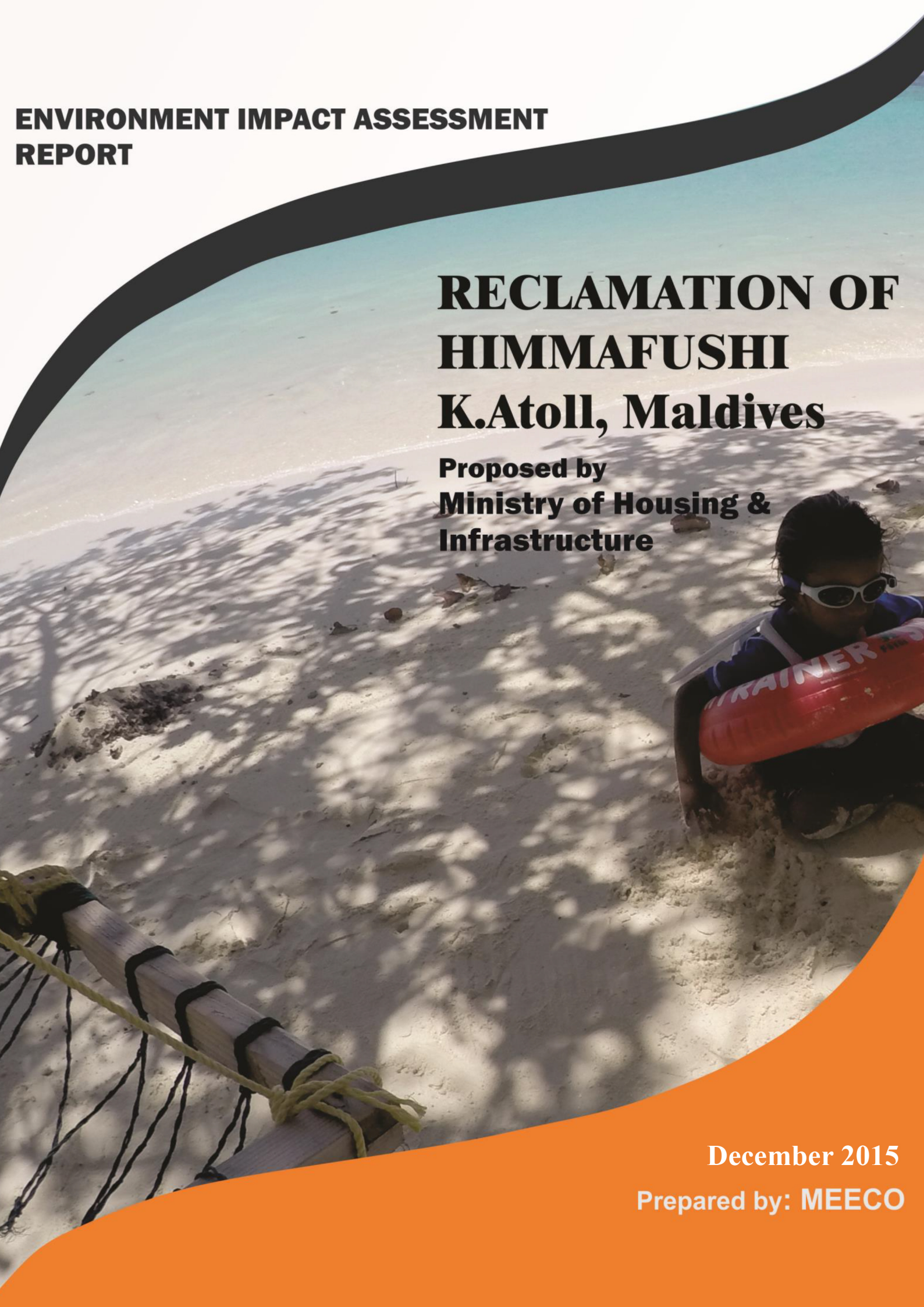
ENVIRONMENT IMPACT ASSESSMENT REPORT

RECLAMATION OF HIMMAFUSHI K.Atoll, Maldives

Proposed by
Ministry of Housing & Infrastructure



December 2015

Prepared by: MEECO

Environment Impact Assessment for reclamation of Himmafushi, Kaafu Atoll, Maldives

Prepared For:
Ministry of Housing and Infrastructure

Prepared by:
MEECO

DECEMBER 2015

PROJECT SYNOPSIS

Name of the Project: Environmental Impact Assessment for Reclamation of Hinmafushi, K.Atoll.
Project Proponent: Ministry of Housing and Infrastructure
Project Contractor: One Noor Pvt Ltd
Project Value: USD 9,078,087
Expected Duration: 305 days
EIA Consultant: Ahmed Saleem
EIA Date: December 2015

WEIGHTS AND MEASURES USED IN THE REPORT

1 metric tonne = 2,204 pounds (lbs.)
1 kilogramme (kg) =2.2 lbs.
1 metre (m) = 3.28 feet (ft.)
1 millimetre (mm) = 0.03937 inches (")
1 kilometre (km) = 0.62 mile
1 hectare (ha) = 2.471 acres

LIST OF ABBREVIATIONS

ORP	Oxidation Reduction Petential
EIA	Environment Impact Assessment
MEE	Ministry of Environment and Energy
EPA	Environmental Protection Agency
TIZ	Thilafushi Industrial Zone
MHI	Ministry of Housing and Infrastructure
MWSC	Male' Water and Sewerage Company
MSL	Mean sea level
GHG	Green House Gas
NEAP	National Environment Action Plan
EPPA	Environment Protection and Preservation Act

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Declaration

Consultant

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

Ahmed Saleem (EIA03/1)
December 2015

Proponent

The proponent has elected to submit an Environmental Impact Assessment for the proposed reclamation of Himmafushi, K. Atoll in accordance with Environmental Protection and Preservation Act (Act No. 4/93) and the EIA Regulations (2012).

Ministry of Housing and Infrastructure

Authors

The report was written and compiled by:

Ahmed Saleem
Ali Shareef
Zammath Khaleel
Shafiya Naeem
Ali Hammadh

Technical Assistance
Farah Amjad

1. މިއީ، ދިވެހިރާއްޖޭގެ ތިމާވެށި ހިމާޔަތްކުރުމާއި ރައްކާތެރިކުރުމާ ބެހޭ ޤާނޫނު، 93/4 ގެ ދަށުން ހެދިފައިވާ، ތިމާވެށްޓަށް އަސަރުކުރާ މިންވަރު ބަލާނެގޮތާ ބެހޭ ގަވާއިދު 2012، ގެ ދަށުން، މާލެ އަތޮޅު ހިންމަފުށީގެ އިރުދެކުން ފަރާތުން 21.6 ހެކްޓަރުގެ ބިން ހިއްކުމުގެ މަޝްރޫޢުގެ، ހައުސިންގ މިނިސްޓްރީން އެކުލަވާލައްވާފައިވާތީ މިމަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ކޮށްފާނެ އަސަރުތައް ބެލުމުގެ ގޮތުން މޯލްޑިވްސް އެންވަޔަރަންމަންޓަލް އެންޖިނިއަރިންގ ކޮންސަލްޓެންސީ (މީކޯ) އިން ތައްޔާރުކޮށްފައިވާ ރިޕޯޓެކެވެ. މިމަޝްރޫޢުގެ މައިގަނޑު މަގްސަދަކީ ހިންމަފުއްޓަށް ދިމާވެފައިވާ ބިމުގެ ދަތިކަން ހައްލުކުރުމެވެ.

2. ހިންމަފުއްޓަކީ ބިންފުޅި ބިމުގެ ދަތިކަން ވަރަށް ބޮޑަށް ކުރިމަތިވެފައިވާކަން ފާހަގަ ކުރެވިފައިވާ ރަށަކަށްވުމާއެކު، ގައުމީ ތަރައްގީގެ ސިޔާސަތުގެ ދަށުން ބިން ބޭނުންކުރުމަށް ސަރުކާރުން ހަމަޖެއްސާފައިވާ ރަށެކެވެ. ރަށަށް ކުރިމަތިވެފައިވާ ބިމުގެ ދަތިކަމުގެ މައްސަލައަށް އެތައް ފަހަރަކު ރައްޔިތުންގެ ފަރާތުން ސަރުކާރުގެ ސަމާލުކަމަށް ގެނެވިފައިވާ މައްސަލައެއްކަން ފާހަގަ ކުރެވިއްޖެއެވެ. ބިންފުރުމުގެ ސަބަބުން ގޮތްގޮތުގެ ދަތިކަމަކަށް ކުރިމަތިވުމުގެ އިތުރުން، ބިމުގެ ދަތިކަމުގެ ސަބަބުން ރަށުގެ ސިނާއީ މަސައްކަތްތަކަށް ލިބެންޖެހޭ ކުރިއެރުމަށް ހުރަސް އެޅިފައިވާކަން ފާހަގަ ކުރެވިފައެވެ. މިކަންކަމުގެ ހައްލެއްގެ ގޮތުގައި، ރަށުގެ އިރުދެކުން ފަރާތުން 21.6 ހެކްޓަރުގެ ބިން ހިއްކުމަށްޓަކައި މަޝްރޫޢު ސަރުކާރުން ކަނޑައަޅާ އެކަމަށް ދައުލަތުގެ ބަޖެޓުން ހަރަދު ކުރާ ގޮތަށްވަނީ ހަމަޖެއްސާފައެވެ. މިމަޝްރޫޢުގައި ހިމެނޭ ބިންހިއްކުމާއި، އަދި ބައެއް ސަރަހައްދުތަކުގައި ގޮނޑުދޮށް ހިމާޔަތްކުރުމެވެ. ބިން ހިއްކުމަށް ގާތްގަނޑަކަށް 7.5 ލައްކަ ކިއުބިކް މީޓަރުގެ ވެލި ބޭނުންވާނެ ކަމަށް އަންދާޒާ ކުރެވިފައެވެ. ބޭނުންވާ ވެލި ނަގަމުން، މައިގަނޑު ދެ ސަރަހައްދެއް ފާހަގަ ކުރެވި، އެ ދެ ސަރަހައްދުން ވެލިނަގަން އެންމެ ރަނގަޅުކަމަށް އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީން މަޝްވަރާގެ ފަރާތްތަކާއި ވަނީ ދަނޑުނާވާފައިވާ. މި ދެ ސަރަހައްދުގެ ބޮޑުއިން، ފަޅު ނަގަމުން އެކަށީގެންވާ އަރިއަޅާ އެވްރެޖް ޑްރެޖިންގއިވާ 3 ސަރަހައްދުތަކުންނެވެ. މީގެ އިތުރުން ހިންމަފުށީގެ ހުޅަނގު ދެކުން ކޮޅުގެ ފަޅުތެރެއިން ވެލި ނެގުމަށް ބަލާފައިވާ ގޮތުގައި ފާހަގަ ކުރެވިފައިވެއެވެ .

3. ހިންމަފުށީގެ ފަޅުގައި އެކަށީގެންވާ ޖާގަ ބަނަން އިތުރު ކުރުމަށް ބިމާ އަދި ފަސޭހައިން ހިއްކާނެ ސަރަހައްދު އޮތް ކަމަށް ފާހަގަ ކުރެވިއްޖެ، ހިންމަފުށްޓާ ބަނދުގެ ފަޅުތެރޭގައި ހިނގަމުންދާ ދެ ރިސޯޓު އޮތުމުގެ އިތުރުން ބަނދަރާއި މާ ދުރުނޫން ހިސާބެއްގައި، ހިމާޔަތް ކުރެވިފައިވާ ދެ ސަރަހައްދު ހިމެނޭ ގޮތުން އޮންނަ ބަޔާއި ކަމަށްވެސް ފާހަގަ ކުރެވިފައެވެ

4. މުހިންމު މާހައުލު ބެހޭ ހިންމަފުށްޓާ ގޮތުގައި އުފެދިފައިވާ ފުރާނައެވެ، ބިންހިއްކުމުގެ ސަރަހައްދުން މާހައުލަށް ކޮންމެ ނުރައްކާ އަސަރުތަކާއި ދުނިޔޭގެ އެކިކަހަލަ މަސްތަކާއި ރީފުތަކާ ކުރިމަތިވެފައިވާކަމެވެ. ކޮރަލް ތަކުގެ ސަރަހައްދުތަކާއި ބިމުގެ ވައްޓަފާޅި ދެކޮޅަށް ފަރާތުން ބިމަށް ދިޔުމަށް އުފެދުމަށްވެސް ފެށިގެން ގެއްލި ދިޔަ ކަމަށް ފާހަގަ ކުރެވެއެވެ. އަދި އެއްޗެހި ބަލައިލެވޭ ސަރަހައްދުގެ ބިމުގެ ހިއްސާ ގެއްލި ދިޔަ ގޮތަކަށްވާނެ ކަމުގެ ފާހަގަވެ. އަދި ގިނަގުނަ ހިސާބުގެ މަޑުވެގެން ދިމާވާއިރު ބޮޑު ބަނގުރާކަމަކަށްވާނެ ގޮތަށް ނުރައްކާ އެސަރަހައްދު ކުރަމުން ގެނެސްދޭ ކަމަކަށްވެސް ފާހަގަކުރެވެއެވެ. ރީފު ސަރަހައްދުގެ ވާދަވެރިކަމުގެ މާހައުލު މަޑުވެރި ކަރަންޓު ދޭ ހަށިވެރިކަން ބޮޑެތި ކޮރަލް ތައް ރީފުގެ ދިރުމަށް ބަލާއިރު ގެއްލި އުނިވާ ކަމެވެ. އަދި ރާއްޖެ މިމަސައްކަތުގެ ފައިދާ ގެއްލޭ ކަމަށް ފާހަގަކުރެވެއެވެ. އަސަރު ކޮށް ބޮޑު މަސައްކަތް ގެއްލިދާނެ ކަމަށް ފާހަގަކުރެވިފައިވެއެވެ .

މިމަސައްކަތުގެ ސަރަހައްދު ބަދަލުވާ ފަރުތައް ގެއްލުން ނުރައްކާ އަސަރުތަކާ ބެހޭ، މިއަސަރުތައް ވިލާފުށް ކުޑަކުރުމަށް، އެކިކަހަލަ ފަރުތަކުގެ ކުރަނީ ކަނޑުއަތުން މިރީފްގެ ދާދިކުރިއަށް ކުރިއަށްވާނެ ކަމަށް ފާހަގަ ކުރެވިފައެވެ. އަދި ރީފްގެ ބޮޑުބައި ބައްޓަން ދަނޑުވެރިކަމަށް ގުޅުން ގެނެސްދޭ ޢިލްމީ ފަރާތްތަކުން އެޅިގެން މަސައްކަތް ކުރަން ޖެހޭ ފިޔަވަޅުތަކެއް ކުރާ އަސަރުތައް ކުޑަކުރުމަށް ދިރާސާ ކުރެވިފައިވެ ޖެހޭނެ ގޮތަށް ގޮތްތަކެއް ފާހަގަކުރެވިފައިވެ .މަސައްކަތް ކުރިއަށް ގެންދިޔުމުގައި ވިސްނުމަށް އަންނަ ބަދަލުތައް ދުނިޔޭގެ މާހައުލު، ނިޒާމު އަސަރުތައް ކުރާނެ އެހެން ފިޔަވަޅުތައް އެޅުމަށް ބޭނުންވާ މަސައްކަތް ފުރިހަމަ އެކުލަވާލުމަށް ފާހަގަ ކުރެވިފައެވެ.

5. މިމަސައްކަތުގެ ސަރަހައްދު ބަދަލުގެ ބައްދަލުވުންތަކުން އެތަކެއް ފައިދާއެއް ލިބޭނެ ކަމަށް ރިޕޯޓްގެ ދިރާސާއިން ފާހަގަ ކުރެވިފައެވެ. އަދި މިމަސައްކަތުގެ ސަރަހައްދު ނުހުންނަ ތިމާވެށީގެ މައްސަލަތައް ކުޑަކުރަން އެތައް އެކަށީގެންވާ ފިޔަވަޅުތައް ހުށަހާ، އެ ފިޔަވަޅުތަކުގެ މަސައްކަތު ކުރިއަށް ގެންދިޔުމުގެ ތިމާވެށްޓަށް ކުރާ އަސަރުތައް

ބަލައިގަނެވޭ މިންވަރަކަށް ކުޑަ ކުރެވޭނެ ކަމަށް ފެންނާތީ، އަދި މަޝްރޫއުގެ ސަބަބުން ލިބޭނެ އިޤްތިޞާދީ އަދި އިޖްތިމާޢީ ފައިދާ ބޮޑުކަމަށް ފެންނާތީ، މަޝްރޫއު ކުރިއަށް ގެންދިޔުން ކަމަށް ފެނެއެވެ.

++++

NON TECHNICAL SUMMARY

1. This report provides the finding of an environmental impact assessment conducted for the reclamation of 21.6 hectares land on the southeastern lagoon of Himmafushi to facilitate much needed additional land for the residents of the island. The project is proposed by Ministry of Housing and Infrastructure. According to EIA Regulations 2012, an Environmental Impact Assessment is required for reclamation and dredging projects. Hence, this report has been prepared to fulfil the requirements under the EIA regulations.

2. Himmafushi is a highly industrial island community and the industrial footprint covers 30% of the total land area, 35% is utilized for residential plots and 25% used for government use. As a result, almost all land available is currently being used for housing, economic establishments and socio- economic infrastructure on the island and the island is land-locked. Hence, there is an urgent and immediate need for additional land to meet the various demands. It is estimated that 745,200 cubic metres of borrow materials would be needed to reclaim 21.6 hectares of land in Himmafushi. The proposed locations for the sand borrow areas are within intra-atoll basin of AA Atoll. Alternatives have been identified in the project document. These include alternatives for the dredge areas, dredge method and alternative locations for land reclamation.

3. Himmafushi is located in a sensitive geographic area where its house reef is shared by two popular tourist resorts and two marine protected areas are situated within close proximity to the island. These sensitivities have been taken into account when analysing the impacts. Environmental impacts were identified and assessed for both the reclamation (construction) phase and operational phase of the project. The negative impacts of the project would be felt mostly during the construction (reclamation) phase and on the marine ecosystem. Sedimentation has been highlighted to be one of the most important negative effects of the project. Following careful evaluation of the negative impacts, appropriate and practical mitigation measures have been proposed to reduce adverse impacts that would arise from the project. Significant positive impacts have been identified for the implementation phase resulting. The project would not only address the land shortages for housing but also will boost the economy of the island due to stimulated businesses. These positive effects would translate into improved socio-economic conditions and improved well-being of the community.

4. The Proponent, Ministry of Housing and Infrastructure is committed to undertake the necessary mitigation measures and monitoring during all stages of the project. The project is in line with the national development polices of the government and panned to be executed in compliance with the relevant laws and regulations of the Maldives pertaining to conservation of the environment.

5. In conclusion, this EIA has looked into the key factors that shall be taken into account during construction and operational stage of the project. Even though this project does have significant environmental impacts to the marine environment, with appropriate measures, those negative effects can be mitigated to an acceptable level. It is also worth highlighting significant positive impacts that the project is expected to bring to the community would translate into improved living conditions and overall social well-being of the community.

*****

1 INTRODUCTION

1.1 BACKGROUND

K. Himmafushi is an inhabited island located at the eastern side of Northern Kaafu atoll, and is just 17 km NNE from the capital Male'. Registered population of the island as of 16th October 2015 is 1059 people. However, the total living population is estimated to be about 1725 people. The island has high level of industrial activities including a bottling factory, a slipway as well as a fish processing plant. The island also host the government's Drug Rehabilitation Centre. These activities although provides jobs to the local community also takes up a large amount of land. To cater for these needs, reclamation on the island has been carried out at the west and southwest in one instance and a second instance at the south of the peninsula to expand the rehabilitation centre. Despite these expansions currently, there is no more land to expand either residential area or the industrial activity. On top of that, island faces erosion at northern shore, which is adversely affecting residential area including some community purpose buildings.

To address this Government of Maldives through Ministry of Housing and Infrastructure has taken the initiative to reclaim approximately 21.6 hectares of land in the South Eastern bay area. The reclamation would allow more land for residential purposes as well as provide more land to expand the industrial and commercial activities. It would bring in additional income generating opportunities for the locals and this would give an additional boost the economy of the island.

1.2 PURPOSE OF THE EIA

Given the potentially adverse environmental impacts associated with reclamation and dredging work at Himmafushi, the proponent has requested consultancy services for preparation and submission of an Environmental Impact Assessment (EIA) report to EPA to comply with the Environmental Protection and Preservation Act (4/93) and EIA Regulations 2012.

The objective of the EIA study is:

a) To provide an assessment of the potential environmental effects of the proposal and determine which of these, if any are likely to result in a significant effect on the environment and to propose ways and means of avoiding, mitigating, and or compensating the perceived negative effects of the project;
b) To provide necessary information to EPA applicable to the proposed development;
c) To assess how the proposals have been developed to achieve a satisfactory level of environmental performance in line with the EIA Regulations.
d) Assess the current social and economic issues faced by the community and ensure that all the aspects are addressed within the project;
e) Assist in the informed decision making process

1.3 EIA REPORT AND EIA IMPLEMENTATION PROCESS

In general, the objective of an EIA report is to address the environmental concerns of the developmental project. The EIA will help to achieve efficient planning, aid in identifying impacts and their potential mitigation measures. The EIA report will also help to promote informed environmental and sound decision making during the development of the project.

The aim of the EIA is to identify, describe and assess in an appropriate manner, proposed development, in accordance with the provisions of guidelines and regulations of the GoM, the direct, indirect and residual effects of the project on the following factors:

- Physical and chemical characteristics of the environment;

- Biological conditions including flora (trees/shrubs and endangered species), fauna (birds, land animals, coral and endangered animals) habitats (environmentally sensitive areas protected area etc);
- Cultural and social factors including aesthetic and human interest (scenic views and vistas, wilderness qualities, landscape design, historical and archaeological sites and objects), and cultural status (employment); and
- Ecological relationships including pollution, eutrophication, disease and insect vectors, and introduction of alien species etc.

EIA preparation process followed is as follows:

- The consultant prepares EIA application form with necessary relevant documentations for the proponent for submission to EPA, and the proponent submits the application along with the approved site plan and concept design;
- EPA calls for a scoping meeting with proponent, consultant and relevant stakeholders from government agencies to determine the scope of the EIA study;
- Based on the discussion of the scoping meeting the consultant submits a draft TOR of the EIA;
- EPA reviews the drafts ToR finalize and send to the proponent and consultant;
- The consultant undertakes literature review and gathers relevant data and information on the project;
- Consultant undertakes the field assessment work;
- The consultant analysis data and information gathered and identify environmental impacts, determine mitigation measures, rationally evaluate and suggest alternatives and limitations and propose a monitoring plan;
- The consultant discusses major findings with the proponent and suggests possible changes to the project/project component;
- Based on the discussion with the proponent the consultant reviews the EIA and makes necessary changes to the document;
- The proponent should provide written commitment to undertake mitigation measures and post development environmental monitoring as per the EIA report;
- The consultant submits the final EIA to the proponent who subsequently will submit to EPA for review and to issue decision note;

Once the decision note is issued from EPA the proponent is obligated to implement the EIA and matters highlighted in the decision note. Also the proponent shall implement the periodic monitoring programme during construction and operational phase of the project and submit monitoring report as indicated in the EIA report.

1.4 PROJECT SETTING

Himmafushi island is located approximately 4º 18' 25" N and 73º 34' 15" E in North Kaafu atoll (Figure 1). It is approximately 16 km NNE of capital city, Male. Himmafushi lies on a relatively large reef platform which is shared by two other islands, both are tourist resorts. The western side of the reef flat is very shallow and has the potential to be reclaimed. Two protected marine areas are found not very far from Himmafushi; Thamburudhoo Thila to the north and Lankan Thila to the southwest. Approximately 1600 people (1059 registered) resides in the island. The non-registered residents are mostly expatriates and Maldivian hired to work at the industrial sites of the island. Almost all land of the island is used up for various purposes. Almost a third of the land is dedicated to industrial activity, and almost a third is dedicates for Rehabilitation Centre. The island is well connected to the capital island Male and the airport island of Hulhule'. It also enjoys 24hrs of uninterrupted electricity and clean drinking water. The sewerage system for the island has been planned to be incepted in near future. Guesthouse business is thriving on the island and it is a popular destination for divers and snorkelers. The island is considered to be having a huge potential for business development. But such developments have been hampered by un availability of land from the island.

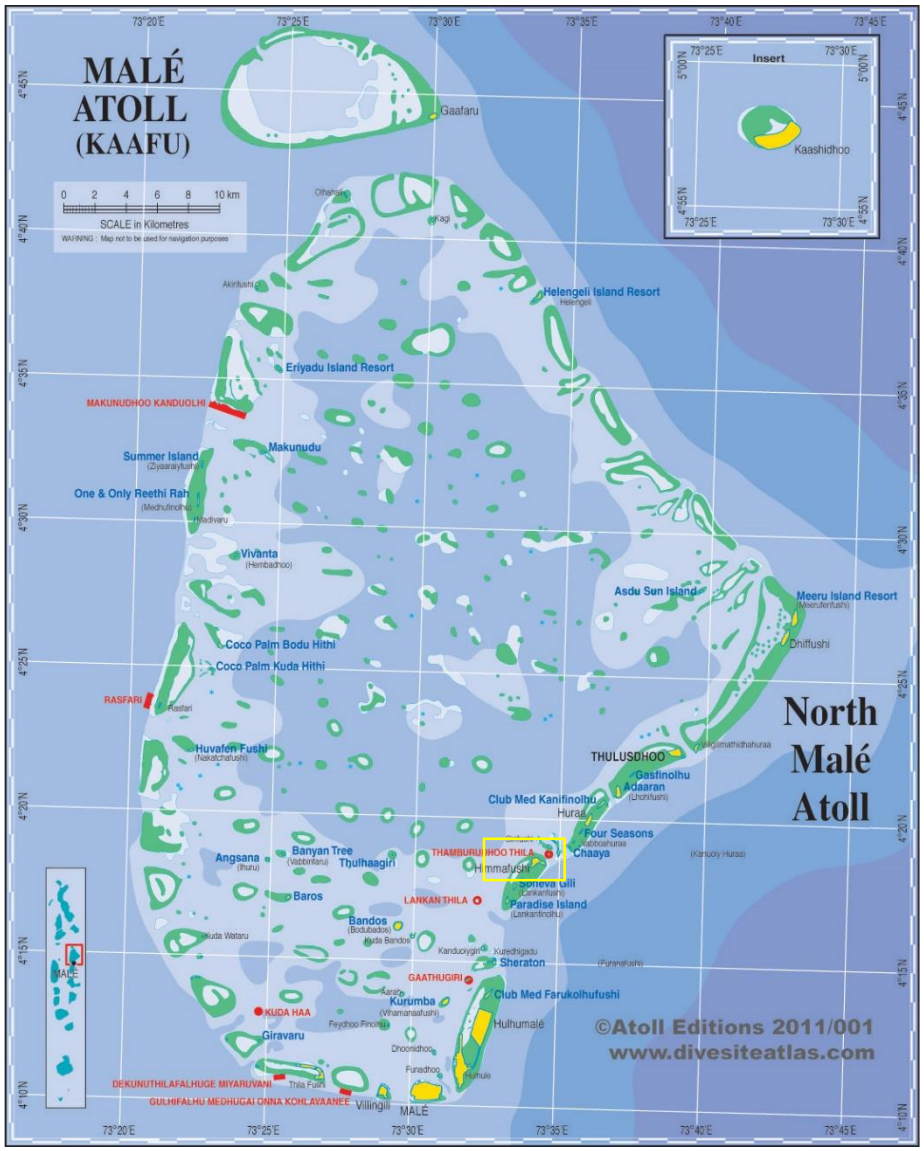


Figure 1: Map showing location of Himmafushi.

1.5 PROJECT JUSTIFICATION

The project has been planned and executed by the Ministry of Housing and Infrastructure – the government authority responsible for housing, land and infrastructure projects by the government. The project is funded by the state budget approved for the project by the Peoples Majlis. Hence, the project has been planned in line with the government's policies and priorities. The land in K. Himmafushi is almost entirely occupied for various uses and at present, the island community is facing acute shortage of land. The island council stated that the despite repeated requests by the people for land plots for housing they have been unable to respond positively to such requests simply because there is no spare land available on the island. It is beyond doubt that the island is required to have additional land to accommodate current population and accommodate for growth of population. The island is well known for tourism related businesses and light industrial activities. In addition to industrial activities, it also hosts national facilities such as the Drug Rehabilitation Centre, which has also taken up a sizeable plot of land from the island. Due to the it's close proximity and good connectivity to capital city and the main airport, there exists good potential for further business development on Himmafushi provided that land is available for such.

The island was developed in the past with a clear view of keeping residential area and residential area separate as can be seen in the current land use plan of the island (Figure 2). A large number of people employed in the industrial zone are also based on the island. Hence, the demand to expand existing businesses and industries have not diminished. Thus to further expand these industrial activities and further develop the commercial activities land reclamation is considered key. In addition, very shallow reef flat available to the island within the administrative boundary of Himmafushi, which has not been utilised for any significant activity at present is also seen a good reason to proceed with the reclamation.

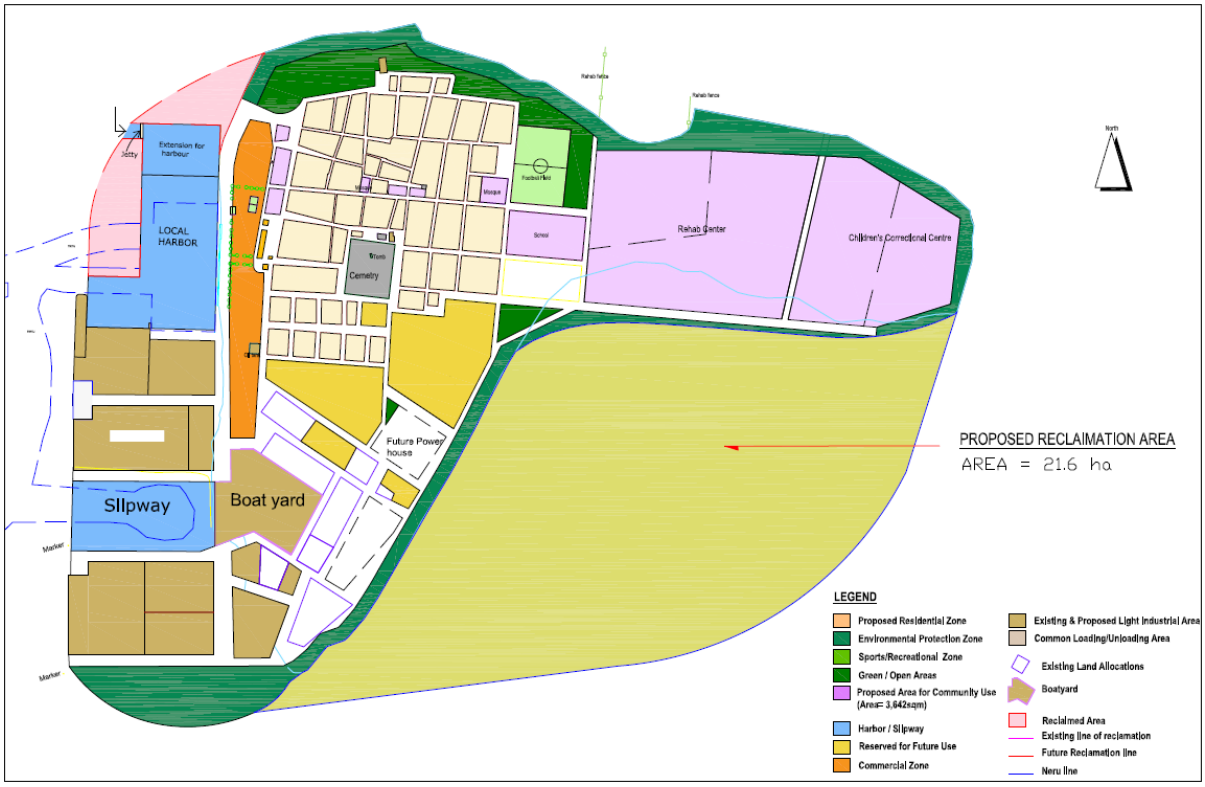


Figure 2: Map of Himmafushi island

2 DESCRIPTION OF THE PROJECT

2.1 THE PROPONENT

The project proponent is the Ministry of Housing and Infrastructure (MHI). MHI is mandated with development and regulation of the infrastructure development activities of the country. In this regard, reclamation projects in islands fall under the management of MHI.

The contact details of the proponent is given below:

Ministry of Housing and Infrastructure.
Ameenee Magu,
Maafannu, Male', 20392, Republic of Maldives.
Tel: +(960)3004300, Fax: +(960)3004301
Email: mohamed.muizzu@housing.gov.mv

2.2 PROJECT LOCATION AND SITE AREA

The project is located at Himmafushi island is located approximately 4º 18' 25" N and 73º 34' 15" E in North Kaafu atoll. The proposed area for reclamation is at the southeastern side of the island as marked in Figure 3. Gililankan Fushi resort lies approximately 1400 m to the south of the proposed reclamation site. A total of 21.6 hectares is proposed to be reclaimed.

Figure 3: Project Location

2.3 PROJECT BOUNDARY AND IMPACT ZONE

The proposed reclamation project's impacts are almost exclusively concentrated in the marine and coastal environment of Himmafushi reef flat. Figure 4 shows the project boundary and the predicted impact zone where the inner circle is the primary impact zone and the larger is expected to be the secondary impact zone.

Figure 4: Project boundary and impact zone with primary and secondary impact zones.

2.4 BORROW AREA

To fill in the reclamation site the proponent have suggested two options to dredge material. The first option is 3 locations just South of AA. Ukulhas within the AA. Atoll (Figure 5).The second option is located within the Himmafushi lagoon. Option 1 is the preferred option and it is planned that option 2 would only be utilized if there is not enough dredge material available from option 1 dredge sites. In option 1, materials have to be borrowed from the deep atoll lagoon. Three potential locations within the atoll basin were approved by the EPA (see Annex 3). No dredging will be carried within a 500m radius around any reef.

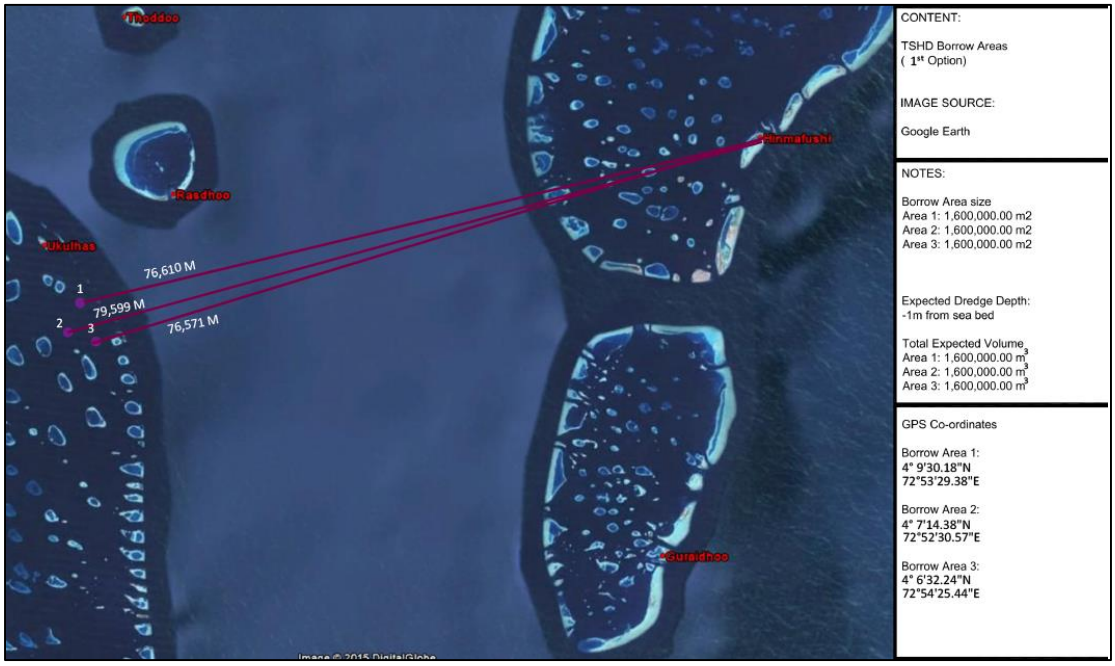


Figure 5: Approved Borrow area for dredged material

2.5 PROJECT DURATION AND SCHEDULE

The proposed project is planned to be completed in 305 days. This reclamation project has been awarded to a foreign contractor, One Noor Pvt Ltd of Netherlands. The preparatory work is expected to take one month and the dredging for fill material is expected to take three weeks. Reclamation works including compacting, levelling and coastal protection will take 9 months. A tentative schedule of the work is found in Table 1. Details are attached in the Annex.

Table 1: Work plan for Himmafushi reclamation

Activity	Duration
Preliminaries	35 days
Mobilization	*15 days*
Site setup works	*15 days*
In survey	*5 days*
Reclamation works	270 days
Compaction, levelling and coastal protection works	*270 days*
Total	305 days

2.6 THE PROJECT

The project involves reclamation of an area of 21.6 Ha of land on the South Eastern side of K. Himmafushi. The new land would be reclaimed to a height of 1.6 m above MSL. It is estimated that approximately 745,200 cubic meters of sand would be needed for the reclamation. The project price is expected to be approximately, USD 9,078,087.

2.6.1 Borrow Material and Reclamation

The proposed locations for the sand borrow areas are within the atoll basin of AA Atoll. At this stage, EPA has approved three locations where sand could be borrowed within AA Atoll

No dredging will be carried by the hopper dredger within 500 m around a reef and no dredging would take place in the buffer areas.

The atoll basin is selected due to the use of a large TSH dredger and outside the atoll basin into the deep ocean it is not appropriate for dredging, as the depth would be too deep. The quantity of fill materials required for reclamation would be made available from the three identified borrow locations. Currently the facilities required to assure if the needed volume of material could be obtained before the project is not available. A detailed assessment and site survey needs to be done before commencing the work. Once the facilities are available before the project beings, the required assessment would be carried and shared with EPA as part of the monitoring program.

2.6.2 Quantity and Characteristics of Borrow Material

The required burrow volume is estimated as follows:

Burrow volume = height x *Area*,

where

height = sum of the bathymetric height with respect to MSL plus height to be reclaimed
Area = area of land to be reclaimed (21.6 Ha)

With the bathymetric heights and the area to be reclaimed, it is estimated that 745,200 cubic metres of borrow materials would be needed to reclaim 21.6 hectares of land in Himmafushi as indicated in Table 2.

Table 2: Estimates of quantity needed

Parameter	Magnitude
Area of reclamation	21.6 (HA) = 216,000 sqm
Reclamation height above MSL	1.6 m
Fill height (using bathymetry)	3.45 m
Required volume	745,200 cbm

2.6.3 The Detailed Dredging Process

Dredging would take place using a Trailing Suction Hopper Dredger (TSHD). TSHD is a ship with the full sailing capacity equipped with one or two suction pipes. Suction pipes with trailing drag heads are lowered into the sea from the sides of the ship. As the ship navigates and slow speeds, the head is trailed along the seabed loosening the material. Due to a pressure difference created within the pipe, these loosened material is sucked into the pipe and the material would be surfaced to land in the hopper. The TSHD will transport the materials to the reclamation site on the eastern side of Himmafushi. The dredger will be located within the atoll basing close to the dredging locations during trailing. Once the hopper is filled, it will be brought near shore on the northern side of the causeway and the material would be pumped onshore via pipes under the causeway. The pipes would be laid until the reclamation is complete. Figure 6 shows a typical TSHD used in Maldives and the process of dredging and reclamation.

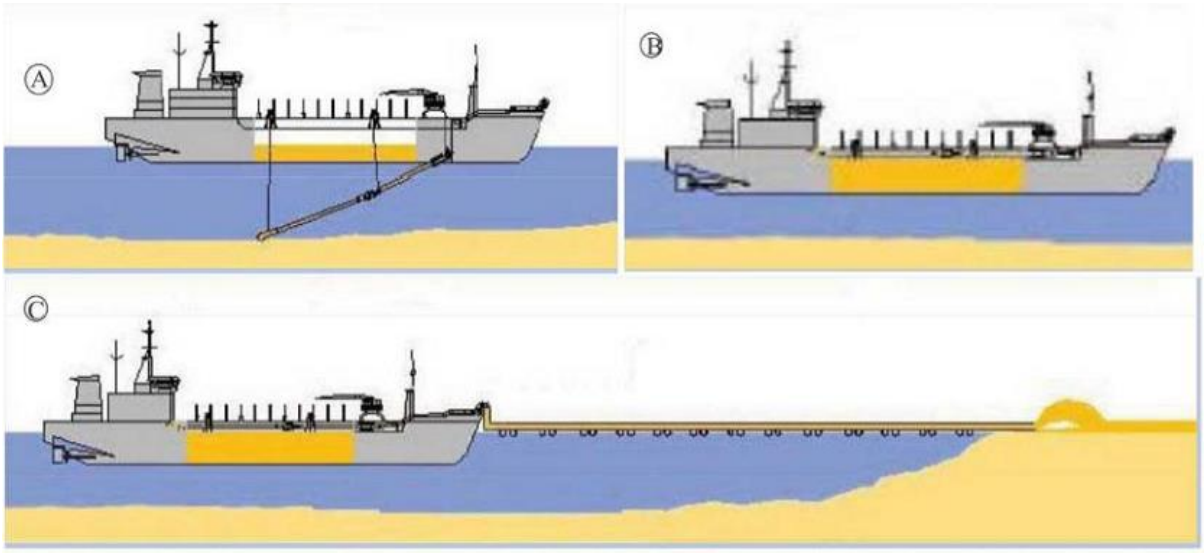


Figure 6: Dredging and reclamation methodology in illustration (Ministry of Housing and Environment 2010).

2.6.4 Justification for Using The Selected Dredging Method

Use of hopper dredgers are less environmentally damaging as the sand is burrowed from well surveyed locations. These locations would constitute of fine sand. The sand is sucked into the dredger like a vacuum cleaner and is transported to the fill site. A cutter suction dredger will do a considerable damage during its cutting-suction process, which will modify the natural environment of the reef system. Moreover, a hopper dredger less time for reclamation compared to the time consumed by a cutter suction dredger.

2.6.5 Access Channel

For the dredger to be deployed into the dredging area, the proper access channel will be provided. AA atoll have many entrance channel in the northern and north eastern part. As the dredging area proposed is within the atoll basin one of these channels could be used as an entrance.

2.6.6 Filling and Reclamation

Bund walls should be created around the proposed reclamation area. The filled material would be left for settling and compacting. It would be necessary to create perimeter bund walls and use silt screens to prevent dispersion of silts into the surrounding reefs. Some of the stages involved in the reclamation process is as below:

- Reclamation would be carried section by section.
- Before reclamation, the area to be reclaimed would be marked with sand bunds with adequate height for reclamation. This area would be filled to create the land.
- Once this area is filled another section would be marked with a similar bund wall and filled.
- Reclamation and filling continues until the desired area is achieved.

2.6.7 Coastal Protection of the Reclaimed Land

Coastal protection would be put in place to prevent erosion and loss of the reclaimed land in the long term. Revetment would be put in place with rock boulder. A length of approximately 890m of coastal protection would be put in place. This means up to 80% of the reclaimed coast would be protected under the planned project. The remaining 20% would be left as beach area.

2.6.8 Compacting and Levelling Of the Reclaimed Land

Once reclaimed, the land would undergo compacting allowing the water to percolate through the sediment. With this process, the sediment will eventually settle. Levelling of the surface would be done once the entire area of the reclamation is completed. Excavators and trucks will be used during the levelling stage. Levelling of the reclaimed land will be undertaken to 1.6 m above MSL. Coastal protection will be undertaken to prevent erosion. Rock boulder revetment would be constructed for protecting of the coast.

2.6.9 Management of the Vertical Gradient between Lands

The area of the reclaimed land would be slightly higher than the Himmafushi original land. Therefore this creates a surface gradient between the two lands. For the surface runoff and flood management, a buffer zone of 5-10 m would be created between the existing and the newly reclaimed land. The new land would be sloped with drainage gutters during the road construction of the new land.

2.6.10 Management of Waste

Waste will be segregated before being stock piled. Reusable material would be obtained through segregation. Any hazardous material, waste oil by power plants and use of vehicles, vessels, grease, and construction waste would be stocked until the end of the project, which will be transferred to Thilafushi at the end of the project. A summary of the waste management is given in the table below.

2.6.11 Machinery to be Used

The following or similar machinery would be used in the project

- Trailing hopper dredger
- Cranes
- Barges
- Trucks
- Excavators
- Levellers
- Pipelines with ball joints, pontoons, nuts, bolts etc…
- Bulldozers
- Wheel loaders
- Survey equipments

2.6.12 Emergency Plan in Case Of Spillage (diesel, grease, oil)

Accidental spillage can happen during the construction period if proper measures are not taken. Oil, grease and other fuel storage will be stored at a temporary site with adequate impervious flooring. Refilling of the machineries and power facilities would be done via these facilities.

2.6.13 Labour Requirements and Availability

The required labour would be provided by the contractor as part of the contract. The contractor would be an experienced contractor who has carried similar projects within Maldives and familiar to the environment. It is envisaged that approximately 50 labourers will be required.

2.6.14 Vegetation Clearance

There will be no clearance of significant vegetation needed as the area of reclamation is currently the lagoon. No vegetation clearance will be required for the temporary facilities as they would be situated on land suggested by the Island Council. No cutting down of trees will be required.

2.6.15 Temporary Facilities during the Project Implementation

Temporary accommodation and services required for not more than 50 persons will be established on the island in consultation with the Island Council. A container-based office and/or temporary sheds at site for accommodation and material storage will be provided. Temporary septic tanks will be constructed at the temporary facilities to dispose sewage and wastewater. Rainwater collection with a small desalination plant and a small generator set may be installed at the temporary site.

During dredging operations workboats near the site will provide the basic services for the workers.

2.7 SEWERAGE SEPTIC TANKS AND SOAK PITS

Currently Himmafushi does not have a sewerage network. Consultations with the island council reveals that currently only septic tanks and soak pits are there in the island. However, there are some septic outfalls from the industrial region. They have been consulted and it is planned that these outfalls would be extended beyond the reclaimed area. Therefore, there would be no issue of blockage of any sewerage systems.

2.8 OCCUPATIONAL HEALTH AND SAFETY

The contractor will ensure that the necessary occupational health and safety measures for the workers involved is in place. Proper gears with the suites, helmets, gloves, goggles, hearing aids etc shall be provided. In addition, emergency response measures with the SOPs, proper use of signboards, fire and safety equipment shall be made available on the site.

2.9 PROJECT INPUTS AND OUTPUTS

The main inputs into the project would be human resources, machinery, fuel, water, facilities for the workers, concrete, and dredged materials. The major outputs would be the new reclaimed land, the new coastal protection, and as by products, solid waste and emission are also considered outputs.

Table 3: List of major inputs to the project

Inputs	Source	Method of Obtaining
Project staff	Skilled and semi-skilled labour, Manager (1) Supervisor (1) Excavator Operator (2), Loader operator (1), Welder (1) Labourer (15) consisting of skilled and semi-skilled and unskilled labourers persons.	All workers will be sourced by the contractor. Contractor will ensure the workers hired for the project are capable and possesses necessary skills and in case of foreign workers that they have necessary documents
Machinery and Equipment	Dredger (1) Excavator (01), dump trucks (02), loader (02), barge (2) Concrete mixer (01), work barge (01), Crane (01), Survey equipments.	To be obtained and operated by the contractor. Contractor will be required to bring to the site machines in good working conditions to avoid loss of time due to breakdown of machines, vehicles and equipment.
Fuel	Diesel, lubricants and Petrol (will be taken in bulk volume to the site and stored in containers)	Local suppliers or purchased from Male' obtained by contractor
Construction materials	Rock boulders, cement, aggregate, iron rods, fuel	Imported materials to be used for the project.
Electricity (during construction period)	Onsite generators	Contractor

Water	Desalinated/mineral/rainwater	Using existing facilities at the island
Communication	Existing communication networks	
Food (during construction)	From the island	Contractor
Borrow Material	About 745,200 cubic metres of sand	Inside AA. atoll lagoon floor using TSHD

Table 4: List of major outputs from the project

Outputs	Quantities	Method of Disposal/Outcome
Reclaimed Land	21.6 hectares	
Solid waste	Approximately 10kg/person/day	To be disposed of at Thilafushi
New coastal protection	1000 metres	Shore protection
Noise	Noise from site mobilization and use of machinery	It would have minimal impact since there are few residents of the island
Waste oil and grease by machinery/generator/vehicles	Approx. 100 litres/month	Collected and disposed at waste facility or transported to Thilafushi by contractor
Sedimentation		Managed as per the mitigation measures described in this report
Air pollution	Limited quantities of dust and operation power plants and machinery	Disbursed to the atmosphere

2.10 PROJECT RISKS

There are some risk factors associated with this project mainly arising out of the geography and physical situation of the island. Himmafushi's house reef is shared by two resorts Gili Lankanfushi, and Paradise Island Resort. Noise and sediment plume in the lagoon may become an issue for the guests as well as for the management of the resorts. If the problem becomes prolonged it could also affect the business of these resorts due to cancellations and claiming for refund by some tourists. Such complaints may result in having to temporary halting of the project which in turn may be costly for the contractor as well as for the government due to idle time. Hence, proper information needs to be provided and complaints shall be given due attention and work shall be arranged and carried out to minimise the negative effects to the operations of the resort. Control measures needs to be taken to mitigate the sedimentation and siltation due to reclamation. Sedimentation will be felt to some extent at the burrow areas even though material is burrowed from deep. If the proper measures could be taken such negative effectives could be controlled and maintained at an acceptable level.

The outfall pipe of a private company producing desalinated water was noticed in the area earmarked for reclamation. Some wastewater outfalls from individuals houses have also been spotted in the area. There may be other similar issues related to the project. It would be important for the proponent to discuss these issues with the Island Council and resolve such potential issue prior to starting of the project.

There is also the risk of project delays caused by bad weather. The project period falls in the onset of the southwest monsoon. This risk can be minimized if the works are scheduled as such that weather is taken as important aspect in the project planning.

Financial and technical capacity of the selected contractor can also affect the project performance. Hence, due consideration shall be given to selecting a capable contractor to minimise capacity related risks.

Delays in project implementation would mean negative effects of the project getting exacerbated. Hence risk mitigation aspects shall be given a high priority

2.11 REVIEW OF SIMILAR PROJECTS

Ministry of Housing and Infrastructure has over 25 years of experience in planning and executing large infrastructure projects. Dredging and reclamation are common among those. It is expected that the Ministry will apply the past knowledge and experience in effective implementation of the project and minimising impacts to the environment. A recent land reclamation was carried out in Thulusdhoo, a nearby island for extending the runway of the airport. Some of the studies and EIAs reviewed are found in the appendix of this report. In compiling this EIA some of the recent past reports prepared for dredging and reclamation have been reviewed and the measured proposed in mitigating impacts evaluated.

3 REGULATORY CONSIDERATIONS

3.1 BACKGROUND

Due to the nature of the proposed development, as can be seen from the legal framework, a number of government agencies have a stake in the project. The project is planned and executed by the key government agency, which is responsible for formulating and implementation of policies on infrastructure development in the Maldives which is the Ministry of Housing and Infrastructure. In addition, Ministry of Housing and Infrastructure is also responsible for the construction of harbours, revetments, dredging and reclamation projects on behalf of the government. This ensures that the proposed project is fully in line with the government's development policies and plans. The environment sector of the Ministry of Environment and Energy is granted the broad responsibility to assess development projects that may have a significant impact to the natural environment.

3.2 ADMINISTRATIVE FRAMEWORK

3.2.1 Ministry of Housing and Infrastructure

Ministry of Housing and Infrastructure is the primary government authority responsible for formulating and implementing policies related to housing, land, land use planning, construction industry development, and infrastructure development in the Maldives. In addition, the Ministry is responsible for regulating dredging and land reclamation and planning and executing government projects of similar nature. Coastal protection and harbour development are also among the responsibilities of the Ministry. The proposed project is planned and executed by the Ministry of Housing and Infrastructure on behalf of the government of the Maldives

3.2.2 Ministry of Environment and Energy

The Ministry of Environment and Energy (MEE) is key Ministry in the government mandated with the protection of the environment. Environmental responsibilities assigned to MEE includes formulating environmental policies, coordinating, preservation and management of the environment throughout the country, and enforcing Environmental Protection and Preservation Act (EPPA) (04/93). Under Article 5(a) of EPPA, Environmental Impact Assessment (EIA) is mandatory for projects that may cause potential harm to the environment. The EIA report has to be submitted to the EPA for approval before commencement of a project. As per this legislation, any project that has any undesirable impact on the environment can be terminated without compensation by MEE.

3.2.3 Environmental Protection Agency (EPA)

EPA is the key regulatory body on environment, which is an autonomous body formed under the umbrella of MEE. 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.

3.2.4 Island and Atoll Councils

The K. Atoll Council and Himmafushi Island Council were established under the Act on Decentralisation of the Administrative Divisions of the Maldives (Law Number 7/2010). They have specific responsibilities with regards to the governing the all projects and activities that fall within their jurisdiction. Both councils shall be accountable to the people of respective islands or administrative units.

Himmafushi Island Council is considered as one of the major stakeholder of the project since the project is administered in their jurisdiction. The decentralization act mandates the council to administer and

develop the island in accordance with the Constitution and statutes and provide municipal services as prescribed in this Act. They are also required to prepare island development plans in consultation with the community, and submit the plan to the atoll council. The council is also mandated to assist Government ministries and atoll councils in monitoring the progress of various development projects, and be accountable to the atoll council during project implementation and submit reports according to the requirements of the ministries and atoll Council. In accordance with the Land Law of the Maldives and other statutes, for economic or social use, the council acquire land, reefs and lagoons and own in the name of the council and lease out these properties and invest in and own the investments in the name of the council. The council can also lease out and give lagoons and land for different purposes as mandated by national authority for land management in accordance with the Land Law and as per the island's Land Use Plan.

The proposed project was discussed with the members of the island's council during the field visist and their opinion was fully taken into during the preparation of the EIA.

3.2.5 Ministry of Tourism

The Ministry of Tourism is responsible for the monitoring and the management of the environment related to all tourist resort island. Since resort islands fall within the project environment, the Tourism Law is applicable. Hence, the Ministry has been duly consulted and necessary approval has been sought prior to the commencement of the Project.

3.3 POLICY FRAMEWORK

3.3.1 Strategic Economic Plan

The Strategic Economic Plan highlights the need for further public sector investments into the development of support infrastructure such as harbors and jetties, and in doing so, strengthening linkages between the different sectors, as well as inter-island linkages required for economic growth.

3.3.2 National Environment Action Plan, 2009-2013 (NEAP III)

The third National Environment Action Plan (NEAP III) set forth the agenda for environment protection and management in the Maldives for the five-year period 2009 – 2013. This instrument seeks to achieve the stipulated goals and targets through coordinated effort of the responsible government departments and following the introduction of a decentralized system of governance, through the engagement of local level governance arrangements.

The underpinning theme of the policy instrument is protection of the natural environment and making people and property resilient. NEAP III emphasized on the promoting healthy communities by improving solid waste management, hazardous waste management, safe use and disposal of chemicals, clean air.

3.3.3 National Waste Management Policy (2015)

The first National Solid Waste Management Policy which was formulated in 2008 focused on the following aspects of solid waste management:

- Establishing and activating waste management governance;
- Creating waste producers' duties;
- Establishing waste management infrastructure;
- Activating waste management systems; and
- Influencing consumer choices and waste management practices.

The first National Solid Waste Management Policy framework underwent extensive review in 2015 leading to the formulation of the new National Solid Waste Management Policy framework which was launched on the 4th of November 2015.

The National Solid Waste Management Policy (2015) (NSWMP) was formulated taking cognizance of the changes in waste generation patterns resulting from the changing socio-economic conditions of the country. The main objectives of the NSWMP is to instil a uniform vision in policies, regulations, standards and plans formulated for waste management and to create and identify the responsibility for waste management at individual, household, community, regional and national levels, establish a policy basis for introducing charges for waste management, identify the role of private partners in the waste management hierarchy and identify key stakeholders.

The NSWM 2015 outlines the main policy goals targeted at addressing the solid waste management problem facing the nation. They are as follows:

a) To reduce waste generation promote and inculcate 3R concept;
b) Conduct sustained awareness building activities at all levels to create public awareness on safe waste management practices;
c) Designate the MoE as the lead agency for the implementation of the national solid waste management policy and establish a mechanism to monitor island level waste management systems;
d) Formulate solid waste management plans for each inhabited island and undertake waste management activities in accordance with such plans;
e) Formulate the Waste Management Legislative framework and carry out waste management activities in accordance with the framework;
f) Review medical waste management regulations and carry out waste management activities of the health sector in accordance with such regulations;
g) Collect statistics on waste at island and national levels and disseminate such information;
h) Establish a system to impose and collect fees/charges from waste producers/generators;
i) In each inhabited island, establish a waste management system which is suitable for the needs of the island (to be determined based on the size of the island and the island population) and provide necessary tools and machinery and carry out waste management activities through the established system;
j) In a sustained manner conduct training programmes on safe management of waste targeting stakeholders;
k) Establish, maintain and update an inventory of waste management systems established in inhabited islands;
l) Establish regional waste management facilities in all the designated regions of the Maldives;
m) Transfer residual waste (after waste management at island level) to regional waste management facilities in accordance with the relevant regulations, and manage waste so transferred in the regional waste management facility;
n) Conduct research on latest waste management technologies;
o) Exhort preparation of waste management plans for islands designated and leased for industrial activities and conduct monitoring to ensure compliance with contents of such plans in the waste management activities; and
p) Establish a "National Waste Management Trust Fund"

3.3.4 Third National Environmental Action Plan

The aim of NEAP is to protect and preserve the environment of the Maldives and to sustainably manage the country's natural resources for the collective benefit and enjoyment of present and future generations. Some of the fundamental policies prescribed in NEAP 3, which have been integrated into this environmental impact assessment report include stakeholder participation local democracy, informed decision making, continuous monitoring and improvement, right to information and

participation and most importantly the complementing role of environmental protection in socio-economic development. Some of the goals of NEAP are in direct and indirect relevance to the proposed project. One such goal is to build resilience of fisheries and food production to climate change.

3.3.5 Protected Areas and Environmentally Sensitive Areas

The Ministry of Environment is the government body mandated with the responsibility to identify and designate protected areas and natural reserves. The Environmental Protection Agency (EPA) is mandated with managing the PAs and has the responsibility to formulate and enact the necessary rules and regulation in regards to PAs. Only certain activities which do not cause environmental impacts to the protect areas are allowed to be carried out in protected sites. The project does not fall directly into the boundary of a protected area, however, there are two protected areas in relatively close proximity from the project site; *Thanbrudhoo Thila* and *Lankan Thila* which have been discussed in more detail in the Section on Existing Environment.

3.4 LEGAL FRAMEWORK

3.4.1 Environmental Protection and Preservation Act 1993 (EPPA)

The Environmental Protection and Preservation Act (Law No. 4/93) and the regulations made pursuant to these Acts are the main legislative instrument of relevance to this project. The following articles in the Act are related to this project:

> Article 1: The natural environment and its resources are a national heritage that needs to be protected and preserved for the benefit of future generations. The protection and preservation of the country's land and water resources, flora and fauna as well as the beaches, reefs, lagoons and all natural habitats are important for the sustainable development of the country.
>
> Article 2- Environmental Guidance: Guidelines and advice on environmental protection shall be provided by the concerned government authorities in accordance with the prevailing conditions and needs of the country. Hence, all concerned parties shall take due consideration of the guidelines provided by the government authorities.
>
> Article 5- Environmental Impact Assessment: An EIA shall be submitted to the Environment Ministry before implementing any developing project that may have a potential impact on the environment.
>
> Article 6- Termination of Projects: Projects that have any undesirable impact on the environment can be terminated without compensation.
>
> Article 7- Waste Disposal, Oil and Poisonous Substances: Disposal of waste, oil, poisonous substances and other harmful substances within the territory of the Maldives is prohibited.
>
> Article 8: The penalty for minor offences in breach of this law or any regulations made under this law, shall be a fine ranging between Rf5.00 (five Rufiyaa) and Rf500.00 (five hundred Rufiyaa), depending on the actual gravity of the offence. The fine shall be levied by the Ministry of Environment or by any other government authority designated by that Ministry.
>
> Article 9: Except for those offences that are stated in (a) of this clause, all major offences under this law shall carry a fine of not more than Rf100, 000,000.00 (one hundred million Rufiyaa), depending on the seriousness of the offence. The fine shall be levied by the Ministry of Environment, Energy and Water.

Article 10: The government of the Maldives reserves the right to claim compensation for all damages that are caused by activities that are detrimental to the environment. This includes all activities mentioned in Clause No. 7 of this law as well as those activities that take place outside the projects that are identified here as environmentally damaging.

The proposed project will fully abide by the stipulations of Environment Act and the policies, rules and regulations made pursuant to the Act. It would be ensured that environmental protection and preservation and the sustainable management of natural resources would be at the core of all stages of the proposed project.

This EIA report fulfils the legal requirement to submit an Environmental Impact Assessment report for reclamation and dredging projects (as per Schedule D of the EIA Regulations 2012.
Disposal of solid waste including green waste, wastewater, oil, chemicals and other hazardous substances will be strictly monitored and managed. The proponent is fully aware of the penalties for breaking the law and damaging the environment and will take every possible precaution against such damages to the environment.

3.4.2 Environmental Impact Assessment Regulations, 2012

The EIA Regulations issued under the umbrella law, by Environment Ministry provide guidance for proponents, consultants, government agencies and general public on how to obtain approval, in the form of an Environmental Decision Statement, for a Development Proposal. The criteria and procedures contained in these Regulations shall be used to determine whether a Development Proposal is likely to significantly affect the environment and is therefore subjected to an Environmental Impact Assessment.

Schedule D of the EIA Regulations lists the different environmental projects that require an Environmental Impact Assessment study and reclamation and dredging have been included in the list. This EIA has been undertaken in accordance with all the guidelines and procedures outlined in the Environmental Impact Assessment Regulations 2012. It includes a monitoring programme that requires implementing all mitigation measures identified in the report to which the project proponent is committed to.

3.4.3 Dredging and Reclamation Regulation 2013

Regulation on Reclamation and Dredging of islands lagoons (Regulation 2013/R15) came into effect in April 2013. The regulation requires having permission of EPA on projects requiring alternation of the island, either by reclamation or dredging. Specifically the regulation requires producing scaled maps of the island before and after the proposed intervention. Special provisions have been made on protected and sensitive area restricting changes to the environment of the islands.

This regulation is of highest relevance to this project and would be followed in every step of the way. The contractor as would be fully familiarized with the regulation before site mobilization starts. The proponent has already taken the required dredging and reclamation permit for the purpose of this project from EPA.

3.4.4 Waste Management Regulations 2013

Waste management Regulation (No. 2013/R58) is more recent coming into effect on 6 February 2014. The Regulation was gazetted on 05 August 2013. The regulation provides set of comprehensive guidelines and on collecting, storing, transporting and managing waste as well as management of hazardous waste. The waste management regulation identifies the following areas prohibited from dumping of waste; protected areas under the Environmental Protection and Preservation Act, mangroves, lagoons of islands, coral reefs, sand banks, beaches of islands, coastal vegetated areas of

islands, harbours, parks and roads. Additionally, waste management regulation states that those involved in waste management must be permitted by the Environmental Protection Agency.

The proposed project would fully conform to the regulation and the contractor would be fully made aware of the conditions of the regulation and the fines and penalties associated with offences.

3.4.5 Regulation on Environmental Damages and Liabilities 2011

Under the Environmental Protection and Preservation Act (No. 4/93), the Ministry of Housing and 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.

3.4.6 Regulation on Sand and Aggregate Mining

The regulation on sand and aggregate mining is targeted to manage the practice of uncontrolled sand mining from islands and other bird nesting sand banks. There is a prohibition on the mining of sand and aggregate from the beaches of any island, including inhabited and uninhabited islands. Permission is granted only some very few selected areas in the country to mine sand.

3.4.7 General Fisheries Regulations

Tourism Act does not specify the boundaries of tourist resorts. The exact boundary line for the resort island becomes an issue in situations where multiple island are situated on the same reef platform. However, General Fisheries Regulations provides guidance on situations of multiple islands sharing the same reef system. The Clause on Fishing in the Lagoons (Clause 11c) of the Regulation states that If a reef area boundary needs to be demarcated between two islands within a reef system that have many islands, the boundary line shall be the median line of the reef area found in between the two islands to have equal reef extents to both of the islands. Such boundary line will be demarcated by the Atoll Office in accordance with the instructions from the Ministry.

Due to the past modifications in the lagoon in the surrounding areas between the islands of Holiday Island and Maamigili, only a narrow strip of lagoon now separates the two. The average distance between the two islands have been found to be approximately 200 m. Hence, in conformity to General Fisheries Regulations a 100 m width of lagoon bottom could be dredged to obtain materials for runway extension reclamation.

3.5 REGULATORY AND ADMINISTRATIVE COMPLIANCE SUMMARY

In summary, the proponent will ensure that the project complies with all applicable environmental, administrative, and legal and regulatory statutes.

4 SURVEY METHODS

This section in brief describes various methodologies adopted in assessing the existing environment of the proposed project site, surrounding environments and the environmental impacts.

Data for assessment of environmental impact that may arise due to the proposed project were collected using methods most appropriate for specific environmental, social and economic conditions of the island and atoll environment. Interviews and questionnaires were also used in collecting information from the island.

Assessment of the existing environment was conducted using standard methods that are internationally accepted and locally practiced.

4.1 MAPPING AND LOCATION IDENTIFICATION

The location of data collection sites have been marked using handheld GPS. Figure 7 shows the data collection and sampling locations.

4.2 BATHYMETRIC SURVEY

A Bathymetric survey was undertaken using a GPS and an echo sounder. Bathymetry of the area and the surrounding area were mapped in Arc GIS and is attached in the Annex 8 of this report.

4.3 MARINE SURVEY

A visual observation was carried out and two transect lines were analysed using the Line Intercept Transect (LIT) methodology to determine the richness and density of the reef community inside the lagoon area of the proposed reclamation site.

Two transect lines of 20m length each were laid out for an estimation of the marine life abundance on site. A series of photographs were taken at each location, which were then analysed and categorized into 6 types – sea grass, branching, columnar, digitate, rubble & dead corals and sand.

The identification of fish populations was carried out by snorkelling inside the lagoon.

4.4 SURFACE CURRENTS

A Garmin GPS tracker was submerged on the surface of water and position data was logged every second to determine the current direction and its speed. Four trials were logged, from which direction and speed were calculated. The tracker was launched into the water, and the drift progress was timed between the tracker entering the water and coming out. Using tracker software these times were filtered out to calculate the velocity and current direction.

4.5 MARINE WATER QUALITY

The quality of the marine water in the proposed development site was assessed by testing water samples at location in Figure 7. The samples were tested at the MWSC laboratory. The main parameter that was tested are conductivity, turbidity and pH.

4.6 CLIMATE AND OCEANOGRAPHIC REGIME

Climate oceanographic regime requires long-term data on climate and oceanographic conditions. Such site specific climate data were not available for Himmafushi. However, National Meteorological Centre based in Hulhule which is approximately 13km from the project site collects climatic data and which

was used to predict climatic pattern expected for Himmafushi. In addition, published literature on oceanography was used to predict oceanographic conditions at the project site.

4.7 PUBLIC CONSULTATION

The baseline socioeconomic condition of the island community was assessed using existing literature and through stakeholder consultations. A scoping meeting was held at EPA with the involvement of the stakeholders. In addition, a consultation session was held at the island council office with the island council and other respective communities within the island. A questionnaire was made and asked to provide their explanations, views and concerns regarding the project to be carried. Details of the consultations are found in the respective chapter on the stakeholder consultations.

5 EXISITING ENVIRONMENT

Conditions of the existing environment of the study area were analyzed by using appropriate scientific methods as explained in the methodology chapter. Field surveys were undertaken to get further understanding of the existing environment of the island. These surveys were carried out during field visit to the island on 17 October 2015 to collect baseline data. Before the trip was undertaken all existing information regarding the site was gathered including reclamation plan. The following components of the existing environment were assessed;

- Coastal environment including coastal protection structures, long shore and offshore currents using drogue;
- Existing land use and additional land requirements;
- Socio-economic aspects;
- Marine water quality;
- Marine ecology of the house reef and fill areas; and
- Bathymetry of the project site.

5.1.1 Location Identification

The location of data collection sites have been marked using handheld GPS. Figure 7 and Table 5 shows the data collection and sampling locations. There is an extensive lagoon on the eastern side of the island with mainly sea grass with narrow reef flat connecting to the Atoll lagoon. North end of Himmafushi Island faces the channel between Himmafushi and Thanburudhoo and Girifushi at north eastern side of the island the reef edge experiences high energy waves from the open ocean. This creates a surf zone that is at times used for surfing activity. It has little impact on the island as much of the energy is dissipated at the reef edge.

Figure 7: Location of surveys (WS – sampling, T – reef transects)

Table 5: Location of the sampling.

Sample	Location
Water sample (WS1)	4°18'28.40"N, 73°34'18.09"E
Water sample (WS2)	4°18'14.76"N, 73°34'18.53"E
Marine (T1)	4°18'21.55"N, 73°34'25.32"E
Marine (T2)	4°18'12.00"N, 73°34'26.18"E

5.1.2 Bathymetry

Proposed area for reclamation was found to be very shallow with an average depth of 0.65m. The depth ranged between 0.33 – 0.70m. Bathymetric survey of Himmafushi bay area lagoon, reef by using echo sounder and a GPS. Bathymetry is attached in the Annex 8. On the southwestern side where deep lagoon occurs and identified as a potential borrow area, the depth ranged between 1.7 – 6.3m. The average depth was found to be 3.5m.

5.2 METEOROLOGY AND CLIMATE

5.2.1 Temperature

The daily average temperatures of Hulhule' rarely go above 32°C. The mean daily maximum temperature is of 30.6°C which is lower than the national average of 32°C.The mean minimum temperature for Hulhule is 25.7°C which is marginally lower than the national average of 26°C. The warm period of the year is from March to May with an average daily high temperature above 31°C. The hottest day of the year is during April with the highest record of 34°C, with an average high of 31.6°C and low of 26.7°C. The hottest month of the year is usually April reaching a peak around the last week.

The cool periods lasts from October/November to January with an average daily high temperature below 30ºC. The coldest day of the year is around mid-December, with an average low of 25.1°C and high of 30ºC. The sea surface temperature in the Indian Ocean in July 2014 is recorded to be around 29-30°C (Figure 8).

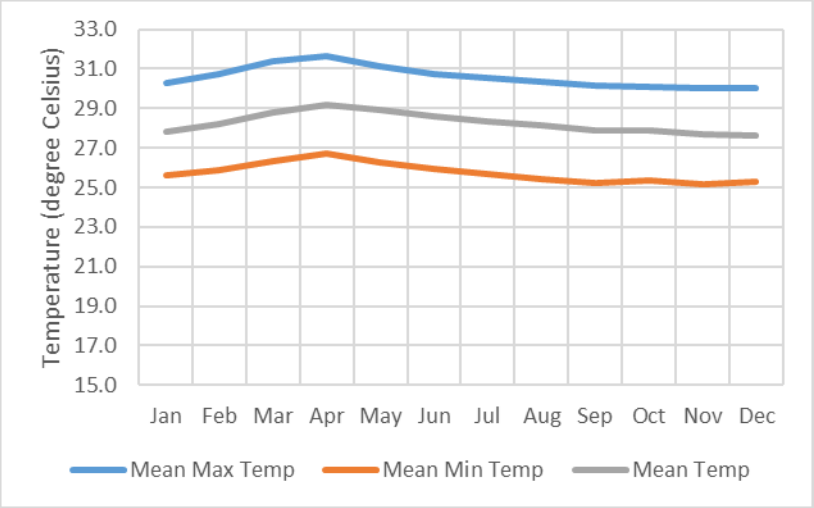


Figure 8: Variations in mean monthly temperature in Hulhule

5.2.2 Rainfall

Rainfall data for Himmafushi was obtained from the nearest meteorological station which is at Hulhule island, which is roughly 13 km southwest of Himmafushi. Analysis of the rainfall data for the 30 years (1975-2006) shows high variability from year to year with an average yearly mean of 2000mm as shown in the Figure 9.

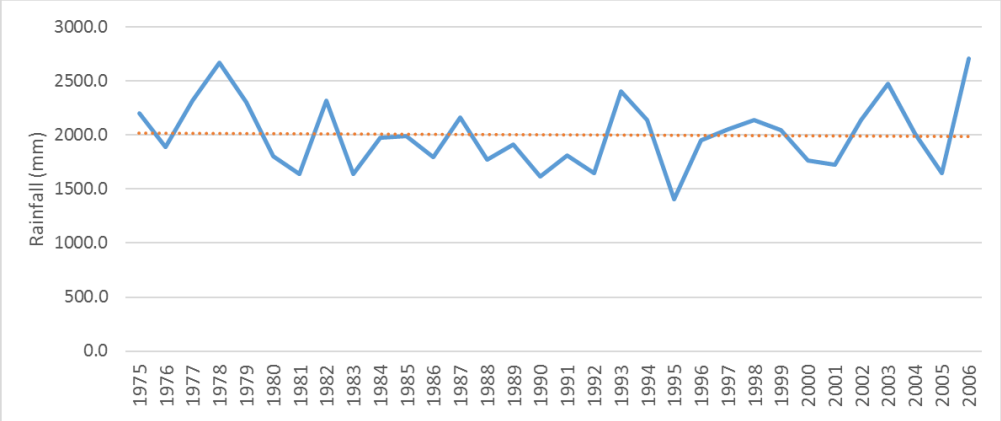


Figure 9: Rainfall data from 1975-2006

Month by month analysis of rainfall data from the 30 year climatological average shows lowest chances of precipitation for the first quarter of the year. The island receives relatively more rain in September than any other month of the year. In addition, February is usually the driest month of the year with a mean rainfall of less than 45mm. Wind and rainfall pattern expected for Himmafushi region show that the higher wind speed during southwest monsoon is coincided with higher precipitation. Since the dredging has been proposed to be undertaken during the first quarter of the year, planning for dredging should expect calmer weather conditions that may occur during the period (Figure 10).

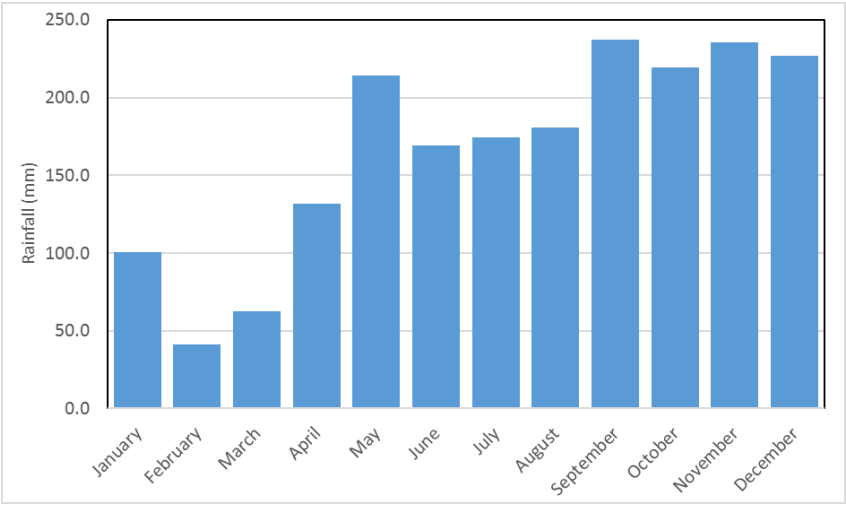


Figure 10: Precipitation rates of Hulhule

5.2.3 Wind

The wind conditions for the islands are dominated by monsoons. These winds approach with great constancy, primarily from the northeast and southwest directions. Some seasonal changes occur within

this pattern, as a result of the relative position of the sun and the earth's surface. Strong winds and gales are infrequent although storms and line squalls can occur, usually in the period May to October. Wind has been shown to be an important indirect process affecting formation development and seasonal dynamics of the islands in the Maldives. Figure 11 &12 shows the average distribution of wind direction and speed through out the year in Himmafushi region respectively.

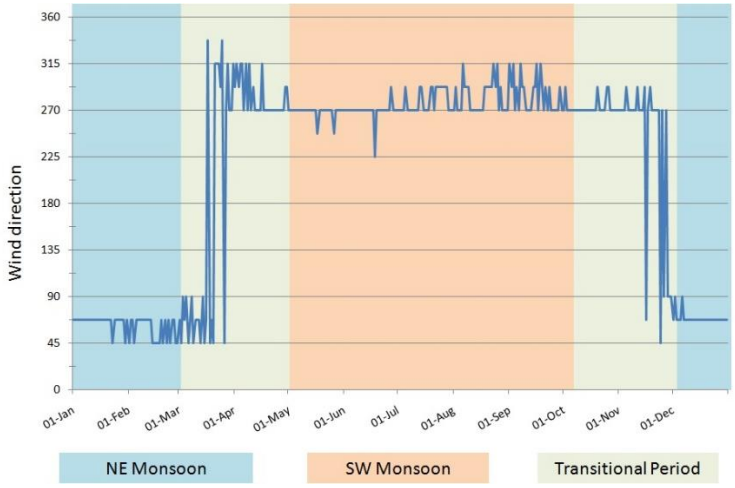


Figure 11: Seasonal distribution of wind direction throughout the year in central region of Maldives

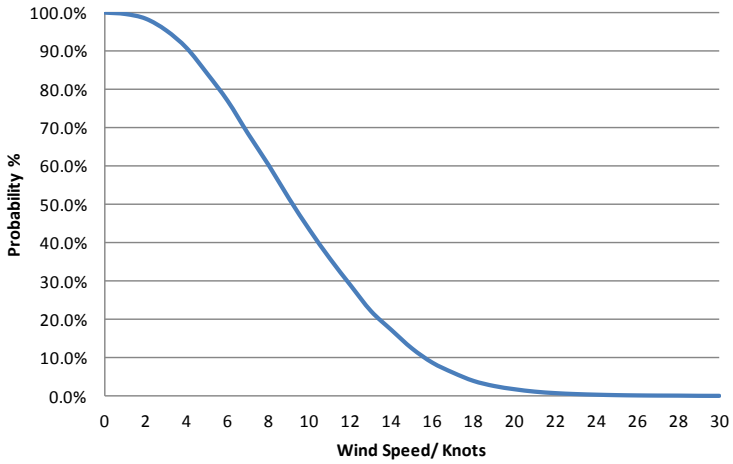


Figure 12: Probability of wind speeds in central region of the Maldives

5.3 HYDROGRAPHY

5.3.1 Tides

Tides experienced in Maldives are mixed and semidiurnal/diurnal. Typical spring and neap tidal ranges are approximately 1.0m and 0.3m, respectively. Maximum spring tidal range is approximately 1.1m. There is also a 0.2m seasonal fluctuation in regional mean sea level, with an increase of about 0.1m during February to April and a decrease of 0.1m during September to November. Like in most other atolls, semidiurnal tides are experienced in Kaafu Atoll that is two high tides and two low tides a day. The tide varies from place to place, depending on the location and on the shape and depth of the basin, channels and reefs and time of the year. Tidal variations in Maldives are presented in Table

6. In the Maldives, tides may have significantly important influence on the formation, development, and sediment movement process around the island.

Table 6: Tidal variations in Maldives

Tide Level	Referred to MSL
Highest astronomical tide (HAT)	+0.64
Mean higher high water (MHHW)	+0.34
Mean lower high water (MLHW)	+0.14
Meal sea level (MSL	0.00
Mean higher low water (MHLW)	-0.16
Mean lower low water (MLLW)	-0.36
Lowest astronomical tide (LAT)	-0.56

5.3.2 Waves

The swell and wind waves experienced on the Maldives are governed mainly by the two monsoon periods. Swell caused by cyclonic storms in the area west of Australia may also reach the southern atolls of the Maldives on occasion. The swells and wind waves experienced by the Maldives are conditioned by the prevailing biannual monsoon wind directions, and are typically strongest during April-July in the south west monsoon period. During this season, swells generated north of the equator with heights of 2-3m with periods of 18-20 seconds have been reported in the region.

Local wave periods are generally in the range 24 seconds and are easily distinguished from the swell waves. Due to the shallow depths on the reef flat, significant wave breaking (energy dissipation) will take place at the reef's edge, reducing the wave height of waves, which pass over the reef flat. A general swell forecast and swell periods are available from various weather related websites. These forecasts are very general and it does not reflect local variations in wave period and wave height (Figure 12).

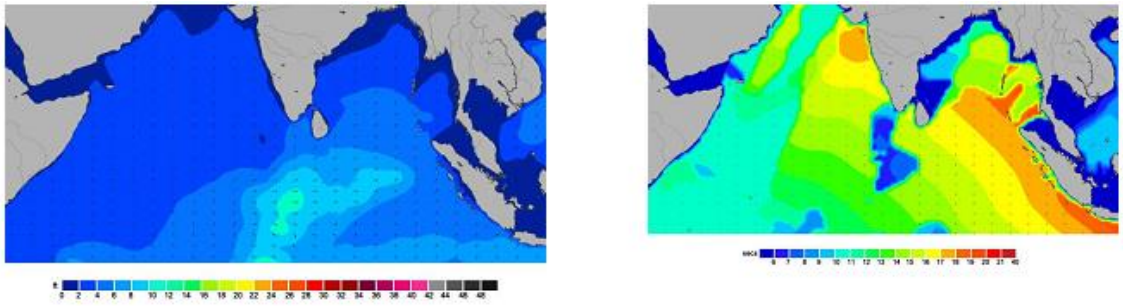


Figure 13: Generalised wave height (left) and wave period (right) prediction for the Indian Ocean (http://magicseaweed.com)

Wave data reported in DHI (1999) shows that the highest waves reaching the central Maldives are from the west direction (Table 7). Himmafushi are mainly exposed to high waves generated by swells on the western side and short wind- generated waves from the open on the eastern side especially during the northeast monsoon. However, the natural protection provided at the east of the lagoon breaks waves and disperses almost all of the energy. Thus, waves seen within the lagoon is minimal. The extent of this natural protection was seen in 2004 Tsunami. Despite tsunami originating in the east, much of its energy was neutralized at the reef edge and impact on the island was limited to a mild flooding in the eastern part of the island.

Table 7: Summary of waves conditions around Himmafushi

Monsoon	Total Waves	Long Period Waves	Short Period Waves
NE Monsoon (Dec-Feb)	Predominantly from E-S. High waves from W	From S-SW	Mainly E-NE. High waves from W
Transition Period 1 (Mar-Apr)	Mainly from SE-E	From S-SW	Mainly from NE-SE
SW Monsoon (May-Sep)	From SE-SW. Mainly from S. High waves also from W	From S-SW	Mainly from SE-S. High waves from W
Transition Period 2 (Oct-Nov)	As SW monsoon	From S-SW	From SE-W. Higher waves from W

5.3.3 Currents

The generally for an island at the edge of the atoll has higher current the side where the island faces a channel. For Himmafushi island the main atoll channel is present to the North of the island. On the south a shallow island lagoon is present between the Himmafushi and resort. Much of the wave induced waves and currents is checked at the reef edge and creates a surf zone at the reef edge. Within the shallow lagoon the currents are mild and generally dominated by the tide movement rather than wind driven current. At the site the currents were measured while the tide was rising. Higher currents were recorded at the edge of proposed reclamation site (0.20 m/s). The currents decrease considerably towards the shore. The bay makes the flow more stagnated. On average the current recorded in the site ranges from 0.07 – 0.20 m/s. Currents may increase after reclamation but taking into consideration low currents in the site and suggested shape, the change would likely be small.

Figure 14: Possible hydrodynamics modifications with the reclamation.

5.4 ISLAND MORPHOLOGY

The islands in the Maldives are typically low lying and flat, at an altitude around 1 m above MSL (Kench et. al. 2006). Composition of beach material in Himmafushi is fairly uniform around the island and consists of medium to fine grained coral sand. The western side towards the reef is exposed to strong surf wave action throughout the year. The western lagoon of Himmafushi consists of a medium to fine size sandy floor, and scattered patches of coral colonies (patch reefs).The depth of the lagoon ranges between 0.6 to 0.8 meters at mean sea level. Extensive sea grass growth and their effects on the white sandy beaches can be seen. There is no real beach due to seasonal sand movement being restricted in the bay. There are no other major problems in the existing beach areas except erosion.

Himmafushi Island has an elevation ranging between 1-1.5 m above MSL. Average finished height of the reclaimed land has been planned to be of 1.6 m above MSL. Elevation variations between old and new lands can create flooding situation when newly created land is higher than the old land. In such cases without a proper drainage system in place, it could cause significant damages to the people and properties.

5.5 MARINE PROTECTED AREAS AND SENSITIVE SITES

Although the project has not been planned in a protected area, two protected marine sites are found not so far from the project site (see Figure 15);

- *Thamburudhoo Thila*

Thamburudhoo Thila or Girifushi Thila is located between Himmafushi and Thamburudhoo Island. It is just a kilometre to the northeast of the project site. The site is popular for rich fish life; good coral cover especially soft corals and gorgonians.

- *Lankan Thila*

Located at 4° 17.133'N, 73° 32.180'E, Lankan Thila lies approximately 5km southwest of the area marked for reclamation. The site is known for sharks, napoleon wrasse, mantas, barracudas, eagle rays and coral rock formation.

Figure 15: Protected marine sites with respect to the project location

5.6 MARINE WATER QUALITY

Marine water quality has been sampled and analysed in the laboratory to establish the baseline for future monitoring during the field work. Seawater samples were obtained from the south-western side lagoon. Water quality was assessed at the Male Water and Sewerage Company's Water Quality Assurance Laboratory using standard methodologies. The comparison seawater samples from various islands shows no significant variation with regards to the existing seawater quality around Himmafushi site. It is recommended to use the monitoring data during the project implementation against the baseline information in assessing the environmental impacts. Table 8 shows the summary of the marine water quality analysis. Water sample was obtained from the lagoon from a randomly selected location. Sample was taken in a plastic bottle after washing it with seawater obtained from the same location. The sample was kept in low temperature and was delivered to the MWSC lab within 24 hrs of collection. Analysis was carried out at MWSC laboratory using certified methodology.

Table 8: Marine water quality tests

Parameters	Sample I	Sample II
Temperature (℃)	23.7	23.8
pH	8.19	8.23

Turbidity (NTU)	0.104	0.125
Salinity (‰)	34.48	34.22
TSS (mg/L)	<5	<5

5.7 COASTAL AND MARINE ENVIRONMENT

Himmafushi is found on a reef system that includes two other islands to the south that is currently in use as resorts. The house reef facing the open ocean (in the east) extends approximately 4.5 km. This reef edge is exposed during low tide. To east of the reef edge depth increases dramatically to excess of 1000m depth in the open ocean. Towards the island there is a shallow lagoon of with few feet of water extend till the shore. In some area the shallow lagoon is exceeds 700m width between house reef and shore. On the west side of Himmafushi the lagoon is deeper with depths exceeding 20 ft. In the west, we find the harbour and therefore there is some artificial deepening of the lagoon done. It is also important to note that the harbour and currently used for communal purposes on the western side had been reclaimed. In the south of the island with in the lagoon a sharp gradient of with the depth of lagoon shallowing from 22ft to 1.5 ft with in 10 m lateral distance. On the north, there is a shallow lagoon extending 200-250 m to the reef edge. Beyond the reef edge is deep channel with strong current and depths exceeding 30 m. The reef system includes sea grass environments, patch reefs and vary large shallow lagoon environments.

5.7.1 Reef Surveys

Visual observations showed there were minimum coral coverage throughout the site, with dispersed coral blocks and sea grass patch distributions. Higher numbers of these scattered coral blocks were found in closer proximity to the reef edge, although in relation to the total size of the lagoon, these were minimum. It was generally observed that both the transect lines comprised mostly of sand. The low percentage of live cover that were present comprised mostly of sea grass and branching, columnar and digitate coral forms (see Figure 16 & 17).

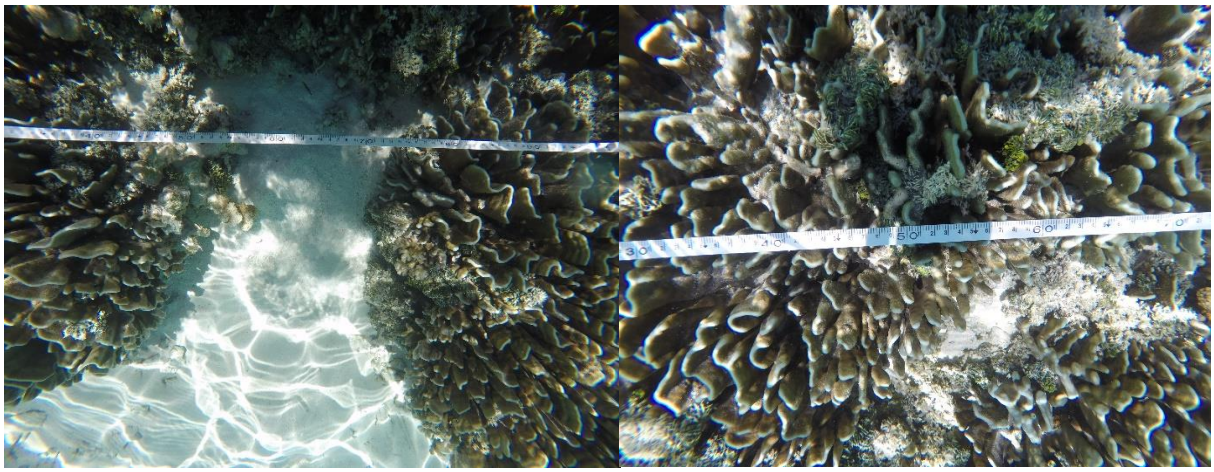


Figure 16: Images showing types of corals found on the transect 2(T2)

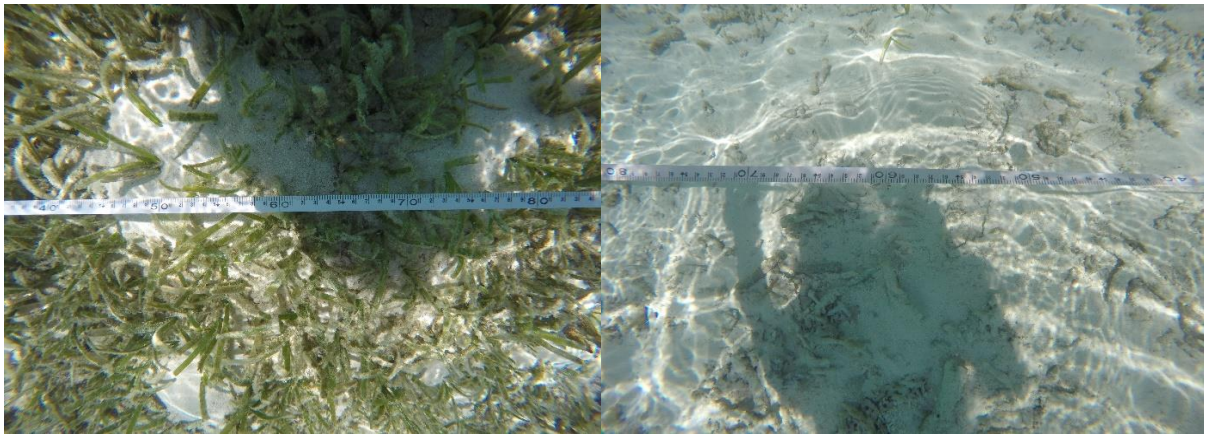


Figure 17: Images showing sea grass and sand, which dominated, the transect 1 (T1)

In transect 1, roughly 74% of the total transect length was covered by sand. About 15% was covered by sea grass (GR) and 9.5% was rubble and dead corals. Small areas of digitate and columnar coral coverage were also present, in that columnar accounting for 1.1% and digitate growth forms accounting for just 0.4% of the total transect length.

Transect 2 was laid close to the reef edge, where a relatively higher proportion of live corals were observed. Sand (SA) accounted for approximately 63% and rubble and dead corals (DC & RB) accounted for approximately 6% of the total transect length. Among the live corals observed, columnar corals (CO) accounted for 28%, branching coral forms (BR) covered approximately 1.7% and digitate coral forms (DI) approximately 1% of the total transect length (Figure 18).

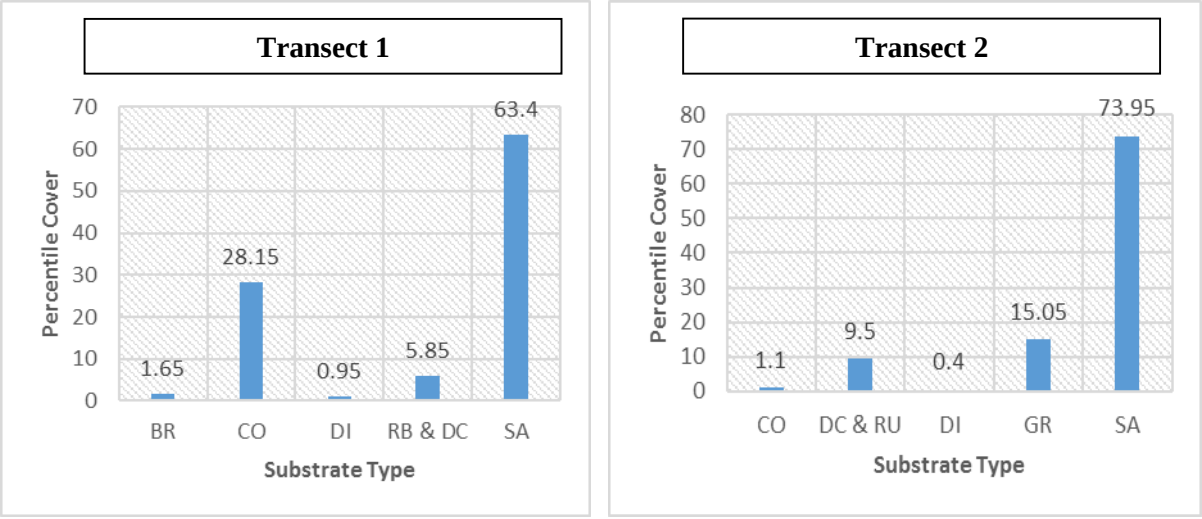


Figure 18: Graphic representation of the results of the two transects.

5.7.2 Coral Reef Fish Visual Census

The bundance and diversity of fish species observed in the lagoon area were relatively low with the fish population mainly consisting of juveniles. Observed species include fishes in the families of Chaetodontidae (butterfly fishes), Heniochus acuminatus(banner fishes), Acanthuridae (surgeon fishes), Pomacentridae(damsels), Labridae(wrasses), Caesio teres(fusiliers), Plectorhinchus (sweetlips),

Tetradontidae(pufferfishes) and Ostracion cubicus (box fishes) which are all commonly found in the Maldivian waters.

5.8 TERRESTERIAL ENVIRONMENT AND VULNERABILITY TO FLOODING

The coastal vegetation on the northern border of reclamation site is minimal. This region is reclaimed land and vegetation is scarce except for one or two kuredhi (*Pemphis acidula*) trees. On the western border of the site there is little distance between the shore line and vegetation line. The vegetation here is dominated by high saline resistant vegetation like Magoo (*Scaevola taccada*). There extends small wetland area to the north west of the site limiting use of land for any purpose. Beyond that towards the center of island we find larger trees including a handful of coconut palm. However, these trees were considerably far from the site (Figure 19).

Currently the wetland area is low lying in relation to the rest of island, it gets flooded in heavy rain. There is little human activity nearby and causes no direct problems due to flooding. However, the stagnation of water provides a breeding ground for mosquitoes. This is a concern for islanders and have suggested back filling of the area during the reclamation. Other thing to note is there exist a revetment protection on the northern border of proposed reclamation site. This was put in there after the reclamation work done to expand rehabilitation facilities on the island.

There is no historical record of flooding being reported in Himmafushi. The island remained unaffected during the storm swell events of 1987 and 2007 that saw flooding in many islands in the country including the capital Male'. The 2004 tsunami only lead to mild flooding in the eastern part of the island. The natural protection provided by the shallow lagoon and exposed reef flats negates much of the wave action on the eastern side of the island.

Figure 19: Coastal vegetation found along the shoreline of proposed reclamation site

6 SOCIOECONOMIC ENVIRONMENT

6.1 BACKGROUND

Male' Atoll also known as K. Atoll consists of geographically two separate atolls; North Male' Atoll and South Male' Atoll but for administrative purposes it is considered as a single Atoll. The capital of the Maldives is naturally located within the North Male' Atoll but administratively not considered part of the Atoll. The atoll capital is Thulusdhoo Island, which is situated in the North Male Atoll region. Thulusdhoo is approximately 11.4km to the northeast of Himmafushi. The Secretariat of the Atoll Council coordinates the functioning of the respective Island Council Secretariats.

Of the 09 inhabited islands found in the atoll only 03 islands are situated in the South Male' region; Gulhi, Maafushi and Guraidhoo while all other inhabited islands are found in the North Male'

The 09 inhabited islands of the atoll has in place almost all basic services. These include; 24-hour electricity, transport, water and sanitation services, basic health facilities, harbour facilities, schools, tourist services and police services. Except for two islands, the rest of the inhabited islands lack banking services and no island has legal services available. Himmafushi has almost all basic services established on the island.

6.2 POPULATION

According to the census (2014), the atoll has a total local population of 12,166 people which also registered an increase of 20% in population compared to the previous census carried out in 2006. Of the total population, 6,777 are males while, 5,389 are females. The total population living in the atoll is registered to be 14,092 including the foreigners.

According to census enumerated population, Male' Atoll is among the two atolls with the highest foreign resident population and the other being Addu Atoll (NBS, 2015). Of the 1926 foreigners in the atoll 1788 are males and 138 are females.

Population distribution among the 09 inhabited islands of the atoll are shownThe total population of Himmafushi is 1725 with 861males and 467 females according to the census of 2015.Table 9 shows the population census of the island.

Table 9: Population census Kaafu atoll

		Total			Maldivians			Foreigners		
Atoll	Island	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
K	Kaashidhoo	1,865	960	905	1,715	821	894	150	139	11
K	Gaafaru	1,066	569	497	1,010	519	491	56	50	6
K	Dhiffushi	1,053	548	505	966	467	499	87	81	6
K	Thulusdhoo	1,408	811	597	1,127	552	575	281	259	22
K	Huraa	1,300	758	542	1,014	495	519	286	263	23
K	Himmafushi	1,725	1,241	484	1,328	861	467	397	380	17
K	Gulhi	912	523	389	831	447	384	81	76	5
K	Maafushi	3,025	2,140	885	2,606	1,753	853	419	387	32
K	Guraidhoo	1,738	1,015	723	1,569	862	707	169	153	16

While Maafushi has the highest population, Himmafushi has the fourth highest population in the atoll. Population of Himmafushi accounts for 11% of the total atoll population (see Figures 20).

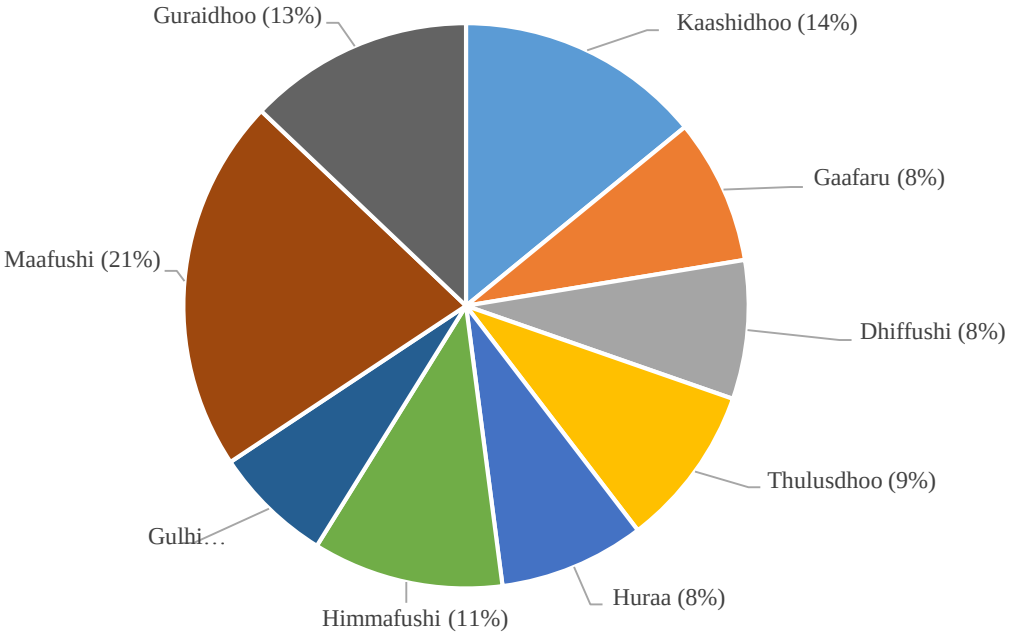


Figure 20: Distribution of local population in K. Atoll

6.3 EMPLOYMENT & LOCAL ECONOMY

The island has high level of industrial activities including a bottling factory, a slipway as well as a fish processing plant. The island houses the drug rehabilitation center located at the East to which residential activity is restricted.

Tourism plays a significant role in the local economy of the region. In addition to the large number of tourist resorts in Male' Atoll, guesthouses are increasingly becoming an important economic activity in Himmafushi. Gilli Lankan Fushi and Paradise Island Resort are situated in the house reef of the Himmafushi. In A good number of guesthouses and luxury hotels operate on the island with providing various excursions, including, snorkelling, fishing, water sports, and picnic island excursions. Large souvenir boutique shops also operate on the island. The guesthouse business is thriving on the island due to its close proximity to famous surf and dive points.

Due to its close proximity to Male' and well established tourism related businesses thriving on the island has provided ample opportunities for the local community. Local unemployment is virtually non-existent and crime rate on the island is extremely low.

These activities although provides jobs to the local community also takes up a large amount of land. To cater for these needs, reclamation on the island has been carried out at the west and southwest of the island's peninsula to expand the rehabilitation centre. Despite these expansions currently, there is no more land to expand either residential area or the industrial activity. On top of that, island faces erosion at northern shore, which is adversely affecting residential area including some community purpose buildings.

6.4 TRANSPORT

Himmafushi has good transport connectivity from nation's capital Male'. Public ferryboats makes daily trips between Male and Himmafushi on a regular basis. Ferry boats takes approximately 50minutes to reach the island from Male'.

6.5 WASTE MANAGEMENT

Waste management system is not particularly well developed on the island. As a general practice, waste generated on the island is dumped at a designated location and transported to Thilafushi. The only final waste disposal site that exists in the Maldives being located in the atoll is an advantage for Himmafushi to lift their residual waste which is Thilafushi.

6.6 WATER AND SEWERAGE

Safe drinking water is available on all islands and a sewerage network has been planned to be developed on the island.

6.7 PUBLIC SAFETY

The island has police service established and the crime level in the islands is considered very low.

6.8 HEALTH

Basic health services are available on the islands. Health Centre provides limited diagnostic service. Pharmacies are also established on the island. For those treatments that are not available on islands those in need travel to Male'.

6.9 EDUCATION

The island has a functioning school providing education up to GCSE O' Level.

6.10 ELECTRICITY & COMMUNICATION

24hrs electricity and telecommunication services are available on the island.

7 STAKEHOLDER CONSULTATIONS

The key stakeholders of the project are the Himmafushi community, island council, Ministry of Housing and Infrastructure, Environmental Protection Agency, Proponent Contractor. The stakeholders that participated in the Scoping Meeting held at EPA, had discussed on the various aspects and issues relating to the project. At the time of scoping, Proponent has not hired a contractor for the project and therefore were excluded from stakeholder consultation.

7.1 METHODOLOGY

The stakeholders were explained briefly about the project. A set of standard questions were put to the stakeholders. The questions were framed about the current issues they have socially, economically and environmentally. In addition they were asked about the concept of the project and how the proposed solution will solve their raised concerns.

7.2 SCOPING MEETING

The Scoping meeting was held on 30 August 2015 at EPA. The meeting was attended by the following institutions:

- Ministry of Housing and Infrastructure
- Himmafushi Island Council
- International Beverages Company Pvt Ltd

After a brief overview of the project given by the EIA Consultant, the discussions were carried out mainly on the reclamation options and issues and impacts of the proposed project. EPA noted the need to identify the cumulative impacts on the hydrodynamics from reclamation.

7.3 MEETING WITH MINISTRY OF HOUSING AND INFRASTRUCTURE

Ministry of Housing and Infrastructure is the proponent of the project and one of the critical stakeholders with the government. They are responsible for the housing aspects of the general public. Specific information regarding the project was provided by the Ministry. To abide by those restrictions, they will be planning the new land plot when allocating the land plots. Since they have been carrying reclamation projects in the past, they have wealth of experience with such projects and the environmental concerns, which is addressed in this EIA and would be abide by that.

7.4 MEETING WITH INTERNATIONAL BEVERAGES COMPANY PVT LTD

Meeting was held with the International Beverages Company Pvt Ltd who is producing bottled water under the brand name “Life” at Himmafushi. Their factory is located rather close to the area proposed for reclamation. Their main concern was to see if there would be any impact on their inlet. Currently their inlet is through a borehole mechanism and hence, it was clarified to them that the impact on the inlet would be nil as a result of the reclamation. However, it was noted that their outlet pipe falls within the lagoon area proposed for reclamation. The Company was supportive of the project and stated that the outlet could be re-located to avoid any disruptions to their operations.

7.5 MEETING WITH THE ISLAND COUNCIL

Island council are the representatives of the island community who are the direct beneficiaries to the project. Council informed the proposed reclamation was indicated in 2008 to the community, however got delayed due various reasons. With the inclusion of this project in Government budget, the community was consulted and community found the project extremely favourable. They highlighted key issues the island is facing and provided information on the ongoing development activities on the island. They indicated that currently the slipway is in the process of being lease for operation and future

plans of upgrading the power system in the island. Key issues they indicated was the lack of space and the enhanced erosion that they are experiencing on the northern side near the football stadium. They also highlighted that currently they are unable to allocate residential plots due to scarcity of land. They highlighted the dire need of reclamation of the island.

They highlighted that it would provide land necessary for residential plots and future economic activities, most notably potential of hospitality industry with a focus towards surfer community. In raising the potential issues due to reclamation, they indicated that currently the reclamation site is used for recreational activities like swimming and fishing. They also indicated the need to relocate the waste management site to an alternative location. They informed that detailed development and land use plan will need to be developed in consultation with Ministry of Housing and Environment. The council raised issues with potential dredging with in the island lagoon as given as option 2. They feared potential enhancement of erosion as well as possible disturbances it might have to the Gili Lankan Fushi operations.

They indicated few other works which they would like to address during the reclamation project. First is to fill in the eroded area on northern part of the island near the football stadium and provide a more holistic coastal protection that would address the erosion on the North as well. Secondly, they would like to backfill the small wetland area just adjacent to current waste management site. Overall, the island community was looking forward to the potential opportunities the reclaimed land would present to them.

8 IMPACTS AND MITIGATION MEASURES

8.1 BACKGROUND

Developmental projects involving coastal development and coastal modification in island environments are considered to generate a various levels of environmental impacts, some of which can be felt on the immediate environment and some impacts can be cumulative. Marine environment is directly affected from changes in coastal morphology and hydrodynamics due to coastal modification from dredging and reclamation projects. Coral reefs are very vulnerable to changes water quality brought about by sedimentation in particular. As this is a coastal development project, majority of the impacts of the project are expected during the construction stage. Therefore, during the scoping, designing of the project activities and field surveys, consideration must be given to minimize the impacts felt on the environment. This chapter describes in detail the potential environmental impacts and measures proposed to mitigate the impacts arising Himmafushi reclamation works both during construction and operation phases of the development.

8.2 METHODOLOGY, NATURE AND IDENTIFICATION OF IMPACTS

Following data analysis and literature review and stakeholder consultations, a system called Rapid Impact Assessment Matrix (RIAM) was used to determine the impacts. RIAM methodology as described in detail by Jensen *et al* (1998) brings together the individual multi-disciplinary parts of an EIA in a transparent and semi quantitative manner. This methodology has been found be effective for EIA involving coastal development projects.

The process of defining the components, which are of importance in evaluating the possible changes due development, is called scoping. In the RIAM these components are considered in a holistic manner and fall into four groups. These groups represent the issues relating to the Physical/Chemical environment (P/C); those relating to Biological/Ecological (B/E) concerns; human issues defined as Social/Cultural (S/C); and issues dealing with the Economic/Operational (E/O) aspects of development.

In the RIAM analyses, all problems are analysed according to five characteristic criteria. Two criteria relate to properties that are of singular importance to the condition, and three criteria to properties that are of value to the situation. The first type of criteria is the importance of the condition, which is assessed against the spatial boundaries or human interests it will affect; and the magnitude, which is defined as a measure of the scale of benefit/dis-benefit of an impact of a condition.

For the importance of condition (I) the scale is defined as:

4 = important to national/international interests
3 = important to regional/national interests
2 = important to areas immediately outside the local condition
1 = important only to the local condition
0 = no importance

For the magnitude of a change or effect (M) the scale is defined as:

+3 = major positive benefit
+2 = significant improvement in status quo
+1 = improvement in status quo
0 = no change/status quo
-1 = negative change to status quo
-2 = significant negative dis-benefit or change
-3 = major dis-benefit or change

Criteria that are of value to the situation are defined as permanence, reversibility and cumulative properties. Permanence defines whether a condition is temporary or permanent, e.g. an embankment is a permanent condition even if it may one day be breached or abandoned, whilst a coffer dam is a temporary condition, as it will be removed.

Reversibility defines whether the condition can be changed and is a measure of the control over the effect of the condition.

Cumulative property is a measure of whether the effect will have a single direct impact or whether there will be an accumulated effect over time, or a synergistic effect with other conditions. See (Table 10 &11 for details).

Table 10: The scale used for the criteria that are of value to the situation

Score	Permanent (P)	Reversible (R)	Cumulative (C)
1	No change/not applicable	No change/not applicable	No change/not applicable
2	Temporary	Reversible	Non-cumulative/Single
3	Permanent	Irreversible	Cumulative/of indirect effect/synergistic

Table 11: Environmental classifications according to RIAM

Environmental classification (ES)	Value of the class	Value of the class (numerical)	Description of the class
72 to 108	E	5	Extremely positive impact
36 to 71	D	4	Significantly positive impact
19 to 35	C	3	Moderately positive impact
10 to 18	B	2	Less positive impact
1 to 9	A	1	Reduced positive impact
0	N	0	No alteration
-1 to -9	-A	-1	Reduced negative impact
-10 to -18	-B	-2	Less negative impact
-19 to -35	-C	-3	Moderately negative impact
-36 to -71	-D	-4	Significantly negative impact
-72 to -108	-E	-5	Extremely negative impact

The assessment of the different problems that have been selected for evaluation by the scoping process gives a value ascribed (by the consultants) to each of these criteria. By the use of a simple formula a score (the environmental score) for the individual components was calculated:

$ES = I*M*(P+R+C)$

To use the evaluation system described, a matrix of cells showing the criteria used, set against each defined component, is produced for each project option. From the formulae given above each ES number is calculated and recorded. To provide a more certain system of assessment, the individual ES scores are banded together into ranges where they can be compared. The ranges cover impacts from a major positive change/impact (+5/E) to similarly negative effect (-5/-E). Conditions that have neither importance nor magnitude will score a zero and be banded together (0/N); and any condition in this band is either of no importance or represents the status quo, or a non-applicable situation.

In order to present the data in the RIAM, it was necessary to covert the classification format of the environmental impact study, in the RIAM format. Following that the different phases of the project were identified. Then from the impact assessment rating for each components were introduced.

Graphical presentation of the results according to categories for the Phase of Construction and Operations are shown in Figure 21 and 22 respectively.

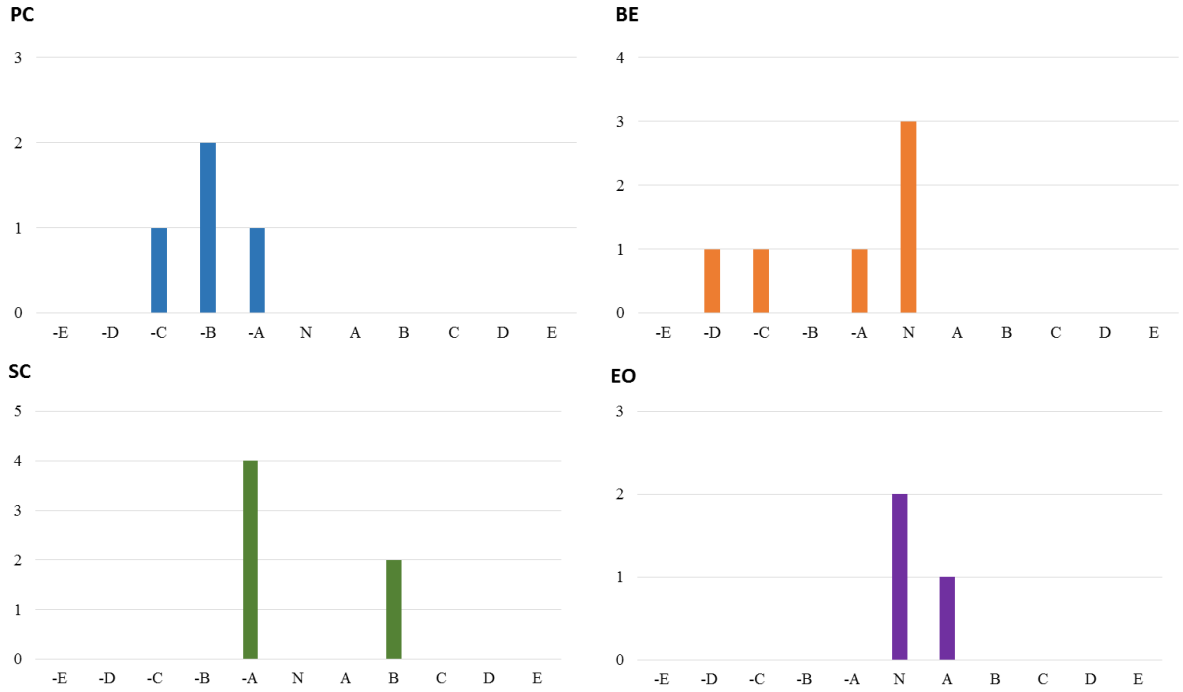


Figure 21: Graphical presentation of the results according to categories for the Phase of Construction

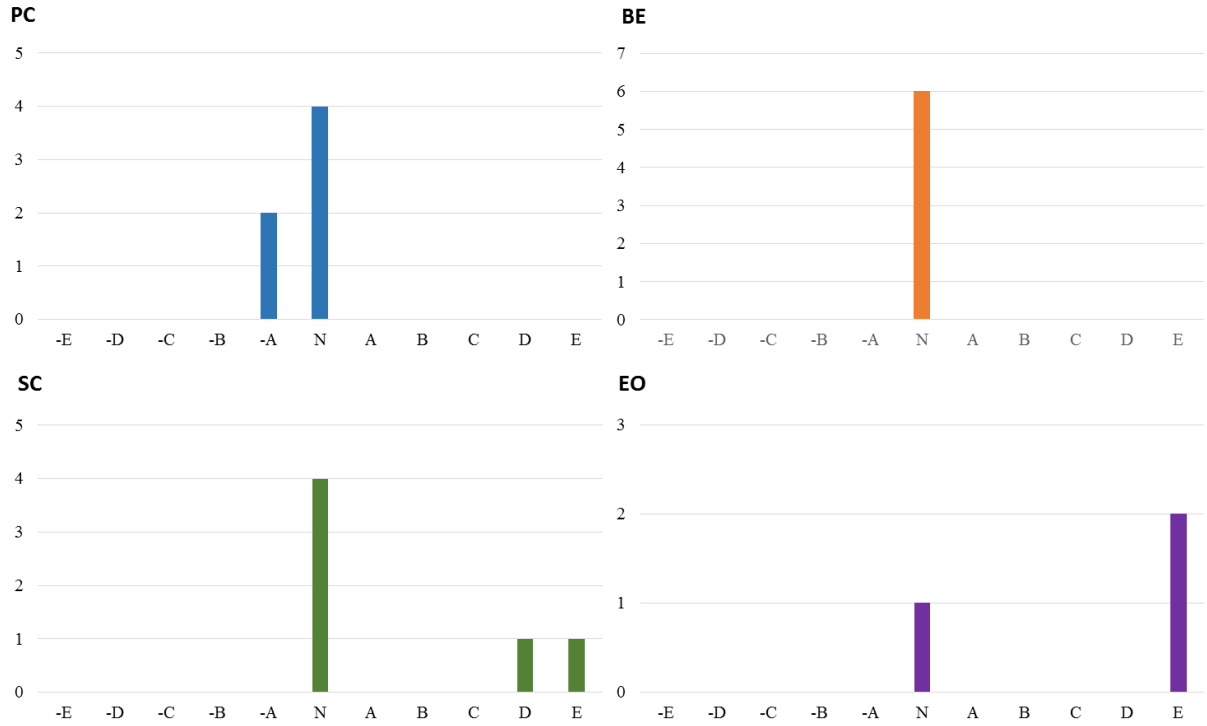


Figure 22: Graphical presentation of the results according to categories for the operational phase

8.3 POTENTIAL ADVERSE IMPACTS ON THE ENVIRONMENT

8.3.1 Construction Phase

8.3.1.1 Physical and chemical category

In this category, the following parameters have been analyzed: coastal morphology, hydraulic conditions, water quality, natural disasters, and pollutants. RIAM indicates that in this category and in this phase, there are four types of impacts, being, however, all of them negative: coastal morphology, hydraulic conditions, water quality and pollutants. Each of these negative impacts and mitigation measures are discussed below.

Coastal morphology

The coastline on the westerns side of the island will be permanently altered due to the proposed reclamation. It should however be noted that the island's coastline had undergone various changes in the past following reclamation, harbour construction, coastal protection, dredging etc. Changes in the coastal morphology will be the most dramatic of the impacts of the project and this impact will be inevitable so long as it is a land reclamation project. The impact is considered less negative due to its localised nature.

Mitigation

- Mitigation would require long term monitoring of the island's coastline to see erosion and accretion pattern changes because of the reclamation.

Hydraulic conditions

There are no studies conducted in Maldives, to assess the impacts of dredging and reclamation on the coastal dynamics. But based on experiences and from large reclamation projects carried out in Hulhumale' and Gulhifalhu, general observations confirm changes in the current patterns around the dredged area, where the currents get stronger. It is expected, the same might happen to the borrow area, when certain locations of the lagoon area get deeper from dredging thus decreasing the energy of the waves.

The proposed reclamation site currently experiences low hydrological flow but due to shallow bathymetry, it carries sediments along the shore leading to erosion at the western boundary of the bay and some accretion at the northern boundary of bay. The reclamation would lead to slight increase in hydrological flow in the south of the island between the resort and Himmafushi. This does increase the risk of erosion at the newly reclaimed site and possibly at the north-eastern corner of Himmafushi.
The impact on current regime of the marine environment in the area is unavoidable. The reclaimed areas may be prone to erosion from tidal fluxes due to coastal margin moving closer to the reef crest there by leaving little lagoon space for the wave energy to dissipate.

Overall, the impact on the hydraulic condition is considered less negative impact by RIAM assessment.

Mitigation

- The effect on hydrological conditions around Himmafushi reef platform can be almost completely avoided by choosing to borrow sand from North Ari region (the preferred site) where there are no islands close by.
- Installing proper beach protection on the reclaimed areas of Himmafushi by means of rock boulders.
- Long-term monitoring of changes to the current flow pattern following reclamation would be necessary.

Water quality

Any accidental spill of oil and toxic substances from any machinery and heavy vehicles used during the project works would contaminate the marine environment. If the waste oils/toxic substances from machinery are not managed properly in site, it may end up in the marine environment and on the ground water lens of the island, from the vehicles managed on existing land. The island houses one of the largest water purification and bottling plants owned by International Beverages Company and the product is available to islanders at retail cost. However, islanders do depend on the groundwater for non-potable purposes. Any contamination to water aquifer from the project activities should be avoided at all stages of the project. The following mitigation measures would be used to avoid impacts on marine and groundwater of the island.

The impact on water quality is considered less negative impact.

Mitigation Measures

- The vessels and machinery used in the construction face should be fitted with wastewater collecting equipment to avoid the waste seeping into the ground or marine environment.
- The residue waste from the construction activities would be sorted on site and taken to the designated waste management site of the project.
- Machinery service would be done on concrete to reduce the spilling of oil and lubricants to the soil.
- All proper best practices should be strictly adhered and are should be taken not to dump anything to the marine environment of the project site and regular visual surveys would be undertaken.
- The machinery, vehicles and vessels should be regularly maintained.
- Machineries and equipment shall be regularly serviced to avoid breakages and accidental spills.
- The work should be properly supervised by a site supervisor.

Pollutants

At the reclamation site bulldozers and excavators would be working non-stop producing noise which may be unacceptable to sensitive people. Although the local population of Himmafushi may raise it as an issue, the tourists both in Himmafushi and Gili Lankanfushi may find it troublesome. Similarly light pollution from project site during night may also become an issue for some people. During westerly monsoon, the effect of noise may be relatively worse off due to wind blowing towards the island.

As the work environment would be in an open marine environment, the air pollution generated by the emission from vehicles and other machinery is expected to be minor to nil. With proper mitigation measures, best practices and site supervision and monitoring, the impacts from air and noise from project activities would be insignificant.

Pollution arising from littering and careless disposal of solid waste can pollute the environment and may be harmful for marine organisms. Currently Himmafushi has no proper waste management. Hence, there is also the possibility of the project waste burdening the existing waste disposal arrangements.

Overall, the effects of pollution is considered moderately negative.

Mitigation

- Waste generated from the construction activities shall be stockpiled in a designated area at the project site for transfer to Thilafushi.
- A paved area within this will be designated for hazardous waste such as waste oil, used batteries, chemicals, etc. These wastes will be placed in a separate container that is enclosed.
- Waste material arising from the project activities shall not be allowed to burden Himmafushi's existing waste management system.
- All residual solid waste and all hazardous waste will be regularly transferred to Thilafushi placed in a boat.

- All vehicles shall be regularly serviced to enhance their efficiency to minimise emission
- Work shall only be carried out during day time to avoid noise and light disturbance to guests
- Proper information shall be communicated to the Gili Lankanfushi and guesthouse on Himmafushi regarding the reclamation project.

8.3.1.2 Biological and ecological category

In this category, the following parameters had been analyzed: coral reefs, seagrass beds, mangroves, endangered species, sedimentation/eutrophication and terrestrial ecosystem. The RIAM indicates that in this category and this phase there are three types of impacts: significantly negative impacts for coral reefs, less negative impacts for seagrass and moderately negative impacts due to sedimentation/eutrophication.

Coral reef

Dredging and reclamation cause adverse impacts on reef and lagoon ecosystems, and it is inevitable that physical and biological content of a reef system including the lagoon to have adverse impacts.

Lagoon bottom is a habitat to benthic organisms such as worms, mollusks, amphipods, crustaceans, etc, which are important food sources for reef fish communities. The main damage would be to the seabed from sand mining by TSHD due to direct removal of benthic communities and habitats. However, when the dredging is over or when the disturbances ends, the lagoon dwelling organisms would re-establish themselves in the area.

Sedimentation, silt deposition on coral colonies, other benthic organisms at the receiving environment of borrow materials (areas proposed for reclamation) would lead to very significant changes in the biotic composition and sometimes lead to the death of the reef in the outer atoll. This is due the fact that coral and algae from a coralline reef ecosystem are very sensitive to change in environment and would suffer immediately from sedimentation. The reclamation to enlarge the island would result in permanent loss of lagoon and lagoon space that is reclaimed. However, since the reclamation is limited to the lagoon in the bay area of Himmafushi, the affect on the outer reef areas is expected to be less severe but if uncontrolled sediments can settle on reef substrate. It is expected, after the sediments settle down, corals and other related marine life are expected to resettle.

After studying the marine environment and current patterns in the project area, a primary impact zone was identified for the marine environment during the construction phase (Figure 24). During the reclamation phase, significant amount of sediment is expected to be suspended and carried to the south towards Gili Lankanfushi and to east to the deeper part of the lagoon by tidal currents.

Figure 23: Primary impact zone (yellow line) and secondary impact zone (red line) due to sedimentation during reclamation

As a result of dredging and reclamation and consequential and cumulative impacts on the physical and biological environments, a large number of baitfish, reef fish and other marine organisms are likely to be impacted. It should be noted that of the two protected areas in close vicinity, Thamburudhoo Thila is particularly close to the project site. Although the island "peninsula" will to a large extend act as a barrier to sediment movement towards north to impact Thambrudhoo Thila, a strict monitoring should be in place to ensure sediment level outside the house reef of does not exceed a pre-determined level.Although Lankan Thila is further away compared to Thamburudhoo Thila from the reclamation area, sediment impact cannot be completely ruled out if sediment is uncontrolled. These protected sites are particularly important at national level as well as island. The protected marine sites are known attract a significant number of tourists to the island guesthouses and are considered significant sources of revenue for the community.

Mitigation Measures

- Corals that can be manually removed from dredging and reclamation areas shall be removed and re-planted in an unaffected area.
- Other measures prescribed in Section shall apply to mitigate negative effects on corals and marine environment.

Sea grass beds

Seagrass areas in the Maldives are not considered significantly important ecosystems. They are commonly considered unsightly and a marine weed. Often very few marine species are observed to be associated with sea grasses in the Maldives. Similarly, during the filed investigations at Himmafushi lagoon where sea grass were found very few species were observed. On the other hand, past aerial photos of the lagoon area of Himmafushi shows progressive expansion of seagrass area as shown in Figure 24. Although a significant area of the existing seagrass will be permanently lost as a result of reclamation, due to its low importance, loss of seagrass is considered a reduced negative impact.

Mitigation

N/A

Figure 24: Sea grass progression in the lagoon of Himmafushi

Sedimentation and turbidity

During dredging and filling the area proposed for reclamation, a significant amount of siltation and sedimentation to the lagoon area is expected, leading to increased level of turbidity in the water column. Excessive sedimentation, this may cut sunlight reaching the benthic animals and may affect the health of live coral cover in the reef areas. When sediments settle on corals and other benthic organisms it can cause smothering and may even cause mortality. The sedimentation impacts would depend on the sand grain size and the distance to the coral reefs. Sedimentation plumes in the sea are distinctly identifiable and can create a negative perception. Proposed area for reclamation is beleieved to be more sensitive to sedimentation compared to borrow area, due to the fact that Himmafushi is located close to protected areas as well as its house reef is shared by two tourist resorts. Overall effect of sedimentation and turbidity is considered moderately negative impact from RIAM assessment.

Mitigation Measures

- Reclamation shall be carried out carefully by monitoring the sediment plume movement. All measures should be in place not to cause sedimentation in the lagoon space belonging Gili Lankanfushi. In this regard, turbidity barriers either in the form of silt screens or sand bund shall be used as demonstrated in Figure 25.

Figure 25: Proposed sediments control barriers

- In cases where relatively quiescent current conditions (0.06m/s or less) are present, turbidity levels in the water column outside the curtain can be 80 to 90 percent lower than the levels inside or upstream of the curtain. While there may be a turbid layer flowing under the curtain, the amount of suspended material in the upper part of the water column, as a whole, is substantially reduced. The currents measured in the lagoon showed moderate currents speeds between 0.12 ms^{-1} and 0.16 ms^{-1} at the proposed reclamation site implying during normal weather, silt curtains can be an effective sediment control. However, the effectiveness of turbidity barriers can be significantly reduced in high-energy regimes characterised by currents

and turbulence. If the reclamation to continue even during rough weather conditions sandbag barriers shall be considered.

- Restrict dredging and reclamation to the areas specified and not to go beyond it;
- Controlling sediments shall be given the highest priority at outside boundary of reclamation area bearing in mind that there is no legislation in the Maldives with regards to permitted levels of turbidity. It is proposed once the reclamation boundary is established under the project's monitoring program to set up geo-referenced monitoring stations just outside the boundary of the reclamation boundary. In this regard, at least 5 monitoring stations shall be set up. Samples is to be taken at a depth of 3 feet from the surface at each station and at a frequency of at least once a day during the dredging operations. Nephelometric Turbidity Units or NTU's so that during construction, the turbidity level to be maintained below 29 NTU's against the associated background turbidity levels as prescribed in the Monitoring Section. Measurements will be taken prior to commencing dredging in order to determine the background turbidity level whilst turbidity is affected movement of vessels in the harbour. The pre-determined limit of turbidity levels at the compliance stations will therefore be [background turbidity] + 29 = [upper limit for turbidity] NTUs. Measured average turbidity levels at the time of the EIA study was found to be 0NTU hence it would be acceptable to take the upper limit as 29 NTU. If monitoring reveals turbidity levels at the compliance sites in excess of the limit of 29NTUs or the background measurements, whichever is higher, construction activities shall cease immediately and not resume until corrective measures have been taken and turbidity has returned to an acceptable level. Any such occurrence shall also be immediately reported to the Project Manager.
- Complete the project within the shortest time possible by putting in place measures to avoid idle time;
- There should be daily supervision by the contractor of the work progress and the work force should be properly trained on environmental awareness and best practices.
- With regards to the borrow areas, as the borrow sites are towards atoll-ward side, prior information should be given to nearby resorts and the marine transport operators about the dredging locations and when the dredger would be in operation.

8.3.1.3 Sociological and cultural category

In this category, the following parameters had been analyzed: aesthetic and cultural value, income, fishery, recreational value, employment and public health and safety. The RIAM indicates that in this category and this phase there are six types of impacts, of which aesthetic and cultural value, fishery, recreational value and public health and safety all have reduced negative impact while income and employment have less positive impact.

Aesthetic and cultural values

Overall the impacts on aesthetic and cultural values due the project is considered to be slightly negative. Reclamation has been proposed on the beach and in the near shore areas where locals and tourists have free access to. The natural façade of the beach may be lost when sediment is added to the area. Changes that take place to the natural façade of the beach as a result of replenishment and loss of lagoon space may be interpreted as decline in natural appeal for some. However, the significance of this impact may vary from person to person. While additional land created for the island could be perceived as a positive impact while losing the naturalness of the beach and lagoon space may be seen as a negative by others. When finished, the freshly reclaimed land would lack any greenery and glare effect created by the sandy area of the reclaimed land may also The aesthetic quality of the house reef may be further degraded if the sediments blanket on top of it.

Sediment plume if uncontrolled may be visible from distance and has the chance to create a negative perception of the project. During the construction phase the work site with machines and equipments in operation may also not be appealing.

During dredging and reclamation, site bulldozers and excavators would be working non-stop and it is likely some noise would be generated from the work. Even though residents of Himmafushi may accept noise due to the importance of the project for them, tourists in Himmafushi and Gili Lankanfushi may find it unacceptable. Most of these impacts are however are limited to the construction phase and are considered to be short-lived.

Since some people use beach on the western side for leisure activities, they will have to forgo using the beach and lagoon during the construction phase. Since the there are other alternatives available for such activities for the locals, these issues are not considered significant.

Littering of waste during construction and operational phase of the project can lower the aesthetic quality of the project environment.

Strong lights during the nighttime can also disturb some tourists depending on the location of their hotel room.

Mitigation

- Develop a coastal vegetation belt as soon as reclamation is over. Coastal vegetation belt would not only enhance natural appeal but also would protect the people from salt spray and wind.
- Carry noise-generating activities during the daytime.
- Strong lights shall be avoided as far as possible during night.
- Complete the project within the shortest time possible.

Income and employment

During construction period there will be a limited opportunity for employment at local level. Reclamation workforce will also contribute to the local economy of the island during their stay on the island.

Mitigation

N/A

Fishery & recreational value

According to the locals, there are no bait fishing grounds near Himmafushi. However, the dredging and reclamation, and associated sedimentation would impact the reef fishery from house reef at least during the construction phase of the project. Since there are alternative sites for recreational fishing this is considered a less negative impact.

Mitigation

N/A

Health and safety

Accidents relating to work cannot be ruled out during the project. Similarly unauthorised access to work areas can also create unintended accidents to the public. Although this is considered a less negative impact, it can be completely avoided by appropriate safety measures and good workmanship.

Mitigation

For all works the following safety measures will be required. Appropriate personal protection equipments (PPE) will be worn at all times. This will typically include hard hats, eye protection, protective trousers, and gloves. Hearing protection, masks and wet weather clothing where necessary.

In addition, the following safety measures will be in place;

- First aid kit shall be available on site at all times;
- All machinery shall be operated by competent certified operators;
- All machines and vehicles shall be serviced regularly;
- Manual lifting operations will be kept to minimum by the use of mechanical means; and
- Life buoy will be on site close to relevant work areas at all times.

8.3.1.4 Economical/operational category

In this category, the following parameters had been analyzed: infrastructure, navigation and regional economy. The RIAM indicates that in this category and in this phase, navigation has less negative impact while regional economy has less positive impact.

Navigation

The three borrow areas suggested in AA Atoll if become the borrow sites for the project there would be a number of trips by barges in a heavy marine traffic zone implying likelihood of marine accidents. Similarly, workboats and dredgers anchored at the site of dredging can become transport obstructions especially during night. However, with proper mitigation measures these hazards can be almost completely be avoided.

Mitigation

- Ensure valid seaworthiness certificates for all seagoing vessels.
- Minimise and preferably avoid nighttime transport of materials.
- Ensure indicator lights on anchored vessels.
- Avoid rough weather

8.3.2 Implementation Phase

8.3.2.1 Physical and chemical category

In this category, the following parameters have been analyzed: geophysicists, Coastal morphology, hydraulic conditions, water quality, natural disasters, and pollutants. The RIAM indicates that in this category and this phase reduced negative impact for coastal morphology and hydraulic conditions can be expected.

Coastal morphology

Permanent alterations to the existing coastline of the island can lose the existing equilibrium around the coastal areas of the island altering erosion/accretion pattern that currently exists. These changes would become obvious following a long term monitoring of the island's coastline.

The dredging of the seafloor can similarly change the bathymetry of the area. Although there are no nearby islands to affect as a result of changes to hydrography of the area as a result of dredging, its important to monitor changes that take place.

Mitigation

- At least one year of monitoring of the island's coastline
- Bathymetry of the dredging area before and after dredging. Final bathymetry should be taken one year after the dredging has been completed.

8.3.2.2 Biological and ecological category

In this category, the following parameters have been analyzed: coral reefs, sea grass beds, mangroves, endangered species, sedimentation, and terrestrial ecosystem. The RIAM indicates that in this category and this phase there no impacts associated with biological and ecological category.

8.3.2.3 Social/cultural category

In this category, the following parameters have been analyzed: aesthetic and cultural value, income, fishery, recreational value, employment, public health and safety. The RIAM indicates that in this category and this phase there no significantly positive impact for the income and extremely positive impact for the regional economy as a result of the project.

8.4 UNCERTAINTIES IN IMPACT IDENTIFICATION

Environmental impact prediction itself involves a certain degree of uncertainty, as the predicted impacts may vary according to weather, ecological conditions and social conditions in the atoll or island. Furthermore, limited time allocated for conducting the EIA studies does not permit collecting adequate primary data on the existing environment of the project location. Data on environmental aspects such as currents, waves, and sediment transport regimes may require at least one full year of data collection to make informed judgments. Given the time and budgetary constraints, the impact predictions largely had to be based on short term primary data and secondary information obtained from literature review and conducting interviews with the locals. However, the level of uncertainty, in the proposed project is considered low, given that dredging and reclamation projects are very common in the Maldives and that experience from such projects carried out in many islands and resorts in the Maldives are readily available.

9 ALTERNATIVES

According to the EIA regulations, alternatives of the options for the proposed project must be considered. First alternative is the option of "no project option". The other options of use of technology and locations for dredging and reclamation and coastal protection are also considered.

9.1 NO PROJECT OPTION

If "no project scenario" was considered, environmental impacts associated with the project could be avoided completely. No project would also mean no financial implications on the government. However, the socio-economic issues facing the island would continue and the community pressure on the authorities would persist. The advantages and disadvantages of the no project option are discussed below in Table 12.

Table 12: Advantages and disadvantages under a no project scenario.

Advantages	Disadvantages
• Environmental problems related to project can be avoided. • No development costs to government. • All risks associated with the project can be avoided.	• Land needed for housing and infrastructure will not be available. • The development of the island would be impeded. • No unique or exceptional environment preserved. • Public pressure on the government would persist. • Risk of losing the funds if not utilised for allocated purpose before the end of the fiscal year

As the Table 12 shows the disadvantages of not undertaking the project outweighs the advantages, hence no project potation is not considered the preferred option.

9.2 ALTERNATIVE OPTIONS

Following alternative options are considered.

9.2.1 Alternative Burrow Site

Alternative location for borrowing sand has been identified by the project proponent as shown in Figure 26. The site is very close to project location being just within the house reef of Himmafushi. This site has a number of advantages. Close proximity means, transport distance made short and hence lowered project cost and significant time saving, and several risks associated with long distance transport avoided. However, a number of disadvantages have also been identified as such, borrowing from the same house reef would mean more disturbance to the area, increased cumulative effects, increased disturbance to nearby resorts. Additionally the site is the area from where locals exploit sand for their local construction activities. The community also raised many issues including the potential effect it would have on the morphology and hydrology of the island leading to faster erosion of either the newly reclaimed area or the north of the island where erosion is currently a big issue. Hence, obtaining sand for reclamation works from the southwestern side of lagoon is not preferred.

Figure 26: Alternate dredge locations

An area outside the atoll lagoon could not be chosen as the depths outside the atoll reefs would be too deep for the hopper dredger. The next option would be to dredge on the reef flat close to the project site. However, this will be more environmentally damaging compared to the current proposed location.

9.2.2 Alternative Fill Area

Alternative fill area that can be identified is the south of the island adjacent to the industrial area. However this option would be intrusive to the resort and the boundary issues could complicate the project. The proposed fill area is geographically is more protected and less exposed requiring more extensive coastal protection. In terms of island planning such an extension would also place industrial zone in the middle of the island which could bring about social, administrative and even environmental issues.

9.2.3 Dredging Technology

Alternative technology for dredging could be the cutter suction dredger. Although this might be cheaper, this technology will cause more environmental damage through its drilling/cutting and suction process than using the proposed technology. Table 13 below shows mitigation measures that need to be adopted while using CSD.

Another alternative would be to use excavators. Excavators are not preferred as excavators could not be used for deep dredging and control of sedimentation would be very difficult.

Table 13: Mitigation measures on use of CSD as dredging technique

Impacts	Mitigation Measures
Sedimentation and siltation on lagoon and reef systems	- Erect bund walls and silt screens on the boundary of borrow area and also on reclamation site - Work in calm and low tide water and complete the work in least possible time - Continuous assessment of sedimentation plume and turbidity over the dreading period and beyond
Physical damage to the live coral	- Operate the machinery with extra carefulness and avoid as much possible areas where there is live corals - Work in calm and low tide water and complete the work in least possible time - Continuous assessment of live coral over the dreading period and beyond
Contamination of sea water	- Work in calm and low tide water and complete the work in least possible time - Continuous assessment of waster quality during dreading period and beyond

9.2.4 Alternative Coastal Protection

There are other alternative options of coastal protection including geotextile containers (tubes or bags), sheet piling, concrete blocks or tetrapods. Each of these are considered as below and explains why they are not chosen over the preferred option of rock boulders.

Geotextile containers involve filling of the containers which create further sedimentation and also are less durable. In the previous experiences from coastal protection of using geotextiles elsewhere in the country, it is found that they have a less life span compared to rock boulders. They cannot withstand the continuous wave actions for a longer life time. If they are put in place, the maintenance cost would go higher although the initial cost might be lower. Thus in the longer run, it would be more cost effective to have rock boulders.

Sheet piling would very effective in terms of their robustness. However, the sheets have to be driven to the bed and would cause a considerable about damage to the environment and this is not a preferred option.

Tetrapod can withstand the high wave impacts and are very durable. However, the cost would be significantly high compared to rock boulders. Rock boulders also have a similar withstanding power as the tetrapod and these rock boulders for saving costs and minimising construction time. Concrete blocks and or use of groins would be another technology.

It has been planned that the 80% of the new coastline will be protected and 20% will be left as a beach. The most appropriate segment of the coast to be left as beach was considered by anylising two options as shown in Figure 27.

Figure 27: Options for segment of the beach

Of the two options, option 1 was preferred over option 2. Placing beach segment on eastern side was not considered since closeness to the wave zone. Moving closer to the southern tip although will

increase the current speed, but this current is not expected to be too strong most for much of the time hence moving away from the tip would decrease the current speed creating a more favourable environment for the swimmers. While this being the case, option 2 would limit the space available for the beach to stretch and hence beach users may be confined to a relatively small area. Additionally, option 2 would require breaking up of the coastal protection. These issues were discussed with the island council and with the given environmental constraints, it became apparent that option 1 would be the most suitable.

10 ENVIRONMENTAL MONITORING

10.1 AIMS AND OBJECTIVES

The section would present in detail the management and monitoring measures put in place by the proponent and the contractor to manage and monitor the environmental impacts that would arise from the project activities. The assessment of impacts and mitigation measures that would be put in place had been discussed in detail in the previous chapter. The focus of this plan would be on the boundary of the project, which is the eastern and southern parts of Himmafushi lagoon where the reclamation would be carried out and location where sand borrowing will take place. The main scope or objectives of the environmental management plan are to:

a) Monitor and manage any major impact on the project environment, any unmanaged and not mitigated impact would have major impacts on the species and ecosystem that it might not be able to recover from;
b) Produce a framework for anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions during dredging, reclamation and operational phase;
c) Manage environmental matters in a synchronized manner and to collect information that can be used for documentation and verification of environmental impacts;
d) Collect information that can be used for evaluating the effectiveness of implemented mitigation measures so it can provide information for better decision making and future improvement of environmental quality for similar projects;
e) Ensure that these impacts are eliminated in a timely manner; and
f) Provide evidence of compliance assurance to laws and regulations and requirements of enforcement agencies.

The measures and parameters that are most relevant for monitoring and managing the impacts that may arise from the proposed project are included in the monitoring plan. These include:

- The amount of sedimentation in the marine environment;
- the degree of sedimentation on the reef;
- water quality;
- beach profile and hydrodynamic changes; and
- bathymetry changes of the borrow site.

10.2 ENVIRONMENTAL MONITORING SYSTEM

The environmental monitoring framework for the proposed project is based on the standards and policies set out by the Environmental Protection Agency under EIA Regulation 2012.

Environmental monitoring planning and establishment of key performance indicators:

a) Use the field data for the EIA development as the baseline for monitoring conditions and measure;
b) The operational works of the construction (reclamation and dredging phase) and associated coastal protection (if any) will be established and operated according with the monitoring plan;
c) Monitoring and corrective action: The implementation of the monitoring measures will be monitored during operational stage and will be reported. Any inconsistencies between the monitoring plan and its on-site implementation will be identified and addressed through corrective actions; and
d) Auditing, reviews and enhancement: The Monitoring Plan will be reviewed. Improvements to the monitoring plan will be made as necessary to achieve desired environmental outcomes.

10.3 ENVIRONMENTAL MONITORING PLAN

Monitoring would begin from the EIA preparation phase to record any possible changes to the environment from the activities of the project and would continue into the operational phase until the end of the monitoring plan. As per the Terms of Reference of this project, marine water quality and monitoring of the marine ecosystem has to be conducted on a regular basis.

The monitoring programme targeted at monitoring the coastal and marine environment of Himmafushi and dredging site is given in Figure 28. 4. Figure 28 shows the proposed locations for monitoring the imapcts of dredging around Himmafushi. Once the borrow site is finalised from the options discussed in the report, the proponent and the consultant will determine the exact location marine environment monitoring. This programme would commence from the beginning of the project. The proponent is committed to undertake this monitoring programme for at least three years from the end of the project.

Figure 28: Proposed monitoring location for Himmafushi

It is required that as part of the monitoring plan, as soon as the borrow site is finalised, that the bathymetry of the borrow area is conducted to ensure availability of adequate materials. This will be conducted by the contractor as soon as the contract is awarded.

10.4 REPORTING

Reporting will be carried out by the environmental consultant assigned for the purpose by the proponent. The report will include among other information;

- Details of the site;
- Methodology of data collection and data analysis;
- Major findings; and
- Mitigation measures that would be implemented based on the monitoring.

A detailed environmental monitoring report is required to be compiled and submitted to the EPA or the enforcement authority at the end of the project and final report for this project will be submitted at the end of the one-year monitoring period as detailed in the Table 16.

In addition to this, regular site monitoring would be carried out the contractor and site supervisors during construction. Enforcement officers from Ministry of Housing and Environment would also visit the site for inspection based on their routine schedules when even the need arises. The required consultation and communication would be carried out among the environmental consultant; the contractor (site supervisors) and project proponent to ensure possible negative impacts are mitigated appropriately during and after the project work ends.

10.5 PROJECT MONITORING COST & TIMEFRAME

This monitoring should be commenced during the preparation stage and continued at least one year after the completion of the project. The monitoring frequency, costs and details of various monitoring aspects are explained in Table 14.

Table 14: Monitoring framework - parameters, cost and frequency

Environmental aspect	Parameters and Methods of Monitoring	Monitoring and Reporting Frequency	Cost (USD)
Coastal morphology and marine bathymetry	Changes to the Himmafushi coastline by using standard surveying method and equipments. Bathymetry of the borrow site using sonar and GPS	Beach profile surveys and coastal boundary surveys every 4 months for one year Bathymetry surveys to be done before dredging, after dredging and one year after completing the dredging works.	Approx. USD 5000 for all surveys
Water quality	Sediment levels in the water column shall be monitored daily by the contractor at boundary just outside the sediment barrier in the lagoon between Himmafushi and Gili Lankanfushi and at the inner edge of the house reef of Himmafushi on the eastern side and northern side. Four samples shall be analysed for each of these locations using a reliable turbidity meter. Monitoring shall be conducted at least once a day during dredging period. Daily records shall be kept in order to demonstrate compliance. Weekly summary reports shall be prepared and be made available to the proponent. Visual surveys and sediments deposited on reef substrates by the Consultant. Sediment monitoring reports will include the following information for each sample: a) time of day; b) antecedent weather conditions; c) tidal stage and direction of flow; and d) wind direction and velocity. Reports shall be complied daily even when no sampling is conducted. When sampling is not conducted, a brief statement shall be given to explain the rationale, such as “dredge not working” or “no sampling due to high seas”. Reports shall contain the following information: 1) dates and times of sampling and analysis; 2) state plane coordinates (X and Y) of the sampling stations and the dredge and discharge locations, and the distance between the sampling stations and the dredge/discharge for each sample to demonstrate compliance with the above required distances; 3) a statement describing the methods used in collection, handling, storage, and analysis of the samples, as well	Daily during construction and monthly after completing the project till the end of an year of monitoring. At the end of each monitoring event a summary report shall be prepared. Final report at the end of the monitoring program	Approx. USD 5000

	as the authenticity, precision, limits of detection, and accuracy of the data; 4) results of the analysis; and 5) a description of any factors influencing the dredging or disposal operation or the sampling program. The summaries shall be submitted in Excel Spreadsheet.		
Coral reef	At the house reef of Himmafushi and dredging areas the following shall be carried out Visual inspection of fish abundance. Visual inspection photography of sediment impact on the reef.	Weekly during construction. Six months after completing the dredging and reclamation works. Survey shall be repeated in the same location.	No additional costs since the survey can be done simultaneously with other studies.

10.6 MONITORING COMMITMENT

The commitment to undertake the monitoring and mitigation by the proponent is given in Annex 4.

11 CONCLUSIONS

This EIA has been undertaken to assess the proposed project, evaluate various alternatives, and to determine potential impacts and respective mitigation measures. The EIA was carried out in a participatory manner where views collected from stakeholders have been incorporated in to the EIA where appropriate.

This project would is critical for the people of Himmafushi to address the acute shortage of land available for housing, infrastructure development and diversifying the local economy of the island.

This EIA has found no evidence of any major significant negative environmental impact or disbenefit or change that are of importance at national/international level. Nevertheless due to the inherent constraints and limitations of the project site, negative environmental impacts due to the project are still expected. These potential impacts have been assessed in a comprehensive manner under this EIA with effective and practicable mitigation measures recommended to maintain the impacts at an acceptable level. All social and environmental effects identified can be effectively mitigated with the measures recommended in this report. In addition to the environmental and social mitigation measures, the following recommendations have been proposed in order to enhance project acceptability and smooth implementation of the project.

- Ministry of Housing and Infrastructure to brief the main stakeholders in particular the resort operators in the affected area of the project and likely negative impacts.

- Resolve all relocation of outfalls falling into the proposed reclamation area.

- Make arrangements to relocate the island's waste management centre to an appropriate site. When reclamation is complete, the waste management centre which is currently located close to the coastal area on the eastern side of the island would find itself in the middle of the island when the land is reclaimed. This is not acceptable to the community.

- The risk of rainfall flooding of the existing part of the island cannot be ruled out during can be completely avoided by proper levelling of the newly reclaimed land. Hence, the contractor and proponent shall take special consideration into this aspect while undertaking the reclamation works.

- The proponent to make necessary arrangements to carryout the necessary monitoring works.

- Ensure that implementing mitigation measures is included in the contact document for undertaking the works.

Based on the results of the assessments, the EIA study concludes that the project is in compliance with the relevant environmental legislation and regulations. With implementation of the recommended environmental mitigation measures, no unacceptable adverse residual impacts from the project are anticipated. A comprehensive monitoring programme will be implemented to check the effectiveness of mitigation measures and necessary steps will be taken to control unforeseen negative effects.

+++++++

12 REFERENCES

DHI (1999). Physical modelling on wave disturbance and breakwater stability, Fuvahmulah.

Kench, P. S., Brander, R. W., Parnell, K. E. & MCLean, R. F. (2006). Wave energy gradients across a Maldivian atoll: Implications for island geomorphology. Geomorphology, 81, 1-17.

Jameel (2013), EIA for proposed reclamation of 15 hectares at Dhaalu Meedhoo.

Jensen, K., Bach, H. and Pastakia, C. (1998). A New EIA Method Applied on Coastal Reclamation Projects. *Transactions on Ecology and Environment*, 18(1743-3541), pp.35-43.

Stoddart D. R. 1969. Ecology and Morphology of Recent Coral Reefs. Biological Reviews, 44, 433-498.

Zahir (2011), EIA for the harbour in Gan, Addu City, LaMer, Maldives.

13 ANNEXES

Annex 1: Terms of Reference (ToR) for the project
Annex 2: Approved site plan
Annex 3: Dredging permit from EPA
Annex 4: Commitment Letter from the proponent
Annex 5: Letter from Himmafushi Island Council
Annex 6: List of people Consulted
Annex 7: Water sample test report
Annex 8: Bathymetry of the proposed reclamation site
Annex 9: CV's of contributing authors

ANNEX 1: APPROVED TERMS OF REFERENCE (TOR) FOR THE PROJECT

ANNEX 2: APPROVED SITE PLAN

ANNEX 3: DREDGING PERMIT FROM EPA

ANNEX 4: COMMITMENT LETTER FROM THE PROPONENT

ANNEX 5: LETTER FROM HIMMAFUSHI ISLAND COUNCIL

ANNEX 6: LIST OF STAKEHOLDERS CONSULTED

Name	Designation	Stakeholder	Contact
Shaana Farooq	Director General	Ministry of Housing and Infrastructure	7913342
Nafha Aujaz	Environment Analyst	Ministry of Housing and Infrastructure	7721554
Shaan Ibrahim	President	Himmafushi Council	7775438
Ahmed Siraj	Vice President	Himmafushi Council	
Ahmed Hameed	Councillor	Himmafushi Council	
Moosa Ismail	Councillor	Himmafushi Council	
Hassan Faiz	Councillor	Himmafushi Council	
Shafiya Naeem	Director	Marine Research Center	7971586

ANNEX 7: WATER SAMPLE REPORT

ANNEX 8: BATHYMETRY OF THE PROPOSED RECLAMATION SITE

ANNEX 9: CVS OF CONTRIBUTING AUTHORS

FATHIMATH FARAH AMJAD

G.Male' Hiya 2 (11-04) | Male', Rep. of Maldives | (960)7688861 | fara.a@outlook.com

PERSONAL DATA

Date of Birth:	April 30th, 1990
Nationality:	Maldivian
Marital Status:	Single

OBJECTIVES

To gain knowledge in the fields of environmental conservation and research, marine sciences and oceanography which will help me actively contribute to improving the livelihoods of marine ecosystems and the natural environment.

To take part in a professional team, get hands on experience in the field and understand the practical methods and approaches.

EDUCATIONAL BACKGROUND

2015 - Present — **Bachelor of Environmental Management**
Maldives National University, Male'

2013 — **ABE Diploma in Marketing Management - Level 4**
Maps College, Male'

2010 - 2011 — **Foundation in Built Environment**
UCSI University, Kuala Lumpur, Malaysia

2007 — **Advanced Certificate in Residential Drafting**
Male' Centre of Technology, Male'

2007 — **Certificate in AutoCad 3D**
Male' Centre of Technology, Male'

2003-2005 — **Cambridge O' Levels**
Aminiya School, Male'

TRAININGS AND SKILLS

- Year 2014 – PADI Open Water Diver Certification
- Year 2014 – PADI Advanced Open Water Diver Certification
- Year 2015 – Reefcheck.org Eco-Diver Certification
- Year 2015 – Certified Assessor at Greenfins.org
- Year 2015 – PADI emergency first response Certification (Pending)

FATHIMATH FARAH AMJAD

G.Male' Hiya 2 (11-04) | Male', Rep. of Maldives | (960)7688861 | fara.a@outlook.com

EMPLOYMENT RECORD

2015 October - Present

Research Assistant
Maldives Energy and Environmental Company (MEECO)

- *Data collection and analysis: Coral reef transects, fish census, description of existing environments, etc.*
- *Assist in drafting Environmental Assessment Reports.*
- *Organize and coordinate site visits.*
- *Communicate with government authorities, island councils and other parties regarding ongoing work at the company.*

2014 March – 2015 September

Project Assistant/ Draftsperson
Renewable Energy Maldives Pvt Ltd, Male'

- *Data management and monitoring of the installed PV solar systems at sites in Male' and several islands.*
- *Designing and drafting technical and electrical layouts. I.e. Roof layouts, Waste to energy Incinerator design, etc.*
- *Regular communication with suppliers about equipment for PV installations and a variety of other DC products.*
- *Communication with customers, government authorities and other parties regarding various matters for PV systems, equipment clearance and site installations.*
- *Drafting proposals and bid documentations.*
- *Assisting the engineer in the preparation of energy audit reports, data collection and site surveying.*

2012

Freelancer designing and drafting work (Refer to Referee Ahmed Ashfam)

2009 January- 2009 April

Draftsperson
Arcade Pvt Ltd, Male'

- *Designing exterior and interior layouts of buildings.*
- *Drafting all finalized architectural, structural, plumbing and electrical drawings sets for various residential and commercial buildings with the assistance of the civil engineer.*

2008 August - 2008 November

Customer Services and Data collection Officer (3 month contract)
Estate Department, Hulhumale' Development Co-operation, Male'

- *Collecting and processing data, communicating with customers.*

FATHIMATH FARAH AMJAD

G.Male' Hiya 2 (11-04) | Male', Rep. of Maldives | (960)7688861 | fara.a@outlook.com

2008 Jan-July **Draftsperson**

Gedor Consultancy Pvt Ltd, Male'

- *Drafting architectural and structural drawings with the guidance of the head architect and engineer.*
- *Worked in the designing and drafting phase of a number of resort projects, residential, commercial and government buildings.*

2007 Jun- Sep **Draftsperson Trainee**

Design House Pvt Ltd, Male'

- *Draftsman Trainee during residential drafting course at Male' Centre of Technology.*

COMPUTER SKILLS

- Extensive knowledge in use of Autocad 2D.
- Proficient in use of Microsoft Office, Autocad 3D, Adobe, Coraldraw.

COMMUNICATIONAL SKILLS

- English.
- Dhivehi (Mother tongue).

AFFILIATIONS

- Assessor at **Greenfins**, a non-profit initiative by Reef World Foundation and UNEP aimed to protect and conserve coral reefs by establishing and implementing environmentally friendly guidelines to promote a sustainable diving and snorkeling tourism industry.

- Certified surveyor of **Reefcheck.org**, an international non-governmental organization dedicated to the conservation reefs by collecting data from volunteer scuba diver teams in over 80 countries. This is the United Nations' official coral reef monitoring program.

- Volunteer at NGO **Save the Beach**, working at clean up events at Villimale' beach and in Villimale' house reef, awareness programs and reef monitoring programs.

- Volunteer at **'Project Damage Control'**, a collective like-minded group of volunteers, working at cleanups in the greater Male' area.

- Researcher/Writer at '**Backpack in Maldives'** blog.

FATHIMATH FARAH AMJAD

G.Male' Hiya 2 (11-04) | Male', Rep. of Maldives | (960)7688861 | fara.a@outlook.com

PROFESSIONAL REFEREES:

- Aishath Hudha Ahmed
  Director
  Renewable Energy Maldives Pvt Ltd
  Contact No: (960) 7788010, (960) 3337734

- Ismail Rasheed (Bobby)
  Managing Director
  Arcade Pvt Ltd.
  Contact No: (960) 7773283

- Ahmed Ashfam
  Human Resources Manager
  ADK.Akarsu Developments Pvt. Ltd.
  Contact No: (960) 7661988

Ali Hammadh

Address:
Ma.Glassge, Nikagas Magu, Male', Maldives• +960 7433241 • zoogya@gmail.com

Personal statement

Motivated, resilience and self-sufficient individual eager to work and progress in the environmental management and impact assessment field..

Key Skills

- Proficiency in all areas of Microsoft Office, including, Excel, Word and PowerPoint
- Communication skills, both written and verbal.
- Sample collecting and handling skills combined with the knowledge of using analytical instruments such as UV-Vis spectrometers, Handheld XFR spectrometers, IR spectrometers, Voltammeters and HPLC.
- Interdisciplinary knowledge of environmental water quality management and familiarity with Australian water quality standards.
- Knowledge of data regression and map building using ArcGIS software

Employment History

Townsville Atmospherically deposited Dust Metal Study

(August 2014 – December 2014)

Responsibilities

- Open up a dialogue between NQCC (North Queensland Conservation Council)
- Arrange Accommodation and finances.
- Do preliminary desktop research on history of laws and regulation, previous similar studies.
- Gather information about regulatory bodies and stakeholders.
- Open up a dialogue between Townsville port and meteorological centres to gather data.
- Take notes and keep up to date records of project with respect to Professor Mark P. Taylors
- Update Professor on the progress of tasks assigned to team members.
- Stake out sampling sites to be confirmed by professor.
- Fieldwork. (Collecting samples/transporting them to laboratories/inventory check)
- Regress raw data into tables and graphs. Responsible for the results section of the report.
- Media day with ABC network. Answer their questions and assist them in providing information

Media report:
http://mobile.abc.net.au/news/2014-12-05/high-toxin-levels-in-townsville-playgrounds-alarms-researchers/5946730?pfm=sm&section=qld

Laboratory Demonstrator At MQ University Study Labs

(June 2014 – July 2014)

Responsibilities:

- Introduction of teaching laboratory to year 12 students from Kilara High School and North Sydney Boys High School students
- Demonstrate general sample handling and preservation when collecting and testing water samples
- Explain the chemistry and process of determining dissolved oxygen and orthophosphates in water using the calorimetric method of phosphomolybdic acid reduction
- Explain the use, advantages and disadvantages of external standardisation method in testing for orthophosphates in water and explain the workings and use of UV-Vis spectrometers.
- Guide and manage a group of 20 students during the experiment.
- Help students with calculation and maintain the spectrophotometers.

Note Taker for Unit: PHYS 159

(August 2012 – December 2012)

Responsibilities:

- Upload concise clear notes to the disability student's portal after attending weekly lectures.
- Include diagrams and upload notes routinely on time with adequate depth and detail in report format.
- Review existing notes with other note takers to develop a general standard
- Meet with special needs students to discuss the quality of notes and discuss ways of refining and improving notes uploaded

Ministry Of Tourism

(February 2011 – March 2011)

Responsibilities:

- Maintaining and organising the ministries filing system
- Prepare meeting rooms and take notes during meetings
- Drafting letters.
- Inputting gathered information about islands into database

Education

Macquarie University
(January 2012 – December 2014)

Award: Bachelor of Environment
Major: Chemistry
Environmental Management

- GPA 3.3

CHSE
(June 2008 – June 2010)

Four Edexcel Subjects
- Chemistry Grade A
- Physics Grade A
- Biology Grade B
- Maths Grade B

Majeediyya School
(2004 – 2007)

Six Cambridge GCE Subjects
- Chemistry Grade A
- Physics Grade A
- Biology Grade A
- Computer Studies Grade A
- English as a Second Language Grade A
- English Language Grade A

Jammaluddin School
(2000 - 2007)

Achievements

2014 – Bachelor of Environment Majoring in Chemistry and Environmental Management
2012 – Robert Menzies College Deans Award for Academic Achievement
2011 – Australian Development Scholarship
2010 – CHSE Certificate of Merit (achieving passes in elective subjects with distinctions)
2008 – National Top Ten Award

Hobbies & Interests

- Sea
- Diving
- Fishing
- Sports

References

Attachments include:

- A welcoming letter from senior lecturer at Macquarie University Mr Ian Jamie
- Academic Transcripts/certificates

"ދިވެހިން ދިވެހިންގެ ގޮތުގައި - މިނިވަންކަންމަތީ އަބަދަށް"

މާލެއަތޮޅު ހިންމަފުށި ކައުންސިލްގެ އިދާރާ

Secretariat Of The Himmafushi Council, Male Atol

ކ. ހިންމަފުށި / ދިވެހިރާއްޖެ

K. Himmafushi / Republic Of Maldives

ނަންބަރު: 335/MIS/2015/242

ޕެންޝަން އެޑްމިނިސްޓްރޭޝަން އޮފީސް

ވުޒާރާސަލާމަށް ފަހު ދަންނަވަމެވެ.

24 ނޮވެމްބަރު 2015 ގައި ބާއްވަ ދަނޑުން ކޮންފަރެންސް ފެއިލް ރ އެކްޓިންގ ކަރެސްޕޮންޑަންޓް ކް ފަރި ނަ ހިލޫޖ މިޢުލޫމާތު ދިނުމަށް ކޮށްދެއްވި ދަންނަވަމެވެ.

އިޙްތިރާމް ގަބޫލު ކުރެއްވުން އެދެމެވެ.

١٤ صَفَر ١٤٣٦

26 ނޮވެމްބަރު 2015

ޚާދިމުކުމް

ޝުޖާޢު އިބްރާހީމް

ކައުންސިލްގެ ރައީސް

ޕެންޝަން އެޑްމިނިސްޓްރޭޝަން އޮފީސް

މާލެ / ދިވެހިރާއްޖެ

ފޯން: 6642024 ފެކްސް: 6642024، އީމެއިލް: hinmafushi@kaaf.gov.mv

އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ
Environmental Protection Agency EPA

بسم الله الرحمن الرحيم

ނަންބަރު: 203/128/2015/218

މިނިސްޓަރ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ ޑރ. މުޙައްމަދު މުއިއްޒު،

ވުދުން ސަލާމަށްފަހު ދަންނަވަމެވެ.

ކ. ހިންމަފުށި ބިންހިއްކުމުގެ މަޝްރޫޢު ގުޅޭ

ކ. ހިންމަފުށި ބިންހިއްކުމުގެ މަޝްރޫޢާއި ގުޅޭ ގޮތުން ތައްޔާރުކުރައްވާފައިވާ އީ.އައި.އޭ ޓާރމްސް އޮފް ރިފަރެންސް(ޓީ.އޯ.އާރު) ފާސްކުރުމަށްފަހު މިސިޓީއާއެކު ފޮނުވީމެވެ. އަދި ދަންނަވަމެވެ. ޓީ.އޯ.އާރު ފާސްކުރުމަށްފަހު ރިޕޯޓް ތައްޔާރު ކުރުމުގެ ކަންތައްތައް ކޮންސަލްޓެންޓާއި މަޝްވަރާކޮށްގެން ކުރިއަށް ގެންދިޔުމާއި އީ.އައި.އޭ ރިޕޯޓް އީ.ޕީ.އޭއަށް ހުށަހެޅުމަކީ ޕްރޮޕޯނަންޓުގެ ޒިންމާއެއް ކަމުގައި ދަންނަވަމެވެ.

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

އިޙްތިރާމާ ޝުކުރާ ކުރައްވާން އެދެމެވެ.

2 މުޙައްރަމް 1437

15 އޮކްޓޯބަރ 2015

ޚާދިމުކުމް

މުޙައްމަދު ހަލީމް ޝަރީފް

އެސިސްޓެންޓް ޑިރެކްޓަރ، އެންވަޔަރަމަންޓް އެސެސްމަންޓް

މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ،

މާލެ، ދިވެހިރާއްޖެ

ސ.ސ-001

EPA/ToR/2015/155

Terms of Reference for Environmental Impact Assessment for a Land Reclamation Project in Himmafushi, Kaafu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on 30 August 2015 for undertaking the EIA of the proposed land reclamation project in K. Himmafushi. 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 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 link other activities that are carried out or that is being carried out within the project boundary. Identify the project financing and institutional arrangements relevant to execution of the project.

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, suchas relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds nesting or roosting sites, ecologically and economically 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**– Identify and number tasks of the project including preparation, construction and decommissioning phases.

   Task 1. Description of the proposed project – Provide a full description and justification of the key activities of the reclamation works, using maps, diagrams and figures using appropriate scales where necessary. The following should be provided (inputs and outputs related to the proposed activities shall be justified):

   The main activities of the reclamation and coastal works are
   a) Dredging material from burrow area (s)
   b) Location and size of sand burrow areas (s) on a map

c) Justification for the selection of borrow area location
d) Quantity and characteristics of fill material for the reclamation
e) Method and equipment used for dredging with justification for selecting the methods and equipment
f) Duration of dredging activities
g) Labour requirements and (local) labour availability
h) Housing of temporary labour, and
i) Emergency plan in case of environmental contaminant spills (diesel, grease, oil etc.)
j) Construction of bunds
k) Pumping dredged materials into the reclamation area
l) 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, access to site, safety, equipment and material storage, fuel management and emergency plan in case of spills)
m) Finishing reclamation area to required levels
n) Environmental monitoring during construction activities;

Task 2. Description of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the project. The report should outline detailed methodology applied for data collection. Information for following shall be provided.

a) Temperature, rainfall, wind, waves (including extreme conditions)
b) Bathymetry (bottom morphology) of all dredge and reclamation locations using maps;
c) Seasonal patterns of coastal erosion and accretion;
d) Shoreline and vegetation line (use maps);
e) Beach Profiles from around the island;
f) Tidal ranges and tidal currents;
g) Wave climate and wave induced currents;
h) Wind induced (seasonal) currents;
i) Seawater quality (physical) to include temperature, pH, salinity, Electrical Conductivity, turbidity, Total Suspended Solids. Sea water quality should be tested from the project site and at least from one control site for data comparison.
j) Identify marine protected areas (MPAs) and sensitive sites near the reclamation areas and borrow sites. Include description of economically important marine species.
k) Benthic and fish community at the reclamation area and control site near the reclamation site.
l) Description of the coral reef formation and type of coral species
m) Demography: total population and pressure on land and marine resources;
n) Income situation and distribution

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951 : ގުޢުރ
Fax: [+960] 333 5953 : ފެކްސް
ވާތావரணް ރައްކާތެރިކަން ދިރާސާ ތަންކަޅި
ފ. ހަންޑުވަރީ ހިންގުން، 3 ވަނަ ފަންގިފިލާ، ދިވެހިރާއްޖެ
ދާދި، ދިވެހިރާއްޖެ، 20392
Email: secretariat@epa.gov.mv : ޕޯ
Website: www.epa.gov.mv : ވެބްސައިޓް

o) Economic activities of both men and women (e.g. fisheries, home gardening, fish processing, employment in industry, government);
p) Land use planning, and zoning of activities at sea;
q) Accessibility and (public) transport to other islands;
r) Service quality and accessibility (water supply, waste/water disposal, energy supply, social services like health and education);
s) Community needs;
t) Vulnerability of area to flooding and storm surge.

Task 3.Legislative and regulatory considerations. Identify all relevant laws, regulations, guidelines and standards and environmental policies that are applicable to the proposed project, and identify the appropriate authority jurisdictions that would specifically apply to the project. .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. Legal requirements:

a) Dredging and reclamation permit from EPA

Task 4. Potential impacts (environmental and social) of proposed project: The EIA report should identify the impacts, direct and indirect from the dredging operations. Particular attention shall be given to impacts associated with the following:

Task 4a. Impacts to natural Environment

a) Changes in flow velocities/directions, resulting in changes in erosion/sedimentation patterns, which may impact shore zone configuration/coastal morphology.
b) Loss of marine biota, both in the borrow area as well as in the reclamation site, resulting in (temporary) loss of bottom life, which may impact fish stocks and species diversity and its density.
c) Sediment dispersion in water column (turbidity at the dredging site, the reclamation areas and related to shore protection activities), possibly resulting in changes in visibility, smothering of coral reefs and benthic communities and affecting fish and shellfish etc.
d) Impacts of noise, vibration and disturbance.
e) Impacts on ground water table and quality as a result of reclamation areas (change in ground water formation).
f) Estimated time required to reach water quality of acceptable levels and soil conditions suitable for home gardening;
g) Impacts on unique or threatened habitats or species (coral reefs, sea turtles etc.), and
h) Impacts on landscape integrity/scenery.

Task 4b. Impacts on the socio-economic environment

a) Impacts of the works in fishing activities (disturbance);

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951 : ގުޅުއްވުން
Fax: [+960] 333 5953 : ފެކްސް
Email: secretariat@epa.gov.mv : ޕޯސްޓް
Website: www.epa.gov.mv : ވެބްސައިޓް

ފަރުވާތެރިކަމާ ގުޅޭ ދާއިރާ
ހަންވަރު ތިމާވެށި، 3 ވަނަ ފަންގިފިލާ ހިނގާ ދަތުރު
ދަތުރު، ދިވެހިރާއްޖެ، 20392

b) Impacts of the dredging and reclamation works on tourism (nearby resorts and dive sites);
c) Impacts on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works;
d) Employment and economic opportunities and diversification;

Task 4c. Construction related hazards and risks

a) Pollution of the natural environment (e.g. oil spills, discharge of untreated wastewater and solid waste, including construction waste);
b) Risk of accidents and pollution on workers and local population, and
c) Impacts on social values, norms and belief due to presence of workers of dredging company on local population.

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. Identify impacts that are cumulative and unavoidable.

Task 5. Alternatives to proposed project – Describe alternatives including the "no project 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 project option alternative". This should include but not limited to alternative borrow sites, alternative equipment/machinery for dredging and alternative containment measures. The report should highlight how the dredging location was determined.

Task 6. Mitigation and management of negative impacts

Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These should include both environmental and socio-economic mitigation measures with particular attention paid to sedimentation control. Mitigation measures to avoid, minimize or compensate habitat destruction caused by dredging need to be considered, e.g. temporal sediment control structures.Give cost of the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. An environmental management plan (EMP) for the proposed project, identifying responsible persons, their duties and commitments shall also be given. In cases where impacts are unavoidable arrangements to compensate for the environmental impacts 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. Give details of the monitoring program including the physical and biological parameters for monitoring, cost of monitoring and commitment letter

Environmental Protection Agency
ފަރުވާތެރިކަމާ ގުޅޭ ދާއިރާ
Green Building, 3rd Floor, HandhuvareeHingun
ގްރީން ބިލްޑިންގ، 3 ވަނަ ފަންގިފިލާ، ހަނޑުވަރީ ހިންގުން
Male', Rep. of Maldives, 20392
ދިވެހިރާއްޖެ، 20392
Tel: [+960] 333 5949 [+960] 333 5951 : ގުޅުއްވުން
Email: secretariat@epa.gov.mv : ބްރޯޝަރ
Fax: [+960] 333 5953 : ފެކްސް
Website: www.epa.gov.mv : ވެބްސައިޓް

from responsible person to conduct monitoring, detailed reporting format and schedule. The monitoring report shall cover, but not limited.

a) Sea water quality
b) Marine Assessment
c) Assessment of nearby marine sensitive ecosystems
d) Shoreline monitoring

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 Hinmafushi council, the general public of Hinmafushi. 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 shall 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 related 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.

ENVIRONMENTAL PROTECTION AGENCY Male, Republic of Maldives

15th October 2015

E.C.A 001

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951
Fax: [+960] 333 5953
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

North

Rehab fence

Rehab fence

Extension for harbour

Jetty

LOCAL HARBOR

Football Field

Mosque

Mosque

School

Rehab Center

Children's Correctional Centre

Tomb

Cemetry

neru

neru

13M ROAD

Industrial Lot 1
AREA = 6,301.62 sq.m

Proposed Extension for Industrial Lot 1
AREA = 5,146.91 sq.m

Oil tank

22.86m (75 ft)

T-JETTY

13M ROAD

Industrial Lot 2
AREA = 10,211.79 sqm

Industrial Lot 3
AREA = 2352.59 sqm

Future Power house

Slipway

Boat yard

Marker

13M ROAD

Industrial Lot 4
AREA = 10,986.85 sqm

Proposed Industrial Lot 5
AREA = 4863.12 sqm

Proposed Industrial Lot 6
AREA = 4084.56 sqm

13M ROAD

Marker

LEGEND

- Environmental Protection Zone
- Green / Open Areas
- Proposed Area for Community Use (Area= 3,642sqm)
- Harbor / Slipway
- Reserved for Future Use
- Existing line of reclamation
- Future Reclamation line
- Neru line
- Commercial Zone
- Existing & Proposed Light Industrial Area
- Common Loading/Unloading Area
- Existing Land Allocations
- Boatyard
- Proposed reclamation Area

K. Himmafushi Industrial Area

MINISTRY OF HOUSING AND URBAN DEVELOPMENT

7th Floor, MTCC TOWER, BODUTHAKURU FAANU MAGU, MALE' 20-06, REPUBLIC OF MALDIVES.
TEL: 321960, 325785, FAX: 328999, email: mail@mhud.gov.mv

PROJECT:

K. HIMMAFUSHI INDUSTRIAL AREA

DWG NO: 1 OF 2	SURVEYED BY:
SCALE :	DRAWN BY: YR
DATE : 24th JANUARY 2008	CHECKED BY: HR / ZS

بسم الله الرحمن الرحيم

އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީ
Environmental Protection Agency
EPA

ދިވެހިން ދިވެހިންނަށް ގޮތަށް – މިނިވަންކަމުގައި އަބަދަށް
"Dhivehin" – Always Maldivian, Forever Independent

ނަންބަރު: 203-PROREC/138/2015/170

މިނިސްޓަރ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ ޑރ. މުޙައްމަދު މުއިއްޒަށް،
ވަރަށް ސަލާމަތުން ދަންނަވަމެވެ.

ކ. ހިންމަފުށީ ބިންހިއްކުމުގެ މަޝްރޫޢު – ހަވާލުކުރެވުނު ބިންހިއްކުމުގެ ހުއްދަ

ސުންގަޑީގައި ދަންނަވާލައިވާ މަޝްރޫޢާއި ގުޅޭގޮތުން، މިއަދު މިނިސްޓްރީއިން 03 އޮގަސްޓް 2015 ގައި ހުށަހެޅުއްވި ދިވެހިރާއްޖޭގެ ރަށްރަށާއި ފަޅުފަޅު ސަރަހައްދު ހިއްކުމާއި ފުންކުރުމަށް ހުއްދައަށް އެދި ފޮނުއްވި ހަވާލާދީ ދަންނަވަމެވެ.

ހުށަހެޅުއްވުމާއި މައުލޫމާތުގައި ބަޔާންވެގެންވާ ގޮތުގެ ސަރަހައްދުތަކާއި ބޮޑުމިން ތިރީގައިވާ ހަވާލުކުރެވުނު ބިންހިއްކުމުގެ މަސައްކަތުގައި ތިމާވެށްޓަށް އަސަރުކުރާނެ މިންވަރު ބަލައިގެން ރިވިއު ހުށަހެޅުއްވަނީ ކުރިއަށް ގެންދިއުމަށް ދަންނަވަމެވެ.

1. ފުރަތަމަ އޮޕްޝަންއެއްގެ ގޮތުގައި ވެލި ނަގައިގެން ހުށަހެޅުއްވުމާއި އަދިއަދު އުތުރުބައިގެ އިރުމަތީ ފަރާތު އުތުރަށް ދިމާލުން ބްލޮކް 1 (1,600,000 އަކަމީޓަރު) ގެ ގޮތުގައި ފާހަގަކުރައްވާފައިވާ ސަރަހައްދުން ނުވަތަ ބްލޮކް 2 (1,600,000 އަކަމީޓަރު) ގެ ގޮތުގައި ފާހަގަކުރައްވާފައިވާ ސަރަހައްދުން ނުވަތަ ބްލޮކް 3 (1,600,000) ގެ ގޮތުގައި ފާހަގަކުރައްވާފައިވާ ސަރަހައްދުން އީ.އައި.އޭ ގަވާއިދުގައި ކަނޑައެޅޭ ވެލިނެގުމަށް އެކަށީގެންވާ ސަރަހައްދުގެ ވަށައިގެންވާ ބޮޑުމިނުން ފުރިގެން 500 މީޓަރު ދުރުގައިވުމަށް ފުރުވާ ބިންހިއްކުމުގެ މަޝްރޫޢުގެ މަސައްކަތަށް ބޭނުންވާނެ ތަކެތި ބޮޑު 745200 ކިޔުބިކްމީޓަރުގެ ވެލިނެގުން.
2. ނުވަތަ ވެލިން ބިންހިއްކުމުގެ މަސައްކަތް ކުރުމަށް ހަމަޖެހިފައިވާ ކ. ހިންމަފުށީގެ ދެކުނު ފަރާތު ދެ ސަރަހައްދުގައި އިންވެގެން 21.6 ހެކްޓަރުގެ ބިންހިއްކުމުގެ މަސައްކަތްކުރުން.

ދަންނަވަމެވެ. ފުރަތަމަ އޮޕްޝަންއެއްގެ ގޮތުގައި ވެލިނެގުމަށް ހުށަހެޅުއްވާފައިވާ ސަރަހައްދުން މަޝްރޫޢުގެ މަސައްކަތަށް ބޭނުންވާ ވަރަށް ވެލި ނުލިބޭކަމަށްވާނަމަ ނުވަތަ ވެލިނެގުމަށް ހުށަހެޅުއްވާފައިވާ ގޮތަށް ޑްރެޖިން ސަކްޝަން ކުރިމަތިން މަޝްރޫޢުގެ މަސައްކަތް ކުރިއަށް ގެންދެވޭނެ ގޮތެއް ނުވެއްޖެނަމަ، ދެވަނަ އޮޕްޝަންއެއްގެ ގޮތުގައި ހުށަހެޅުއްވާފައިވާ ހިންމަފުށީގެ ހުޅަނގުދެކުނު ފަރާތު ސަރަހައްދުގެ 210,000 އަކަމީޓަރުގެ ސަރަހައްދަކުން މަޝްރޫޢުގެ މަސައްކަތަށް ބޭނުންވާ ވަރަށް ވެލިނެގުމުގެ މަސައްކަތް ތިމާވެށްޓަށް އަސަރުކުރާނެ މިންވަރު ބަލައިގެން ރިވިއު ހުށަހެޅުއްވުމަށް އެންގުމުގެ ޝަރުޠުތަކާއިއެކު ހުއްދަދެވޭނެކަމުގައިވެސް ދަންނަވަމެވެ.

އަދި ދަންނަވަމެވެ. މިފަދަ މަޝްރޫޢުތައް ކުރިއަށް ގެންދެވުމުގައި ސަރުކާރުގެ ސިޔާސަތާއި އެއްގޮތަށް ފަރާތްތަކުން ނަންގަވަންޖެހޭ ހުއްދަތަކުގެ ތެރޭގައި، މަޝްރޫޢުގެ މަސައްކަތް ފެށުމުގެ ކުރިން އީ ހުއްދައާ ނަމުގައި ހުށަހެޅުން ވެސް ދަންނަވަމެވެ.

މި ސިޓީއާއެކު، މަޝްރޫޢުގެ މަސައްކަތުގައި ކުރިއަށް ގެންދެވުމަށް ކަނޑައަޅާފައިވާ ސަރަހައްދުތައް އިސްކުރެވިފައިވާ ޗާޓެއް ފޮނުވީމެވެ.

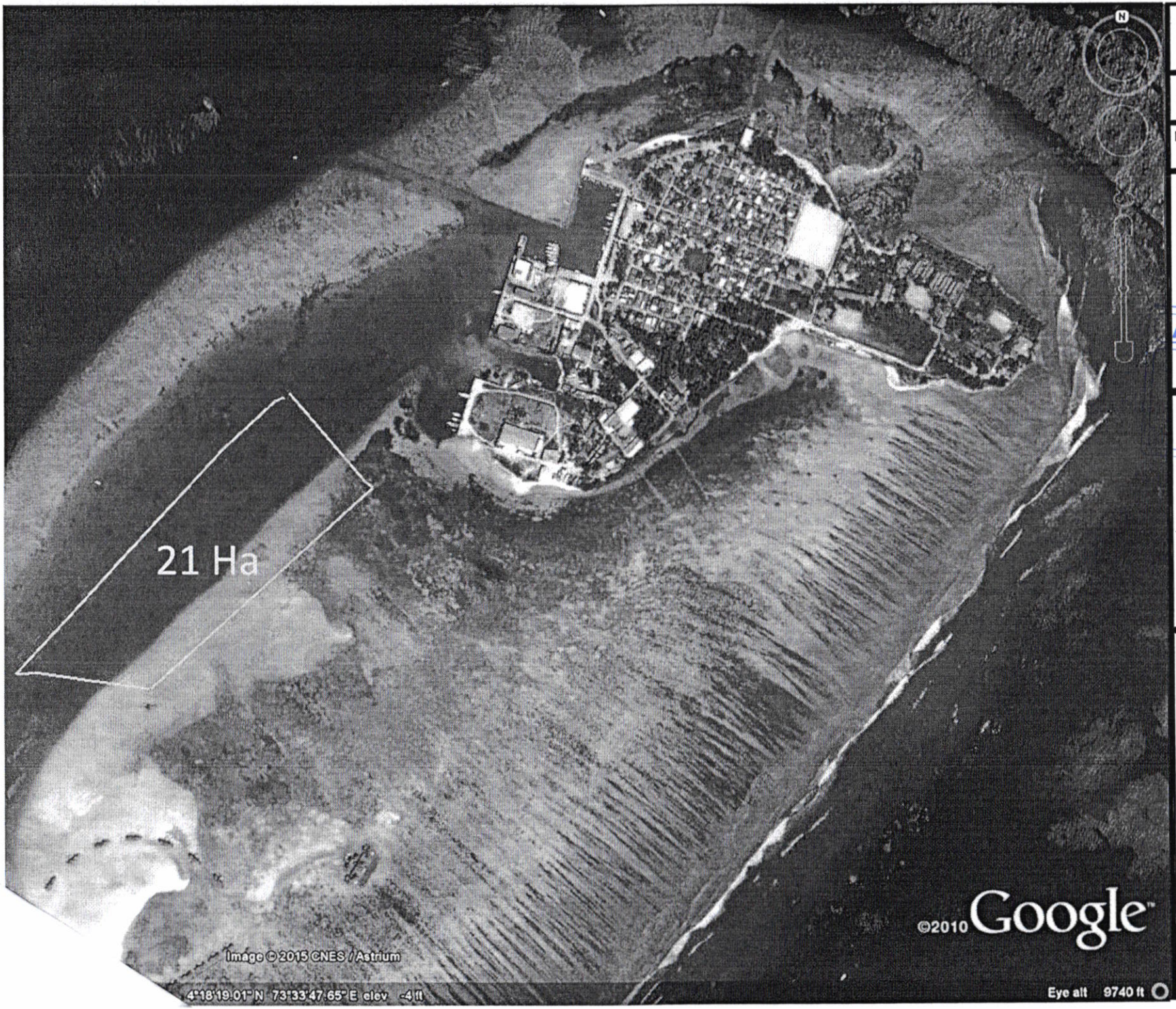
އިޙްތިރާމް ގަބޫލުކުރެއްވުން އެދެމެވެ.

20 ޝައްވާލް 1436
05 އޮގަސްޓް 2015

ޑިރެކްޓަރ، އެންވަޔަރަންމަންޓް އެސެސްމަންޓް

މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ
މާލެ، ދިވެހިރާއްޖެ

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951
Fax: [+960] 333 5953
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv
އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީ
ގްރީން ބިލްޑިންގ، 3 ވަނަ ފަންގިފިލާ، ހަނދުވަރީހިނގުން
މާލެ، ދިވެހިރާއްޖެ، 20392
ފޯނު:
ފެކްސް:
އީމެއިލް:
ވެބްސައިޓް:



PROJECT:
K. Himmafushi Reclamation

SITE: K. Himmafushi

Date : 23rd July 2015

CONTENT:

CSD Borrow Areas
(2nd Option)

IMAGE SOURCE:

Google Earth

APPROVED

203-PROREC/138/2015/170

NOTES:

Borrow Area size:
210,000m2

Expected Dredge Depth:
-5m from lagoon bed

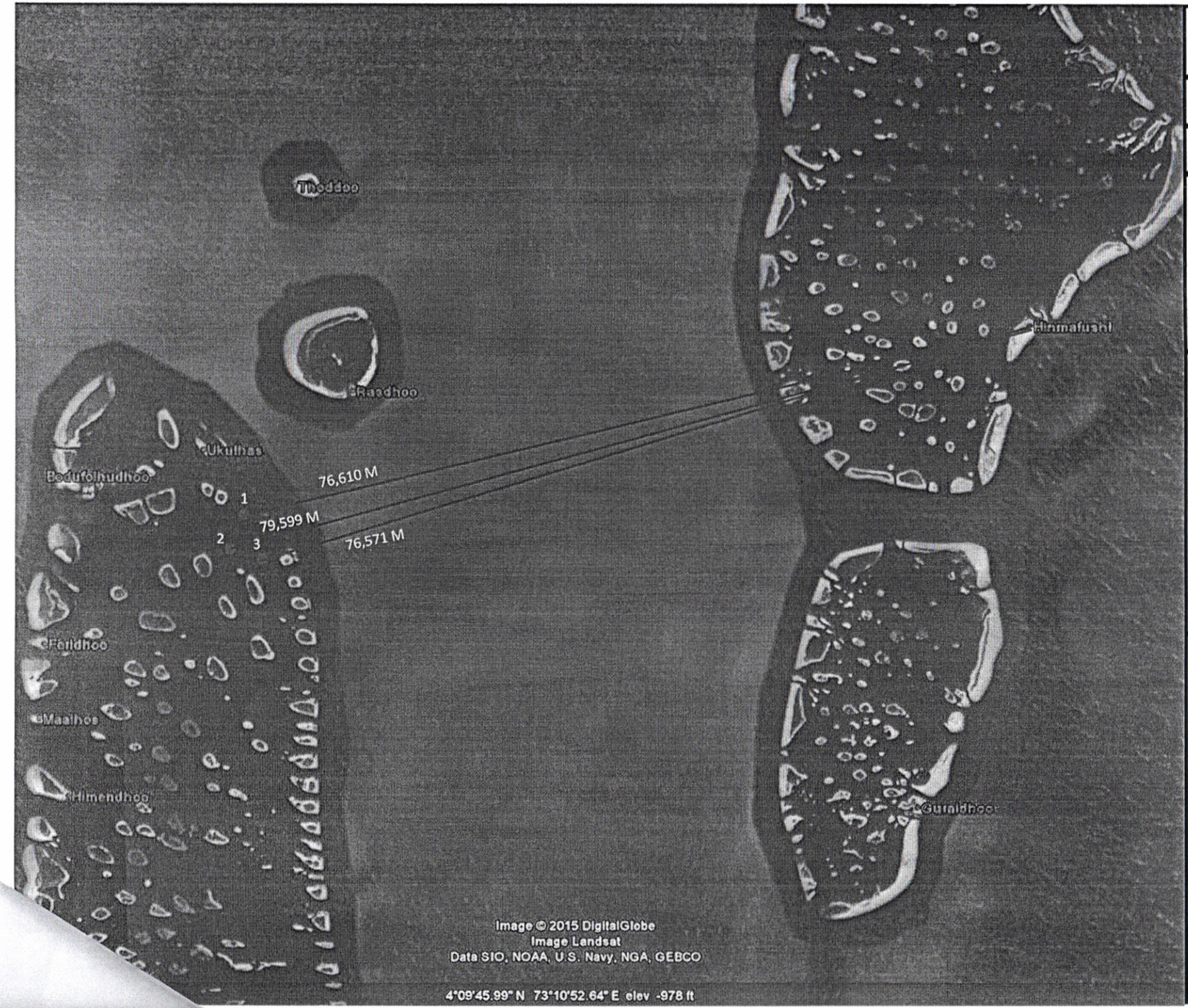
Total Expected Volume:
1,050,000.00 m3

GPS Co-ordinates

Borrow Area:
4°18'18.87"N
73°33'38.69"E

MINISTRY OF HOUSING

ENGINEERING & PROJECT IMPLEMENTATION
MINISTRY OF HOUSING AND INFRASTRUCTURE
MALE' 20392
REPUBLIC OF MALDIVES
TEL:3004300, FAX:3004301



PROJECT:
K. Himmafushi Reclamation

SITE: K. Himmafushi

Date : 23rd July 2015

CONTENT:

TSHD Borrow Areas
(1st Option)

IMAGE SOURCE:

Google Earth

APPROVED

NOTES:

Borrow Area size
Area 1: 1,600,000.00 m2
Area 2: 1,600,000.00 m2
Area 3: 1,600,000.00 m2

Expected Dredge Depth:
-1m from sea bed

Total Expected Volume
Area 1: 1,600,000.00 m^3
Area 2: 1,600,000.00 m^3
Area 3: 1,600,000.00 m^3

203-PROREC/138/2015/170

GPS Co-ordinates

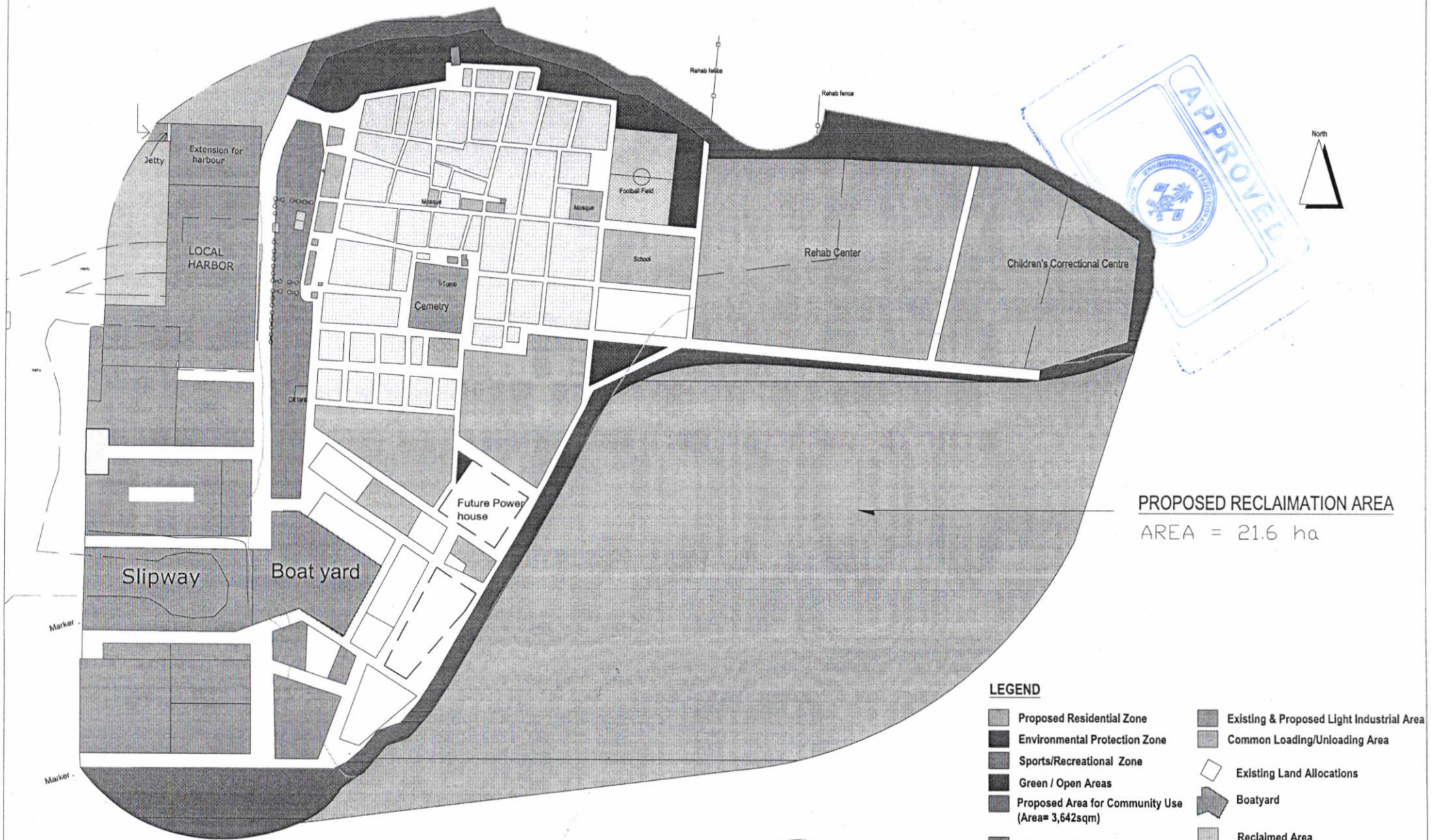
Borrow Area 1:
4° 9'30.18"N
72°53'29.38"E

Borrow Area 2:
4° 7'14.38"N
72°52'30.57"E

Borrow Area 3:
4° 6'32.24"N
72°54'25.44"E

MINISTRY OF HOUSING AND INFRASTRUCTURE
REPUBLIC OF MALDIVES

ENGINEERING & PROJECT IMPLEMENTATION
MINISTRY OF HOUSING AND INFRASTRUCTURE
AMEENEE MAGU MALE' 20392
REPUBLIC OF MALDIVES
TEL:3004300, FAX:3004301



APPROVED

MINISTRY OF HOUSING AND INFRASTRUCTURE ★ REPUBLIC OF MALDIVES ★

203 - PROREC/138/2015/170

STRY OF HOUSING AND INFRASTRUCTURE AMEENEE MAGU, MALE' 20405, REPUBLIC OF MALDIVES , PHONE: 3004300, FAX: 3004301, E-MAIL: planning@housing.gov.mv	TITLE: PROPOSED DRAFT ZONING PLAN	PROJECT: K. HIMMAFUSHI RECLAIMATION CONCEPT	DRAWN BY: YR CHECKED BY: MA	DRAWING NO: 2 OF 3 SCALE: DATE: 30 Aug 2010

بسم الله الرحمن الرحيم

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

ހިންގާ ގޭގެ ތަރައްގީ ހާއްސަ ތަންތަނުގެ ވަޒީރުގެ ދާއިރާ
ދަގަ، ދިވެހިރާއްޖެ.

Date: 10th December 2015

No: 138-PIS2/203/2015/292

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

Sub: EIA to the Proposed Reclamation in K.Himmafushi:

As the proponent of the project, we guarantee that we have read the report and to the best of our knowledge all non-technical information provided here are accurate and complete. Also we confirm our commitment to finance and implement all construction mitigation and the monitoring program as specified in the report.

Signature:

Name: Fathimath Shana Farooq

Designation: Director General

Ameenee Magu, Maafannu, Male', 20392, Republic of Maldives. ދިވެހިރާއްޖެ، ދަގަ، ފަތްތިލާ، 20392
+(960) 300 4 300 +(960) 300 4 301 secretariat@housing.gov.mv
www.housing.gov.mv www.facebook.com/housing.gov.mv www.twitter.com/HousingGovMv

މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ
މާލެ، ދިވެހިރާއްޖެ.

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

ނަންބަރު: 138-PIS2/203/2015/291

އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީގެ ޑިރެކްޓަރ ޖެނެރަލް ދަރުމަވަރުން،
ފުދުން ސަލާމަތުން ދަންނަވަމެވެ.

<u>ކ. ހިންމަފުށި ބިންހިއްކުމުގެ މަޝްރޫޢުގެ އީ.އައި.އޭ އާއި ގުޅޭ:</u>

ސަބްޖެކްޓްގައި ދަންނަވާލައިވާ މަޝްރޫޢުގެ އީ.އައި.އޭ ރިޕޯޓް އިތުރު މަޢުލޫމާތާއިއެކު 3 ހާޑް ކޮޕީއާއި 1 ޕީ.ޑީ.އެފް ކޮޕީ މި ސިޓީއާއި އެކު ހުށަހަޅަމެވެ.

އިޙްތިރާމް ޤަބޫލުކުރެއްވުން އެދެމެވެ.
27 ޛުލްޤަޢިދާ 1436ހ.
10 ސެޕްޓެމްބަރ 2015މ.

ޚާދިމުކުމުގެ

ފާތިމަތު ޝާނާ ފާރޫޤް
ޑިރެކްޓަރ ޖެނެރަލް

އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ
މާލެ، ދިވެހިރާއްޖެ

ނމ

Ameenee Magu, Maafannu, Male', 20392, Republic of Maldives.
އަމީނީމަގު، މާފަންނު، މާލެ، 20392، ދިވެހިރާއްޖެ.

+(960) 300 4 300
+(960) 300 4 301
secretariat@housing.gov.mv
www.housing.gov.mv
www.facebook.com/housing.gov.mv
www.twitter.com/HousingGovMv

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
FEN Building 5th Floor, Machangoalhi, Ameeneemagu, Male', Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

WATER QUALITY TEST REPORT

Test Report No: 301032/2015/18

Customer Informations : *Meeco,*
G. Aakakaage-1, 2nd Floor,
Alikilegefaanu Magu,
Male'
Rep. of Maldives

Date: 25/10/2015

Sample Description / Location~	Proposed Reclamation Site-K. Himmafushi	Proposed Reclamation Site-K. Himmafushi-2	TEST METHOD	UNIT
Sample Type~	Sea water			
Sampled Date~	17/10/2015			
Sample Received Date	18/10/2015			
Test Requisition Form No.	900162452			
Sample No.	820193	820195		
Date of Analysis	19/10/2015 -25/10/2015			
PARAMETER	**ANALYSIS RESULT**			
Physical Appearance	Clear	Clear	Visual	-
Conductivity	52500	52600	Method 2510 B. (adapted from Standard methods for the examintation of water and waste water, 22nd edition)	µS/cm
pH	8.19	8.23	Method 4500-H^+ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
Salinity	34.48	34.22	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
Total Suspended Solids (TSS)	<5 (LoQ 5 mg/L)	<5 (LoQ 5 mg/L)	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Turbidity	0.104	0.125	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

Keys:

UNITS: µS/cm: Micro Seimen per centimeter **mg/L:** Milligrams per litre, **‰:** Parts per thousand, **NTU:** Nephelomteric Turbidity Unit

LoQ: Limit of Quantification

Checked by:	Approved by:
Afnan Farooq Laboratory Executive	Mohamed Eyman Senior Technical Officer

Notes:

Sampling Authority: Sampling was not done by MWSC Laboratory

This test report is ONLY FOR THE SAMPLES TESTED.

~ Information Supplied by the customer

**********END OF THE REPORT**********

7576500

info@meeco.com.uy

MEECO

2nd Floor, Aakakaage-1, Galolhu
Alikilegefaanu Magu
Male', 20129
Republic of Maldives
(960) 301-0855
(960) 301-0844
info@meeco.com.mv

Key Plan

Notes :

_UNITS IN METERS
_ELAVATIONS ARE REFERRED TO MSL.

LEGEND

	EDGE OF EXSITING ROAD
	Shore line

SCALE :	1:4000
SURVEYED BY :	(SURVEYOR)
DATE OF SURVEY :	DATE
DRAWN BY :	Dinal (DRAUGHTSMAN)
CHECKED BY :	Hashika (SENIOR SURVEYOR / ENGINEER)
DATE OF SUBMIT :	24/11/2015

LOCATION
HAMMAFUSHI
KAAFU ATTOL

PROJECT : PROJECT NAME

DRAWING TITLE : DRAWING OF

DRAWING No : 2015/018

SHEET No : 01

REV	DESCRICTION	BY	DATE