by EPA on behalf of MHE.

Clause 2 of the EPPA mandates the Ministry of Environment to formulate policies, rules and regulations regarding the environment.

Clause 5 of this Act specifically provides for environmental impact assessment (EIA), a tool implemented to attempt to integrate environmental issues into development decisions. According to the Clause, environmental impact assessments are a mandatory requirement for all economic development projects.

Clause 6 of the EPPA gives the Ministry of Environment the authority to terminate any project that has an undesirable impact on the environment.

Clause 7 of the EPPA refers to the disposal of oil, wastes and poisonous substances in to the Maldivian territory. According to this clause, any type of waste, oil, toxic gas or any substance that may have harmful effects on the environment should not be disposed within the Maldivian territory. If, however, the disposals of such substances become absolutely necessary, the clause states that they should be disposed only within the areas designated for that purpose and if incinerated, appropriate precautions should be taken to avoid harm to the health of the population.

Furthermore, clause 9 sets a fine between five and five hundred Rufiyaa for minor offenses in breach of this law and a fine of not more than one hundred million Rufiyaa for major offenses. The fine shall be levied by the Ministry of Environment or by other government authorities designated by that Ministry in case of minor offenses.

Finally, Clause 10 of EPPA gives the government of the Maldives the right to claim compensation for all damages caused by activities that are detrimental to the environment.

The Environmental Act or Law 4/93 is the single most important legal instrument with regards to environmental management and it gives very high prominence towards safeguarding the environment with regard to all the development activities. Under this Act, the Ministry of Environment have developed regulations and guidelines concerning the environmental protection through implementation of EIA procedures.

3.3.2 Land Act of the Maldives

The Articles of the Maldivian Land Act (Law No. 1/2002) addresses the following aspects of land issuing, receiving, owning, selling, leasing, utilizing and using Maldivian land, which are relevant, understood and adhered to in the proposed project.

Policies concerning Maldivian land shall be decided by the President of the Maldives on the advice of the discussions in the Ministers Cabinet

In compliance with the land policies stated in subsection (a) of this section the President of the Maldives shall for different purposes and uses allocate land and change the allocation from one to another.

In accordance with section 3 of this Act, land shall be allocated for the following purposes and uses:

- For residential purposes
- For commercial use.
- For social use
- For environmental protection
- For institutional use.

The Ministry of Home Affairs, Housing and Environment (now the Ministry of Housing and Infrastructure) shall entrust the land allocated for different purposes and uses in accordance with sections 3 and 4 of this Act to the concerned Ministries.

The Ministry shall in accordance with the provisions stated in this Act, maintain written records of land in the Maldives.

The following data should be recorded:

- The way in which land has been allocated for different purposes and uses in accordance with sections 3 and 4 of this Act
- The location and size of the land
- In accordance to section 5 of this Act, the Ministry to which land was transferred to and the purposes and date of transfer
- Private dwellings, private lands and the owners of the aforesaid lands.

The Ministries entrusted with land in accordance to section 4 of this Act shall allocate the land, lease or transact any business in regard to the land only in accordance with this Act and any other Acts in force regarding the allocation of land for different purposes and uses.

3.3.3 Landuse Planning Regulation

The Landuse Planning Regulations was gazetted on January 2005 and later amended on July 2005. There is no official English translation of the regulation at the moment and relevant sections of the regulations described below are unofficial translation.

3.3.3.1 Environmental Protection (Section 12)

Habitats / Areas that are of significant ecological value (12.1)

Sensitive environments and unique habitats on islands should be preserved as per relevant laws and regulations when allocating land for infrastructure and other uses. However, instead of leaving the areas and these resources untouched, using them sustainably should be considered during land-use planning. For instance, using freshwater ponds (Kulhi) could be considered as a source of freshwater for the community; similarly, wetland and mangrove areas are vital habitats for some species of wildlife and could in turn provide a source of income in future. Therefore, during landuse planning, these areas should be identified and their level of protection, relevant regulations and restrictions on development activities within the areas should be addressed.

Protected areas (12.2)

A 20m wide coastal vegetation belt should be left out from infrastructural development; between shoreline and housing plots. However, small sections of coastline, such as harbors and industrial zones could be exempted from this vegetation belt. A regulation defining how the protected area is to be managed should be compiled.

3.3.4 Environmental Impact Assessment Regulation

The EIA Regulation, which came into force in 2007, but it has been recently revised and the revised EIA Regulation 2012 is currently in effect since May 2012. This EIA is subjected to EIA Regulations 2012.

The EIA Regulation 2012 is currently only in Dhivehi and an official translation is awaited. The Regulation sets out the criteria to determine whether a development proposal is likely to significantly affect the environment and is therefore subject to an EIA. Schedule D of the EIA Regulations defines the type of projects that would be subject to Environmental Impact Assessment; dredging and land reclamation is among those.

The main purpose of this Regulation is to provide step-by-step guidance for proponents, consultants, government agencies and general public on how to obtain approval in the form of an Environmental Decision Statement.

3.3.5 Dredging and Reclamation Regulation

The Dredging and Reclamation Regulations was gazetted on 2 April 2013 as Regulation No. 2013/R-15. This regulation is currently in Dhivehi and an English translation is awaited. Clause 6 of the Regulation requires applying for approval under this Regulation by submitting

the project details, land use plan, project justification and scaled maps of existing site plan and site plan with proposed project components. The EIA process can be commenced once EPA approves the application under this Regulation. This process, was therefore, completed for the purposes of the project under consideration.

Clause 7 provides the conditions for dredging, clause 8 for reclamation and clause 9 for beach nourishment or beach enhancement. Clause 10 is of specific relevance to the project under consideration in this EIA. As per Clause 10, all the development projects approved by the government in inhabited islands are exempted from rest of the regulation except for Clause 6 (Clause 6 says proponent should obtain approval from EPA for dredging and reclamation components before EIA process could begin. However, with a recent change in the procedure, approval under DnR regulation and EIA process are carried out simultaneously; application under DnR has been submitted to EPA for this project).

3.3.6 Waste Management Regulation

The Waste Management Regulation (Regulation No. 2013/R-58) came into effect in August 2013. The objective of Waste Management Regulation is to implement the National Waste Management Policy; through which it aims to protect the environment by minimizing the impact of waste on the environment, including the impact of waste on human health, establishing an integrated framework for minimizing and managing waste in a sustainable manner and establishing uniform measures to reduce the amount of waste generated. The regulation also ensures waste is reused, recycled and recovered in an environmentally sound manner before being safely treated and disposed. The regulation covers the management of general, hazardous and special waste. Wastes arising from paints and chemical solvents are considered as special waste.

Clause 1.4 of this regulation is of relevance to the projects under consideration. This clause is for construction waste and it states that;

a. Building construction works shall be planned and organized in a manner that there is minimal waste

b. Measures shall be in place to minimize construction waste

c. Reusable or recyclable waste among demolition/construction waste shall be reused or recycled

d. Construction waste shall be kept at the demolition site until demolition is completed

e. Demolition of buildings shall be done with minimal disturbance due to dust and emissions to the environment and people living in the vicinity.

This regulation was effective from 6 January 2014 and EPA would be responsible for the implementation this regulation.

The proposed project will be subjected to the requirements of this regulation and all waste produced under this project will be disposed in an appropriate manner.

3.3.7 Regulation on Environmental Damage Liabilities

Under the Environmental Protection and Preservation Act (No. 4/93), the Ministry of Environment formulated the Environmental Damage Liabilities Regulation in February 2011, which encompasses the basis to avoid environmental deterioration, extinction of biological resources, environmental degradation and avoid wastage of natural resources. The main purpose of this regulation is to stop unlawful activities on environment and adequately implement a fining procedure for violations as well as implement a compensation mechanism on environmental damages. Its Schedules form the basis for levying fines on various environmental components and activities. Hence, the proposed project will be subject to this Regulation for any activity outside of the EIA scope and Environmental Decision Statement.

3.3.8 Consultation and public participation laws

In the Maldives public participation has been limited to the review stages of the EIS until recently with the EIA Regulation, which considers public consultation as an important and integral part of the EIA process. Hence, this EIA has also taken public views into consideration. However, public consultation has not been conducted so far in order to take public opinion, views, suggestions and expectations into consideration in the design of the project. Therefore, it is recommended to discuss the proposed design with the public stakeholders and finalize the design based on mutual understanding.

3.3.9 Regulation on sand and aggregate mining

This regulation addresses sand mining from uninhabited islands that have been leased; sand mining from the coastal zone of other uninhabited islands; and aggregate mining from uninhabited islands that have been leased and from the coastal zone of other uninhabited islands.

3.3.9.1 Ban on coral mining

Coral mining from the house reef and the atoll rim has been banned through a directive from the President's Office dated 26th September 1990. According to the Directive,

- coral mining is not to be carried out on island house reefs;
- coral mining cannot be carried out on atoll rim reefs and common bait fishing reefs;

- coral or sand mining is only allowed from designated sites, and approval from the concerned Atoll Office is required prior to the commencement of any mining operation.
- requests for coral or sand mining from residents of inhabited islands are required to be submitted to the Atoll Office through their respective island office
- the island office is required to estimate the quantity of corals required for the applied construction work and hence this ensures that permission is granted to mine just the required amount;
- every island is required to keep a log book of the amount of corals mined.
- sand mining is not allowed on the beaches of inhabited islands, islands leased for industrial developments and tourist resorts and within the lagoons adjoining these islands.

3.4 International and Regional Context

3.4.1 Environment Sector

The major global issue facing the Maldives is climate change, global warming and subsequent sea-level rise. The small size of the islands and their low elevation above MSL makes possible impacts of it very seriously. Consequently, the country plays a prominent role in fore-fronting environmental issues faced by many other small islands developing states including the Maldives in the international arena. The Maldives is therefore, a party and signatory to various international conventions and declarations. These include;

- UN Convention on the Law of the Sea – UNCLOS (1982)
- International Convention for the Prevention of Pollution of the Sea by Oil (1982)
- Vienna Convention for the Protection of the Ozone Layer (1985)
- Montreal Protocol on Substances that Deplete the Ozone Layer (1987)
- Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (1989)
- The London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1990)
- Agenda 21 and the Rio Declaration of the United Nations Conference on Environment and Development (1992)
- Convention on Biological Diversity (1992)

- United Nations Framework Convention on Climate Change (1992)
- The Copenhagen Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1992)
- The Montreal Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1997)
- The Beijing Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1999)
- Washington Declaration on Protection of the Marine Environment from Land-Based Activities
- Kyoto Protocol to the United Nations Framework Convention on Climate Change (1998)
- International Convention for the Prevention of Pollution from Ships – MARPOL (1973)
- Cartagena Protocol on Biosafety (Maldives acceded on 2 September 2002)
- United Nation Convention to Combat Desertification (2002)

The Maldives is also a key player in formulating and adopting various regional plans and programmes to protect the environment by continuously participating in various activities organized by regional bodies such as SACEP, ESCAP and SAARC. As a result the Maldives is committed to the following;

- SAARC Environment Action Plan adopted in 1997 in Male'
- SAARC Study on Greenhouse Effect and its Impact on the Region
- South Asian Regional Seas Action Plan and Resolutions concerning its implementation (1994)
- SAARC Study on Causes and Consequences of Natural Disasters, and
- South Asian Seas Programme initiated by SACEP

4 Existing Environment

This section covers the existing environmental conditions of HA. Dhidhdhoo; especially those areas which may be impacted by the proposed works. In addition, the socio-economic conditions of Dhidhdhoo has been considered as the project has direct links to it. The key environmental, social and economic components of the project under consideration are described below.

- Socio-economic aspects
- Marine ecology of the house reef
- Marine water quality
- Coastal environment

4.1 Methodologies

Conditions of the existing environment of the study area were analysed by using appropriate scientific methods. Since proposed project is carried out in the southwest coast of Dhidhdhoo, the assessments were primarily restricted to the environmental components of this area.

The different methods used in assessing and reporting the conditions of the existing environment of the outer reef are given in the following subsections.

4.1.1 General meteorological conditions

Secondary sources of information were used to describe meteorological conditions such as temperature, relative humidity, rainfall and wind data. The sources used include MHAHE, windfinder.com and MEE.

4.1.2 Currents

A purpose built drogue with a GPS (Trimble Juno) was made to create spaghetti diagrams of the ocean currents at the study site. On 4 selected locations around the study area, drogue tests were conducted to assess currents.

4.1.3 Bathymetry

Spot depths were recorded using a staff and a handheld gps.

4.1.4 Water Quality

Marine water quality was tested in situ at three different locations using YSI portable water quality logger and Hach portable turbidity and TSS meter. These two meters recorded Temperature, Salinity, E. Conductivity, Total Dissolved Solids, Dissolved Oxygen, pH, Turbidity and Total Suspended Solids.

4.1.5 Housereef Assessment

Analysis of coral cover was done using underwater cameras and 1m by 1m quadrate. A surveyor would randomly place the quadrate on the reef and take a photo. Ten quadrates were done for each transect; the photos were later analyzed using CPCe software.

To assess fish community at study sites, a surveyor would swim parallel to housereef with a handheld underwater video camera for two minutes. Fish found in the video were then identified and their abundance recorded.

4.1.6 Social Environment

Information on social status was obtained through secondary sources; mainly from Ministry of Planning. Census 2006 and 2014 data were the primary source.

4.2 General meteorological conditions

The Maldives, in general, has a warm and humid tropical climate with average temperatures ranging between 25°C to 30°C (MHAHE, 2001) and relative humidity ranging from 73 per cent to 85 per cent. The country receives an annual average rainfall of 1,948.4mm. Table 4-1 provides a summary of key meteorological findings recorded for Maldives.

Monsoons of Indian Ocean govern the climatology of the Maldives. Monsoon wind reversal plays a significant role in weather patterns. Two monsoon seasons are observed: the Northeast (*Iruvai*) and the Southwest (*Hulhangu*) monsoon. Monsoons can be best characterized by wind and rainfall patterns. These are discussed in more detail in the following subsections. The southwest monsoon is the rainy season which lasts from May to September and the northeast monsoon is the dry season that occurs from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November. However, according to Elliot *et al*, 2003 due to proximity to the equator, the monsoon seasons in Maldives are not as well defined as they are

in Sri Lanka. The monsoons in Maldives are best defined in the northern part of the country where a distinct monsoon seasons including the strong southwest monsoon from June through September and a noticeable northeast monsoon from December through February occurs.

Table 4-1: Key meteorological information

Parameter	Data
Average Rainfall	9.1mm/day in May, November 1.1mm/day in February 1900mm annual average
Maximum Rainfall	184.5 mm/day in October 1994
Average air temperature	30.0 ^{0}C in November 1973 31.7 ^{0}C in April
Extreme Air Temperature	34.1 ^{0}C in April 1973 17.2 ^{0}C in April 1978
Average wind speed	3.7 m/s in March 5.7 m/s in January, June
Maximum wind speed	W 31.9 m/s in November 1978
Average air pressure	1012 mb in December 1010 mb in April

The climate of the Maldives varies slightly from South to North of the country. As pointed out by Elliot *et al*, 2003 the monsoon in north region is more pronounced and distinct. In Maldives, meteorological data are not recorded in all islands across Maldives. It has been recorded regional airports. General meteorological conditions prevailing in the region based on meteorological data for Hanimaadhoo has been used to understand climatic factors affecting the project site. Table below shows summary of four seasons in Maldives.

Table 4-2: Summary of Seasons in the Maldives

Season	Months
North East-Monsoon (Iruvai moosun)	December
	January
	February
Transition Period - 1 (Hulhangu Halha)	March
	April
South West-Monsoon (Hulhangu moosun)	May
	June
	July
	August
	September
Transition Period - 2 (Iruvai Halha)	October
	November

4.2.1 Wind

Wind has been shown to be an important indirect process affecting formation, development and seasonal dynamics of the islands in the Maldives. Winds often help to regenerate waves that have been weakened by travelling across the reef and they also cause locally generated waves in lagoons. Therefore, winds are important here, as being the dominant influence on the

hydrodynamics around the island (waves and currents). With the reversal of winds in the Maldives, NE monsoon period from December to March and a SW monsoon from April to November, over the year, the accompanying wave and current processes respond accordingly too.

Wind was 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 the Maldives during both monsoons, with a maximum wind speed recorded at 18 m/s for the period 1975 to 2001. Maximum wind speed recorded in the south was 17.5 m/s during the period 1978 to 2001. Mean wind speed was highest during the months January and June in the central region, while wind speed was in general lower and more uniform throughout the year in the southern region. Wind analysis indicated that the monsoon was considerably weaker in the south (Naseer 2003). During the peak months of the SW monsoon, southern regions have a weak wind blowing from the south and south-eastern sectors.

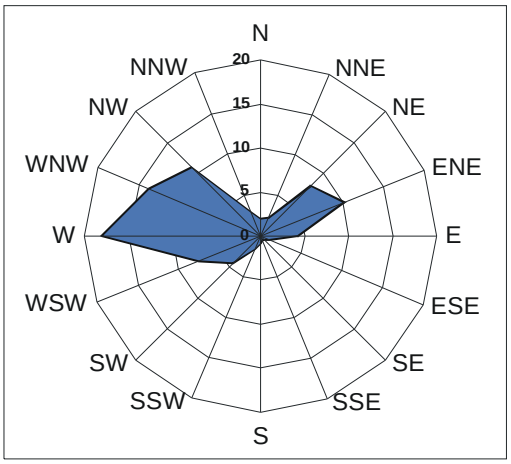


Figure 4-1: General wind rose diagram for the Maldives (source MEEW 2005)

Figure 4-1 shows the wind pattern in the central region based on over 20 years of data and this wind rose has been used in determining the impact of wind on the project.

Table 4-3 summarizes the wind conditions in the region throughout the year and Figure 4-2 provides the wind-rose diagram typical to the atoll (adapted from windfinder.com). This analysis represents wind data from Hanimaadhoo Airport taken between 07/2002 and 03/2015 from 0700 to 1900hrs local time.

Table 4-3: Summary of general wind conditions in HA. Atoll

Month of year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	01	02	03	04	05	06	07	08	09	10	11	12	1-12
Dominant wind direction	➤	➤	➤	➤	➤	➤	➤	➤	➤	➤	➤	➤	➤
Wind probability >= 4 Beaufort (%)	5	2	3	4	17	41	42	28	21	13	5	5	15
Average Wind speed (kts)	6	6	6	6	8	10	10	9	8	7	6	6	7
Average air temp. (°C)	28	28	29	31	30	29	29	29	29	29	29	27	28

The Maldives experiences strong ocean wind at speed of 6m/s to 7.5m/s at a height of 10m during June, July and August (Elliott *et al*, 2003).

The project is best undertaken during the northeast monsoon since the northeast monsoon is generally mild; and proposed project location is on the southwestern side of the island, therefore, working in the northeast monsoon is not going to pose much difficulty in this area. Also, the net flow is in the easterly direction. So, there will be stronger currents in the area during southwest monsoon compared to the northeast monsoon; so it may be easier to mobilize and operate heavy machinery at this site during northeast monsoon.

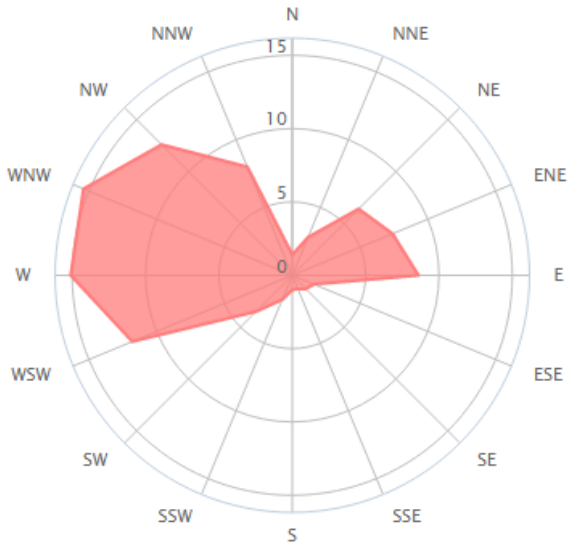


Figure 4-2: Windrose diagram based on data from Hanimaadhoo International Airport

Due to strong waves, current and wind present during southwest monsoon, vessels using the proposed access channel during May to October may face difficulties manoeuvring through the access channel.

4.2.2 Waves

Wave energy also plays a key role in the movement and settlement of sediments and suspended solids, and is also a crucial factor controlling coral growth and reef development. Studies by Lanka Hydraulics (1988a & 1998b) on Malé reef indicated that two major types of waves in Maldives coasts: wave generated by local monsoon wind and swells generated by distance storms. The local monsoon predominantly generates wind waves which are typically strongest during May-July in the south-west monsoon period. During this season, swells generated north of the equator with heights of 2-3 m with periods of 18-20 seconds have been reported in the region. Local wave periods are generally in the range 2-4 seconds and are easily distinguished from the swell waves.

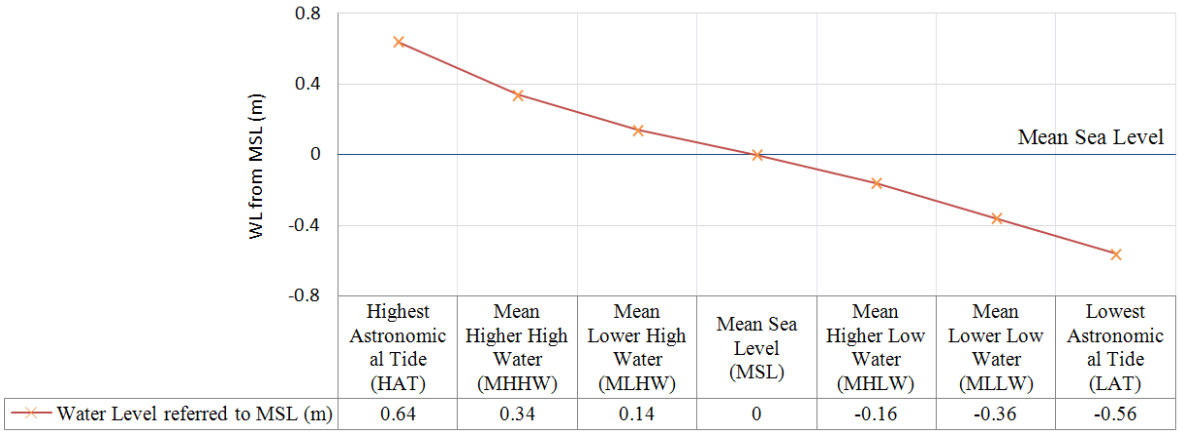
Distant cyclones and low pressure systems originating from the intense South Indian Ocean storms are reported to generate long distance swells that occasionally cause flooding in Maldives (Goda, 1988). The swell waves that reached Malé and Hulhule in 1987, thought to have originated from a low pressure system of west coast of Australia, had significant wave heights in the order of 3 metres.

The combination of wind and strong currents in the channels around Dhidhdhoo can cause waves to build up. It is estimated that the maximum wave height outside the flat reefs can reach more than 3m (ocean side, northwest side of Dhidhdhoo), whereas on the flat reef areas the wave height can reach from 0.6 to 1.2 meters (maximum). During the survey period in wave activity was minimal and well below 0.5m on southwestern side.

4.2.3 Tides

The Maldives experiences mixed semi-diurnal/diurnal type of tides which on two extreme ends of the country (North to South) found varying tidal range. The tide at Hanimaadhoo, HDh. Atoll is about 20cm lower than that recorded in Gan, Seen Atoll (MHAHE 2001). Tides affect wave conditions, wave-generated and other reef-top currents. Tide levels are believed to be significant in controlling amount of wave energy reaching an island, as no wave energy crosses the edge of the reef at low tide under normal conditions. In the Maldives, where the tidal range is small (1m), tides may still have significantly important influence on the

formation, development, and sediment movement process around the islands. Tides would play an important role in lagoon flushing, water circulation within the reef and water residence time within enclosed areas.



	Highest Astronomical Tide (HAT)	Mean Higher High Water (MHHW)	Mean Lower High Water (MLHW)	Mean Sea Level (MSL)	Mean Higher Low Water (MHLW)	Mean Lower Low Water (MLLW)	Lowest Astronomical Tide (LAT)
Water Level referred to MSL (m)	0.64	0.34	0.14	0	-0.16	-0.36	-0.56

Figure 4-3: Astronomical tidal variation in the Maldives

4.2.4 Currents

Studies on current flow within a reef flat in Male' Atoll suggests that wave over wash and tides generate currents across the reef platforms, which are also capable of transporting sediments (Binnie Black & Veatch, 2000). However, available information suggests that tidal currents are not strong due to small tidal range.

Generally current flow through the Maldives is driven by the dominating two-monsoon season winds. Westwardly flowing currents are dominated from January to March and eastwardly from May to November. The change in currents flow pattern occurs in April and December. In April the westward currents flow are weak and eastward currents flow will slowly take place. Similarly in December eastward currents flows are weak and westward currents will take over slowly.

Studies on current flow process within a coral atoll have shown that waves and tides generate currents across the reef flats, which are capable of transporting sediments on them. Currents, like waves are also modified by reef morphology. Under low-input wave conditions (0.5m heights) strong lagoonward surge currents (>60cm/sec) are created by waves breaking at the crest. Studies on current flow across reef platforms have shown that long-period oscillations in water level cause transportation of fine-grained sediments out of the reef-lagoon system, while strong, short duration surge currents (<5sec.) transport coarse sediments from the

breaker zone to seaward margin of the backreef lagoon. Always sediment accumulates at the lee of high-speed current zones. Generally zones of high current speed (jets or rips, 50-80cm/sec) are systematically located around islands.

4.2.5 Bathymetry

Spot depths at the proposed dredging and reclamation area were taken during the field visit. Depths at the project area was found to range between 1.52m and 2.02m from MSL. It should be noted, 2m depths were recorded within the existing small channel. Rest of the area had a relatively even depth ranging from 1.5m to 1.7m.

Figure ‍4-4: Bathymetry and drogue test results

4.3 Marine Water Quality

Marine water quality has been measured from representative locations around the reef. The water quality results (in-situ) are given in Table 4-4. The tested parameters show the marine water quality was similar to that of typical Maldivian reefs. There were no significant deviations from results obtained at other locations of Maldives.

Table 4-4: Water quality results

	Units	Site 1	Site 2	Site 3
Coordinates		291600.5282E 760710.3098N	291355.8261E 760832.5387N	291807.9281E 760573.1750N
Temperature	^{o}C	29.84	28.87	28.45
E.conductivity	mS/cm^3	48.98	48.04	48.52
TDS	g/L	31.55	31.44	31.34
Salinity	Sal	31.33	31.45	31.54
DO	mg/l	5.21	6.35	7.14
pH		7.60	7.90	7.40
Turbidity	NTU	0.410	0.520	0.511
TSS	mg/l	0	0	0

4.4 Ecology

This section of the report describes condition of the biological environment; both the marine and coastal components of relevant areas in detail.

4.4.1 Housereef of Dhidhdhoo

Dhidhdhoo sits in an isolated housereef on the northwestern rim of HA. Atoll. A reef flat with coral formations on the outer edges can be found around the island. Two deep channels run from the open ocean into the atoll lagoon; one on the northern side of the island and one on the southern side of the island.

The shallow reef flats on the west side are wider (up to 1000 m) compared to the east side (up to 200 m). The typical reef flat depth around Dhidhdhoo depends on the tidal influence and varies on average from -0.5m MSL on the East side to -1.5 to -6.0 m MSL on the West side.

The reef flats around Dhidhdhoo mainly consist of bare sand and very sparse coral (<5% live coral cover). The corals on the western reef flat were dominated by table and finger corals. The reef flat contains a steep to very steep slope on the Ocean side. Towards the east, the reef

flat goes down in to the lagoon to approximately -20 m MSL with a steep slope.

Two narrow channels (roughly 5-8m wide) exist at the project location. Access channel to be constructed under this project is proposed to be made on the eastern of the two channels. Quantitative assessment of benthic and mobile fauna at 3 selected locations was done under this study.

Figure 4-5 shows characteristics of the assessed sites obtained from photo quadrate analysis in terms of percentage of benthic cover.

The following sub-sections provide results of the quantitative assessment of the marine environment of the project site in terms of percentage benthic cover, fish count and general status of the reef.

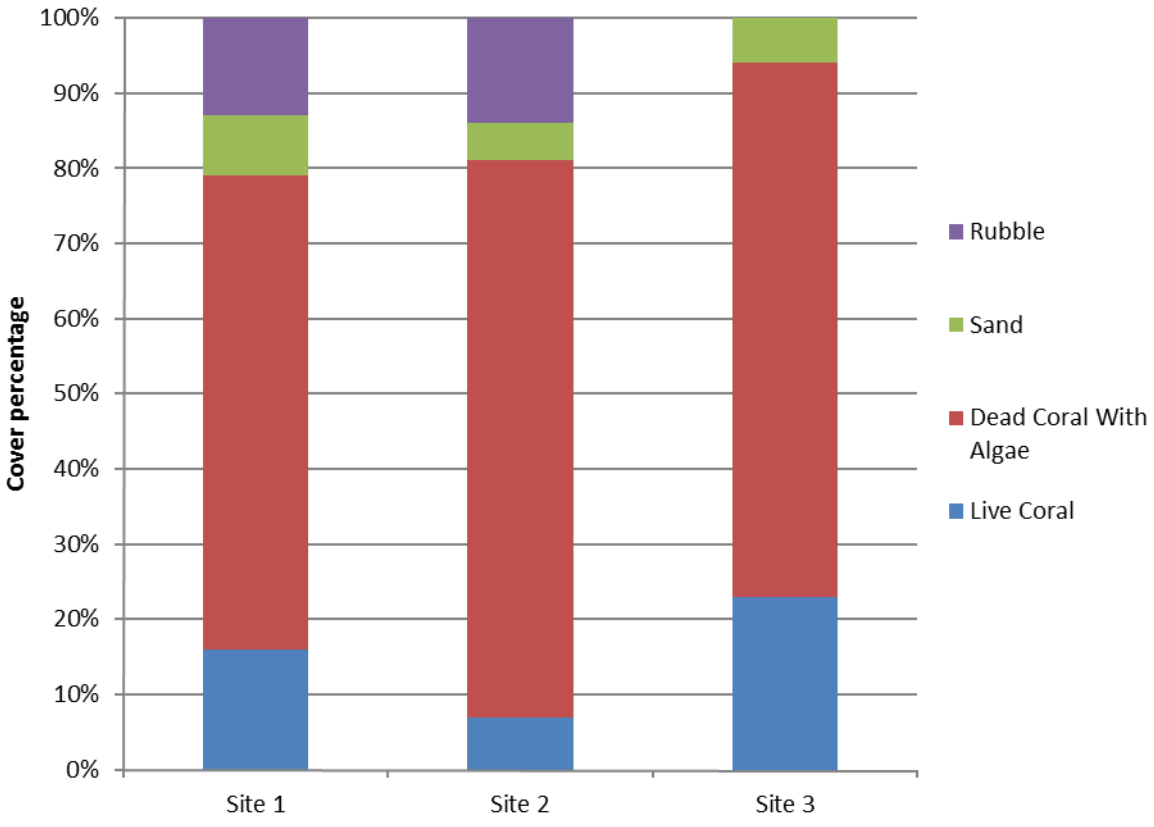


Figure 4-5: Attributes of marine environment

4.4.1.1 Site 01

Site 01 was located near the edge of reef; directly south of the proposed reclamation area. Few live coral colonies were observed at this site; most of which were very small colonies of *Acropora* sp. and *Porites* spp.

Conversely, a fair amount fish was observed at this location during the time of survey. Most of the fish found at this location were that of Scaridae, Acanthuridae, Balistidae and Pomacentridae families.

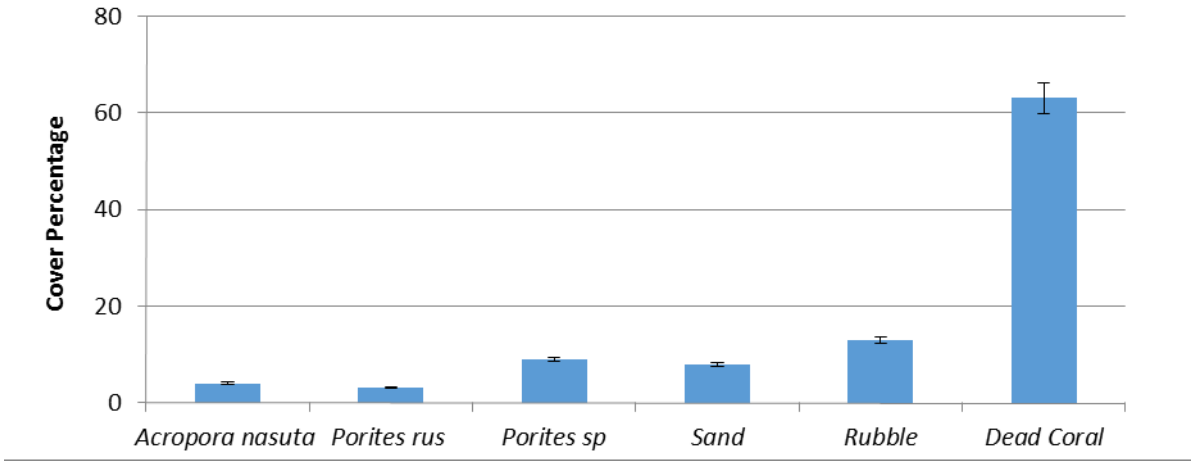
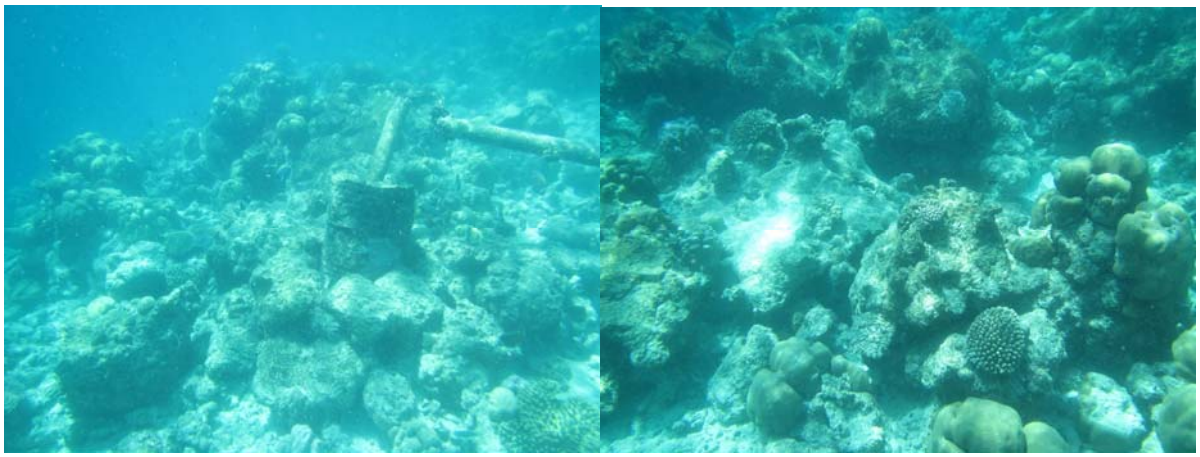


Figure 4-6: Cover percentages of benthic substrate at Site 01

4.4.1.2 Site 02



Site 02 was located west of the proposed access channel and reclamation area; on the reef flat.

Substrate composition was found to be similar to that of the Site 01 with dead corals dominating transect and few live coral colonies of small *Acropora* spp. and *Porites* spp.

Fish community was similar to Site 01 as well with typical reef fish such as Labrids, Pomacentrids and Acanthrids abundant.

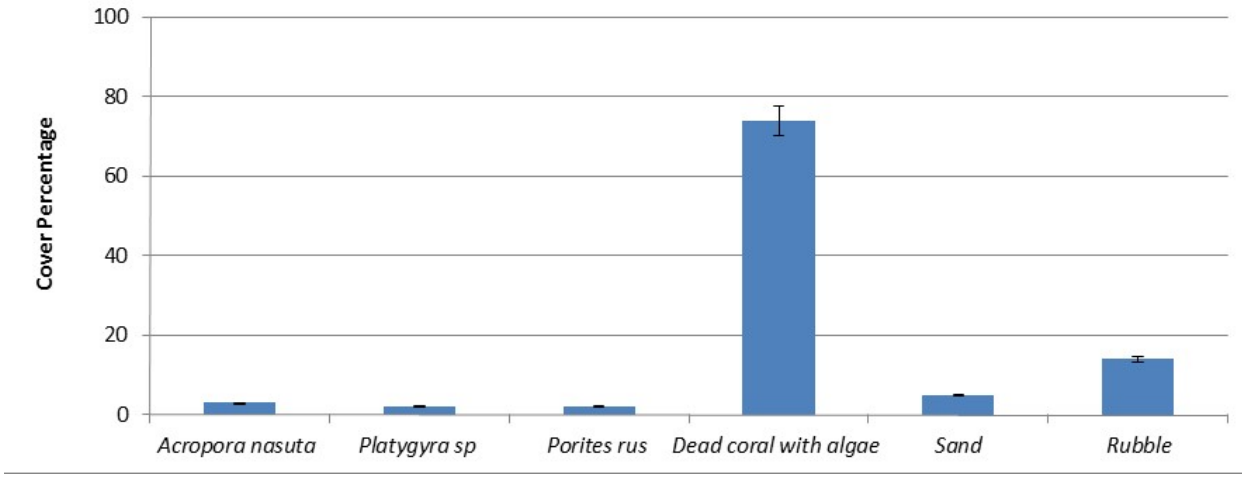


Figure 4-7: Cover percentages of benthic substrate at Site 02

4.4.1.3 Site 03

Site 03 is located on the reef edge, east of the proposed access channel. No significant deviations in terms of benthic substrate and fish community were found between Sites 01, 02 and 03.

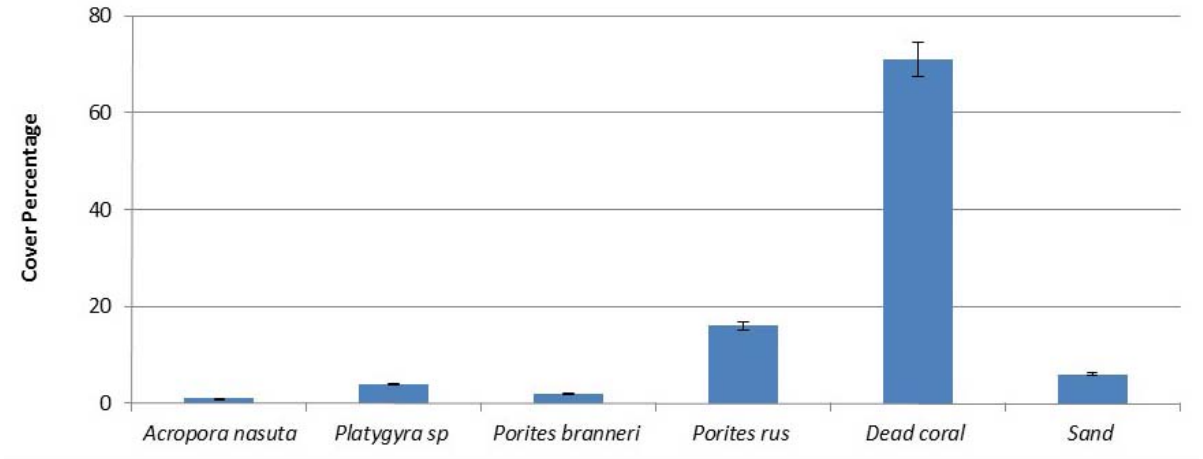
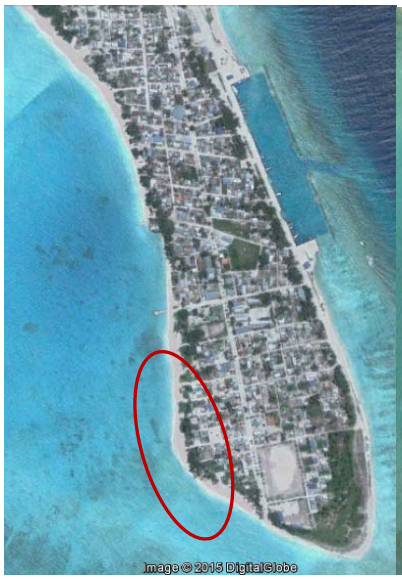


Figure 4-8: Cover percentages of benthic substrate at Site 03

4.4.2 Coastal Environment



22nd July 2006

24th March 2010

(Before Reclamation)

30th November 2010

(After Reclamation)

2nd April 2014

29th December 2014

As can be observed from the above dated aerial photos, majority of the shoreline is rather stable; except for south and southwestern shoreline. Before construction of the revetment, seasonal sand accretion and erosion can be seen at this location in response to changes in dominating currents during monsoons. Additionally, after construction of the revetment, dry beach on the western side of the island has decreased noticeably. Similarly, a significant decrease in dry beach on the western side of the island (towards center) was also observed after major reclamation and southwestern coastal protection structures were constructed.

At the proposed reclamation area there is no vegetation within 20m inland from the revetment. However, slightly northeast, few mature coconut palms were seen. Further inland, mature Hirundhu trees are present.

Figure 4-9: Proposed reclamation area (coastal environment)

4.5 Social Environment

This section looks at the current social environment of the island such as population and employment.

4.5.1 Demography and Services

As per the results of Census 2014, Dhidhdhoo, has a total population of 2854; of which 1314 are males. An estimated inter censal average annual growth rate of 1.7% was found for the island. With an area of 91.1Ha, Dhidhdhoo is estimated to have a population density of 31 individuals per Ha. However, it should be noted, about 33Ha of the island area is recently reclaimed and is not populated. A total of 656 housing plots are present on the island.

There are 6 mosques, atoll hospital, atoll education centre (offering up to A levels), two pre-schools, a branch of Bank of Maldives and Fenaka operated power plant. Even though there is a waste collection site on the southern tip of the island, waste management suffers from lack of proper equipment and space.

A large harbor measuring 395m by 77m is present on the eastern side of the island.

4.6 Natural hazard vulnerability

The following information on the vulnerability of the islands in the Maldives are taken from published literature such as Developing a Disaster Rick Profile for Maldives by UNDP (2006) as site. This information is considered relevant although specific information on vulnerability of the project site was not available. The natural vulnerability of the islands and atolls of the country to potential hazards have been modelled to understand the risk factors of the country by UNDP in 2006. It can be summarized that the northern parts of the country are vulnerable to cyclones and storm surges while southern parts of the country are vulnerable to seismic activity. The eastern side of the country is more exposed to potential tsunamis and surges.

The disaster risk scenario for Maldives can be described as moderate in general. Despite this, Maldives is among the most severely affected countries hit by the Asian tsunami on December 26th, 2004. Maldives experiences moderate risk conditions due to a low probability of hazard occurrence and high vulnerability from exposure due to geographical, topographical and socio-economic factors.

Following are some of the risks that have been identified and potential areas that may be within the range of risks based on its sensitivity, location, exposure, historic events, etc.

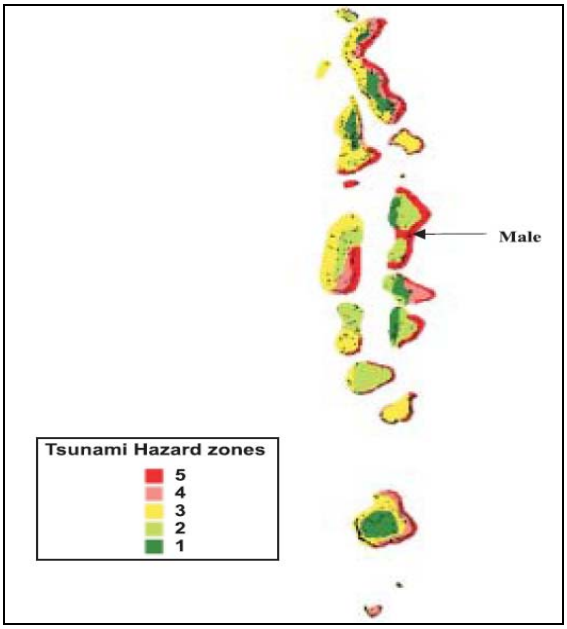


Figure 4-10: Tsunami hazard zones

Figure 4-10 show that Maldives faces tsunami threat largely from the east and relatively low threat from the north and south. So, islands along the eastern fringe are more prone to tsunami hazard than those along the northern and southern fringes. Islands along the western fringe experience a relatively low tsunami hazard. This map is produced based on the experience of the tsunami in 2004 and also occurrence of historic tsunami events in the greater region where most of the events have identified to have occurred from the Sumatra Region (UNDP 2006).

Besides heavy rains and strong winds during monsoons, hazardous weather events which regularly affect Maldives are tropical storms or 'tropical cyclones', and severe local storms. At times, tropical cyclones hitting Maldives are destructive due to associated strong winds that exceed a speed of 150 kilometres per hour, rainfall of above 30 to 40cm in 24 hours and storm tides that often exceed four to five meters (UNDP 2006).

Cyclonic winds sometimes can cause a sudden rise in sea-level along the coast, leading to a storm surge. The combined effect of surge and tide is known as 'storm tide'. Storm tides can cause catastrophe in low-lying areas, flat coasts and islands such as Maldives.

Maldives is also affected by severe local storms- thunder storms/ thunder squalls. Hazards associated with thunder storms are strong winds, often exceeding a speed of 100 kilometres per hour, heavy rainfall, lightning and hail; they also give rise to tornadoes in some regions. In general, thunderstorms are more frequent in the equatorial region than elsewhere, and land areas are more frequently hit by thunderstorms as compared to open oceans. However, thunder storms close to the equator are less violent when compared with those in the tropical regions and beyond. Maldives being close to the equator, thunder storms are quite frequent but less violent here. Strong winds generated by severe local storms generate large wind-driven waves which are hazardous for Maldives (UNDP 2006).

The islands of Maldives are less prone to tropical cyclones. The northern islands of the country were affected by weak cyclones that formed in the southern part of the Bay of Bengal and the Arabian Sea. Figure 4-11 shows the tracks of cyclones affecting Maldives during the period 1877-2004. The number of cyclones directly crossing Maldives is small. Only 11 cyclones crossed the islands over the entire span of 128 years. Most of the cyclones crossed Maldives north of 6.0o N and none of them crossed south of 2.7^{o}N during the period (UNDP 2006).

Figure 4-11: Tracks of Cyclones affecting Maldives, 1877-2004

UNDP (2006) stated that there were 21 cyclonic disturbances within the 500km radius during 1877-2004, of which 15 were depressions with an average wind speed of about 28 knots. The highest wind speed due to cyclonic disturbances that affected the islands during that time was about 65 knots. Figure 4-11 shows the tracks of cyclonic disturbances that passed through the circle with 500km radius.

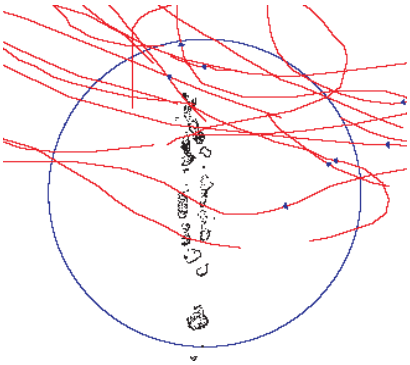


Figure 4-12: Tracks of Cyclones passed within the Scan Radius of 500 kilometres

Based on the above information, Maldives is divided into zones with varying scales of cyclone hazards based on based on a qualitative judgment based on the gradient of the storm tracks from north to south.

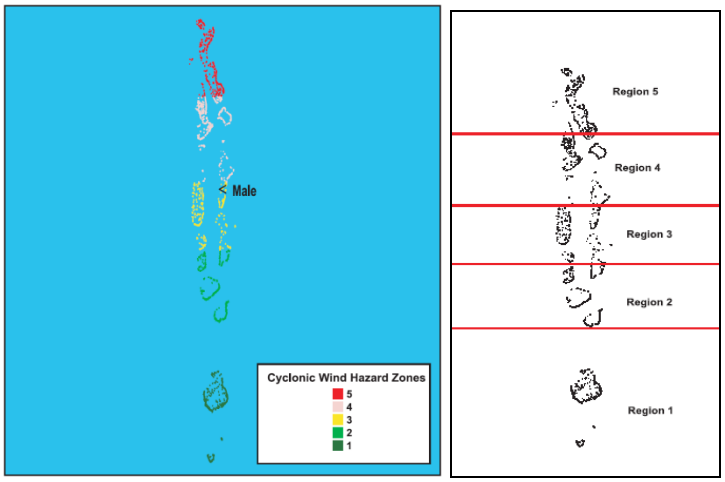


Figure 4-13: Regions to capture Cyclones passing through Maldives for Hazard Zoning

Figure 4-13 shows the regions used to compute the highest wind speed of each cyclone captured within the region. Majority of the cyclonic disturbances crossed the northern region. The frequency and wind speed decreases from northern region to southern region. Region 1 is not affected by any storm. Thus, Maldives can be divided into three cyclone hazard zones – the northern zone with high cyclone hazard, central zone with moderate cyclone hazard and the southern zone with very little cyclone hazard.

With regards to the storm surge potential, the bathymetry around the Maldives shows that the ocean slope close to the east coast is steeper than the west coast, hence it can be generalized that the eastern islands of the Maldives are vulnerable to higher surge hazard compared to the western islands. Figure 4-15 shows the bathymetry around Maldives. Figure 4-16 shows storm surge hazard zones based on computed model with maximum pressure drops for 100 year return period and with historical data (UNDP 2006).

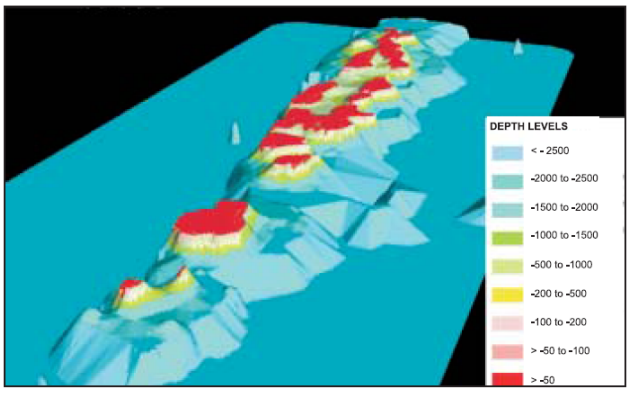


Figure 4-14: Three Dimensional View of Bathymetry of Maldives (depth in meters)

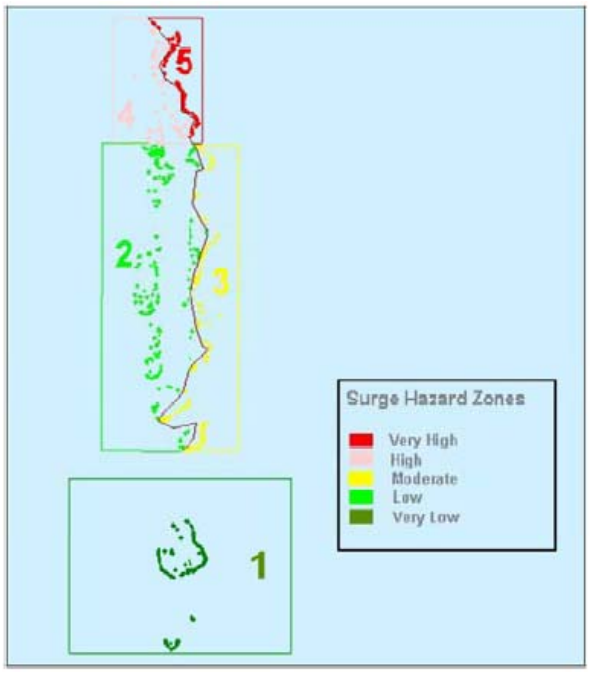


Figure 4-15: Storm Surge Hazard Zones with Cyclones Affected

Based on the above figure, it can be said that the north-eastern parts of the country are very vulnerable to storm surges.

Based on historical catalogues of earthquakes in the region, identifying seismic sources based on this historical information and based on numerical models, it was found that except for Seenu, Gnaviyani and Gaafu Atolls, earthquake hazard is low across the country. The probable maximum Modified Mercalli Intensity (MMI) is estimated between 7-8 in Zone 5 (Figure 4-15). This level of MMI can cause moderate to high damages (UNDP 2006).

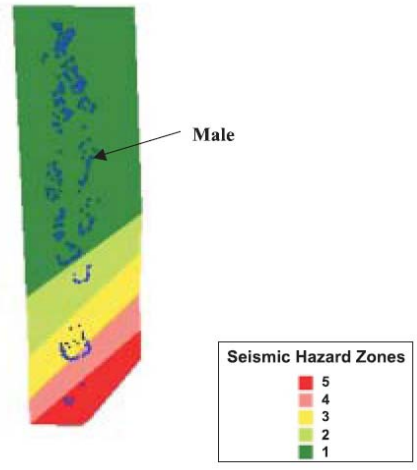


Figure 4-16: Maldives Seismic Hazard Zones

Figure 4_17: Survey locations

Figure 4-18: Illustrated representation of marine environment

Figure 4-19: Illustrated representation of coastal environment

5 Stakeholder Consultations

The key stakeholders of the project include the Atoll Council, Ministry of Environment and Energy, Environmental Protection Agency, Ministry of Housing and Infrastructure, Proponent Contractor and Project Engineers, Consultants and general public. The stakeholders that participated in the Scoping Meeting have extensively discussed on the issues relating to the project.

5.1 Scoping Meeting

The Scoping Meeting was held on 4th October 2015. The meeting was attended or represented by the following:

- Environmental Protection Agency
- Island Council
- Proponent
- Consultant

A brief introduction of the project was given by the proponent. The meeting was rather short as only few issues were raised by the participants. Among them were the potential changes to hydrodynamics and sediment transport regime of the west coast due to the shape of proposed project. EPA requested consultants to address this concern in the report and provide possible solutions. The other major issue raised was from the island council; the council wishes proponent to move proposed beaching area slightly north so as to give access to beach from main road.

Table 5-1: List of participants in the Scoping Meeting

Name	Designation	Office
Hussain Fizah	Consultant	Sandcays
Nafha Aujaz	Env. Analyst	Min. of Housing & Infrastructure
Mohamed Hamdhaan	AD	EPA

In addition, representatives from Dhidhdhoo Island council and HA atoll council also participated in the meeting.

6 Environmental Impacts and Mitigation Measures

6.1 Introduction

Development projects involving construction of coastal structures and dredging in island environments are believed to generate a series of environmental impacts, of which some can be felt immediately on the surrounding environment while others can be felt continually and can be far reaching. By far and large the most significant environmental impacts are those that are felt on the immediate environment. Marine environment is directly affected from high rates of sedimentation caused by dredging activities. Coral reefs environments are very sensitive and highly susceptible to immediate changes in physical environment such as changes in water quality. Therefore, all the development activities must take into consideration the understanding of the environment and changes as well as implications that it will bring about to the environment and surrounding.

The following account describes potential environmental impacts that will be associated with the proposed construction of beaching area at HA. Dhidhdhoo.

6.2 Methods and Limitations

The methods used to predict and evaluate the environmental impacts that may be associated with the proposed development of beaching area may not be the most comprehensive methods as they are quite simple prescriptive methods. The main shortcoming of these methods is that only assumptions have been made to predict the impacts which may or may not be accurate. Also, the degrees at which these impacts are either accurate or inaccurate as well as uncertainties and natural variability are the key factors that affect the accuracy of these methods. Nonetheless, the methods used are concise and provide a general overview as well as the range of impacts that can affect the environment. Also, the EIA report has taken into consideration similar studies undertaken in the Maldives as well as expert judgment in identifying the main environmental impacts that may be associated with the proposed project.

6.3 Impact Identification

Impacts on the environment from various activities of the proposed development have been identified through:

- A consultative process within the EIA team and the Proponent
- Purpose-built matrices
- Existing literature and reports on similar developments in the Maldives
- Baseline environmental conditions described in Chapter 4.
- Consultant's experience of projects of similar nature and similar settings

A purpose built matrix has been used to evaluate the overall impacts of the proposed project. The impacts of the project have been evaluated according to the following criteria:

1. Magnitude (or severity): the amount or scale of change that will result from the impact
2. Significance: importance of the impact. Reversibility is considered part of its significance
3. Duration: the time over which the impact would be felt
4. Extent/spatial distribution: the spatial extent over which the impact would be felt

The scales associated with the above criteria are given in the table below.

Table 6-1: Impact evaluation scale

Criteria	Scale	Attribute
Magnitude *Change caused by impact*	-3	Major adverse
	-2	Moderate adverse
	-1	Minor adverse
	0	Negligible
	1	Minor positive
	2	Moderate positive
	3	Major positive
Significance/Reversibility *Impact implications / Reversibility of impact's effects*	0	Insignificant
	1	Limited implications / easily reversible
	2	Broad implications / reversible with costly intervention
	3	Nationwide or global implications / irreversible
Duration *Duration / Frequency of Impact*	0	Immediate
	1	Short term/construction period only
	2	Medium term (five years of operation)
	3	Longterm/continuous
Extent/Spatial Distribution *Distribution of impact*	0	None/within 1m from point of discharge/no affected party
	1	Immediate vicinity/household level/developer/consumer
	2	Specific areas within the island/atoll/specific parties
	3	Entire island/atoll/nation/all stakeholders

Based on the above scale, an impact matrix was developed for the proposed development to determine the overall impact of the proposed project. This matrix is given in Table 6-2.

An impact potential index was then developed from Table 6-2. The impact potential index table represents a product of the magnitude (M), significance (S), duration (D) and extent/spatial distribution (E) given in the above table. The sum of all key component specific indexes for one activity (i.e. sum by rows) provides the Activity Potential Impact Index (API) and the sum of all activity specific indexes for one key component (i.e. sum by column) provides the Component Potential Vulnerability Index (CPVI) which gives an indication of the vulnerability of each key component to activity related impacts. Table 6-3 represent the impact potential indices for the proposed project.

6.4 Overall Impacts of the Proposed Project

The overall impact of the proposed project is slightly positive due to the strong socio-economic potential of the proposed project. However, there are some minor negative impacts on some of the environmental components. The direct and project specific negative impacts of the proposed project are due to sedimentation and sediment re-suspension in the water column as a result of dredging and reclamation (minor), and impact on lagoon and marine biodiversity.

Provision of beaching area and consequent relocation of boat maintenance activities to one location away from residential areas has a number of indirect positive socio-economic impacts. In addition, addressing the growing need for such an area on the island is expected to raise the property value of the island.

Table 6-2: Impact matrix for the proposed project

	KEY COMPONENTS								
	Environment				Socio-Economic				
PROJECT ACTIVITIES	Reefs incl. live bait	Lagoon/seawater	Hydrodynamics	Air/Noise/land or seascape	Services and Infrastructure	Health and Safety	Employment	Property Value	Costs to consumer/tax payer
Construction									
Temporary facilities, machinery and workforce	0	-1 0 1 1	0	-1 2 1 1	-1 1 1 1	-1 1 1 1	1 2 1 3	-1 1 1 2	-1 1 1 2
Dredging	-2 2 1 1	-2 0 1 1	-1 0 1 2	-1 1 1 1	1 1 1 1	-1 1 1 1	1 2 1 1	-1 1 1 2	-1 1 1 2
Reclamation	-1 1 1 1	-2 0 1 1	-1 0 1 2	-1 2 1 1	-1 1 1 1	-1 0 1 1	1 2 1 1	-1 1 1 2	-1 1 1 2
Coastal Protection	-1 0 1 1	-1 0 1 1	-1 1 1 2	-1 1 1 1	1 1 1 1	-1 1 1 1	1 2 1 1	-1 1 1 2	-1 1 1 2
Operation									
Use of Beaching Area	0	-1 0 3 1	-1 1 3 1	1 2 3 1	2 1 3 2	1 1 3 2	1 1 3 2	2 2 3 2	1 1 3 1

KEY: M S Magnitude Significance
D E Duration Extent (spatial)

Table 6-3: Impact potential indices for the proposed project

	KEY COMPONENTS									
	Environment				Socio-economic					
PROJECT ACTIVITIES	Reefs incl. live bait	Lagoon/seawater	Hydrodynamics	Air/Noise/land or seascape	Services and Infrastructure	Health and Safety	Employment	Property Value	Costs to consumer/tax payer	**TOTAL API**
Construction										
Temporary facilities, machinery and workforce	0	0	0	-0.02	-0.01	-0.01	0.07	-0.02	-0.02	-0.01
Dredging	-0.05	0	0	-0.01	0.01	-0.01	0.02	-0.02	-0.02	-0.08
Reclamation	-0.01	0	0	-0.02	-0.01	0	0.02	-0.02	-0.02	-0.06
Coastal Protection	0	0	-0.02	-0.01	0.01	-0.01	0.02	-0.02	-0.02	-0.05
Operation										
Use of Beaching Area	0	0	-0.04	0.07	0.15	0.07	0.07	0.3	0.04	0.66
TOTAL CPVI	-0.06	0	-0.06	0.01	0.15	0.04	0.2	0.22	-0.04	0.46

API = Activity Potential Impact Index
CPVI = Component Potential Vulnerability Index

The table above indicates that the project has minor negative environmental impacts during construction which are short-lived and moderate to major positive social impacts during the operational phase. As such, the social and economic benefits of the project outweigh the negative environmental impact, as a result of which the total potential impact index for the project is slightly positive.

6.5 Project Specific Impacts – Construction Phase

6.5.1 Temporary facilities, machinery and workforce

Based on the experience of several projects of this nature that has been undertaken in the region and elsewhere in the Maldives, this project is not expected to have adverse negative impacts of noise or pollution.

During the construction phase, there will be few temporary facilities (mostly at the worksite) used by contractor's workforce though existing infrastructure such as accommodation will also be used.

The use of diesel as well as petrol in vehicular engines and operation of machines such as the excavators cause emissions of carbon dioxide, sulphur dioxide and nitrogen oxides with fine particulate matter. For the proposed project, carbon emissions are considered to be negligible. However, carbon dioxide being the primary greenhouse gas and the main contributor to global warming, likely future carbon emissions would be a cause for concern, as the impact cumulatively adds to the global burden of carbon emissions.

The project will have noise levels of less importance but it may be of concern to the people using the area during construction phase. It is not expected to interfere with their daily livelihood too much nevertheless. The construction period is expected to last months; hence temporal and spatial extent of the impact is limited. However, in order to reduce any possible disturbance to the community, the construction work will be carried out during day time only.

There is an unlikely risk of pollution given that the hazards are well controlled. Usually, in projects involving heavy machinery, fuelling of excavators and other machinery is undertaken manually and it carries the risk of spills. Such spills are a cause for concern in the case of using excavators in the marine environmental as fuelling occurs on the water. However, small spills can be avoided from being disposed to sea using appropriate caution and care. Also, this impact is considered to be minor negative given the small scale of the project. Yet, all precautions shall be taken during fuelling of machinery to avoid spills.

Finally, some general impacts relating to such projects have to be identified. These involve the mobilisation of the excavator and barge as well as construction phase impacts. They are:

- Accidental spillage of fuel, as discussed above
- Accidental grounding of large vessels such as barges or landing craft.
- Breakage of fragile corals while unloading of barge and excavator to site.
- Damage to reef due to workers' negligence

To mitigate the above impacts, it is important to educate the staff, especially supervisory staff regarding proper environmental controls and the need for environmental protection in every little detail prior to mobilisation to site. The reclamation area and access channel shall be marked using buoys or bunds to avoid accidental increase of project footprint. This shall also be done prior to mobilisation so work is started as soon as machinery is mobilized.

The project would not affect social values, norms and beliefs due to the workforce significantly as there are already a number of expatriates on the island. Besides, the construction phase being short, any such impacts would be negligible.

6.5.1.1 Health and Safety

This project will not have any major health and safety issues due to its small scale. However, in general, for dredging/harbour projects, key impacts predicted for the construction workforce is related to health and safety issues. Often in such construction environments, workers are prone to injuries. Also, if precautionary measures on health and safety are not taken into consideration, the entire operation may be affected as a result of incidents and injuries. Therefore, adequate safety measures are necessary. These could include provision of safe drinking water, suitable wastewater management, supervision and education (about risks of working on the location) of workers should be done.

6.5.2 Dredging and Reclamation

The primary activity under the project is dredging and reclamation. Dredging and excavation will be carried out for construction of access channel and manoeuvring area. Excavated material from this dredging activity will be used for reclamation. Excavators on barge along with dump trucks will be used for these activities. These activities will cause sedimentation and sediment re-suspension and consequential increase in turbidity of coastal marine water.

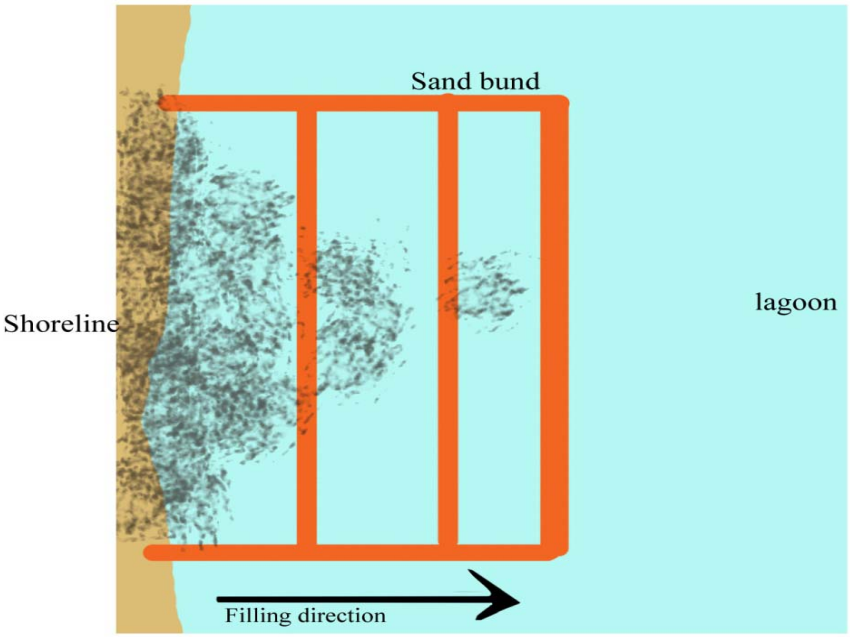
High amount of sedimentation will stress live corals and filter feeding marine organisms greatly if exposed to high rates for prolonged periods of time. Excavations could directly destroy benthic habitats in certain circumstances as well. With existing and predicted currents in the area, sediment plume is expected to move west and south-west during dredging and reclamation activity; however, some sedimentation is expected to occur on the house reef near the project area, especially during construction of the access channel.

Given the low live coral cover of the housereef near project area, this impact is considered a minor negative impact with minor significance and small temporal and spatial distribution.

To mitigate sedimentation from reclamation, physical sediment barriers could be employed. Physical barriers commonly used in the Maldives for silt control in dredging and reclamation projects are earthen berms and silt screens. Earthen berms include three types: (1) deposit of

excavated sand around the dredge/reclamation area to minimize further sediment flow, (2) adequately cover the fill area using sand bags and (3) geotextile tubes.

Physical barriers used to reduce the spread of sediments during the dredging process include silt curtains/silt screens. Silt screens are flexible barriers that hang down from the water surface. This system uses a series of floats on the surface and a ballast chain or anchors along the bottom. Silt screens are made from synthetic geotextile fabrics, which allow water to flow through, but retain a large fraction of the suspended solids. In order to successfully reduce sedimentation via this method, silt screens would need to be placed around the entire reclamation area. This is roughly a perimeter of 400m. However, silt screens are not recommended for this project because the experience with silt screens had not been as successful as it was initially thought to be, especially in high current areas, such as the proposed project area, mainly due to anchoring difficulties and breakage. Therefore, for this project it would be more effective to use the boulders from existing structures and to create a solid perimeter around the area to be reclaimed. This will also mitigate material loss during reclamation due to strong wave and currents in the area. Additionally, an earthen berm using sand bags can be made around reclamation area to create settling ponds.



6.6 Project Specific Impacts – Operational Phase

6.6.1 Changes in hydrodynamics and sediment transport

Due to proposed shape and location of the reclamation area, some concerns were raised by EPA during the scope meeting. After assessment of nearshore currents in the area and historical shoreline dynamics, it is evident, significant sediment movement from southern tip to western shoreline did occur in the past. However, with the construction of rock boulder revetment, the transport regime has been interrupted. At present, sediment movement occurs from the shallow areas towards the western shoreline. Proposed reclamation could interfere with this process and hence lead to noticeable erosion on the western coastline. In addition, this would also mean the maneuvering basin will be fill very quickly and require frequent maintenance dredging to preserve sufficient depth. To mitigate this, slight changes to reclamation shape can be brought about. With sand yield calculations, a fair amount of excess sand will be dredged under the project. Shape of the reclamation can be altered using the sand.

6.6.2 Transport related emissions

Air and noise pollution are the main impacts related to vehicular traffic using the beaching area. The use of diesel as well as petrol in vehicular engines cause emissions of carbon dioxide, sulphur dioxide and nitrogen oxides with fine particulate matter. Carbon dioxide being the primary greenhouse gas and the main contributor to global warming, carbon emissions would be a cause for concern although the carbon dioxide emissions from the vessels that use beaching area are small in size and number, the impact cumulatively adds to the global burden of carbon emissions. The amount of sulphur dioxide and nitrogen dioxide emitted by vessels using the beaching area would be small and would be an insignificant addition to the global emissions. Yet, the per capita cumulative impact would be moderate. However, with the country's goal of carbon neutrality by 2020, carbon emissions are expected to go down significantly over the years.

6.6.3 Socio-Economic Impacts

The socio-economic benefits of the proposed project are considered to be mainly positive or beneficial. These include moving boat maintenance work away from residential areas in addition to providing sufficient space to expand the industry on Dhidhdhoo.

Figure 6-1: Predicted Sediment Plume for Construction Phase

6.7 Uncertainties in Impact Prediction

Environmental impact assessment 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 socio-economic conditions in a particular place. The level of uncertainty, in the case of the proposed development, may be expected to be low due to the experience of similar projects in similar settings in the Maldives. Dredging and reclamation projects are common in Maldives and some have shown to have major negative impacts while others have low impact. Also, the know-how to minimize the impacts exists in most of the contractors.

Nevertheless, it is important to consider that there are elements that are different from other projects and that there will be uncertainties and to undertake voluntary monitoring as described in the monitoring programme given in this EIA report.

7 Project Alternatives

7.1 Introduction

This section looks at alternative ways of undertaking the proposed project. There are two basic options: (1) leave the problem as it is (no project option), or (2) take measures to resolve the problem (undertake the project options). If the project were to continue, it would be necessary to take economic, ecological and social aspects of the project into consideration and ensure that these concerns exist within a delicate balance. Neither the economic benefits nor the social and ecological concerns can be avoided. Therefore, it is important to consider all options and ensure that the best available option(s) is/are chosen to solve the issues/problems.

Not all the impacts of a project can be completely prevented, however, with the use of appropriate technology and management measures; the magnitude of most of these impacts can be either reduced or minimized. Nevertheless, the effectiveness of these technology and mitigation measures highly depends on the environmental condition and procedures in which they are applied in the field. On the other hand, there are complex and sophisticated procedures of minimizing environmental impacts by means of alternative methods to some of the activities. Often, alternative means are not economically competent with the extent of the project itself. However, to some of the activities where predicted impacts and its magnitudes on the environment are very adverse, alternate means must be applied considering long-term benefits from use of alternatives, as short-term environmental restorations can become very costly.

Potential alternatives to different components of the project, including “No Project” option is discussed below.

7.2 No project option

No project option involves taking the following argument into consideration:

- The existing boat maintenance areas and operations are sufficient
- The project cost will be better utilized for other purposes

As has been described in the “Need and Justification” section of the report, existing boat maintenance operations are carried out near residential areas of Dhidhdhoo and hence pose a health hazard in addition to disturbance caused by equipment noise.

Without the proposed project, these will remain in place, as such “No Project” option is not favoured by the consultants.

7.3 Alternative location

During the scope meeting and separate discussions held with the island council during the field visit, the council said they would like the proponent to move proposed beaching area slightly west just enough to free up the main road. Currently the proposed reclamation will block the main road. Council wants the community to have direct access to the beach from the main road. As far as the impacts and cost of the project is concerned, consultants do not expect any changes to predicted impacts and project cost from this slight change to the project.

Figure 7-1: Alternative location (proposed left; alternative right)

7.4 Alternative shape of reclamation area

With proposed reclamation shape, potential to influence nearshore sediment transport is high. However, if shape of the reclamation is adjusted to match that of the original shoreline (Figure 7-2), effect on sediment transport will be reduced. An excess of roughly 7000m^3 sand will be dredged from the project; using this amount an area of 2300m^2 can be reclaimed.

Figure 7-2: Alternative shape of reclamation area

8 Environmental Monitoring

8.1 Introduction

Environmental monitoring is essential to ensure that potential impacts are minimized and to mitigate unanticipated impacts. The parameters that are most relevant for monitoring the impacts that may arise from the proposed project are included in the monitoring plan. These include water quality, shorelines, live coral cover and nektonic fauna.

Monitoring would ensure that the proposed activities are undertaken with caution and appropriative care so as to protect and preserve the built environment of the areas in proximity to the site or those areas and environmental aspects affected by the development.

The purpose of the monitoring is to provide information that will aid impact management, and secondarily to achieve a better understanding of cause-effect relationship and to improve impact prediction and mitigation methods. This will help to minimize environmental impacts of similar projects in future.

The monitoring plan shall target to measure:

- live coral cover and nektonic fauna
- water quality
- impacts are accurate and mitigation measures taken are effective, and
- the thresholds are kept within the baseline limits predicted.

8.2 Recommended Monitoring Programme

The proposed monitoring programme is targeted at monitoring the coastal and marine environment of Dhidhdhoo southwest marine environment with specific emphasis on the proposed project as given in Table 8-1. This programme starts from the onset of the project. In addition, if the project were to be delayed by more than six months from the approval of the EIA report, it is proposed to undertake further assessment of all baseline components covered in this EIA report. In addition to the annual monitoring programme given in Table 8-1, in-situ testing of water quality for total suspended solids and turbidity shall be carried out during the construction phase for the project area once a day. Water quality during construction shall cover about 3 sampling points within about 50m of the dredging/reclamation area and water quality during the operational phase shall cover the

water quality locations given in the EIA report for pH, dissolved oxygen, turbidity and total suspended solids. Simple drogues need to be done prior to start of works to understand the potential sediment movement and minimize impacts on reef areas. The monitoring programme for this project is considered for about two years and the Proponent's commitment to undertake this monitoring programme forms part of this report.

8.3 Monitoring Report

A detailed environmental monitoring report is required to be compiled and submitted to the Environment Protection Agency yearly based on the data collected for monitoring the parameters included in the monitoring programme given in this report. In addition, a post construction monitoring report will be prepared and will cover mainly the water quality parameters given in the monitoring schedule. The following monitoring requirements covered in the approved Terms of Reference will also be considered in the post construction report.

- Environmentally sound site clearance
- Environmentally sound removal of dredging and other equipment

The reports 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. The report will also include fuel and water consumption data and greenhouse gas emission calculations.

Table 8-1: Proposed annual monitoring schedule with costs

No.	Indicator/locations	Parameters to be monitored	Frequency and duration	M1	M4	M7	M10	M12	Total	Rate (USD)	Total (USD)
1	Marine water quality (EIA baseline locations)	Water quality: temperature, conductivity/salinity, DO, pH, Turbidity, TSS	Every six months	3		3			6	50.00	**300.00**
2	Marine life/biodiversity (3 baseline locations)	Live coral cover and fish survey - Photo quadrates/LIT and fish survey	Annual	3					3	30.00	**90.00**
3	Currents/hydrodynamics	Drogue tracks	Every three months for one year	4	4	4	4		16	30.00	**480.00**
4	Water quality during construction within 50m radius of dredging and material disposal area	Water quality: total suspended solids (TSS) and turbidity	Daily during construction	5					5	50.00	**250.00**
6	End of construction stage monitoring report		Construction phase only	1					1	200.00	**200.00**
7	Annual Monitoring Report							1	1	500.00	**500.00**
TOTAL				**610.00**	**120.00**	**270.00**	**120.00**	**500.00**			**1,820.00**

Note:

M indicates Month

After the initial end of construction monitoring report, the proponent will submit a monitoring report annually for 2 years

9 Conclusions

In conclusion, it appears justified from a technical and environmental point of view, to carry out the proposed project to construct a beaching area in HA. Dhidhdhoo. However, one of the main concerns regarding the proposal is its potential impact on longshore sediment movement. Alternatives were described in the report after consultation with project proponent. These alternatives may usefully guide the designer/engineer in the final design.

The main negative impacts of the proposed project are sedimentation and changes in water quality, which will be short-lived and the low level of live coral cover at the project area makes sedimentation impact's significance low. The project undertaken brings about a number of socio-economic benefits. The consultants are of the opinion; the project is best carried out after taking proposed practical alternatives into consideration.

There are a few general mitigation measures such as appropriate supervision during the civil works and workers' awareness on environmental protection. Such guidance shall focus on ensuring that fuelling of excavator and other machinery is undertaken with caution. Additionally, sediment control measures have been proposed for this project.

10 Acknowledgements

The author wishes to acknowledge the work of several people who have contributed to this report. The following people have been mentioned due to their specific contributions. Thanks are also due to those who participated in the different meetings, interviews, discussions although their names have not been specifically mentioned here.

1. Proponent, for providing relevant project information, for taking part in the scoping meeting and helping the survey team gather necessary data in the field.

The Technical Team of Sandcays who gathered field data, analysed the data and presented some of the data in the report are worthy of credit for the important work they did.

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11 Appendices

Appendix 1: Terms of Reference

Appendix 2: Receipt from City Council

Appendix 3: Beach Profiles

Appendix 4: Council Meeting minutes

بسم الله الرحمن الرحيم

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Environmental Protection Agency EPA

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"Dhivehin" – Always Maldivian, Forever Independent

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މިނިސްޓަރ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ ޑރ. މުޙައްމަދު މުއިއްޒު،

ވެދުން ސަލާމަށްފަހު ދަންނަވަމެވެ.

<u>ހއ. ދިއްދޫ ދޯނި އަޅާ ސަރަހައްދު ހެދުމުގެ މަޝްރޫޢު ގުޅޭ</u>

ހއ. ދިއްދޫ ދޯނި އަޅާ ސަރަހައްދު ހެދުމުގެ މަޝްރޫއާއި ގުޅޭ ގޮތުން ތައްޔާރުކުރައްވާފައިވާ އީ.އައި.އޭ ޓާރމްސް އޮފް ރިފަރެންސް (ޓީ.އޯ.އާރް) ފާސްކުރުމަށްފަހު މިސިޓީއާއެކު ފޮނުވީމެވެ.އަދި ދަންނަވަމެވެ.ޓީ.އޯ.އާރް ފާސްކުރުމަށްފަހު ރިޕޯޓް ތައްޔާރު ކުރުމުގެ ކަންތައްތައް ކޮންސަލްޓެންޓާއި މަޝްވަރާކޮށްގެން ކުރިއަށް ގެންދިއުމާއި އީ.އައި.އޭ ރިޕޯޓް އީ.ޕީ.އޭއަށް ހުށަހެޅުމަކީ ޕްރޮޕޯނަންޓްގެ ޒިންމާއެއް ކަމުގައި ދަންނަވަމެވެ.

އަދި މި ޓީ.އޯ.އާރަށް އެއްވެސް ބަދަލެއް ގެންނަވަން ބޭނުންފުޅުވާނަމަ ތިން (3) ދުވަސް ތެރޭގައި މި އޭޖެންސީއަށް އަންގަވަން އެދެމެވެ.

އިޙްތިރާމް ޤަބޫލު ކުރައްވަން އެދެމެވެ.

27 މުޙައްރަމް 1437

09 ނޮވެމްބަރު 2015

ހާދިމްކުމް

މުޙައްމަދު ހަމްދާން ޒަހީރު

އެސިސްޓަންޓް ޑިރެކްޓަރ، އެންވަޔަރަންމަންޓް އެސެސްމަންޓް

މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ،
މާލެ، ދިވެހިރާއްޖެ

ހ.ސ.ހ- 001

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އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީ
ގްރީން ބިލްޑިންގ، 3ވަނަ ފަންގިފިލާ، ހަނދުވަރީ ހިނގުން
މާލެ، ދިވެހިރާއްޖެ، 20392
އީމެއިލް : Email: secretariat@epa.gov.mv
ވެބްސައިޓް : Website: www.epa.gov.mv

EPA/ToR/2015/173

Terms of Reference for Environmental Impact Assessment for Proposed Beaching Area at HA. Dhidhdhoo

This is the Terms of Reference (ToR) for undertaking the EIA of the proposed Beaching Area at HA. Dhidhdhoo. This ToR is based on the scoping meeting held on 09th October 2015. While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration of matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the EIA report.

1. **Introduction and rationale** – Describe the purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary.

2. **Study area** – Submit a minimumA3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds site, sensitive species nursery and feeding grounds). Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – The report should be categorised into the following components:

Task 1. Description of the proposed project – Provide a full description and justification of the relevant parts of the coastal modification, using maps at appropriate scales where necessary. The following should be provided:

- Extent of dredging and reclamation proposed;
- Details and justification of location, number, size and materials of coastal protection structures e.g. groins, seawall or breakwaters;
- Construction methods, materials, equipment, man power, expertise and scheduling.
- Excavation methods
- Use of material extracted from dredging activity
- Emergency plan during spillages;
- Environmental monitoring during construction activities;
- Measures to protect environmental values during construction and operation phase i.e. sedimentation control;

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- Project management (include scheduling and duration of the project and life span of facilities; communication of construction details, progress, target dates, construction/operation/closure of labour camps, waste management plan; access to site, safety, equipment and material storage, fuel management and emergency plan in case of spills).

Task 2. Description of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the project (e.g. monsoon season). Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that data collected is suitable for use as a baseline. As such all baseline data must be presented in such a way that they will be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized.

The baseline data will be collected before construction. Baseline data should be collected for both the proposed and the alternative location as agreed in the pre-scoping meeting with the proponent. All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points, reef transects and manta tows sites for posterior data comparison. Information should be divided into the categories shown below:

Climate

- Temperature, rainfall, wind, waves
- Risk of flooding and storm surges;

Geology and geomorphology

- Bathymetry (bottom morphology) (use maps) of all dredging and reclamation locations;
- (Seasonal) patterns of coastal erosion and accretion (shoreline and vegetation line should be mapped for this), and

Hydrography/hydrodynamics (use maps)

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents;
- Sea water quality measuring temperature, pH, salinity, turbidity and total suspended solids. (sea water quality should be tested from at least one control site).

Ecology

- Identify marine protected areas (MPAs) and sensitive sites such as breeding or nursery grounds for protected or endangered species (e.g. coral reefs, spawning fish sites, nurseries for crustaceans or specific sites for marine mammals, sharks and turtles). Include description of commercial species, species with potential to become nuisances or vector.

Socio-economic environment

- Demography: total population, sex ratio, density, growth
- General land use patterns on the island,

<u>Hazard vulnerability:</u>

- Vulnerability of area to flooding and storm surge.

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Include permits and approvals in the EIA document. The report should clearly identify the different articles and clauses that apply to the said project and should state how the project meets these requirements.

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages – The EIA report should identify all the impacts, direct and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

<u>Impacts on the natural environment</u>

- Changes in flow velocities/directions, resulting in changes in erosion/sedimentation patterns, which may impact shore zone configuration/coastal morphology;
- Sediment dispersal in water column (related to shore protection activities), possibly resulting in changes in visibility, smothering of coral reefs and benthic communities and affecting fish etc.;
- Impacts of noise, vibration and disturbance;
- Impacts on unique or threatened habitats or species (coral reefs, sea turtles etc.), and
- Impacts on landscape integrity/scenery.

<u>Impacts on the socio-economic environment</u>

- Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;
- Level of protection against hazards like sea level rise, storm surges, etc.

The methods used to identify the significance of the impacts shall be outlined. One or more of the following methods must be utilized in determining impacts; checklists, matrices, overlays, networks, expert systems and professional judgment. Justification must be provided to the selected methodologies. The report should outline the uncertainties in impact prediction and also outline all positive and negative/short and long-term impacts.

Task 5. Alternatives to proposed project – Describe alternatives including the *"no action option"* should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This should include alternative coastal protection measures, alternative designs, alternative locations and alternative materials. All alternatives must be compared according to international

standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures with particular attention paid to future changes in coastal processes. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the Proponent to implement the proposed mitigation measures shall also be included. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan – Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for coastal modification, beach morphology, sediment movement around the island. Environmental monitoring reports will be submitted to the EPA to evaluate the damages during construction, after project completion and as per the schedule in EIA report. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

Task 8. Stakeholder consultation – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders. Consultation shall be undertaken with HA. Dhidhoo Council and the general public of Dhidhoo. The EIA report should include evidence of consultation, including names of those consulted and their contact details. The EIA report should include the methodology of consultation with justification, details of the date, time and place of the consultation and the summary outcomes. The report should include evidence that EIA report has been submitted to atoll council prior to submission to EPA.

Presentation- The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations f or any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations 2012 and the relevant amendments.

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 6 months from the date of this Term of Reference.

……

09th November 2015

ENVIRONMENTAL PROTECTION AGENCY Male' Republic of Maldives

Document Receipt by Atoll Council

To: Secretariat of Haa Alif Atoll Council

Dhidhdhoo, Haa Alif Atoll

Maldives

Kindly confirm the receipt of the following document:

Final draft report of the Environmental Impact Assessment for the proposed Beaching Area on Dhidhdhoo, Haa Alif atoll

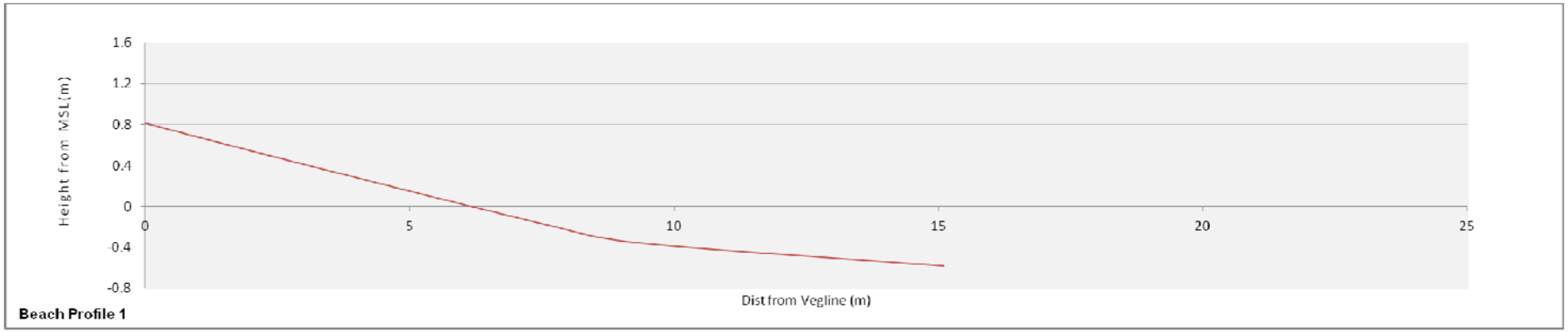
Signature: ....nuXhg.....

Name: ...AISHATH...NUZHA.....

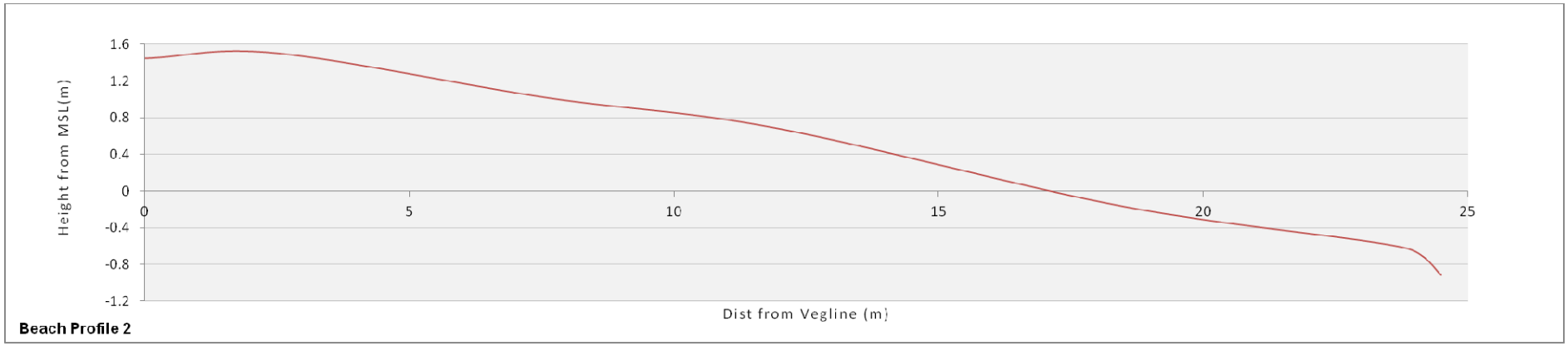
Designation: .ASSISTANT...PROJECT...OFFICER.....

Date: ..07-01-2015.....

Appendix 3: Beach Profiles



Beach Profile 1



Beach Profile 2

ތިލަދުންމަތީ އުތުރުބުރީ ދިއްދޫ ކައުންސިލްގެ އިދާރާ
ދިއްދޫ، ދިވެހިރާއްޖެ.

"ދިވެހިން ދިވެހިންގެ ގޮތުގައި - މިނިވަންކަމުގައި އަބަދަށް"

ދިއްދޫގައި ޓްރެފިކް ނިޒާމު ހަރުދަނާކުރުމުގެ ގޮތުން ރައްޔިތުންނާއި ބޭއްވުނު ބައްދަލުވުމުގެ ޚުލާޞާ

29 މޭ 2015 ވަނަ ދުވަހުގެ ރޭ 21:00 ގައި އަތޮޅުގެ މަޖިލީހުގައި ރަށުގެ ޓްރެފިކް ނިޒާމާ ގުޅިގެން މަޝްވަރާކުރުމަށް ރައްޔިތުންނާއި ބައްދަލުވުމެއް ބޭއްވުނެވެ.

ރަށުގައި ޓްރެފިކް ނިޒާމު ހަރުދަނާކޮށް ޓްރެފިކް ރަނގަޅު ދަމަހައްޓައި ހަދާނެ ކަންތައްތަކުން ކައުންސިލުން ކުރިއަށް ވަޑައިގެންނެވުމާއި ރަށުގެ މަގުތަކުގައި ހިނގާ ސަރަހައްދު ދެނެގަނެ ރައްޔިތުންގެ ހަޔާތް ރައްކާތެރިކޮށް ކުރެވޭނެ ކަންތައްތަކުގެ ތެރެއިން ދިވެހިރާއްޖޭގެ ޖެހޭ ގަވާއިދުތަކާ އެއްގޮތަށް ދިއްދޫ ރައްޔިތުންގެ ހިޔާލު ހޯދުމަށް ބާއްވާ ރައްޔިތުންނާއި ބައްދަލުވުމެކެވެ. މިބައްދަލުވުމަށް ބައްދަލުވުމުގެ ކައުންސިލްގެ ރައީސް އިބްރާހިމް ސިނާން ފުރުސަތު ދެއްވިއެވެ.

އަދި މިބައްދަލުވުމުގައި ދިއްދޫ ފުލުހުންގެ ރަށުގެ ބައިވެރިވުމާއި ކައުންސިލުގެ މެމްބަރުން ރައްޔިތުންނަށް ދެއްވާ މަޢުލޫމާތު ކައުންސިލްގެ މުވައްޒަފުން ބައިވެރިވެވަޑައިގެން ދެއްވިއެވެ. އަދި މިކަންތައްތަކާ ރައްޔިތުންގެ ހިޔާލު ފާޅުކުރުމަށް ހުޅުވާލެވުނު ފުރުސަތުގައި ވާހަކަދައްކަވާ މަޝްވަރާ ގެނެސްދިނެވެ.

- ޓްރެފިކް ސަރަހައްދު:

- ޓްރެފިކް ސަރަހައްދުގައި ދުއްވާ ލޮރީގެ ސްޕީޑް ކޮންޓްރޯލްކުރުމަށް ކަނޑައަޅާ ސަރަހައްދުތަކުގައި ފަރުވާ ބޭނުންކުރުމަށް ސޮއިކޮށް މުޅި އިޝާރާތް ހަރުކުރުމާއި ދުއްވުން ބާރުކުރުމަށް ސަރަހައްދު ކަނޑައަޅާފައިވާ ގޮތުން ހުއްދަ ނެތި ދުއްވާ ގޮތް ހުއްޓުވާލުމަށް ހަމަޖެހިއެވެ. މިގޮތުން ރަށުގެ ރައްޔިތުންގެ ދުއްވުމާ ބެހޭގޮތުން ހޭލުންތެރިކަން އިތުރުކުރުމަށް ބޭނުންވާ މަޢުލޫމާތު ފޯރުކޮށްދިނުމަށް ނިންމިއެވެ.

- ޓްރެފިކްގެ ގަވާއިދާ ޚިލާފުވާ ގޮތުން ސަރަހައްދަށް ދުއްވާ ހުރިހާ ވެހިކަލްތަކާ މެދު ފިޔަވަޅު އެޅުމާ ބެހޭގޮތުން ސަރަހައްދުތަކުގައި އަލިކަން ލިބޭނެ ހުރިހާ ކަމެއް ކުރުމަށް އަދި މިކަމާ ގުޅިގެން ޓްރެފިކް ސަރަހައްދު ކަނޑައެޅުމާއި ބެހޭގޮތުން ދިއްދޫ ކައުންސިލްގެ އަބްދުﷲ ސައީދު ފާހަގަކުރެއްވިއެވެ. މިގޮތުން ބަދަލުގެނައުމަށް ހޭލުންތެރިކަން އިތުރުކުރުމަށް ބޭނުންވާ މަޢުލޫމާތު ފޯރުކޮށްދިނުމަށް ނިންމިއެވެ.

- ޓްރެފިކްގެ ފާހަގަކުރެވިފައިވާ 50 ކިލޯމީޓަރ އިން 75 ކިލޯމީޓަރ ސަރަހައްދުގެ ފާހަގަކުރުމާ ޓްރެފިކް އިޝާރާތް ބޭނުންކުރުމަށް ރައްޔިތުންގެ ހިޔާލު ހޯދާ ހުށަހެޅުއްވި އަބްދުﷲ ސިރާޖް ހުށަހެޅުއްވިއެވެ. ސަރަހައްދު ދެކޮޅަށް ދުއްވުމަށް އިޝާރާތް ހަރުކުރުމަށް ފާހަގަކުރެއްވިއެވެ. ޓްރެފިކްގެ ފާހަގަކުރެވިފައިވާ 50 ކިލޯމީޓަރ އިން 75 ކިލޯމީޓަރ ސަރަހައްދުގައި ހުރުމަށް ގޮތަށް ބަދަލުކުރުމަށް ނިންމުނެވެ. އަދި ޓްރެފިކް ލައިޓް ހަރުކުރުމަށް ހަރުދަނާ ގޮތަކަށް އަތުގައި ވަޒީފާއާއި ލިބޭނެ ގޮތަށް ގެންދިއުމަށް ފާހަގަ ކުރައްވާފައިވެއެވެ.

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ތިލަދުންމަތީ އުތުރުބުރީ ހޮނޑައިދޫކައުންސިލްގެ އިދާރާ
ހދ. ހޮނޑައިދޫ ، ދިވެހިރާއްޖެ.

"ދިވެހިން ދިވެހިންގެ ޚިދުމަތުގައި - މިނިވަންކަމުގެ އަހަރު"

- ނުރުވައިކިރި

- ނުރުވައިކިރިޖެހުމުގައި ދިވައިކިރިވެފައި ޖެހުމާ އުތުރު ފައިކިރި ޖާގައިރު ނުރުއެތިގަނޑާ ހަމައަށް ޖެއްސައިގެން ޖެހުމަށް ބޭނުންވާކަމާ މިގޮތު ނުރުވައިކިރިޖާގާފައިވާ ގޮތުގެ ސަރަޙައްދު ނުރުއެކާތެރި އަދި ހިތްދަތި އެތައް ހާދިސާތަކާ ކުރިމަތިވެފައިވާކަމާއި އެހެންކަމުން ނުރުވައިކިރި ޖާގައިރު ދިވައިކިރިވެފައި އެއްވަރަކަށް ޖެހުން މުހިއްމުކަން އާދެވިރުގެ ތެރެއިން ވާހަކަ ދެއްކެވި އަބަރުގެ އަބްދުﷲ ސައީދު ފާހަގަކުރައްވައިފި.

- ނިންމުމަށް ބޭނުންވާގޮތް

- ދުނި އެހާ ސަރަހައްދު ހުދުމަށް ހައްސޫނުގެ މިނިސްޓްރީން ފޯރުއާވާފައިވާ ފްރީސިޕަލް ކޮންސެޕްޓު ޖެހިއްޖެގައި އޮތް އާޖެއަހާ ސަރަހައްދު ރަށުގެ ބޭރުގަނޑު ނަގާޓް ހުޅަނގުން ޖެއްސުމަށް ކައުންސިލަށް ފޮނުނަކަމަށް ކައުންސިލްގެ ރައީސް އިބްރާހިމް ސިނާން ހަހަރުގެއްވާމައި ދެރިގެން ރައްޔިތުންގެ އިއްތިފާގުން އެގޮތަށް ބަދަލުކުރަން ނިންމުނެވެ.

- މިގޮތު ރައްޔިތުންގެ ތެރެއިން އާދެވިރުގޮތް ކުރީގެން ހުރަހެގާފައިވާ ޒާތުގެތަކާ އެއްގޮތަށް އަބަދުވެއަށް ގެނަސް އ މަސައްކަތެއްގެ ކުރުމަށް ފޮނުނަކަމަށް ބައްދަލުވުމުގެ އިއްތިފާގުން ނިންމުނެވެ.

މިބައްދަލުވުމުގައި ކައުންސިލްގެ ރައީސް އިބްރާހިމް ސިނާން އާއި ކައުންސިލްގެ ނާއިބްރައީސް އަލްފާޟިލް ޙުސައިނު ނަސީރު އާއި ކައުންސިލަރު އަލްފާޟިލް އިބްރާހިމް ވަޙީދު އާއި ޔޫތްމޫވްމަންޓް [illegible] އަލްފާޟިލް އަބްދުﷲ ވަޙީދު އާއި ރައްޔިތުންގެ ތެރެއިން ގިނަބައެއްމީހުން މިބައްދަލުވުމުގައި ބައިވެރިވެވަޑައިގެންނެވެ.

މިބައްދަލުވުން ނިމުނީ 22:00 ގައެވެ.

އިބްރާހިމް ސިނާން
ހޮނޑައިދޫކައުންސިލްގެ ރައީސް

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