Environmental Impact Assessment for the Construction of Fodhdhoo Jetty

Noonu Atoll, Maldives

Proposed by:

Ministry of Housing and Infrastructure
Government of Maldives

January, 2016

MEECO

PROJECT SYNOPSIS

Name of the Project: Environmental Impact Assessment for the Construction Fohdhoo Jetty, Noonu atoll, Maldives
Project Proponent: Ministry of Housing and Infrastructure
Project Contractor: Maldives Transport and Contracting Company
Project Value: MVR 14,999,857.88
Expected Duration: 300 Days
EIA Consultant: Ahmed Saleem
EIA Date: January 2016

WEIGHTS AND MEASURES USED IN THE REPORT

1 metre (m) = 3.28 feet (ft.)
1 millimetre (mm) = 0.03937 inches (”)
1 kilometre (km) = 1000 m
1 hectare (ha) = 10000 m^2

LIST OF ABBREVIATIONS

DIRAM	Detailed Island Risk Assessment in Maldives
DO	Dissolved Oxygen potential
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPPA	Environmental Protection and Preservation Act
GHGs	Greenhouse gases
GPS	Global Positioning System
LIT	Line Intercept Transect
MEE	Ministry of Environment and Energy
MEECO	Maldives Energy and Environment Company
MMS	Maldives Meteorological Service
MoFA	Ministry of Fisheries and Agriculture
MoHI	Ministry of Housing and Infrastructure
MWSC	Male' Water and Sewerage Company
NTU	Nephelometric Turbidity Units
RIAM	Rapid Impact Assessment Matrix
TDS	Total Dissolved Solids
TOR	Terms Of Reference
UNDP	United Nations Development Programme
USD	United States Dollar

AUTHORS

Ahmed Saleem	Lead Consultant
Mohamed Shimal	Environment Consultant
Hamdhoon Mohamed (EIA T05/15)	Environment Consultant
Ali Hammadh (EIA T12/15) Signature: 	Environment Consultant

SURVEYS

Hashika Himal	Surveyor
Muslih Mujuthabaa	Assistant surveyor

ACKNOWLEDGEMENT

The authors of this report would like to acknowledge the support and assistance given by the Ministry of Housing and Infrastructure and the Island Council of N. Fohdhoo in completing this report.

PROPONENT'S DECLARATION

The proponent has elected to submit an Environmental Impact Assessment for the proposed jetty construction at N. Fohdhoo, in accordance with Environmental Protection and Preservation Act (Act No. 4/93) and the EIA Regulations (2012).

Ministry of Housing and Infrastructure

CONSULTANT'S DECLARATION

As the lead consultant of this EIA, I hereby, declare that the content in this EIA report is complete, true, and correct to the best of information that I had while compiling this EIA.

Ahmed Saleem

EIA 03/13

TABLE OF CONTENTS

PROJECT SYNOPSIS ..... **i**
WEIGHTS AND MEASURES USED IN THE REPORT ..... **i**
LIST OF ABBREVIATIONS ..... **ii**
AUTHORS ..... **ii**
ACKNOWLEDGEMENT ..... **iii**
PROPONENT'S DECLARATION ..... **iv**
CONSULTANT'S DECLARATION ..... **iv**
TABLE OF CONTENTS ..... **v**
LIST OF FIGURES ..... **ix**
LIST OF TABLES ..... **x**

.1 ﷺ ﷺ ﷺ **1**

2. NON-TECHNICAL SUMMARY **3**

3. INTRODUCTION **4**
3.1 BACKGROUND 4
3.2 PURPOSE OF EIA 4
3.3 SCOPE OF THE EIA 4

4. ADMINISTRATIVE AND REGULATORY FRAMEWORK **5**
4.1 ADMINISTRATIVE FRAMEWORK 5
4.1.1 Ministry of Environment and Energy 5
4.1.2 Environment Protection Agency 5
4.1.3 Ministry of Housing and Infrastructure 5
4.1.4 Ministry of Finance 5
4.1.5 Fodhdhoo Island Council 6
4.1.6 Noonu Atoll Council 6
4.2 POLICY FRAMEWORKS 6
4.2.1 Strategic Economic Plan 6
4.2.2 Transport Master Plan 6
4.2.3 National Waste Management Policy (2015) 6
4.2.4 Saafu Raajje Initiative 8
4.2.5 MARPOL Convention 8
4.2.6 Basel Convention 8
4.3 LEGAL FRAMEWORKS 8
4.3.1 Environment Act 8
4.3.2 Regulation on cutting down, uprooting, removal and relocation of trees 10
4.3.3 EIA regulation 2012 10
4.3.4 The Regulation on Environmental Liabilities (Regulation No. 2011/R-9) 11
4.3.5 Regulation on dredging and reclamation 11
4.3.6 Maldives Fisheries Regulation 11
4.3.7 Regulation on Sand and Aggregate Mining 12
4.3.8 Regulation on Coral Mining 12

4.3.9 Regulation on Waste Management 12
4.3.10 Decentralization Act (7/2010) 12
4.4 SUMMARY 13

5. PROJECT DESCRIPTION 15
5.1 PROPONENT OF THE PROJECT 15
5.2 STUDY AREA 15
5.3 DESCRIPTION OF THE PROJECT SITE 17
5.4 THE PROJECT 19
5.4.1 Dismantling of the existing jetty 19
5.4.2 Dredging of a basin around the jetty 19
5.4.3 Construction of an access deck and a cargo loading/unloading area 20
5.4.4 Construction of a passenger jetty 20
5.4.5 Dredge material disposal 20
5.5 PROJECT WORK METHODOLOGY 22
5.6 JUSTIFICATION OF THE PROJECT 22
5.7 PROJECT MANAGEMENT 23
5.7.1 Project schedule 24
5.7.2 Inputs and outputs 24
5.7.3 Facilities for the project 26
5.7.4 Plans for safety and emergency 29
5.8 PROJECT BOUNDARY AND ENVIRONMENTAL IMPACT ZONE 31

6. SURVEY METHODOLOGIES 32
6.1 CLIMATE 32
6.2 HYDRODYNAMICS 32
6.3 HAZARD VULNERABILITY 32
6.4 MARINE ENVIRONMENT 33
6.4.1 Bathymetry 33
6.4.2 Benthic cover 33
6.4.3 Fish abundance 33
6.4.4 Water quality 34
6.5 ISLAND GEOMORPHOLOGY 35
6.5.1 Beach profile 35
6.5.2 Shoreline dynamics 35
6.6 LAND SURVEYS 36
6.7 TERRESTRIAL ENVIRONMENT 36
6.8 SOCIO-ECONOMIC SETTING 36
6.9 IMPACT ASSESSMENT 36

7. EXISTING CONDITIONS 39
7.1 CLIMATE 39
7.1.1 Temperature 39
7.1.2 Rainfall 39
7.1.3 Wind 40
7.2 HYDRODYNAMICS 41

7.2.1 Tides 41
7.2.2 Currents 42
7.2.3 Waves 43
7.3 HAZARD VULNERABILITY 44
7.4 MARINE ENVIRONMENT 45
7.4.1 Bathymetry 45
7.4.2 Benthic cover 47
7.4.3 Fish abundance 48
7.4.4 Water quality 49
7.5 ISLAND MORPHOLOGY 50
7.5.1 Beach profiles 50
7.5.2 Shoreline dynamics 52
7.6 TERRESTRIAL ENVIRONMENT 53
7.7 LAND SURVEYS 53
7.8 SOCIO-ECONOMIC SETTING 54
7.8.1 Population 54
7.8.2 Education 54
7.8.3 Economic activities 55
7.8.4 Services availability and quality 57

8. STAKEHOLDER CONSULTATIONS 59
8.1 FODHDHOO COUNCIL 59
8.2 FODHDHOO PUBLIC 61
8.3 PROPONENT AND CONTRACTOR 62

9. POTENTIAL IMPACTS AND MITIGATION OPTIONS 64
9.1 INTRODUCTION 64
9.2 UNCERTAINTY 64
9.3 POTENTIAL IMPACT ASSESSMENT MATRIX 64
9.4 POTENTIAL IMPACTS AND MITIGATION OPTIONS 67
9.4.1 Impacts on coastal morphology 67
9.4.2 Impacts on water quality 67
9.4.3 Impacts on air quality 68
9.4.4 Impacts on hydrodynamics 69
9.4.5 Impacts on coral reefs 69
9.4.6 Impacts on coastal vegetation 70
9.4.7 Impacts on ground water quality 70
9.4.8 Impacts on aesthetic and cultural value 70
9.4.9 Impacts on employment and income 71
9.4.10 Impacts on public health and safety 71
9.4.11 Impacts on waste management 72
9.4.12 Impacts on infrastructure 73
9.4.13 Impacts on transportation and navigation 74
9.5 SUMMARY 74

10. ALTERNATIVES 75
10.1 NO DEVELOPMENT OPTION 75

10.2 DEVELOPMENT OPTIONS 75
10.2.1 No dredge option 75
10.2.2 Dredging method 75
10.2.3 Alternative protective measures for the dredged area and shoreline 76
10.2.4 Construction of a section along the outer edge of the cargo deck 77
10.2.5 Sheet piling of the cargo deck along with construction of breakwaters 77
10.2.6 Construction of the jetty on western side of the island 78
10.2.7 Dredge material disposal 79
10.3 SUMMARY 79

11. ENVIRONMENTAL MONITORING PLAN 80
11.1 MONITORING COSTS 83
11.2 REPORTING 83

12. CONCLUSIONS AND RECOMMENDATIONS 84

13. REFERENCES 85

14. ANNEXES 86

LIST OF FIGURES

Figure 1. Project island, N. Fodhdhoo (a) close up of the jetty area (b) overview of the island. 16
Figure 2. Environmentally Sensitive Areas close to project island, N. Fodhdhoo. 16
Figure 3. Condition of the existing jetty at N. Fodhdhoo 18
Figure 4. Design concept of the N. Fodhdhoo jetty. 19
Figure 5. Roads identified for leveling by island council. (Source: Island Council) 21
Figure 6. Proposed area for setting up of construction camp site 27
Figure 7. Project area and expected environmental impact zone 31
Figure 8. Location of marine surveys 34
Figure 9. Location of water quality test sites 35
Figure 10. Variation of monthly mean temperature for H.Dh. Hanimadhoo. 39
Figure 11. Variation in monthly rainfall for H.Dh Hanimaadhoo) 40
Figure 12. Average monthly wind information for H.Dh Hanimaadhoo. 41
Figure 13. Results of near-shore current survey at the project island. 42
Figure 14. Mean monthly ocean swells for Maldives 43
Figure 15. Major natural hazards distribution pattern in the Maldives. 44
Figure 16. Bathymetry of the area proposed for construction of the jetty and dredging 46
Figure 17. Percentage of benthic cover at transect sites. 47
Figure 18. Photographs of benthic transect study 47
Figure 19. Beach profiles at six locations near proposed jetty area. 51
Figure 20. Shoreline changes of N. Fodhdhoo 52
Figure 21. Vegetation present at the proposed camp site 53
Figure 22. Population of Noonu atoll 54
Figure 23. Number of students enrolled in different levels/grades at Fodhdhoo School 55
Figure 24. Land use plan developed by the island council 56
Figure 25. Consulation with N. Fodhdhoo Council at Fodhdhoo Council Sectretariat Office. 60
Figure 26. Proposed alternative design concept for protection, for basin and shoreline 76
Figure 27. Proposed alternative design concept to ease access to jetty during rough conditions. 77
Figure 28. Proposed alternative design to ease berthing and preventive mitigation measures . 78
Figure 29. Proposed areas for marine environment and shoreline monitoring. 83

LIST OF TABLES

Table 1. Relevant regulatory and policy frameworks to the project and measures to comply. 13
Table 2. A tentative schedule for the activities of the proposed project 24
Table 3. Inputs required for implementation of the proposed project. 24
Table 4. Outputs expected from implementation of the proposed project. 26
Table 5. Mitigation measures for expected safety hazards during the proposed project. 29
Table 6. Qualitative fish abundance ranges used for the study. 34
Table 7. The scale used for the criteria that are of value to the situation 37
Table 8. Range bands used for RIAM 38
Table 9. Tidal variations in Maldives with respect to Mean Sea Level. 41
Table 10. Hazards, frequencies and damage potential for the Maldives 44
Table 11. Total number of Tridacna spp. found within a 4m x 20m band at two transects. 48
Table 12. Fish abundance at the survey area 48
Table 13. Results of water quality assessments, ... 50
Table 14. Availability of services at the island and their description. 57
Table 15. Impacts assessment for the construction phase 65
Table 16. Impact assessment for the jetty operation after reconstruction 65
Table 17. Class totals for major categories of impacts during jetty construction 66
Table 18. Class totals for major categories of impacts during jetty operation after construction 66
Table 19. Monitoring of the marine environment 81
Table 20. Monitoring of the seawater quality, shoreline, waste audit and equipment maintenance 81

1. ސާރާ ހުލާސާ

މި އެންވަޔަރަންމަންޓަލް އިމްޕެކްޓް އެސެސްމަންޓް (އީ.އައި.އޭ) ރިޕޯޓަކީ ނ. ފޮއްދޫގައި ޖެޓީއެއް ހެދުމުގެ މަޝްރޫއާއި ގުޅޭ ގޮތުން މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރގެ އެދުމުގެ މަތިން ލޭންޑް އެންޑް މެރިން އެންވަޔަރަންމަންޓަލް ކޮންސަލްޓިންގ (މީކޯ) އިން ތައްޔާރުކުރެވިފައިވާ އެންވަޔަރަންމަންޓަލް އިމްޕެކްޓް އެސެސްމަންޓް ރިޕޯޓެކެވެ.

މި ރިޕޯޓް ތައްޔާރުކުރެވިފައިވަނީ އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ (އީ.ޕީ.އޭ) އާއި ޕްރޮޕޯނަންޓާއި ދެމެދު އެއްބަސްވެފައިވާ ޓާރމްސް އޮފް ރެފަރެންސަށް ބިނާކޮށެވެ.

މި ރިޕޯޓުގެ މަޤްޞަދަކީ އެންވަޔަރަންމަންޓަލް އިމްޕެކްޓް އެސެސްމަންޓް ގަވާއިދު 2012 ގައި ބަޔާންކުރެވިފައިވާ ކަންތައްތައް ފުރިހަމަ ކުރުމެވެ. އެ ގޮތުން މިރިޕޯޓުގައި، ރޭވިފައިވާ މަޝްރޫއުގެ ސަބަބުން ތިމާވެއްޓަށާއި އިޖްތިމާޢީ އަދި އިޤްތިޞާދީ މާހައުލަށް ކުރާނެ އަސަރުތައް ބަޔާންކުރެވިފައިވާނެއެވެ.

ނ. ފޮއްދޫގައި ޖެޓީހެދުމުގެ މަޝްރޫއުގެ ދަށުން ކުރުމަށް ހުށަހެޅިފައިވާ މައިގަނޑު މަސައްކަތްތަކަކީ:

1. ބަނދަރުގައި މިހާރު ހުރިގޮތަށް ހުރި ފާލަން ނެގުން.
2. ފާލަން ހަދާ ސަރަހައްދު ވަށައިގެން 122 މީޓަރު ދިގު 50 މީޓަރު ފުޅާ ސަރަހައްދެއް ކޮނެ ފުންކުރުން.
3. ކޮންކްރީޓް ޖެޓީއަކާއި މުދާ އަރުވާ ބާލާ ސަރަހައްދެއް ފާލާއި އިންވެގެން ހެދުން.
4. މީހުން އަރާ ފޭބުމަށް ތަނެއް (ޖިމްބަރ) ގެނެސް ހެދުން.
5. ރަށުގެ ބައެއް މަގުތައް ފާލަން ސަރަހައްދުން ކޮނެގެން ނަގާ ވެލި ބޭނުން ކޮށްގެން އެއްވަރުކުރުން.

ނ. ފޮއްދޫގައި މިހާރު ބޭނުން ކުރަމުންދާ ފާލަން ހަލާކުވެ، ބޭނުން ނުކުރެވޭ ހާލަތަށް ގޮސްފައި ވުމުގެ ސަބަބުން، ހަރަކާތްތެރިވުމާ މަޝްރޫއަކީ އިޖްތިމާޢީ އަދި އިޤްތިޞާދީ ނަތީޖާތަކުން ރަށަށް ވަރަށް މުހިއްމު މަޝްރޫއެއްކަމަށް ފާހަގަކުރެވެއެވެ. އަދި މި މަޝްރޫއަކީ ސަރުކާރުން ނ. ފޮއްދޫގައި ދަތުރުފަތުރު ކުރުމުގެ ނިޒާމު ހަރުދަނާކުރުމަށް ކުރިޔަށް ގެންދާ މަސައްކަތްތަކުގެ ތެރެއިން މަޝްރޫއެއްކަމަށް ފާހަގަ ކުރެވެއެވެ. ހަރަކާތްތެރިވުމާ މަޝްރޫއުގެ ދަށުން ނ. ފޮއްދޫގައި ހުރި ޖެޓީގެ ސަބަބުން ރަށުގެ ރައްކާތެރިކަން ލިބޭ ފުރުޞަތު ބޭނުން ކުރާ ހަމަ ފުރިހަމަ ދަތުރު ފަތުރު ކުރުމަށް ލުއިފަސޭހަ ތަކެއް ލިބިދޭނެއެވެ.

މަޝްރޫއުގެ ސަބަބުން ކުރިމަތިވެދާނެ ތިމާވެށީގެ މައްސަލަތައް ދެނެގަތުމަށް ކޮންސްޓްރަކްޝަންގެ ޖާގައެއް ރަނގަޅު ޖާގައެއްކަމުގައި މަޝްރޫއުގެ މާހައުލު ދިރާސާ ކުރެވިފައިވާނެއެވެ. އަދި ރަށުގެ ކަނޑާބީ ފަރާތްތަކުގެ މަޝްވަރާ މި ރިޕޯޓް އެކުލަވާލުމުގައި ބޭނުން ކުރެވިފައިވާނެއެވެ. މަޝްރޫއުގެ ސަބަބުން ކުރިމަތިވެދާނެ ތިމާވެށީގެ އަސަރުތަކާއި އިޖްތިމާޢީ އަދި އިޤްތިޞާދީ އަސަރުތަކުގެ މައްޗަށް ވިސްނައި ދިރާސާގައި އަލިއަޅުވާލެވިފައިވާނެއެވެ. ތިމާވެށީގެ އަސަރުތައް ދެނެގަތުމަށް ބޭނުންކުރެވިފައިވާ، ސައިންޓިފިކް ހަމަތަކާއި ކޮންސަލްޓޭޝަންގެ ތަފްޞީލްތަކެވެ.

ދިރާސާއިން ހާމަވީ ގޮތުގައި، މަޝްރޫއުގެ ކޮންސްޓްރަކްޝަން މަރުހަލާގައި ތިމާވެށިއަށް ބޮޑެތި ނޭދެވޭ އަސަރުތަކެއް ކުރާނެކަމަށް ނުފެނެއެވެ. މަޝްރޫއު މި އީ.އައި.އޭ ގައި ހުށަހަޅާފައިވާ ފިޔަވަޅުތައް ޢަމަލުކޮށް ކުރިޔަށް ގެންދާނަމަ ތިމާވެއްޓަށް ކުރާ އަސަރު ވަރަށް ކުޑަކަމަށް ދެކެވެއެވެ. އެހެން ނަމަވެސް ހަރަކާތްތެރިވުމާ މަޝްރޫއުގެ މަސައްކަތްތަކުގެ ސަބަބުން ބައެއް ދެމެހެއްޓެނިވި ތިމާވެއްޓަށް ކުރާނެ ކުޑަކުޑަ އަސަރުތަކެއް ހުރެ ވީނަމަވެސް އެ އަސަރުތައް ކުޑަކުރުމަށް ފިޔަވަޅުތައް ހުށަހަޅާފައިވާނެއެވެ. ތިމާވެށީގެ ނަޒަރު އަސަރުތަކާ ވާގިވެ މަޝްރޫއުގެ އީ.އައި.އޭ ރިޕޯޓްގައި ފާހަގަ ކޮށްފައިވާ ފިޔަވަޅުތައް އަޅައިގެން މަސައްކަތް ކުރުމަށް ލަފާދެވެން.

ބޭނުން ކުރެވޭނީއެވެ. އެހެން ނަމަވެސް ފަދަ ފުރުޞަތުގެ ސަބަބުން އެސަރަހައްދުން ގެއްލޭ ފަރުގެ ސަރަހައްދަކީ މި މަޝްރޫޢުގެ ސަބަބުން ތިމާވެއްޓަށް ލިބޭނެ ދާއިމީ ގެއްލުމެކެވެ.

ނ. ފޮއްދޫގައި ފާލަން ހެދުމުގެ އަމަލީ މަސައްކަތް ކުރިއަށްދާ ދުވަސްވަރު ތަރުގެ ހަމައެކަނި ވަގުތުތަކުން ބޭރުން ކުރެވޭ ފާލަން ތަޢާރުފުކުރަން ބޭނުންކުރެވޭ ސަބަބުން ތަޢާރުފުކުރަން ކޮންމެވެސް ވައްތަރެއްގެ ދިރިއުޅުން ކުރިމަތިވާނެއެވެ. މި ދިރިއުޅުމުގެ ސަބަބުން ކޮންމެވެސް ވައްތަރެއްގެ އިޤްތިޞާދީ އަދި އިޖްތިމާޢީ ނުރައްކާ އަސަރުތަކެއް ކޮށްފާނެކަން ލަފާކުރެވެއެވެ. އެހެން ކަމުން މި މަސައްކަތު ކުރިއަށްދާ ދުވަސްވަރު ތަޢާރުފުކުރަން ކުރިމަތިވާނެ ދަތި އުނދަގޫތަކެއް ލުއިކުރުމަށް ގޮސްދަނީ ކުރިއަށްގެންދާ ކަންކަމެއް ވީ ރަށުގެކަމުގައި ފާހަގަ ކުރެވިފައެވެ. ފާލަން ހެދުމުގެ މަސައްކަތު ކުރިއަށް ދުވަސްވަރު ދިޔުން ކަންތައްތައް ދިމާވިއަދެވެސް ފާލަންހަދާ ނިމި ބޭނުން ކުރުވުން ފުރުޞަތު ތަރުގެ ހަމައެކަނި ލިބިދާނެ އަސަރުތަކެއް ލިބޭނެ ކަމަށް ލަފާކުރެވޭއެވެ.

މަސައްކަތު ކުރިއަށް ގެންދިޔުމުގެ ސަބަބުން ކުރިމަތިވާނެ ބައެއް މައްސަލަތަކަކީ ހިސާބު ދަތުރުތަކުން ފެށޭ ކަންކަމަށް ނުވެވުމާއި، ދިރާސާތަކުން ހޭލުވުމާއި، ފަހުން ނަތީޖާ ނުކުންނަ ގޮތުން ފަހުން ދިރާސާތަކުގެ ކަންކުރުމަށް ދުރުވެރިވުމަށް ދިމާވެދާނެ އެކިކަހަލަ ކަންތައް ހަމަކުރުމުގެ ނޭނގުމާއި، ތިމާވެއްޓަށް ކުރިމަތިވާ އަސަރުތަކާ އެކުގެ އަނެއްކާ ގުޅިގެން ދުރުގެކަމަށް، އެކަކުކަމަށް އެކުގެ އަމަލު ފެހިވިޔުޖަހާ އެއްޗެހި މަސައްކަތު ހިނގުމުގެ ދުރުގެ އެކަކުލިން ޖަގަހަތަކުގެ ދެތަނަދުރުގެ ކުރިއަށް ގެންދަން ގެންދިޔުމުގެ ކަމަށް މި ރަށުގައި ފާހަގަ ކުރެވިފައިވާނެއެވެ.

މިގޮތުން މަސައްކަތް ހިނގައިގެން އުޅޭ ދަތުރުތަކުގެ ގޮތުން ޖަހާފަހުގެ ކުރިއަށް ގެންދިއުމާއި، މަސައްކަތުގެ މަސައްކަތް ތަކުން ކުރިމަތިވާނެ ތިމާވެށީގެ އަސަރުތަކަށް ކުޑަކުރުމަށް ރަށުގައި ބަދަލުކުރުމަށް ފިޔަވަޅުތައް އަޅައިގެން މަސައްކަތު އެކަށީގެން ގެންދަގައި ކުރިއަށް ގެންދިއުން ކަމަށް ދިރާސާއިން ފާހަގަ ކުރެވިފައެވެ.

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2. NON-TECHNICAL SUMMARY

The Ministry of Housing and Infrastructure requested the services of Maldives Energy and Environmental Company (MEECO) to provide an Environmental Impact Study (EIA) for the construction of a jetty at Fodhdhoo Island, Noonu Atoll.

The assessment addresses specific key issues stated in the Terms of Reference (TOR) as agreed between EPA and the Proponent following the Scoping Meeting held on the matter.

This EIA report was prepared for the fulfilment of the requirements of the Environmental Impact Assessment Regulations, 2012 with the purpose of conducting an assessment of possible impacts on biophysical and human environment arising from proposed development project.

The project is proposed by Ministry of Housing and Infrastructure, Maldives.

The proposed jetty construction project include the following components;

1. Dismantling of the existing jetty
2. Dredging of a 122m by 50m basin around the jetty
3. Construction of a concrete access deck and a cargo loading/unloading area
4. Construction of a timber deck extension for passenger transfer
5. Leveling of roads using dredge material

The proposed jetty construction project at N. Fodhdhoo has been identified as an important and a justifiable project from a socio-economic perspective as well as to achieve the government's objective of facilitating easing transport to and from the island. The existing jetty at the island is seriously damaged, presenting various operational difficulties and safety concerns to frequent jetty users. The construction of the proposed jetty at the island will greatly improve the only transportation facility at the island.

This EIA has been compiled using environmental information obtained during a field visit to the island by a team of consultants. The EIA has also incorporated the views and opinions of relevant stakeholders at the island obtained through consultations. In addition, the report looks into the possible environmental, social and economic impacts that may arise from implementation of the proposed project. The Environmental impacts assessments carried out for this survey employed sound scientific methodologies and experience of the consultants.

The project is expected to have some temporary and permanent negative environmental impacts and temporary socio-economic impacts during the construction phase of the project. Most of the expected adverse environmental impacts can be minimized by following the measures proposed in this EIA, except for the permanent loss of coral reef from the proposed dredge area. The temporary socio-economic impacts during the construction phase will present difficulties to the residents of the island, though some can be effectively mitigated by following the measures proposed, while all these issues are expected to be resolved once the jetty comes into operation. Overall, most of the impacts are expected to be short-lived and only significant during the construction phase of the project. On the other hand, the socio-economic factors will greatly improve during the operational phase of the jetty as a result of the improved facility.

Based on the results of the assessments, this EIA study concludes that with the proposed mitigation in place, the project is justifiable, would be environmentally acceptable and could proceed in compliance with the relevant environmental legislations and regulations. In this EIA, the consultants have proposed an Environmental management plan to ensure that the construction phase of the project does not cause major unexpected impacts on the environment as well as to ensure that the proposed measures are working effectively to safeguard the environment.

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3. INTRODUCTION

3.1 BACKGROUND

The Ministry of Housing and Infrastructure (MoHI) (hereafter referred as the 'Proponent') requested the services of the Maldives Energy and Environmental Company (MEECO) to undertake the Environmental Impact Assessment (EIA) for the proposed jetty construction at Fohdhoo Island, Noonu atoll.

MEECO prepared this document in accordance with the EIA Regulations (2012) and Regulation on Dredging and Reclamation (Regulation 2013/R-15). This EIA provides a focused assessment of the proposed jetty construction project in terms of existing environmental conditions, potential environmental impacts to the surrounding near shore marine environment and shorelines and social-economic impacts as detailed in the Terms of Reference (ToR) for undertaking EIA for this project (ToR is attached in Annex 1).

The proponent plans to improve transportation and access to the island of Fodhdhoo by constructing a jetty through the proposed project. A jetty already exist on the eastern side of the island but the structures of the existing jetty have crumbled, presenting difficulties when accessing the jetty and making it very unsafe for the users. The existing jetty was initially built by the people of Fodhdhoo in the year 1984. This jetty was later repaired and extended by the people in the late 90s. Under the proposed project, the proponent proposes to remove the existing jetty and build an improved jetty at the same location.

The proposed jetty construction project at Fodhdhoo can be divided into five major components. These major components are; (1) Dismantling of the existing jetty (2) dredging of a 122m by 50m basin around the jetty for safe and easy passage for vessels accessing the jetty (3) construction of a concrete access deck and a cargo loading/unloading area (4) construction of a timber deck extension for passenger transfer and (5) leveling of roads using dredge material.

3.2 PURPOSE OF EIA

Given the potentially adverse environmental impacts associated with dredging and the other works in the marine environment for the proposed project at N. Fohdhoo, the proponent has requested MEECO the 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 to 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 negatives effects of the project;
b) To provide necessary information to EPA applicable to the proposed development; and
c) To assess how the proposals have been developed to achieve a satisfactory level of environmental performance in line with the EIA Regulations.

3.3 SCOPE OF THE EIA

This EIA is concerned with the proposed jetty construction project at the island of Fohdhoo, Noonu atoll. The details of the EIA scope are provided in the ToR attached in Annex 1.

4. ADMINISTRATIVE AND REGULATORY FRAMEWORK

This section highlights relevant government stakeholders, their roles and reviews relevant legal, administrative and policy frameworks applicable to the proposed project.

4.1 ADMINISTRATIVE FRAMEWORK

A number of government agencies are have a stake in the proposed jetty construction project at Fodhdhoo. These include:

- Ministry of Environment and Energy;
- Environmental Protection Agency (EPA);
- Ministry of Housing and Infrastructure
- Ministry of Finance;
- Island Council
- Atoll Council.

4.1.1 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 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.

4.1.2 Environment Protection Agency

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 MEE, 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.

4.1.3 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 harbor developments 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.

4.1.4 Ministry of Finance

The Ministry of Finance is responsible for managing the financial resources of Government and to ensure that a proper legal framework and supporting systems are in place for that purpose. The Ministry in

delivering its mandate seeks to promote government's fiscal policy framework; coordinate macroeconomic policy and intergovernmental and external financial relations; manage the budget preparation process; secure and allocate funding for approved public policies and programmes; and to monitor the implementation of departmental budgets.

Ministry of finance is a key stakeholder in the proposed dredging project as the ministry is mandated with disbursement of project funding for the project.

4.1.5 Fodhdhoo Island Council

The Decentralization Act mandates Island Councils to provide primary health care and this was the first function to be decentralized to the Island Councils. The Act also mandates island councils to provide basic municipal services. The island council is also tasked with the development of economic activities, management of island resources and assimilation of projects relating to the island. The island council is a major stakeholder of the proposed project and is the main component which would facilitate the progress of the project once it has been approved by the EPA.

4.1.6 Noonu Atoll Council

Atoll Councils are established under the Act on Decentralization of the Administrative Divisions of the Maldives (Law Number 7/2010). The main function of the Atoll Council is to coordinate functioning of the island councils. In addition, the Atoll Councils are responsible for overseeing the uninhabited islands in the atoll. Hence, the Noonu Atoll Council is considered as a stakeholder.

4.2 POLICY FRAMEWORKS

All development plans in the Maldives are pre-set to achieve certain predetermined goals which would enhance sustainable growth. This section of the report identifies and describes the major policies and plans to which the proposed project falls under.

4.2.1 Strategic Economic Plan

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

4.2.2 Transport Master Plan

This document highlights the requirement for efficient maritime transport networks, including harbour facilities to sustain the country's economic growth. In addition the need to ensure efficient transport systems that systematically link Malé to the rest of the country has been identified as a crucial factor that will contribute to the socioeconomic development across the country.

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

- To reduce waste generation promote and inculcate 3R concept;
- Conduct sustained awareness building activities at all levels to create public awareness on safe waste management practices;
- 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;
- Formulate solid waste management plans for each inhabited island and undertake waste management activities in accordance with such plans;
- Formulate the Waste Management Legislative framework and carry out waste management activities in accordance with the framework;
- Review medical waste management regulations and carry out waste management activities of the health sector in accordance with such regulations;
- Collect statistics on waste at island and national levels and disseminate such information;
- Establish a system to impose and collect fees/charges from waste producers/generators;
- 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;
- In a sustained manner conduct training programmes on safe management of waste targeting stakeholders;
- Establish, maintain and update an inventory of waste management systems established in inhabited islands;
- Establish regional waste management facilities in all the designated regions of the Maldives;
- 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;
- Conduct research on latest waste management technologies;
- 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
- Establish a "National Waste Management Trust Fund"

4.2.4 Saafu Raajje Initiative

The "Saafu Raajje Initiative", which is a long term plan of action for management of waste, was launched by MoEE as a pre-event to the Sixth Regional 3R Forum in Asia and the Pacific held in the Maldives (16-19 August 2015). The initiative, which is a campaign, geared towards proper waste management and encouraging a significant reduction in waste generation was organised by the government of Maldives with the participation of more than 100 resorts operating in the Maldives. The initiative seeks to promote safe management of waste, increase awareness of safe waste management practices and to solicit atoll and island level support for such activities.

4.2.5 MARPOL Convention

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention which covers pollution of the marine environment by ships due to operational and accidental causes. As a member party of the MARPOL convention, the convention applies to the Maldives and is expected to adhere by and maintain the standards specified by the convention with regard to maritime pollution and their control. These include pollution due to

- Oil spillage
- Noxious liquid substances in bulk
- Spillage of harmful substances carried by sea in packaged form
- Sewage and garbage from ships
- Air pollution from ships

Prevention measures should be taken into account with regard to these sources of pollution during the developmental and functioning stage of the project.

4.2.6 Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, usually known as the Basel Convention, is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs). The convention identifies and proposes procedure to be followed with regard to hazardous waste transportation. It encompasses stringent requirements for notice, consent and tracking for movement of wastes. As a member party to the convention Maldives is obliged to practice these measures at both international and national levels.

4.3 LEGAL FRAMEWORKS

Four regulations pertaining to the proposed project have been reviewed and the project's conformity to these have been assessed.

a) EIA Regulations 2012
b) Regulations on cutting down of Trees
c) Regulation on Dredging and Reclamation
d) Regulation and Waste Management

4.3.1 Environment Act

Environment Protection and Preservation Act of Maldives (Law No: 4/93) was enacted in April 1993 as an umbrella law to protect and preserve the environment of the country. The articles and clauses of the law are given below. The clause 5 is directly related to the proposed project in Fiyoari and this study. As the Government authority with a mandate for the protection and preservation of the environment, Ministry of

Environment and Energy has the responsibility of formulating policies, laws and regulations on environmental protection and conservation.

Environment Protection and Preservation Act (Law No. 4/93) (EPPA) is the most important governing law as far as the environmental impact assessment is concerned.
EPPA mandates all development projects in the Maldives to undertake an Environmental Impact Assessment prior to undertaking any such project.

Introduction

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 and lagoons and all natural habitats are important for the sustainable development of the country.

Environmental guidance

2. The concerned government authority shall provide the necessary guidelines and advise on environmental protection in accordance with the prevailing conditions and needs of the country. All concerned parties shall take due consideration of the guidelines provided by the government authorities.

Environmental protection and conservation

3. The Ministry of Environment shall be responsible for formulating policies, as well as rules and regulations regarding the environment in areas that do not already have a designated government authority already carrying out such functions.

Protected areas and natural reserves

4. (a) The Ministry of Environment shall be responsible for identifying protected areas and natural reserves and for drawing up the necessary rules and regulations for their protection and preservation.

(b) Anyone wishing to establish any such area as mentioned in (a) of this clause, as a protected area or a reserve shall register as such that at the ministry of Environment and abide by the rules and regulations laid by the Ministry.

Environmental Impact Assessment (EIA)

5. (a) An impact assessment study shall be submitted to the Ministry of Environment before implementing any development project that may have a potential impact on the environment.

(b) The Ministry of Environment shall formulate the guidelines for EIA and shall determine the projects that need such assessment as mentioned in paragraph (a) of this clause.

The Termination of Projects

6. The Ministry of Environment has the authority to terminate any project that has any undesirable impact on the environment. A project so terminated shall not receive any compensation

Waste disposal, oil and poisonous substances

7. (a) Any type of waste, oil, poisonous gases or any substance that may have harmful effect on the environment shall not be disposed within the territory of the Maldives.

(b) In case where the disposal of the substance stated in paragraph (a) of this clause becomes absolutely necessary, they shall be disposed only within the areas designated for the purpose by the government. If

such waster is to be incinerated, appropriate precautions shall be taken to avoid any harm to the health of the population.

Hazardous/ Toxic or nuclear wastes

8. Hazardous/Toxic or Nuclear Wastes that is harmful to human health and the environment shall not be disposed anywhere within the territory of the country. Permission shall be obtained from the relevant government authority at least 3 months in advance for any transboundary movement of such wastes through the territory of the Maldives.

4.3.2 Regulation on cutting down, uprooting, removal and relocation of trees

Cutting down and relocating of mature trees is regulated in Maldives under the by-law on cutting down, uprooting, digging out and export of trees and palms from one island to another. In the preamble of the law, made in pursuant to Law No. 4/93, it states the purpose of the law is to educate citizens and developers about the importance of trees including sound management to maintain trees and provide standards for the preservation of trees in the Maldives.

Under the law certain tree are prohibited to remove from island. They include:

- The coastal vegetation growing around the islands extending to about 15m into the island
- All trees and palms growing in mangroves and wetlands and, trees and palms found in the area extending 15m out from the boundary of mangroves and wetlands.
- All trees in Government protected areas
- Trees that are being protected by the Government in order to protect species of animal / organisms that inhabit on such trees
- Trees / palms those are unusual in nature.

The law states that prior permission must be obtained for removal and/or relocation of 10 or more trees or palms. For indiscriminate removal and land clearances an EIA Decision Note is required. The size of the trees and palms that are allowed to be relocated should have more than 15feet from lowest point to the crown spread for palms and 8 feet from the lowest point to the trunk to tip of the highest branch for trees other than palms.

The law also states that cutting down and uprooting of the trees shall be made under supervision of the island / atoll offices (in the current context Atoll / Island Councils).

4.3.3 EIA regulation 2012

The most important governing law as far as the environmental impact assessment is concerned is Environment Protection and Preservation Act (Law No. 4/93) (EPPA).

EPPA mandates all development projects in the Maldives to undertake an Environmental Impact Assessment prior to undertaking any such project.

Further the EPPA states an impact assessment study shall be submitted to the relevant Government authority before implementing any development project that may have a potential impact on the environment.

It goes on to say that the relevant Authority of Government shall formulate the guidelines for environmental impact assessment and shall determine the projects that need such assessment as mentioned in above.

The law also gives power to the relevant Government authority to terminate any project that has any undesirable impact on the environment. A project so terminated shall not receive any compensation.

According to the EPPA waste disposal, oil and poisonous substances any type of waste, oil, poisonous gases or any substance that may have a harmful effect on the environment shall not be disposed within the territory of the Maldives.

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

Under the provisions of EPPA the Government of Maldives has formulated and gazetted Environmental Impact Assessment Regulations (2012) detailing the EIA process and the EIA preparation.

In addition to EIA regulations, other relevant regulation will be followed in development and implementation of the proposed project. These regulations include ban on coral mining. Coral mining from house reef and atoll rim reef has been banned since 1990. Sand mining from any island has also been banned since March 2000.

The EPPA, EIA Regulations and other relevant regulations will be duly taken into consideration in preparing the EIA report and in the implementation of the project.

4.3.4 The Regulation on Environmental Liabilities (Regulation No. 2011/R-9)

The objective of this regulation is to prevent actions violating the Environmental Protection and Preservation Act 4/93 and to ensure compensations for all the damages that are caused by activities that are detrimental to the environment. The regulation sets mechanisms and standards for different types of environmental liabilities and equal standards that shall be followed by the implementing agency while implementing the regulation. According to this regulation the Government of Maldives reserves the right to claim compensation for all the activities which have breached the Environmental Protection and Preservation Act 4/93**.**

4.3.5 Regulation on dredging and reclamation

Regulation on Reclamation and Dredging of Islands Lagoons (Regulation 2013/R-15) 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.

Since any EIA submission shall be made only after successful clearance of the dredging and reclamation permit, the proponent has obtained clearance from EPA in advance as per this Regulation. A copy of the permit is given in Annex 3.

4.3.6 Maldives Fisheries Regulation

The Maldives fisheries regulation is formulated under the authority of Maldives fisheries law (5/87), by then Ministry of Fisheries, Agriculture and Marine Resources. The regulation mainly focuses on management of fisheries related activities and marine resources within the Exclusive Economic Zone of Maldives. The section 3 of the regulation, is of particular importance to an EIA, since it give a listing of species banned from catching, fishing, harvesting, or killing. The list of species banned from these activities, under the regulation is listed below.

1. Dolphins
2. Whales
3. Lobsters bearing eggs and any lobster less than 25cm length from its head to tail.
4. Conch
5. Giant Clam

6. Black coral
7. Whale shark
8. Napoleon wrasse
9. Turtles
10. Turtle eggs

The only activities, exempt from the bans in section 3 are, research conducted by Ministry of Fisheries Agriculture and Marine resources or other parties who are registered at Ministry of Trade and Industries for promotion of fishery. However, this exemption does not apply for killing ban imposed under section 3. Such operation are, though, required to be carried out with prior permission obtained from Ministry of fisheries and Agriculture.

The regulation neither specifically exempt infrastructure development projects from carrying out any of the banned activities in section 3 of the regulation nor does it provide a mechanism to address such an issues.

4.3.7 Regulation on Sand and Aggregate Mining

This regulation addresses sand mining from islands and bird nesting sand bars. Sand and aggregate mining from beaches of any island whether inhabited or uninhabited is banned for protection of the islands. Permissions for sand and aggregate mining from other areas shall be obtained from the relevant authorities.

4.3.8 Regulation on Coral Mining

Coral mining from the house reef of islands and the atoll rim reefs is banned through a directive from the President's Office dated 26th September 1990. According to this policy coral mining shall not be carried out from house reefs of islands and atoll rim reefs and common bait fishing reefs. Coral and sand mining is only allowed for house construction from designated sites and approval from the concerned authorities is required prior to mining activities. Request for coral and sand mining from residents of inhabited islands are required to be submitted to the Atoll Offices through the respective island offices. The island office is required to estimate the quantities of coral or sand required for the applied construction work of houses to ensure that the permission is grated for minimum amounts required. Every island is required to maintain a log book of permissions granted and the amounts mined and the site where mining was carried out.

4.3.9 Regulation on Waste Management

Waste management Regulation (No. 2013/R-58) 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 on collecting, storing, transporting and managing waste. In the preamble its states the objective of the regulation is in line with the Article 22 of the Constitution which requires that development activities designed for achieving socioeconomic targets should ensure that environment and its constituent living component is not compromised and that resources are utilized effectively.

The regulation talks of the responsibilities of collection, transport, treating and storage of waste. It also talks of management centres and landfill sites and managing hazardous waste. Various sectors and entities (including tourist resorts) encouraged having their own waste management plans consistent with the Regulation.

EPA is the implementing agency of environmental law and the implementing agency of the EIA regulation.

4.3.10 Decentralization Act (7/2010)

In April 2010 the Decentralization Act was passed by the parliament. This act formalized the roles and responsibilities of Atoll and Island Councils and required that they be democratically elected. Importantly the Decentralization Act did not include any role for the provincial administrations. The Decentralization

Act provided for the establishment of a Local Government Authority to which Island and Atoll councils are accountable. The Local Government Authority was established in late 2010 and the first local council elections were held in February 2011. The Decentralization Act mandates Island Councils to provide primary health care and this was the first function to be decentralized to the Island Councils. The Act also mandates island councils to provide basic municipal services.

4.4 SUMMARY

In summary, the EIA report has not identified any particular law or regulation that the project could contravene if conducted within the proposed scope and mitigation measures are properly implemented. As such, it is concluded that the proposed project can proceed fully in compliance with the relevant laws, regulations, government polices pertaining to the protection and conservation of the environment. Table 1 below summarizes the relevant regulatory and policy frameworks and discusses how the proposed project could comply with them.

Table 1. Relevant regulatory and policy frameworks to the project and measures to comply.

Legal Framework	Measures to Comply
Environment Act (Law No. 4/93) Environment Impact Assessment Regulation 2012	Necessary processes followed and an EIA prepared to comply with the mentioned law and regulation
Dredging and Reclamation Regulation (2013/R-15)	The EIA has been submitted with the drawings of the dredge area, and the report defines the scope and context of the project setting with the perceived environmental impacts to the existing environment. The requirements under this regulation will be fulfilled when the EIA for the project is approved and dredge permit obtained (Application for dredge permit submitted along with EIA submission).
Regulation on Environmental Liabilities (2011/R-9)	EIA report prepared with assessments of likely impacts and mitigation measures proposed or alternatives to address likely impacts. Approval of the EIA indicate that project scope and proposed mitigation measures are acceptable to address impacts arising from the project. An Environmental Monitoring Program is proposed for monitoring of impacts from project activities and effectiveness of mitigation measures, both during construction and operational phase. The results of monitoring activities is to be submitted to EPA at intervals presented in the report to ensure compliance within EPA's environmental standards.
Regulation on Sand and Aggregate Mining (2000)	Although the project involves dredging it is not specified as sand mining. Mining for sand is not included in the scope of the project.
Regulation on Coral Mining	Although the project involves dredging it is not specific to coral mining. Coral mining is not included in the scope of the project. Hence this regulation is adhered.
Waste Management Regulation, (No. 2013/R-58)	Will be complied through the EIA report and its approval. The report specifies preventive and mitigation measures for all types of wastes that may result from the project.

Decentralization Act (7/2010)	The EIA report was shared with the island council and atoll council.
Maldives Fisheries Regulation	Though the project is not related to fisheries, project will result in killing of Giant Clams through dredging, since proposed dredge area has a high density of Giant clams. The regulation prohibits killing of Giant clams and does not specifically address how to deal with such loss from development projects or exempt development projects from any of the prohibited practices. Hence, it is recommended that the proponent negotiate with Ministry of Fisheries and Agriculture on how to proceed under the present circumstances, to ensure that this regulation is fully complied to.
Regulation on cutting down, uprooting, removal and relocation of trees	No trees are proposed to be cut, removed, uprooted or relocated under the scope of the proposed project. Additionally, mitigation measure proposed to ensure no trees are impacted within coastal vegetation protected under the regulation.
Policy Framework	
Strategic Economic Plan	The proposed project aims at strengthening access to islands, which could facilitate economic growth.
Transport Master Plan	The construction of the jetty at the island is expected to improve transportation and navigation, hence have the potential to strengthen transport network of the Maldives.
National Waste Management Policy (2015)	Mitigation measures proposed under this EIA to carry out activities in line with the policy
Saafu Raajje Initiative	Waste management measures proposed under mitigation to adhere to principles of this initiative
MARPOL Convention	In line with the convention, the EIA report proposes waste mitigation measures facilitate proper waste disposal from vessels that are expected to berth at jetty.
BASEL Convention	Hazardous waste storage and disposal are to be managed in accordance with the waste management regulation. EIA report addresses hazardous waste management mechanisms and proposes mitigation measures to comply with hazardous waste management standards set out under waste management regulation. Compliance to this will adhere to principles of this convention.

5. PROJECT DESCRIPTION

5.1 PROPONENT OF THE PROJECT

The project is proposed by Ministry of housing and Infrastructure (MoHI) of the Government of Maldives with the aim of improving transportation to and from the project island. The MoHI is the government institution responsible for infrastructure development and, formulation and implementation of relevant policies and priorities with regard to national infrastructure development. The proponent has awarded the implementation of the project to Maldives Transport and Contracting Company (MTCC).

Contact detail of the proponent is stated 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

5.2 STUDY AREA

The proposed jetty construction project will be undertaken at the island of Fohdhoo, Noonu atoll. The island, which is roughly centered at $5^0$44' 37.32" N, 73^0 12' 58.02" E, and lies on the western edge of the Noonu atoll. The total land area of the island is approximately 26.6 ha which is surrounded by its own reef system covering an area of about 30 ha. The residential area, situated on the northern half of the island, covers only about 6.87 ha of land while the southern section of the island is mostly occupied by dense vegetation and some cleared areas for farming. The beach area around the island is fairly big with no severe erosion observed. However, council members noted an isolated erosion event in a year when wind approaching from southwestern direction continued for prolonged periods, causing the beach on south and southwestern side to erode. The island council members confirmed that erosion is not a serious issue at the island but they noted noticing recession of beach on the windward side of the island while seeing accretion of sand on the leeward side. According to council members, this phenomenon occurs throughout the year with reversal of sand movement when direction of wind changes in two monsoons.

The island of Fodhdhoo is situated 21.5km to the west of the atoll's capital, N. Manadhoo. The closest inhabited island to Fodhdhoo is the island of Holhudhoo. Holhudhoo is located about 5.4km to the east from the project island. No airport exist within the Noonu atoll, however, Fodhdhoo is the closest island from Noonu atoll to a domestic airport. The Ifuru domestic airport situated at the western rim of the Raa atoll is approximately 21.5 km to the west of Fodhdhoo.

The Figure 1 below shows the overview of the project island and the area where the proposed jetty will be constructed. The project island is close to two Environmentally Sensitive Areas (ESA) but no protected area exist in close proximity as there are no protected areas within the Noonu atoll. The closest ESA, Than'burudhoo, falls within an approximately 2.5km radius from the island while the other ESA, Fodhdhipparu, is located within approximately 5km radius (Figure 2). According to EPA website, these two ESA are identified for their significance as two seabird breeding sites. The remaining ESAs present in Noonu atoll fall outside a 10km radius from the project island, hence they are not expected to be of any significance for the EIA assessment of the proposed project.

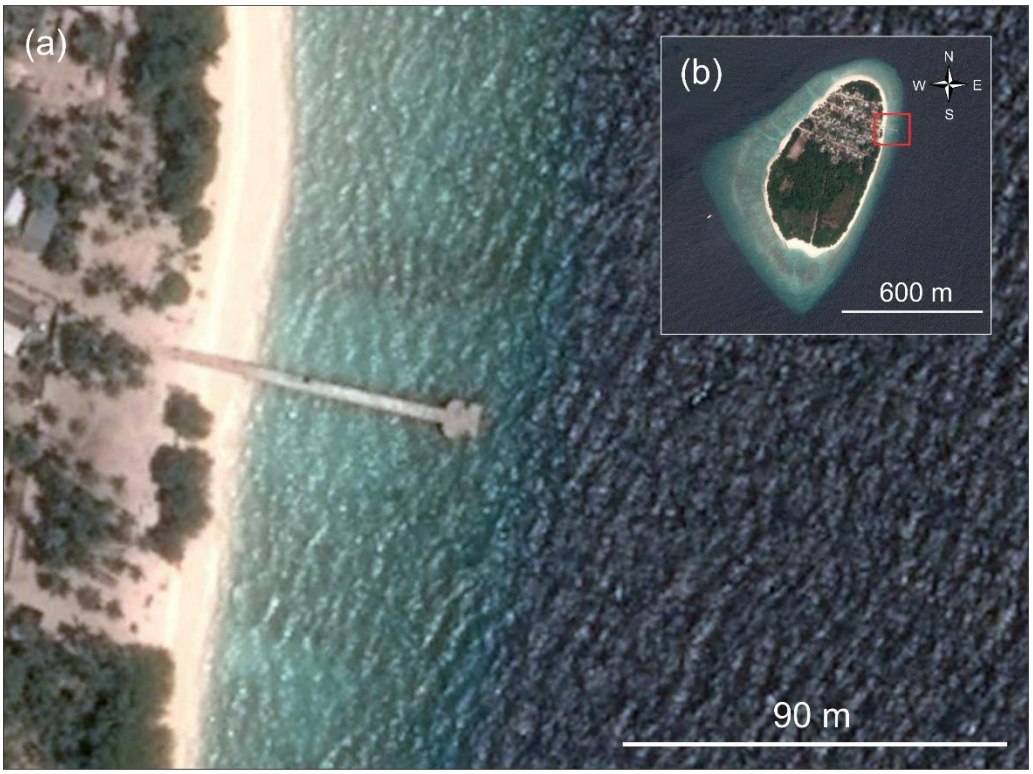


Figure 1. Project island, N. Fodhdhoo (a) close up of the jetty area (b) overview of the island.

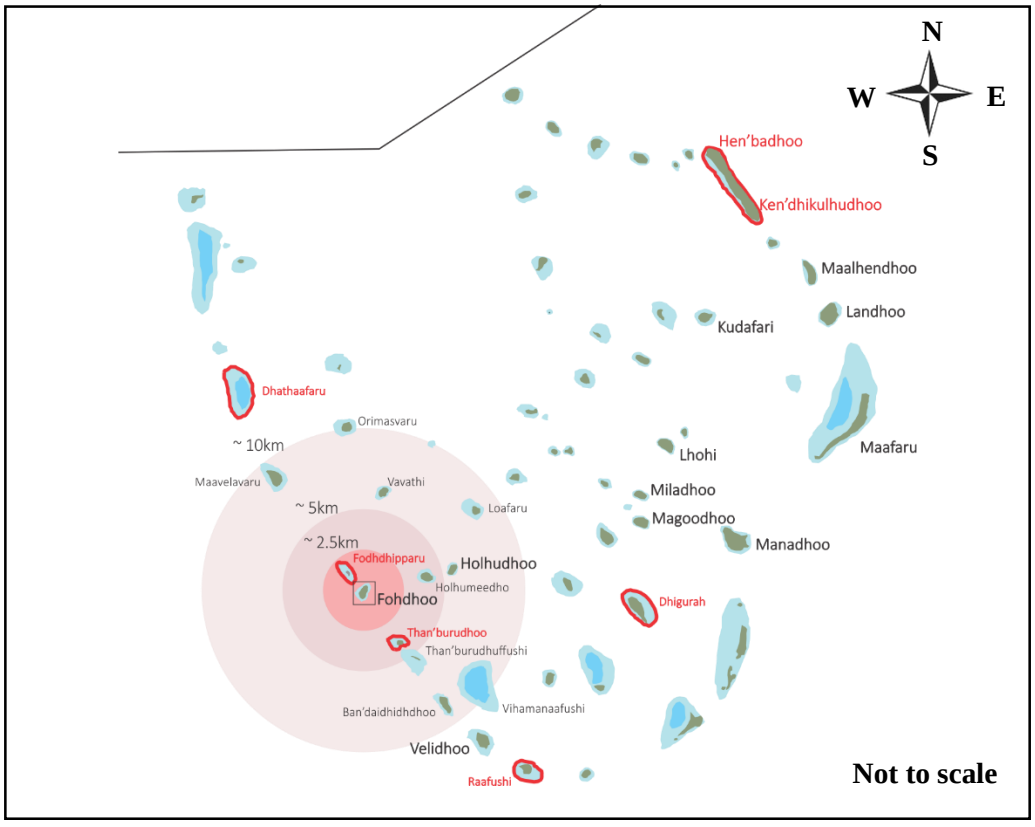


Figure 2. Environmentally Sensitive Areas close to project island, N. Fodhdhoo.

5.3 DESCRIPTION OF THE PROJECT SITE

The proposed jetty construction is planned to be carried out on the eastern side of the island, at the same location of the existing jetty. The existing jetty is roughly centered at $5^0$44' 42.02" N, 73^0 13' 06.42" E. The extent of reef area is lowest on this side of the island, having approximately 0.05-0.08km between the shoreline to the reef's edge. On the other hand, the reef area on the western side extend to about 0.28km from shoreline to the reef's edge on the longest section and the shortest section measures about 0.13km.

According to information provided by the Fodhdhoo council, the existing concrete jetty was built in 1984 by the people of Fodhdhoo. Since then, some renovation and improvement works have been carried out, which includes further extension of the jetty and building a small platform at the seaward end. The access deck of the existing jetty starts from the shore and runs 70m into the reef with a small platform at the end, covering only 0.03ha in footprint for the whole jetty. The beach area near the jetty is seen to be fairly intact with no sign of erosion observed.

The existing jetty at the island is now seriously damaged with some sections already having crumbled and collapsed into the water. Numerous large cracks are found both at the concrete deck and support structures of the jetty. Development of these large cracks at support structures have caused some of them to get detached from the main deck or in some cases, the bottom half these structures has completely fallen off. According to council members, a deck extending about 30ft in width were built at the seaward end of the jetty during the last renovation and improvement works. However, a large portion of this deck have crumbled and leaving only a small section of it intact. As a results, vessels using the jetty have to dock next to sharp edges of the concrete, half hanging structures or steel rods coming out of the structures. Additionally, the disintegrated parts of the jetty make this docking area shallower and pose risks for vessels using the jetty. The Figure 3 below shows the existing conditions of the jetty at the island.

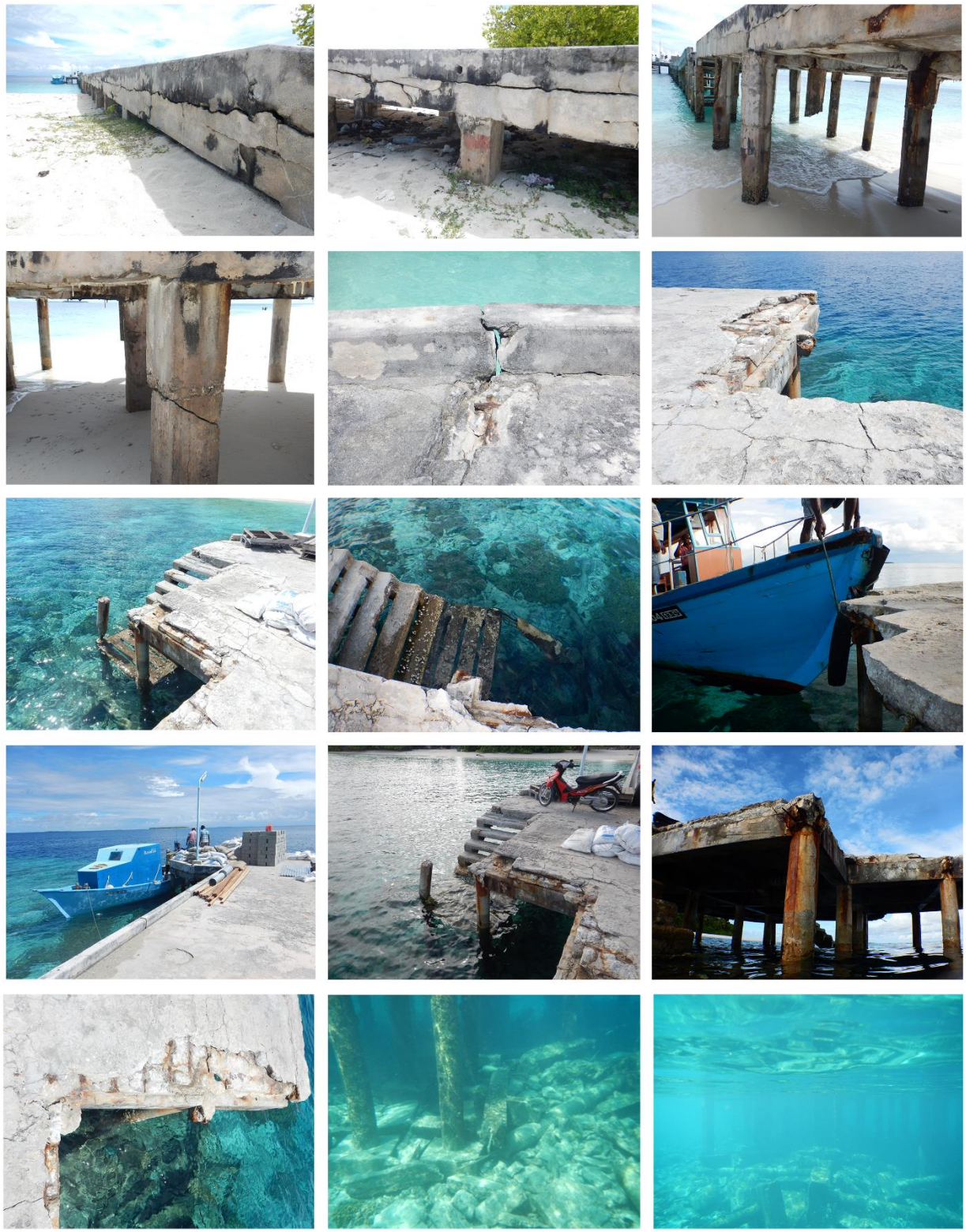


Figure 3. Condition of the existing jetty at N. Fodhdhoo

5.4 THE PROJECT

Under the proposed project, the proponent aims to build an improved jetty in place of the existing jetty at Fodhdhoo. The proposed jetty will have an improved access deck and designated cargo loading/unloading area built using concrete structures. A timber deck extension jetty will also be built, joined to the concrete deck, for the purpose of passenger transfer. An area around the new jetty will be dredged under the proposed project to provide safe and easy passage for vessels accessing the jetty. The Figure 4 demonstrates the proposed design concept of the Fodhdhoo jetty. Further details on the different components of the project are provided in the subsections below.

Figure 4. Design concept of the N. Fodhdhoo jetty.

5.4.1 Dismantling of the existing jetty

Prior to commencing the dredging works, the existing jetty will be removed under this project. The dismantled structures are not planned to be used for any work but shall be transferred from the island to Thilafushi at the end of the project.

5.4.2 Dredging of a basin around the jetty

The proposed project will dredge an area measuring 122m by 50m around the jetty to a depth of 3m from mean sea level (msl). The proposed dredge area boundary is marked on the Figure 4 above. It is estimated that approximately 9200 m^3 of sand will have to be dredged from the location to achieve the proposed depth of 3m from msl. Dredging of this area is required to ensure safe and easy access for vessels even during low tide hours.

5.4.3 Construction of an access deck and a cargo loading/unloading area

The access deck and the cargo loading/unloading area of the proposed jetty will be fully built using concrete structures. The proposed access deck measure 60m in length and 6m in width. An extension area for cargo loading/unloading will be built on the northern side of the jetty, joined to the access deck. This area will measure 26.9m in length and 11.75m in its width. Precast concrete units are proposed to be used as a foundation base for the structures of access deck and cargo loading/unloading area. The footing of these precast units will measure 1.3m in length and width, and 0.3 in height. The footing of these units will be buried to the level of seabed. The precast units have an extended concrete block arising from its centre, which is used to join with the concrete laid on to it for the remaining section of the support structure, and subsequently with the concrete deck. An array of 2 x 16 precast foundation blocks will be used for the access deck while a total of 33 precast blocks are to be used for the base of the cargo loading/unloading area. The arrangement of these precast foundation units and detailed drawings of the structures are attached in the Annex 2.

5.4.4 Construction of a passenger jetty

Under the proposed project, a separate timber deck extension jetty will be built on the southern side of the access deck for the purpose of passenger transfer. The passenger transfer jetty measures 30 m in length and 3m in width, which leads out to the southern side from about 43m of the access deck. The precast foundation units that will be used for the passenger jetty measures 1.7m in length and width and, 3m in height. The footing of these units will also be buried to the level of seabed and concrete laid over the block raising from the center of it up to the level of the deck. Only 8 foundations units are proposed to be used for the support of the passenger jetty. A timber deck will then be built for this section of the jetty. The arrangement of these precast foundation units and detailed drawings of the passenger jetty also are attached in the Annex 2.

5.4.5 Dredge material disposal

The 9200 m^3 of dredged sand is planned to be used for leveling roads identified by the island council. The roads identified (orange colour) by the island council members are shown in the Figure 5 below. According to the council members, these roads are known to form puddles of muddy water in the road after rain due to their low elevation compared to the adjacent areas. Island council members have noted that dredged sand can be made available to locals for construction purposes as an alternative option if it is in excess. As such they identified a location for temporarily placing the excess sand on eastern side of the island as indicated in the figure 5 below.

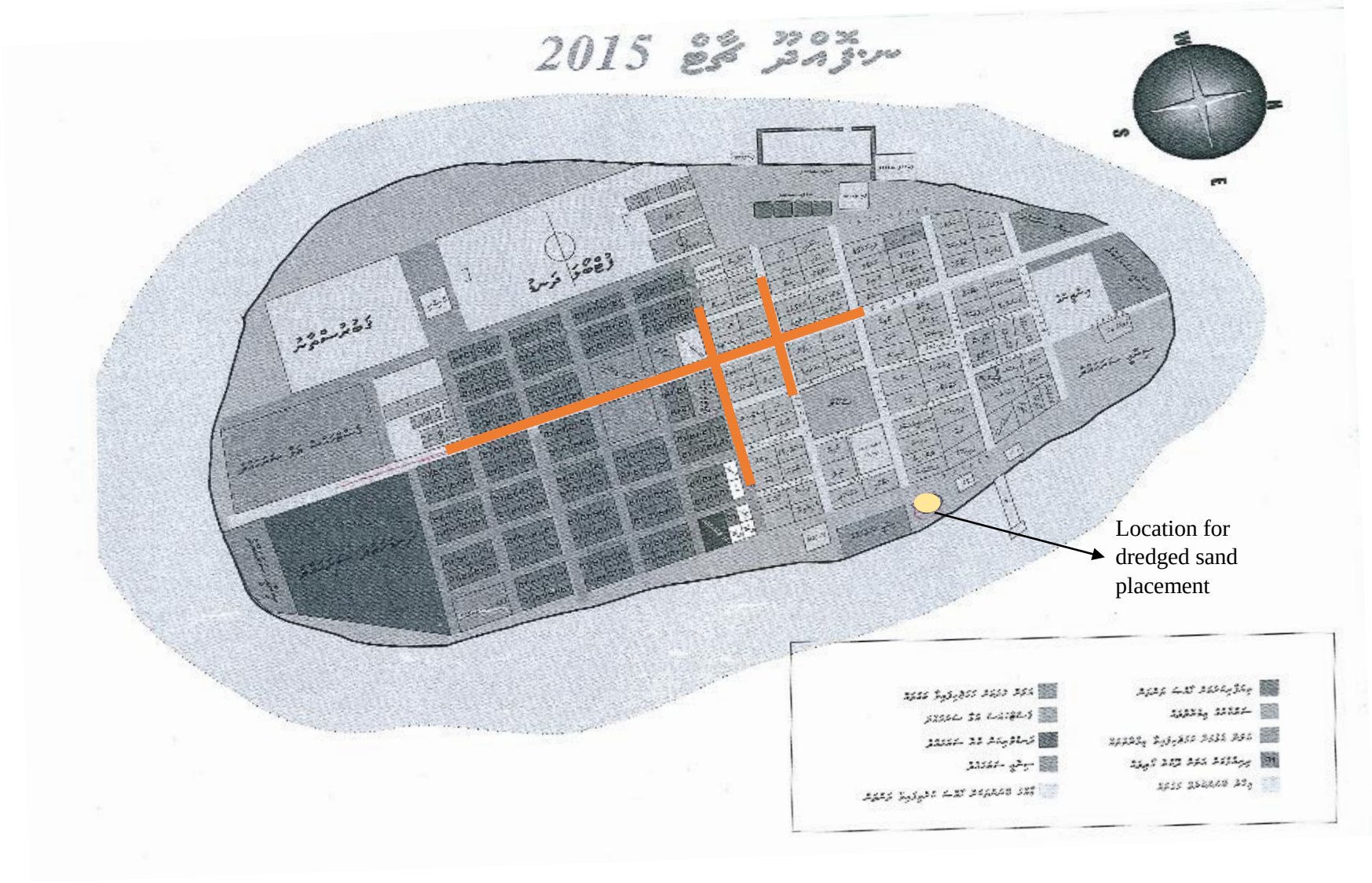


Figure 5. Roads identified for leveling by island council. (Source: Island Council)

5.5 PROJECT WORK METHODOLOGY

The general construction methodologies and equipment widely used in the Maldives will be used for this project. The initial phase of the project will include mobilization of equipment and construction materials, carrying out preliminary works and setting up of the site by the contractor. This phase will involve enacting a site boundary, allocation of space for different purposes, such as storage of construction raw materials, parking of vehicles etc. The contractor will then proceed to dismantling of the existing jetty, using a land based crane or an excavator where possible. The sections unreachable by a land based equipment will be removed using an excavator on a barge. The dredging works will commence once the existing jetty is fully dismantled.

Mechanical dredging using a toothed-bucket excavator is the preferred method for this project. Both the excavator and the dump truck that will be used for transferring of dredged material will be placed on a barge during the process of dredging. The tooth-bucket of the excavator will lift the dredge material from the bottom and place it into the hold of the dump truck. Once the hold of the dump truck is full, the barge will move to the shore, where the dump truck will transport and empty the hold and move for another round. This process will continue until the desired depth is reached across the proposed basin.

Since precast foundation units are essential to immediately start the jetty construction work, production of precast units will begin at the project site during the final stages of dredging. The contractor will first start building the access deck and the cargo loading/unloading area of the jetty. Therefore, the initial precast foundation units produced will be for these components of the jetty. The precast units will be placed at the appropriate locations by a land based crane or using an excavator where possible, or using an excavator on a barge for the locations unreachable by land based equipment. Following this, concrete will be laid to join the support structures with the foundation units and to complete the deck. Upon completion of the concrete deck, the contractor will move on to building the timber deck passenger jetty. The precast foundation units already produced at the project site will be placed at the appropriate locations using an excavator on a barge as this section will be unreachable from a land based equipment. Laying of concrete to join the support structures with the foundation units will then be carried out the same way as described before. Once the concrete framework of the passenger jetty is finished, it will be fully completed by building a timber deck on top of the framework.

The final phase of the proposed project will involve conducting final surveys by the contractor to ensure that the design requirements of the project are met. The contractor will then initiate the process of site clearance and demobilization.

5.6 JUSTIFICATION OF THE PROJECT

The existing jetty at the island has served as an important facility for navigation and transport to and from the island for decades. However, the jetty has been seriously damaged, as explained and shown in subsection 5.3, despite the efforts put by the people to renovate and improve the jetty. Even though the existing jetty has played a central role in facilitating transport to and from the island for several years, according to the island council members consulted, it always presented many difficulties and risks for the users due to its design, structural conditions as well as due to seasonal weather and oceanic conditions.

In addition to the difficulties presented by the damaged condition of the existing jetty, the jetty users have to face very difficult and unsafe conditions due to other natural conditions experienced near the jetty. This include inaccessibility of vessels to the jetty during low tide hours and subsequent difficulties that is faced when transferring people and cargo between vessels and the jetty. Furthermore, according to the council members and the people consulted for this EIA, rough conditions experienced at the eastern side of the island during the southwest monsoon to northeast monsoon transition period (*Iruvai halha*) and during the early days onset of the northeast monsoon severely restrict the use of the jetty. During these periods, jetty users are required to use the western side of the island, which is the side shielded from predominant wind

approaching from north to north eastern direction, for normal operations as well as for keeping their vessels anchored.

The existing jetty is frequently used by passenger and cargo vessels travelling between Noonu atoll and Male', Atoll ferry, small vessels of the island, large fishing vessels that visit the island to sell fish, and other vessels that transport visitors to the island (include both local and tourist visitors).

During the consultation with N. Fodhdhoo island council, it was understood that tourist staying at guesthouses at N. Velidhoo and tourists from Velaa Private Island are sometimes taken to the island for excursions. However, the council members noted that the excursion operators very often raise the damaged and unsafe condition of the existing jetty as a major concern.

The island council members also highlighted the unsafe and difficult situations presented by the conditions of the existing jetty, due to rough conditions at the jetty area and during low tide hours, when transferring people to and from the jetty/vessels. This difficulty present high risks when transferring patients in emergency cases. It was noted by the council members that it during such conditions, it sometimes takes hours to transfer patients to sea ambulance, hence losing very critical hours of the patient. It was also noted that passenger and cargo transfer between vessels and jetty are sometimes are carried out with the help of small vessels (*Bokkura)* as the conditions do not allow large vessels to berth close to the jetty.

Local tourism is not established at the island but it was observed that people have the desire to introduce local tourism to the island since a guesthouse is being constructed at the island. Additionally, the preliminary land use plan (as it is yet to be approved by the relevant government authority) developed by the island council (Annex 3) proposes to lease land on the southern side of the island exclusively for guesthouse development. The relatively intact and considerably large extent of the beach and the reef at the island and low population makes it very appealing for introduction of guesthouse tourism. According to the council, development of local tourism at the island is expected to greatly improve the local economy of the island. However, the existing condition of the jetty or not having a proper transport facility at the island may hinder them from fully realizing the potential benefits from local tourism.

Basing on the concerns raised by the people and the council members and, by observing the conditions of the existing jetty, it is understood that the people of Fodhdhoo greatly need and is hopeful of an improved transportation facility at the island. Even though, according to the council, the proposed jetty construction is not expected to solve all the issues faced by the users, they believe that the proposed design is an improvement over the existing jetty, hence will yield an overall socio-economic benefits to the island if the project is implemented. The implementation of the proposed project is expected to cause some environmental damage, especially from the dredging operation but the impacts can be minimized by following the measures that are recommended in this EIA. The project is hence justified on the basis that the project is expected to provide an improved transportation facility for the people of Fodhdhoo, as intended by the proponent, with minimal damage to the environment by implementing proposed measures in this EIA.

5.7 PROJECT MANAGEMENT

This section describes the implementation of the project specific emphasis on project schedule, required inputs and expected outputs from the project, construction camp set up and on safety and emergency measures that will be during the implementation of the project.

The proponent have contracted the proposed jetty construction project at N. Fodhdhoo to Maldives Transport and Contracting Company (MTCC), who hold the responsibility of carrying out of the proposed project as per the agreed duration of the project. The proponent holds the responsibility of overseeing the progress of the project and ensuring that the works meet the requirements of the proponent. The proponent also holds the responsibility of arranging financial arrangements through Ministry of Finance as per the

agreed project contract with the contractor. The island council shall also support, assist and facilitate the proponent and the contractor at all stages to successfully implement the proposed project.

5.7.1 Project schedule

The main activities of the project are listed in the Table 2 given below. Under the proposed project, the longest activity will be the construction of the jetty structures while dredging is only expected to take two months to complete. The whole project will be completed within 300 days (10 months). This project has been contracted to Maldives Transporting and Contracting Company (MTCC) by the proponent. The proponent will oversee the progress and will finance the project through government funds. The proponent will hence arrange financial payments through Ministry of Finance as per the contract. Fodhdhoo Island Council will play a role in facilitating the contractor and the proponent in successfully implementing the proposed project.

Table 2. A tentative schedule for the activities of the proposed project

	Duration (Months)									
Activity	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Preliminary works										
Site setup										
Survey and setting out										
Dredging and road levelling										
Access deck and cargo loading jetty works										
Passenger jetty works										
Out survey										
Site clearance										
Demobilisation										

5.7.2 Inputs and outputs

The key inputs required for the implementation of the project as per the planned schedule are; machinery, cement, steel rods, electricity, fuel, water, workers, accommodation for workers and other materials required for construction works and maintenance and servicing of the machinery. A detailed list of inputs and their description are provided in the Table 3 below.

Table 3. Inputs required for implementation of the proposed project.

Input	Description
Workers	Skilled and licensed workers will be employed by the contractor to operate the machinery in order to run the operation smoothly and to ensure safety for the workers and the locals
Accommodation	The contractor shall arrange adequate accommodation for workers at the island. The best option for arranging accommodation is presented under section 5.7.3.
Excavator	Excavator will be used for dismantling of the existing jetty, dredging of the basin around jetty and placement of precast foundation units.

Barge	A barge will be used to base the excavator and/or dump truck when carrying out work at areas that cannot be reached by land based equipment.
Tug boat	A tug boat will be utilized to tow and move the barge throughout the project.
Crane	A land based crane will be used for dismantling of existing jetty structures, placing of foundation units as well as for lifting heavy materials.
Dump truck	Dump trucks will mainly be used to transport the dredge waste from the dredge site to the disposal area (roads) and for transporting heavy materials.
Concrete mixer	This will be used to produce concrete that is required for production of the precast foundation units as well as for the concrete required for building different parts of the jetty.
Cement	Cement will be a major raw material for construction of the jetty, since it is required for almost all structures of the jetty. Cement will be sourced by the contractor and transported to island at the mobilization phase of the project.
Fine gravel sand	Imported fine gravel sand will be transported from Male' to the project island during the mobilization phase.
Steel rods	Steel rods will also be sourced and transferred to the island along with cement by the contractor at the mobilization phase of the project. Steel will be used with concrete for reinforcement of the foundation blocks and other structures of the jetty.
Timber	Timber will also be sourced and transported to the island by the contractor at the mobilization phase of the project. Timber will be used to build the deck of the passenger jetty.
Fuel, lubricants and batteries	Fuel is required for operation of the equipment while lubricant is needed for proper maintenance of the equipment. Batteries will be required for operation of machinery and equipment.
Electricity	Electricity is essential to carry out many construction related works at the project site. Electricity for the proposed project will be sourced from the island.
Water	Water needed for construction and other purposes will be obtained from the island

The main outputs of the proposed project are the improved jetty at the island and the deepened basin around the jetty. The other outputs include about 9200 m^3 of dredged material and different types of wastes generated throughout the project. The Table 4 below list the expected outputs from the project and provide their description.

Table 4. Outputs expected from implementation of the proposed project.

Output	Description
Jetty	An improved jetty, with an access deck and, a designated cargo loading/unloading area and passenger transfer jetty is the main output of the proposed project.
A deeper basin around the jetty	The deepening of the area around the jetty is also a significant output of the proposed project, which will ensure easier and safer access to the jetty for the vessels.
Dredge material	An estimated 9200 m^3 of dredged material is expected to be produced from the proposed dredging component of the project.
Dismantled structures	Considerable amount of waste is expected to be generated from dismantling of the existing jetty. Additionally, removal of temporary structures enacted under the proposed project will also generate waste. These dismantled materials shall be removed from the project island, and transferred to Thilafushi at the end of the project.
Solid waste	Solid waste is expected to be generated at the project site from construction operations as well as through daily activities of the workers. General solid waste generated from workers daily activities will be disposed at the island's waste disposal area.
Hazardous waste	The expected form of hazardous waste from the proposed project is the used lubricants oils from equipment. Any hazardous waste generated from the project, such as waste oil, lubricants, chemicals, etc. shall be stored safely at the construction camp site and disposed at Thilafushi on completion of the project, in full compliance with the waste management regulations.

5.7.3 Facilities for the project

A detailed plan for setting up of required facilities for the proposed project has not yet been finalized, but as per the consultation with the council and the contractor, two options have been identified and assessed for setting up of temporary facilities required for the project. According to contractor, a construction camp is required for the proposed project and will be utilized for arranging temporary covered storage areas with cement floors, for the materials required for the project (Materials listed in table 3 above), for basing vehicles, equipment and machinery and to carryout construction related tasks, such as building of precast foundation blocks and other required works (e.g. servicing and repair of machinery) of the proposed project. It was also noted by the contractor that the construction camp will have a designated area for storing of fuel and lubricant oil with an impermeable concrete base to avoid leakage of oil into the ground and will also be used for refueling of vehicles and machineries that will be used during the project. According to the consultation with the contractor, the ideal location for setting up of a construction camp site will be an area close to the project area. During the consultation with the island council, they identified an area close to the project site (Figure 6), for setting up of the construction camp site and assured that they will facilitate the contractor for using the area. This location meets proximity to project area requirement noted by the contractor. It was also found during consultation with island council, through a Fenaka Co. Ltd. representative that provision of temporary electricity to the construction camp site will be possible without a burden on the electricity grid of the island.

The area identified consist of numerous large and small coconut palm trees and small other trees, and would hence require planning from contractor that would effectively use the available space without uprooting any large trees. However, the movement of vehicles/machinery may impact the small (<1m in height) coconut palm trees present in the area, hence the small trees will need to be properly protected using marked boundaries before setting up of the site.

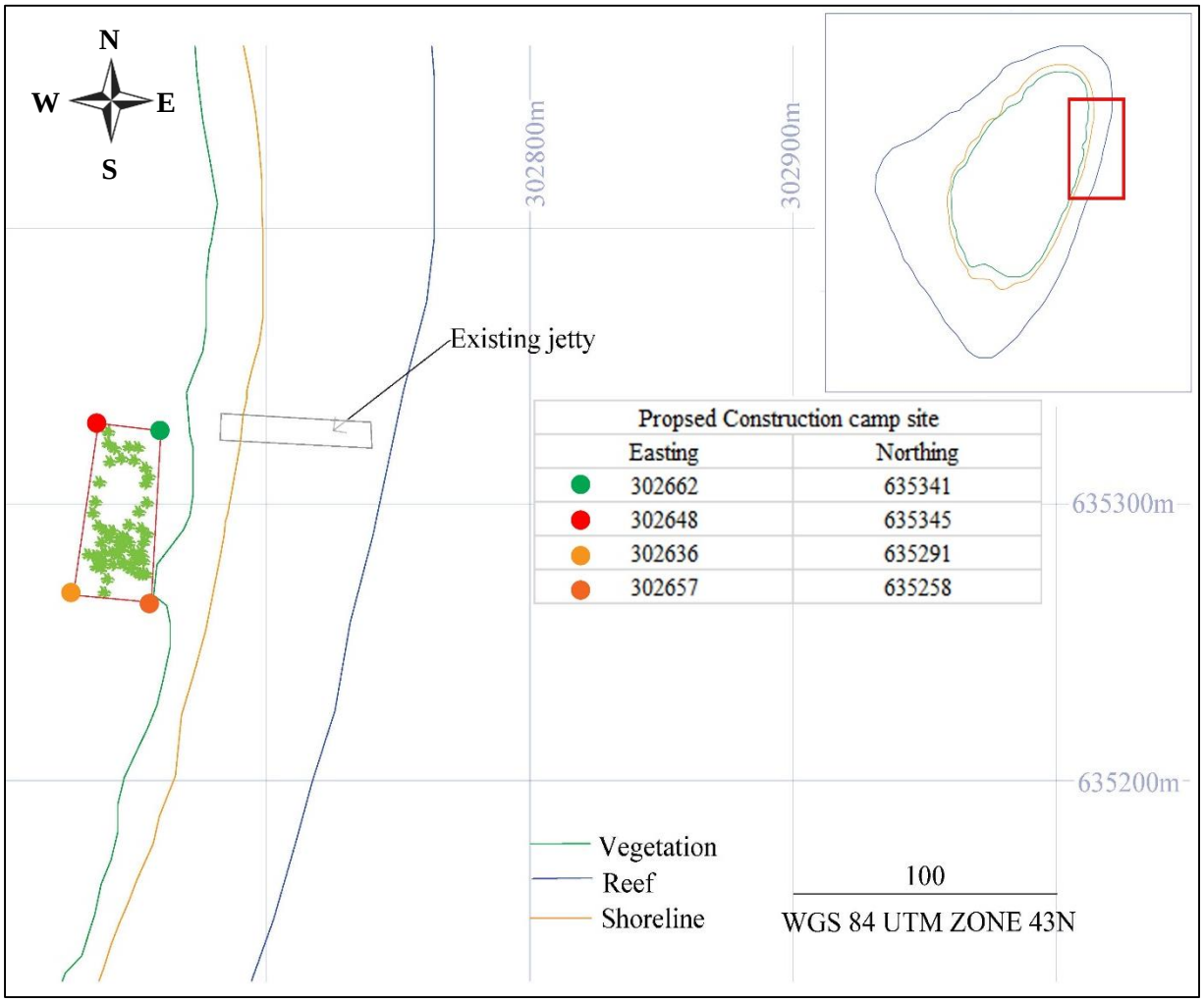


Figure 6. Proposed area for setting up of construction camp site

However, when asked about the potential arrangements of accommodation from houses at the island for the workers, the island council noted that it would be difficult to arrange accommodation from island by renting houses and the only option they could identify is set up of accommodation facilities at the temporary construction site. On the other hand, the contractor noted that the most feasible and the preferred way of arranging adequate accommodation for workers is at local houses and their standard practice is to announce for renting houses at islands. Hence, the contractor noted that they will first attempt renting houses as the first option and they will only opt for setting up of workers camp site if only the aforementioned attempt proves unsuccessful.

The following options are hence identified and assessed, to demonstrate the shortcomings and advantages of setting up of the temporary facilities using two possible scenarios.

Option 1

This option assumes that workers accommodation could not be arranged from local houses and thus facilities for workers accommodation will have to be arranged within the construction camp site. This option however, does not consider that any large trees will be removed from the project area as noted above.

Setting up of temporary facilities required for the project (space for vehicle parking, to keep machinery and equipment, construction work area, storage areas, space for vehicle movement) along with accommodation facilities (extra infrastructure) within the construction camp will result in a very congested site, hence hinder running operations smoothly. The current area identified by the council may also not be sufficient for effectively using the area.

Additionally, arrangement of accommodation within the construction camp will require other adequate facilities and services, such as electricity, proper toilets, shower area, waste management, supply of drinking water, cooking area and a space for eating. Due to the absence of sewerage network at the island, underground septic tanks will also have to be constructed at the camp site to arrange proper accommodation for workers. Building of septic tanks may have undesirable impacts on the ground water. Provision of these facilities within the construction camp will not only congest the work area but also increase the project cost and may cause delays in commencement of construction of the jetty.

Choosing of this option may also require additional space from the island, and such increase in project scope and footprint will have to be conducted as per EIA regulation. Hence such changes to the project need to be addressed through an Addendum to this EIA.

Construction of more temporary facilities also mean that more waste will be generated at the end of the project through removal of the facilities. These removed structure will also have to be transported to Thilafushi at the decommissioning phase, increasing the cost of the project.

Option 2

This option assumes that workers accommodation can be arranged from the local houses, hence the construction camp will only be utilized for other tasks of the project. Similar to above, this option also does not consider that any large trees will be removed from the project area, as noted above.

This option is more appealing than the option 1 since it has important benefits to the island, decrease the burden on the contractor and has less impacts on environment.

Renting of houses from the island will provide a mean of income to locals and it is expected that accommodation can be arranged from many unoccupied houses from the island (Annex 7). Hence it is highly recommended that the contractor announce for renting houses as soon as possible and explore this option with further consultation with island council.

This option does not require building of additional infrastructure at the construction site, hence will reduce time and materials utilized for the project and waste generated from the project. Additionally, this will allow more space at the construction site and more time for contractor to focus on construction of the jetty as well as to carry out other tasks more efficiently.

Recommended option

The option 2 is found to be the most preferable, hence is the recommended option for arranging the facilities required for the proposed project. The proponent confirms that option 2, where accommodating is arranged at houses, will be opted in this project. The setup of other temporary facilities at the construction camp shall only occupy the identified area and shall have proper boundary structures enacted to restrict unauthorized access to the site.

The construction camp site will be cleared at the end of the project construction phase as indicated on the tentative schedule. Site clearance shall include removal of all the temporary structures built during the course of the project, and disposing of all the removed structures along with waste generated from the project at Thilafushi junk yard. At the end of the project, all the machineries, equipment and any extra materials at the camp shall be transported from the island at the decommission stage of the project.

5.7.4 Plans for safety and emergency

Worker safety shall be ensured by exercising the following safety measures during the construction phase. Appropriate personal protective equipment, including but not limited to hard hats, eye protection, protective trousers and gloves, shall be provided to the workers to be worn at all times when the works are being carried out. In addition, hearing protection, masks and wet weather clothing shall be made available to be used where necessary.

In addition to all these measures, the project site and the construction camp will be clearly demarcated with restricted access throughout the duration of the project. The only people allowed within the boundary will be the workers and any other person with approval from the contractor.

Further, the following mitigation measures (Table 5) shall be put in place to ensure safety during the proposed project.

Table 5. Mitigation measures for expected safety hazards during the proposed project.

Potential Hazard	Mitigation measures
Transport related accidents during supply of materials, fuels during construction phase with resulting injuries to personnel and/or spills of hazardous substances such as fuels and chemicals. Such accidents may be caused by bad weather or negligence such running aground on reefs.	Getting latest weather information before starting the journey. Ensuring proper navigation system on board the vessels. If hiring vessels for supply, ensuring seaworthiness certificates prior to hiring supply vessels. Hiring experienced and licensed boat captains and experienced crew. Avoid travelling during night during bad weather
Potential for fire - natural causes (e.g. Lightning) or human activities, has potential to impact project personnel or infrastructure.	Fire suppression supplies shall be retained and located as per requirements.
Spills of hazardous materials	Regularly inspecting storage tanks or equipment for leaks or damage, and maintaining. Ensuring equipment used are in good working order. Ensuring fuel is stored and dispensed appropriately (use of double-walled vessels). Refueling, servicing and lubricating mobile equipment only at designated locations with appropriate spill kits and other mitigation in place

Injuries to workers - site preparation and construction activities may result injuries to personnel such from falling due to toppling of machines, vehicles, drowning while fixing underwater structures, falls from heights etc, injuries due to falling or dropping of tools on workers	Ensure that all personnel are using their Personal Protective Equipment (PPE) for the purposes of their jobs and have all safety equipment in place prior to commencing construction activities. Ensure workers with appropriate training is tasked to undertake jobs that require particular skills and training. E.g. Certified drivers should only be allowed to operate machinery. Providing adequate time and resources to complete tasks. Simultaneous and incompatible works may result in workers distraction which may lead to occupational accidents. Life buoys shall be provided close to the relevant work areas at all times. Providing workers with right tools and equipment.
Electrical shocks – during installing turbines, electrical wiring, testing and commission of equipment and machines electrical shocks can occur to workers.	Certified electrical engineers and technicians shall be tasked to carry out such tasks. Place fire-extinguishers and fire suppressants shall be placed at mobile equipment and machinery and, at construction site. Ensure that all personnel are using their personal protective equipment (PPE).
Health related risks – such as outbreak of diseases, back injuries (from carrying heavy loads, working in inappropriate positions, etc.); respiratory diseases (from inhaling dust fumes, etc.); musculoskeletal disorders (from sprains and strains of the muscles, injuries affecting the hand and wrist, the shoulders, neck and upper back, the knees, etc.); hearing losses (from long time exposure to noise); and Skin diseases (manipulation of dangerous materials, exposure to the ultraviolet rays).	Providing adequate facilities for the workers for personal hygiene, dining, sleeping etc. Providing safe drinking water and sanitary facilities for the workers. Providing suitable lodging facilities and prevent over-crowding in sleeping areas. Ensure that all personnel are using their personal protective equipment (PPE). Providing necessary equipment, tools necessary for performing tasks. Availability of first aid services at work site. Keeping the work environment clean at all times, conduct regular vector control programs such as fogging as necessary.

5.8 PROJECT BOUNDARY AND ENVIRONMENTAL IMPACT ZONE

The main impacts from the proposed project are anticipated in the immediate marine environment of the project site. The proposed project will utilize an area of land to base equipment and machinery, as well as to carry out other construction related operations. Additionally, identified leveling roads will require movement of vehicles and other machineries into the island, hence the impact zone encompasses land area. Therefore, basing on experience from such projects and expert opinion, an expected environmental impact zone, both from the land and marine environment, is identified for conducting baseline surveys and to study the extent of expected environmental impacts.

Due to small scale of the project, and relatively large distance between the project site and ESAs present on northern and southern side of the island, it is considered that no impacts are likely to arise at these ESAs from the proposed project.

The figure 7 below shows the expected project footprint and zone where environmental impacts are likely to occur.

Figure 7. Project area and expected environmental impact zone

6. SURVEY METHODOLOGIES

This section outlines the methodologies utilized in assessing the existing environment and socio-economic condition of the island. For assessing the existing environment, primary data were used wherever possible but secondary information obtained from published literature and other reliable sources were also utilized to present the existing environment as comprehensively as possible. The results obtained from studying the existing environment and socio-economic condition of the island were then used as the basis to assess the impacts from the proposed project using an internationally adopted and locally practiced impact assessment methodology.

All the field studies required for the assessment of the existing environment were carried out on 17th, 18th and 19th December 2015 with the exception of water quality assessments at three locations. In addition to water quality assessments carried out during the field surveys on aforementioned dates, further water quality assessments were carried out for samples collected from three locations on 03rd January 2016.

6.1 CLIMATE

Long term climate data for the specific location of N. Fodhdhoo are not available, hence a site specific climate analysis was not possible for this EIA. This limitation became further challenging due to long distance between Fodhdhoo and weather monitoring stations of Maldives Meteorological Service (MMS) for which long term data are available. The closest long term weather monitoring station of MMS based at the H.Dh Hanimaadhoo airport is approximately 112km away from Fodhdhoo. Nevertheless, 24 years of climatic data acquired from Hanimaadhoo airport were used in this EIA assuming that the climatic conditions of northern atolls of the Maldives are relatively similar. This EIA used 24 years of climatic data obtained from Hanimaadhoo airport to understand likely climatic conditions at the island Fodhdhoo. The climatic data obtained for Hanimaadhoo include wind speed and direction, rainfall and temperature.

Further information on sunshine hours from weather monitoring station based at Hulhule' International Airport. This factor is very likely to be similar across the country, hence is expected to provide a reasonable indication of the conditions at Fodhdhoo.

6.2 HYDRODYNAMICS

Long term wind data obtained by MMS in combination with published literature are used to predict expected current and wave patterns near the island of Fodhdhoo. However, it should be noted that long term primary current data and wave pattern specific for the island or Noonu atoll region is a major limitation of the study to accurately predict and present expected hydrodynamics condition near the project island.

The direction and velocity of near-shore surface current at the project area were also measured during the field trip using a Garmin foretrex301 GPS tracker. This device was submerged on the surface of water and let to drift along with the current for some time. The tracker records its GPS location each second through the drift. These information are then used in a software to deduce the velocity and the direction of current.

Additionally, assuming that tidal variations will be similar across the country, data obtained by MMS from the tide gauge based at Hulhule' International Airport are used to assess and present expected tides at the project island.

6.3 HAZARD VULNERABILITY

Island specific information on the history of natural hazards were obtained from the island council (Annex 4). However, published literature on general hazard vulnerability of the Maldives were also utilized, since it gives a reasonably good overview of the natural hazards expected for Maldives, to identify expected forms of natural hazards that the project island may experience.

6.4 MARINE ENVIRONMENT

The marine environment of the project area and expected environmental impact zone were studied to establish baseline conditions of the area as well as to identify and assess the severity of any impacts that may arise from the proposed project. During the field works for this EIA, surveys were conducted to study the benthic cover, fish abundance and water quality at the project site and expected environmental impact zone. The locations of these surveys are shown and methodologies for the surveys are explained in the following subsections. In addition, bathymetric survey was conducted at the project location and its methodology is also presented in its respective subsection below.

6.4.1 Bathymetry

The bathymetric survey was conducted using a single beam SonarMite MILSpec™ echo-sounder which has an accuracy of 0.01 m. The echo-sounder was mounted on a small vessel (*Bokkura*). The location of the bathymetric survey was mapped using a GNSS RTK system which was set up with reference to the Permanent Station Marker (PSM0081) placed by Maldives Land Survey Authority at the island of Fodhdhoo. The vessel was initially driven parallel to the shoreline with a distance of about 20-30m between each path for the bathymetric survey area. Further depth measurements were taken by driving the vessel perpendicular to the shoreline within the survey area. The exact boundary of the bathymetry survey area is marked on the map provided in the Annex x of this report.

The raw field data were corrected for MSL using Civil3D, which was then used to produce the bathymetry of the survey area. The resultant bathymetric map was used to estimate the amount of dredge material from the proposed dredge area around the jetty.

6.4.2 Benthic cover

The benthic cover for the area was studied using Line Intercept Transect (LIT) method. Three 20m transects (T1, T2 and T3) were laid perpendicular to the shoreline, as illustrated in the Figure 8 below, for recording benthic cover at the study area. This method will yield a reasonably good percentage cover for general classes assessed in this study. The classes used for benthic cover assessment are; live coral, dead coral, rubble and sand.

This study also assessed the density of Giant clams (*Tridacna spp.*) as they were seen to be very common at the study area. Number of *Tridacna spp.* present within a 2m band on either side of the 20m transect were counted for the two transects (T2 and T3) on southern side of the jetty.

6.4.3 Fish abundance

Fish abundance at the survey area was studied using the timed-swim methodology. An observer swam a distance on either side of the jetty, as shown in the Figure 8 below while recording a video of the marine environment, for about 15 minutes. The camera was placed facing ahead on approximately 45^0 from the surface water level.

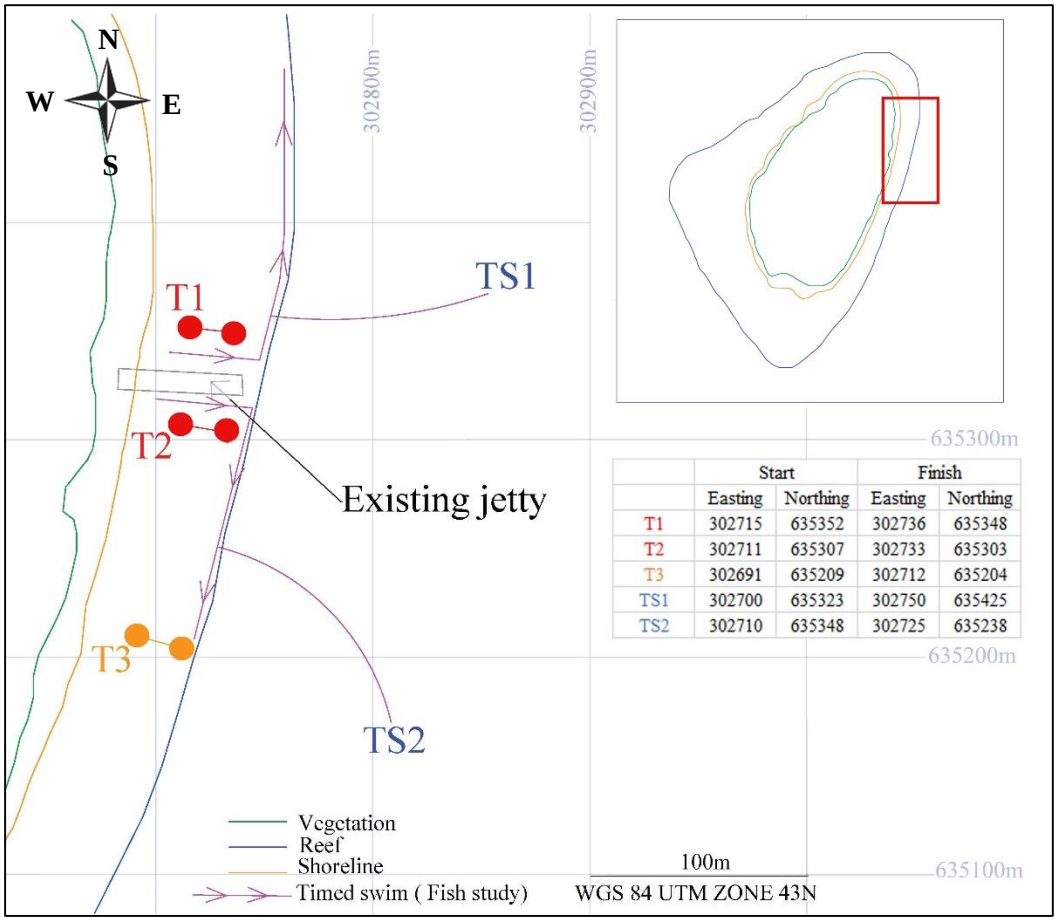


Figure 8. Location of marine surveys

The video was later analyzed to record the species and count the numbers observed. A relative abundance class were then assigned to each species basing on the classification scheme below.

Table 6. Qualitative fish abundance ranges used for the study.

Class	Fish count range
Abundant	> 16
Common	6-15
Rare	0-5

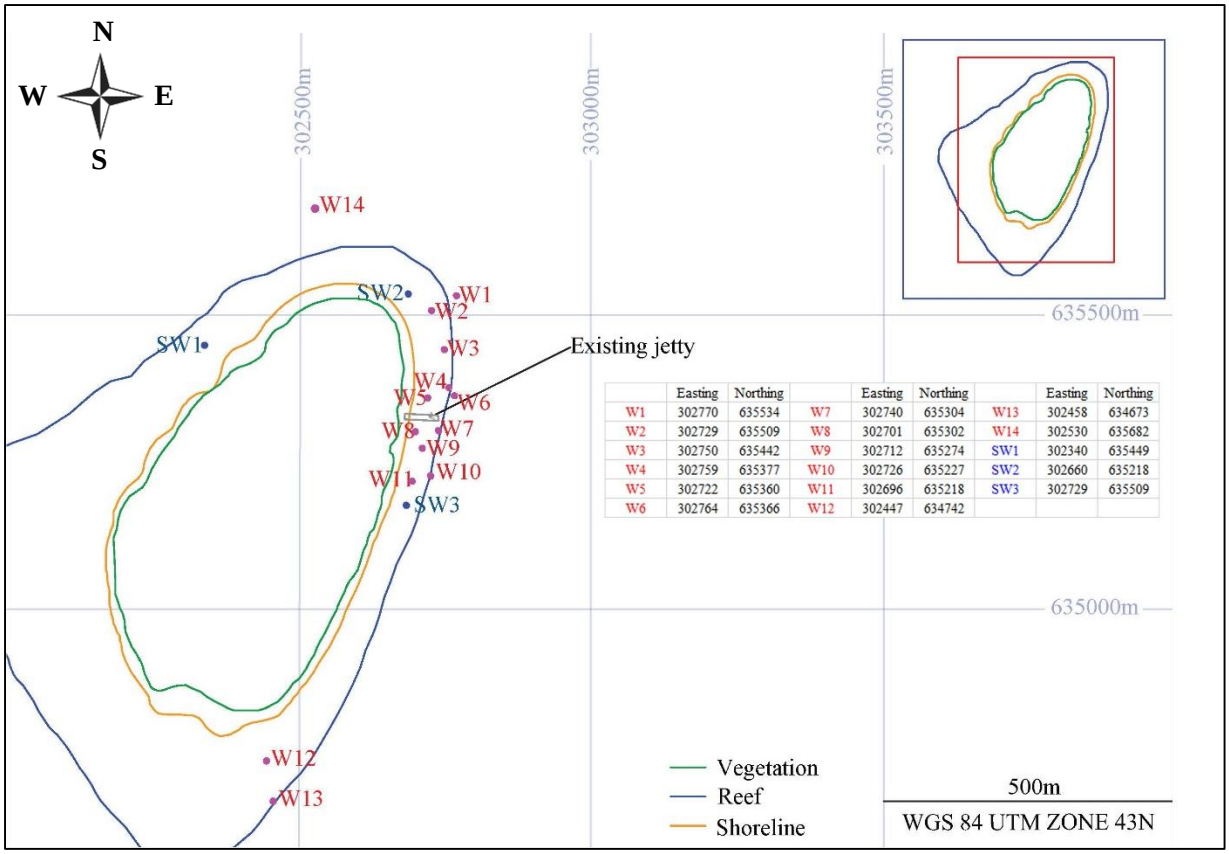
This method may underestimate some species of fish, such as cryptic species or rare species. Nevertheless, this is a quick and easy method that can be used to obtain dependable information in a limited timeframe. Hence the results provide a good baseline for the site and the method can be replicated to compare changes overtime.

6.4.4 Water quality

For this EIA, in situ water quality assessments were carried out at 14 locations (W1-W14 on Figure 9 below). A HORIBA U-52 Multiwater Quality Checker was used to analyze the quality of water. The instrument, which has been span calibrated using standard grade reagents, uses voltammetric methods to analyze conductivity, Dissolved Oxygen (DO) and Total suspended Solids (Turbidity) of water samples.

All the parameters were measured and logged in real time on field which preserves the chemical constituents in equilibrium with their natural physio-chemical environment, thus giving a more accurate picture of the quality and status of water samples. This technique is more reliable than wet laboratory chemical analyses which would require numerous pre-processing steps to alleviate the effect of reduced and oxidized material. The parameters measured during the in situ water quality assessment include; temperature, salinity, pH, Turbidity, DO and Total Dissolved Solids (TDS).

Water collected from further three locations (SW1-SW3 on Figure 9 below) on 3rd January 2015, were also analyzed from the laboratory of Maldives Water and Sewerage Company (MWSC) to assess salinity, pH, turbidity and Total Suspended Solids (TSS). This is then used along with in situ data to establish baseline water condition around the island.



	Easting	Northing		Easting	Northing		Easting	Northing
W1	302770	635534	W7	302740	635304	W13	302458	634673
W2	302729	635509	W8	302701	635302	W14	302530	635682
W3	302750	635442	W9	302712	635274	SW1	302340	635449
W4	302759	635377	W10	302726	635227	SW2	302660	635218
W5	302722	635360	W11	302696	635218	SW3	302729	635509
W6	302764	635366	W12	302447	634742			

Figure 9. Location of water quality test sites

6.5 ISLAND GEOMORPHOLOGY

6.5.1 Beach profile

Beach profiles near the project area were mapped on a section of either side of the jetty. The beach profiling surveys also utilized the same GNSS RTK system setup used for bathymetric survey and the other land based surveying.

6.5.2 Shoreline dynamics

Shoreline dynamics of the island are assessed by comparing shoreline changes observed from different satellite images acquired from Google Earth Pro©. Satellite images of the island from different dates (24th

March 2010, 22nd February 2011 and 24th February 2014) are first obtained on same scale and same orientation. These images were then georeferenced in QGIS and shoreline manually digitized. The digitized shoreline from these images were then overlaid to compare shoreline changes of the island.

6.6 LAND SURVEYS

The land surveys carried out at the island include elevation studies for two cross-sectional profiles of the island; west-east and north-south. The results were used to understand the average height of the island from mean sea-level using field quantitative data, hence to predict any likely impacts from natural hazards (high rainfall events, storm surges, Tsunami etc.) as well as to present assess the roads for leveling. Addition road level surveys were also carried out at the high priority road that the island council identified for leveling. The results of this survey were used to demonstrate the existing elevation of the roads as well as to calculate an estimated amount of fill material required for leveling the roads. All these survey were carried out using the GNSS RTK system which was set up with reference to the Permanent Station Marker (PSM0081) placed by Maldives Land Survey Authority at the island of Fodhdhoo.

6.7 TERRESTRIAL ENVIRONMENT

The terrestrial environment were not extensively studied under this EIA as the project is not expected alter or clear vegetation or any other aspects of the terrestrial environment. The roads identified for leveling also do not have vegetation that will have to be removed for leveling. However, since the island council identified an area for building the construction camp near the existing jetty, the trees present at this area were mapped by recording their GPS locations for demonstrating the environment as comprehensively possible.

Even though coastal vegetation surveys were not required under the TOR of this EIA, the coastal vegetation line for a section on either side of the existing jetty is mapped using a GNSS RTK system with a confidence interval of 3mm, which was set up with reference to the PSM0081 of Maldives Land Surveying Authority.

6.8 SOCIO-ECONOMIC SETTING

The socio-economic setting of the island was studied using several sources. This includes published reports such as Preliminary results of 2014 census, 2006 Census report. Socio-economic information were also obtained from the island council through a questionnaire and through direct consultation with council members. Public consultation was also carried out by calling some residents of the island. Additionally, observation made during the visit to the island were used to describe the socio-economic setting of the island.

6.9 IMPACT ASSESSMENT

Following data analysis, literature review and stakeholder consultations, a system called Rapid Impact Assessment Matrix (RIAM) was used to organize the EIA. 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. It keeps transparent control of the components in a distinct semi quantitative manner allowing direct comparison of different problems, and above all it allows a holistic and coherent anticipation of problems. 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 analyzed 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.

Table 7. 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 8. Range bands used for 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.

7. EXISTING CONDITIONS

This section outlines the existing environment of the proposed project area with reference to surveys carried out during the EIA study while also making use of other available sources to describe the environmental and socio-economic setting of the island as comprehensively as possible.

7.1 CLIMATE

7.1.1 Temperature

Analysis of 24 years of temperature records from H.Dh. Hanimaadhoo airport show that mean monthly temperature is very similar throughout the year with the exception of the period between February and July (Figure 10). The mean monthly temperature for this period is observed to be increasing from February, reaching a mean high of 29.7°C for the month of April and then decreasing to 28.3°C on July. The highest mean monthly maximum temperature is also observed in this period, reaching 32.4°C for the month of April. Similar to mean monthly temperature, mean monthly maximum also stayed fairly stable at approximately 30.6°C from July until February. The highest monthly minimum temperature also coincides with the period of largest fluctuations observed in monthly mean and mean monthly maximum temperatures. The highest monthly minimum temperature observed is 26.5°C for the month of April and May.

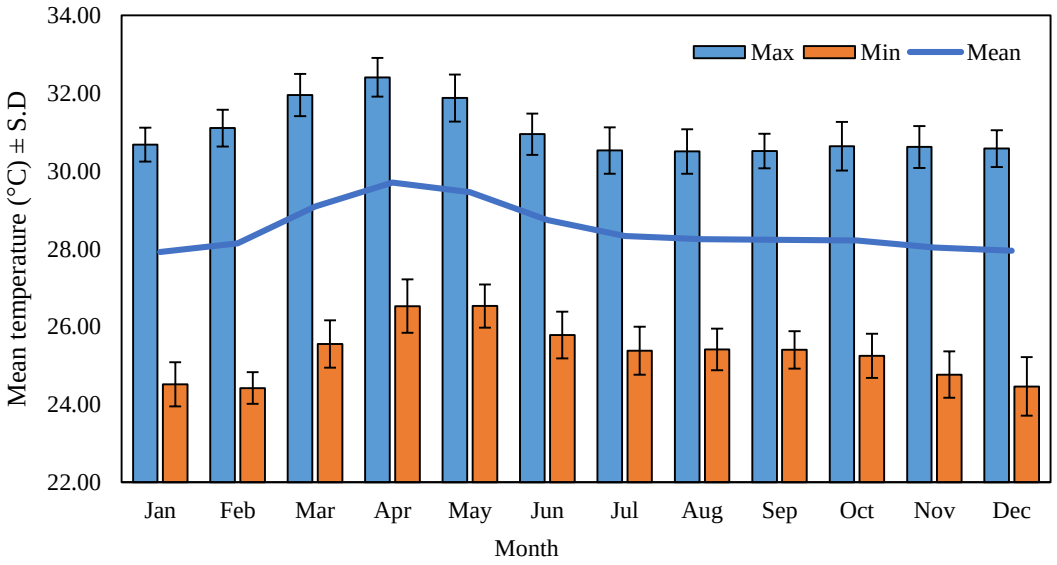


Figure 10. Variation of monthly mean temperature for H.Dh. Hanimadhoo basing on 24 years of data.

Overall, the temperature at H.Dh Hanimaadhoo airport is seen to be fairly stable throughout the year with slight variations observed in mean temperatures. Similar temperatures are expected for the locations of Fodhdhoo, even though it is located some 112km away from H.Dh Hanimaadhoo airport. The observed small fluctuations in temperature may not present significant implications for the environment, and/or for the proposed project.

7.1.2 Rainfall

Rainfall in Maldives is mainly determined by the two seasons: the southwest monsoon (*Hulhan'gu moosun*) and the northeast monsoon (*Iruvai moosun*). The rainy southwest monsoon onset from May and end on

November. After a month of transition period, the northeast monsoon starts from January and end on March. Rainfall during the months of northeast monsoon are very low, hence is termed as the dry season.

The analysis of long term rainfall data indicate a distinct rainfall pattern for two monsoons at the Hanimaadhoo airport (Figure 11). Rainfall at Hanimaadhoo is observed to increase significantly from May through November, coinciding with the southwest monsoon. Mean rainfall for the months of southwest monsoon exceed the annual average monthly rainfall level of 146.8mm, with a maximum rainfall of 226mm observed in July. On the other hand, rainfall amount from January to May is very low, having only recorded less than 50mm of mean monthly rainfall for this period. The rainfall amount during the transition period following the southwest monsoon is higher than that for the transition period following the northeast monsoon.

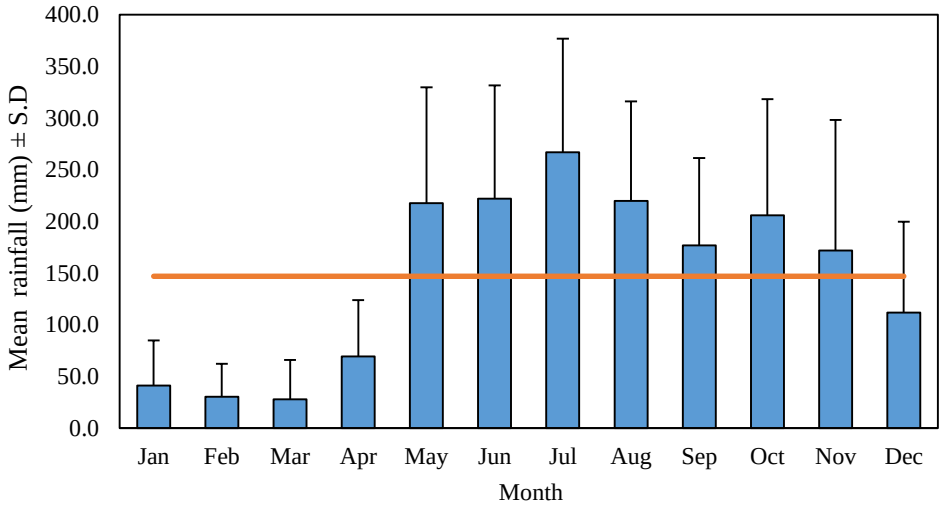


Figure 11. Variation in monthly rainfall for H.Dh Hanimaadhoo basing on 24 years of data. (Solid orange line indicate annual average monthly rainfall)

Basing on the assumption that northern atolls of Maldives have similar climatic conditions, the island of Fodhdhoo is expected to experience a similar rainfall regime to Hanimaadhoo airport, hence having distinct monsoon driven rainfall. This indicate that above annual monthly average rainfall will be expected for consecutive months from May to November and less rainfall for the rest of the months.

7.1.3 Wind

The two monsoon periods observed in the Maldives is marked by strong seasonal reversals in wind direction that are confined to a narrow range of wind angles. During the northeast monsoon, wind generally occur predominantly from north easterly direction whereas during southwest monsoon, predominant wind come from south westerly direction.

The analysis of wind data from Hanimaadhoo airport indicate that strong winds occur at the station from April through October, during when wind direction is predominantly from west-north-westerly direction (Figure 12). The highest mean monthly maximum wind speeds observed at Hanimadhoo is for the months of June and July, having a mean monthly maximum wind speeds of 41 and 42 knots respectively. The mean monthly wind speed eases from November, reaching the lowest for the month of March (13.6 knots), from when the wind slowly pick up in speed. The direction of wind speed for the period from November to May is dominated by winds occurring from easterly direction. The mean monthly wind speeds were observed to be higher than the annual average monthly mean of 19.2 knots between May and October and lower during the rest of the year.

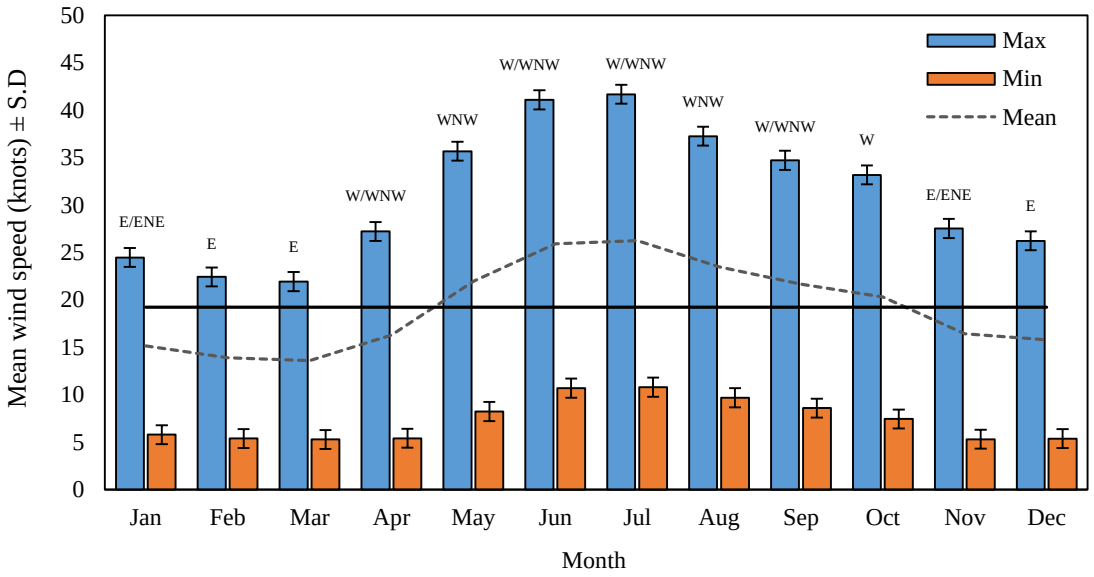


Figure 12. Average monthly wind information for H.Dh Hanimaadhoo. (Solid black line indicate annual average monthly wind speed)

Assuming that wind pattern and speed observed at the Hanimaadhoo airport is representative for the northern atolls of Maldives, it can be predicted that similar conditions will be observed for the project island.

7.2 HYDRODYNAMICS

7.2.1 Tides

Astronomical tide levels recorded at the tide gauge located at Hulhulé airport show that the highest and lowest astronomical tide levels were +0.64 m and -0.56 m from MSL respectively (Table 9). Assuming that the tide measurements at Hulhulé are comparable to those across the country, it was assumed that the tide levels for the project location would be similar. A tidal variation of 1.2 m between the lowest tide and the highest tide were recorded for the country. Tidal fluctuations cause changes in the current flow patterns around the islands and bring subsequent changes in the physical aspects of the shoreline. At low tide, water movement is generally very slow, compared to the movement of water at high tide.

Table 9. Tidal variations in Maldives with respect to Mean Sea Level (MSL).

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
mean sea level (MSL)	0.00
mean higher low water (MHLW)	-0.16
mean lower low water (MHLW)	-0.36
lowest astronomical tide (LAT)	-0.56

7.2.2 Currents

Currents which affect the sea area around the Maldives are caused by one or more of the following system:

- Oceanic currents.
- Tidal currents.
- Wind-induced currents.
- Wave-induced currents.

The oceanic currents flowing across the Maldives are notorious for their strength. The exposure of the Maldives to the vast Indian Ocean ensures that an immense body of water is constantly flowing across the plateau on which the atolls are built. Currents in the channels near Male have been recorded at 4 knots or more. Inside an atoll, current speeds are more settled. Oceanographic currents are driven by two monsoonal winds, namely the westerly and north easterly wind. The westerly flowing current tend to dominate from January to March while the easterly currents dominate from May to November. The changes in current flow patterns occur in April and December. The current velocities are about 0.5m/s, only in May values may increase to 0.8m/s.

The near-shore surface current studies conducted during the field works found that current movement on the eastern side and at northern and western side of the island differed in terms of direction but the speed was relatively similar. The near-shore surface current measurements taken at two locations, C1 and C2, on the eastern side of the island found that current was travelling southwestern and south-south-western direction with a mean speed of 0.24 ± 0.12 ms^{-1} and 0.21 ± 0.11 ms^{-1} respectively. The measurements from the northern and southern side of the island indicate that currents were traveling in west-north-west direction (C4) and eastern direction (C3) with a mean speed of 0.19 ± 0.08 ms^{-1} and 0.34 ± 0.17 ms^{-1} respectively. The Figure 13 below illustrates the current direction and speeds at the locations of near-shore surface current surveys.

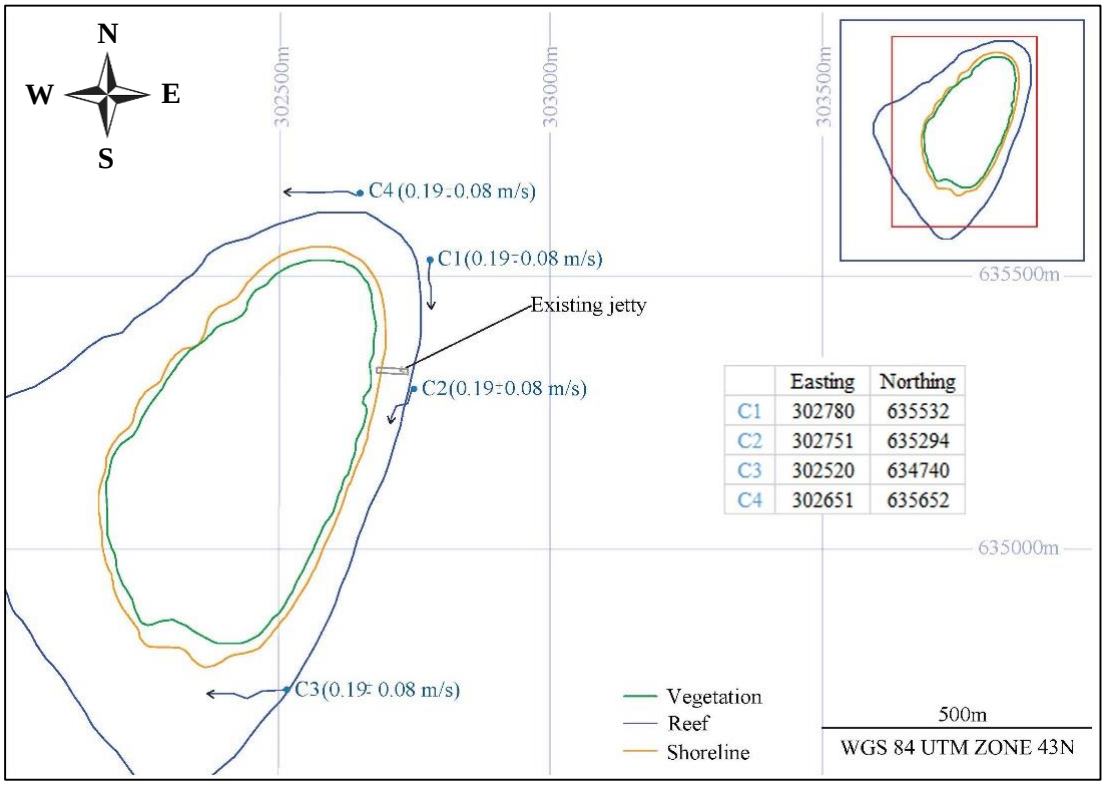


Figure 13. Results of near-shore current survey at the project island.

7.2.3 Waves

Location specific wave patterns are not available for the project island but analysis of published literature indicates that two types of waves are expected at the island; wind driven waves and oceanic swells. Wind driven waves traveling in east-south-easterly direction is expected for Fodhdhoo between April and October, since the island is expected to experience strong winds from west-north-westerly direction in this period. Similar to all regions of the Maldives, oceanic swells approaching from west-south-west to south are expected for the period between April and November (Figure 14). The height of oceanic swell waves are generally higher for this period than for rest of the months of the year. Height of oceanic swell waves reach a peak of 1.8m from msl in June, which is also the period expected to have strongest wind driven waves due to strong winds observed at this time. Wind driven waves from December to March are expected to be travelling in west-south-westerly direction but is predicted to be weaker in strenght due to low mean wind speeds observed for this period. The oceanic swell waves approaching the project island from east-south-easterly direction between December and March will have a shorter height on average than oceanic swells that occur between April and November.

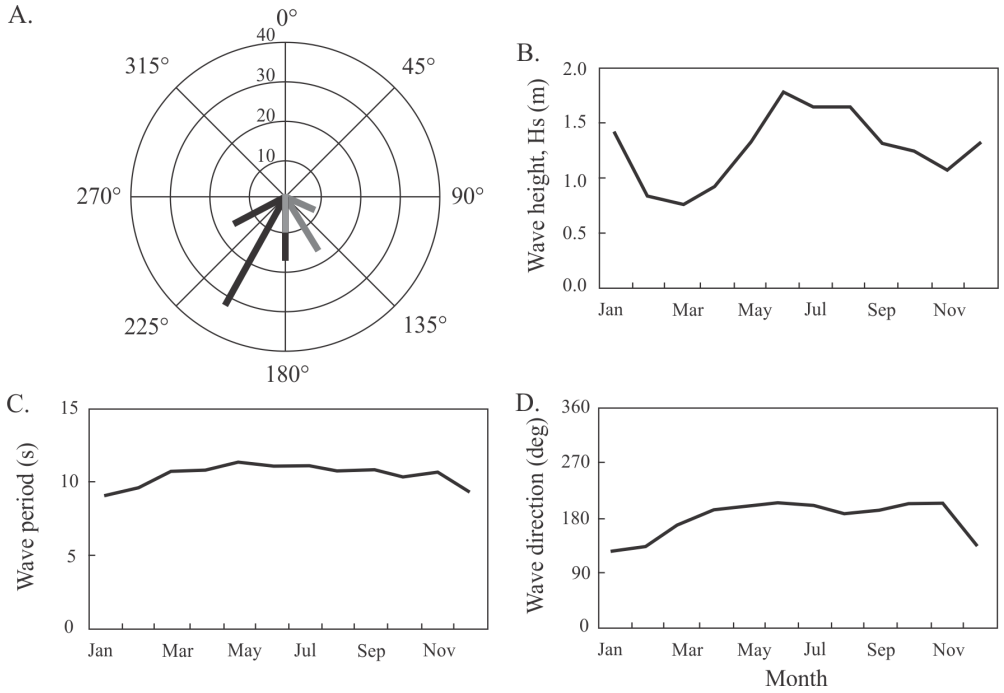


Figure 14. Mean monthly ocean swells for Maldives. (A) wave direction for April to November (black lines) and December - March (grey lines); (B) wave height; (C) wave period; (D) wave direction. Data from young (1999) adapted from Kench and Brander (2006).

With a broad reference to the geographical context of the island, Fodhdhoo can generally be seen as a relatively protected island from oceanic swells that propagate outside Maldivian waters during April to November, since the island is protected by Raa atoll on the western side and Baa atoll on south-western side. Nevertheless refracted oceanic swell waves reaching the island from during this period is expected to generate some rough conditions on the western side of the island, as it coincides with the period of expected strongest wind driven waves and swells that will be generated in the open ocean (*Ali huras kan'du*) just west of the island. However, it should be noted that the project is planned to be carried out on the eastern side of the island, which is the side shielded greatest from waves and swells approaching from the west to south-western direction. On the other hand, the expected wind driven waves approaching from east and

east-north-east direction betwee November to end of January and oceanic swells approaching from southeast and east-south-east direction in the same period could potentially create very rough conditions on the eastern side of the island. However, the eastern side of the island is expected to be generally calm throughout the year except for the aforementioned period.

7.3 HAZARD VULNERABILITY

In 2009, through DIRAM Project by UNDP (2006), the natural vulnerability of the islands and atolls of the country to potential hazards have been modelled to understand the risk factors of the country. The disaster risk scenario for Maldives can be described as moderate in general. Despite this, Maldives is among the most severely affected countries hit by the Asian tsunami on December 2004. The report identified the existing vulnerabilities and identified mitigation measures with costing. The report had identified children, women and low income households as the most vulnerable.

DIRAM report has stated that major natural hazards in the Maldives are strictly controlled by the geophysical and climatic settings and show quite different patterns in their distribution, as shown in Figure 15.

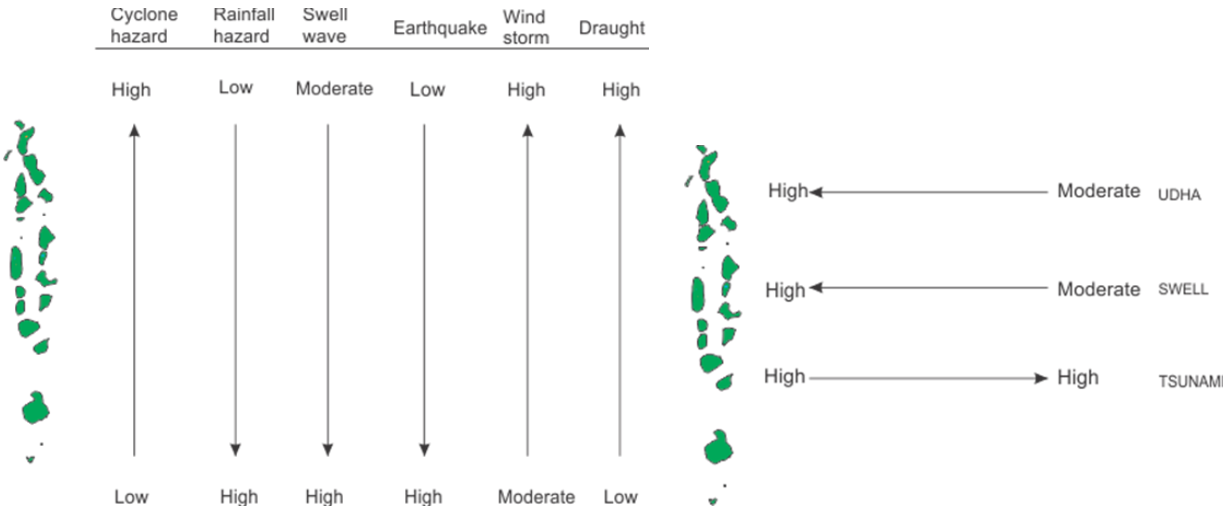


Figure 15. Major natural hazards distribution pattern in the Maldives. (A) Latitudinal variations of major natural hazards. (B) Longitudinal variations of major natural hazards across the Maldives (Adapted from UNDP, 2008)

Hazards, frequencies, and damage potential for the Maldives is summarized in Table 10 (UNDP, 2006).

Table 10. Hazards, frequencies and damage potential for the Maldives

Hazard	Tsunami	Swell waves or storm surges	Rainfall flooding	Strong winds
frequency	Once in 200 years	-	Once in 1 year	Several times a year
Potential damage	Very high	high	moderate	low

Natural hazards that may occur at the project location can be broadly classified into geological and meteorological hazards. Based on the different types of hazards identified in DIRAM, the following hazards have been predicted to be particularly relevant to the project site in relation to the project components:

- Wind storms and cyclones
- Swell waves and wind waves
- Draught
- Tsunami

The project island can be classified as belonging to high risk zone for cyclone, wind storms, Tsunami and draught conditions. The island is expected to experience moderate swells or storm surges. Swell waves, storm surges, wind storms and cyclones are the factors that are most likely conditions that can have significant implications on the proposed project as majority of the works of proposed project is to be carried out at the marine environment. A Tsunami could potentially have devastating impacts on the island, but the damages will not be restricted to the project but to the whole island. However, the likelihood of such an event occurring will be very rare (once in 200 years; refer to Table 10), hence is not considered to be a factor that is likely to have any implications on the proposed project. Additionally, according to the island council members consulted, the Tsunami that hit Maldives in 2004 had no major impact on the island except waves moving in few meters into the island. Furthermore, the information provided by Island council on history of Natural disasters at the island (see Annex 4) indicate that the island has not experienced significant natural disasters.

7.4 MARINE ENVIRONMENT

7.4.1 Bathymetry

The detailed bathymetric map produced from the survey is attached in the Annex 5 of this report and the Figure 16 below repesents the same findings in color coded bathymetric map. The following figure illustrates the same results of the bathymetry in a colour gradient map. The average depth of the area proposed to be dredged around the jetty is about 1.3 m from mean sea level. The subsequent analysis carried on the bathymetry indicate that approximately 9200 m^3 of dredge material will be generated from the proposed dredging. The total dredge material is expected to have fine sand and consolidated sediment rocks but the proportion of these materials cannot be quatified by the surveys

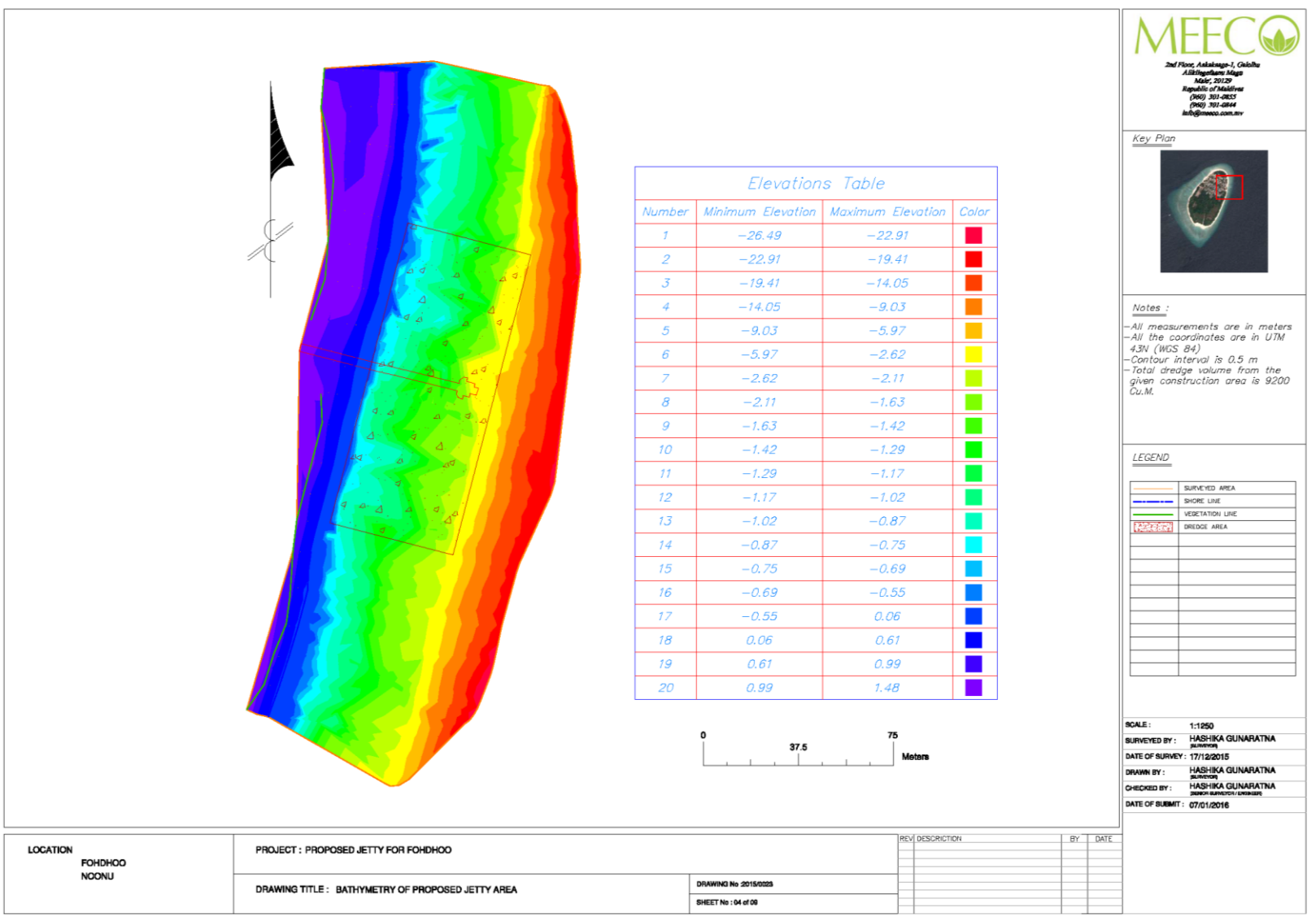


Figure 16. Bathymetry of the area proposed for construction of the jetty and dredging

7.4.2 Benthic cover

Benthic cover at all the sites surveyed had the four basic cover classes (Dead coral, Live coral, Rubble & Sand) used in this study (Figure 17). The two transects, T1 & T2, laid within the proposed dredge boundary showed reasonably good percentage of coral cover with 41% and 32% respectively. Hence it is estimated that about 2230 m^2 out of proposed 6100 m^2 of dredge area is composed of live coral cover. A rough estimate of live coral cover at the island using results obtained from the transect study indicate that approximately 110325 m^2 is live coral from about 297535 m^2 of coral reef area at the island. Basing on this analysis it can be said that the proposed project will only loose about 2% of live coral cover from the island's reef system through the dredging works. The transect laid outside of the dredge boundary also indicated reasonably good cover of corals with approximately 38% of live coral cover.

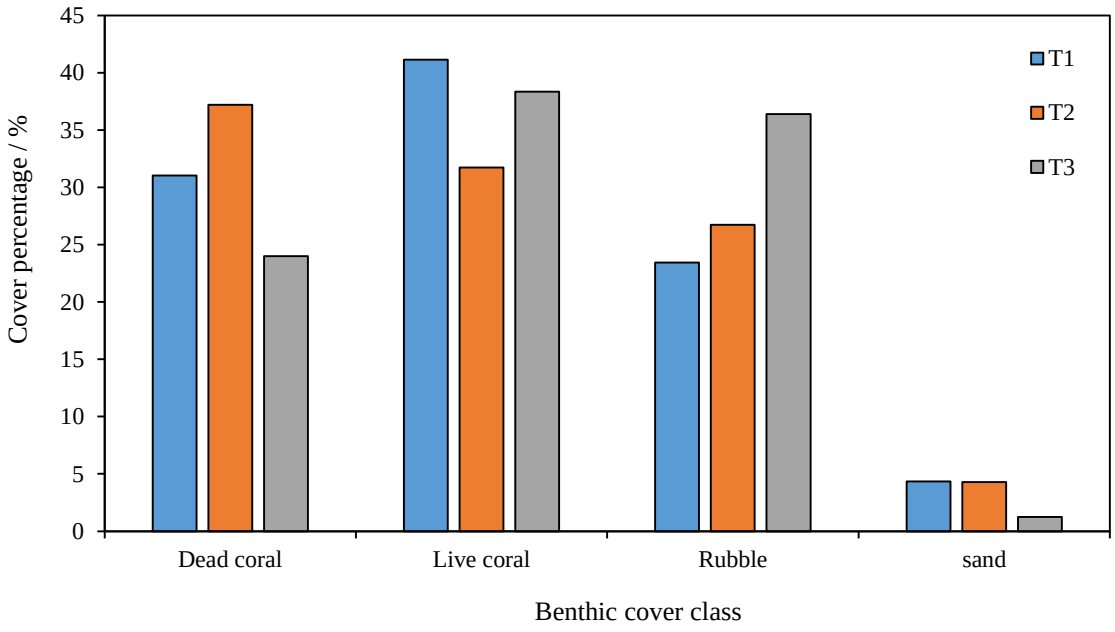


Figure 17. Percentage of benthic cover at transect sites.

The photos below shows photographic representation of benthic cover at Fodhdhoo surveyed area.

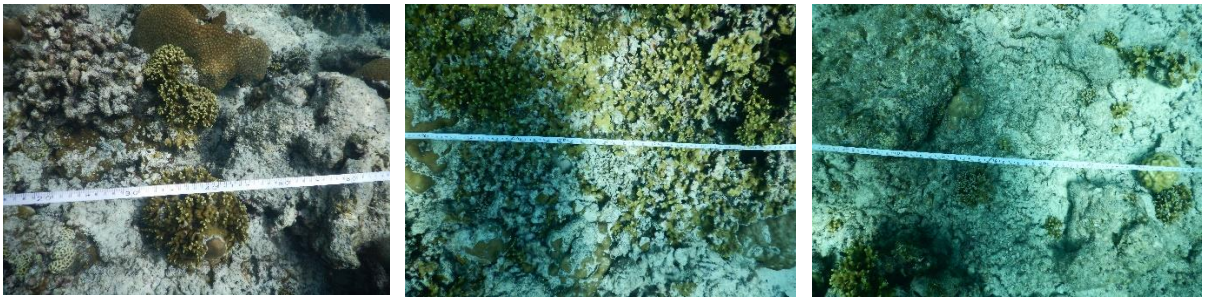


Figure 18. Photographs of benthic transect study (more photos of marine environment attached in annex 18)

Since the survey sites were observed to have high number of Giant clams, *Tridacna spp.*, an additional survey was conducted to estimate the density of these species near the project site. The results obtained

from these surveys are presented below in Table 11. Analysis of these results show a considerably high density of giant clams with 1 occurring every 2 m^2. These species is banned from harvesting or killing under Maldives Fisheries Regulation.

Table 11. Total number of Tridacna spp. found within a 4m x 20m band at two transects.

	T2	T3
Total number of *Tridacna spp* present within 4m x 20m band.	47	43

7.4.3 Fish abundance

The species of fish observed during the survey and their relative abundance are provided in the Table 12 below. The species belong to Acanthuridae and Pomacentridae family were fairly abundant at the survey area with two transects having similar abundance classes for species of these families. Overall, the survey area can be classified as having considerably good diversity of fish species.

Table 12. Fish abundance at the survey area

TS1		TS2	
Family, *species*	**Relative abundance**	**Family,** *species*	**Relative abundance**
Acanthuridae		**Acanthuridae**	
Acanthurus auranticavus	Rare	*Acanthurus leucosternon*	Abundant
Acanthurus lineatus	Common	*Acanthurus lineatus*	Common
Acanthurus leucosternon	Common	*Ctenochaetus striatus*	Abundant
Acanthurus triostegus	Rare	*Naso brachycentron*	Rare
Ctenochaetus truncatus	Rare	*Naso brevirostris*	Rare
Ctenochaetus striatus	Abundant	*Naso elegans*	Rare
Zebrasoma scopus	Rare	*Zebrasoma scopus*	Common
Balistidae		**Balistidae**	
Melichthys indicus	Common	*Melichthys indicus*	Common
Sufflamen bursa	Rare	*Balistapus undulatus*	Rare
Chaetodontidae		**Chaetodontidae**	
Chaetodon citrinellus	Common	*Chaetodon citrinellus*	Rare
Forcipiger flavissmus	Rare	*Forcipiger flavissmus*	Rare
		Forcipiger longirostris	Rare
		Hemitaurichthys zoster	Rare
		Heniochus pleurotaenia	Rare
Labridae		**Labridae**	
Chielinus chlorourus	Rare	*Thalassoma hardwicke*	Rare
Hemigymnus fasciatus	Rare	*Gomphosus caeruleus*	Rare
Labroides dimidiatus	Rare	**Lutjanidae**	
Thalassoma hardwicke	Rare	*Lutjanus biguttatus*	Common
Lethrinidae		**Mullidae**	
Lethrinus mircrodon	Rare	*Parapenus macronema*	Rare
Lutjanidae		**Ostraciidae**	

Lutjanus microdon	Common	*Ostracuib meleagris*	Rare
Mullidae		**Pomacentridae**	
Parapenus cyclostomus	Rare	*Abudefduf vaigensis*	Abundant
Parapenus macronema	Rare	*Chromis dimidiata*	Abundant
Parapenus trifasciatus	Rare	*Chryseptra brownriggi*	Rare
Piniguipedidae		*Plectroglyhidodon lacrymatus*	Abundant
Parapercis signata	Rare	**Scaridae**	
Pomacentridae		*Chlorus sordidus*	Rare
Abudefduf vaigensis	Abundant	*Scarus frenatus*	Rare
Chromis dimidata	Abundant	*Scarus scaber*	Rare
Chromis virdis	Common	**Serranidae**	
Chrysiptera brownriggi	Common	*Cephalapholis argus*	Rare
Chrysiptera unimaculata	Rare	**Tetradontidae**	
Dascyllus arauanus	Common	*Arothon meleagris*	Rare
Plectorglyphididon lacrymatys	Abundant		
Scaridae			
Chlorus sordidus	Rare		
Ctenoscarus bicolor	Rare		
Scarus scaber	Rare		
Serranidae			
Cephalapholis argus	Rare		

There were also some notable observations of fish and rays around the project area, though not during timed swims or at the project location. These observations were made about 200m north of the existing jetty on the northern side reef of the island. The observations include a juvenile Napolean wrasse, *Chielinus undulates*, White-spotted Eagle Ray, *Aetobatus narinari* and Reef Manta Ray, *Manta alfredi*.

The Manta ray was identified through the manta database kept by Manta Trust (www.mantatrust.org) website, by submitting photos to the website. These photos were then analyzed by them and a positive ID of the manta found. According to Manta Trust (T Sawers 2015, pers comm), the Manta seen at Fodhdhoo was first sighted in August 2015, at Reethi Beach resort in Baa atoll. According to the communications with them, it was sighted 5 times feeding near Reethi Beach resort before it was sighted at Fodhdhoo and this sighting is first record of it having moved outside of Raa atoll.

7.4.4 Water quality

The results of the water quality assessment is show in Table 13 below. Overall, the water quality assessment results indicate relatively good condition of water at the project area, impact zone and the baseline assessment sites. All the *in situ* water quality tests resulted in turbidity levels of 0 NTU with all the all the other parameters very similar across the sites. The laboratory water quality tests (WS1-WS3) resulted in a slight increase in turbidity levels for three sample, ranging between 0.280 NTUs and 0.488 NTUs. The pH, on the hand, resulted in a slightly lower value than what was observed from *in situ* water quality tests. However, none of these differences are significantly different from *in situ* water quality test results. The three samples analyzed MWSC laboratory (report attached in Annex 6) were recorded to have only less than 5 mgL^{-1} of Total Suspended Solids (TSS).

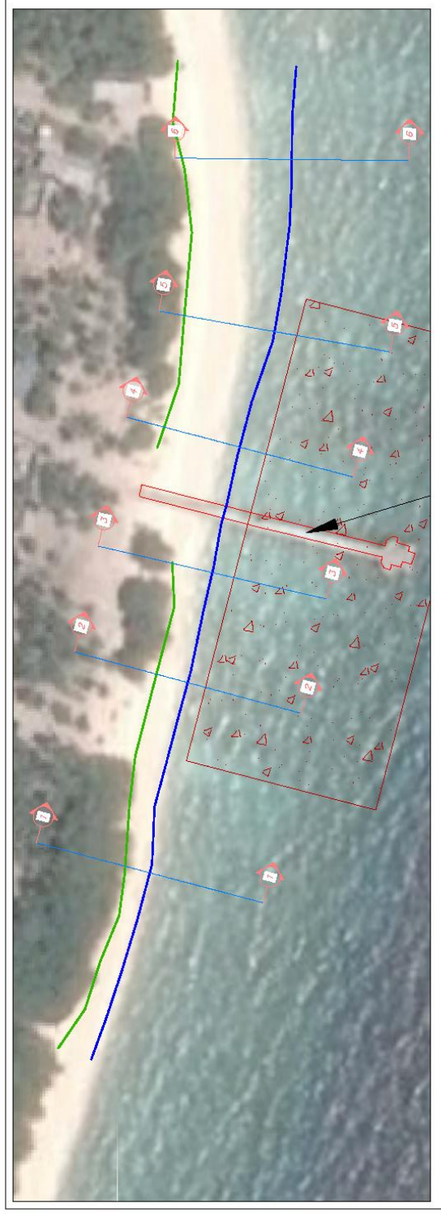
Table 13. Results of water quality assessments, both from in situ tests and laboratory analysis of water samples.

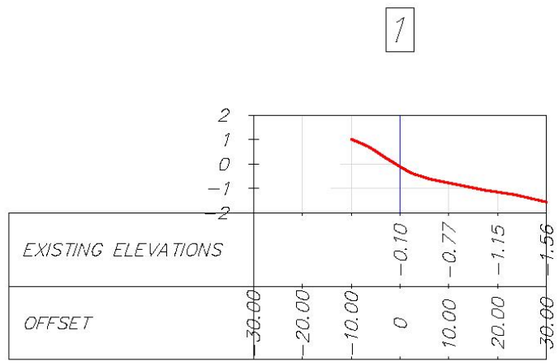
Name	Salinity (ppt)	pH	Turbidity (NTU)	Dissolved Oxygen (mgL^{-1})	Temperature (^0C)	TDS (mgL^{-1})	TSS (mgL^{-1})
W1	32.9	8.56	0	16.52	29.71	30.1	-
W2	33	8.56	0	14.96	29.69	30.2	-
W3	33.1	8.54	0	14.32	29.7	30.3	-
W4	33.2	8.52	0	14.3	29.66	30.4	-
W5	33.1	8.52	0	14.37	29.69	30.3	-
W6	32.7	8.51	0	13.95	29.57	30.5	-
W7	33.4	8.51	0	13.82	29.61	30.5	-
W8	32.7	8.51	0	14.43	29.77	30.4	-
W9	33.1	8.50	0	14.03	29.65	30.3	-
W10	33	8.49	0	13.61	29.56	30.2	-
W11	32.2	8.49	0	13.55	29.65	30	-
W12	33.4	8.61	0	14.59	29.43	30.5	-
W13	33.5	8.59	0	13.78	29.41	30.6	-
W14	33.3	8.57	0	12.65	29.46	30.5	-
SW1	33.63	8.27	0.280	-	-	-	< 5
SW2	33.57	8.21	0.292	-	-	-	< 5
SW3	33.67	8.26	0.488	-	-	-	< 5

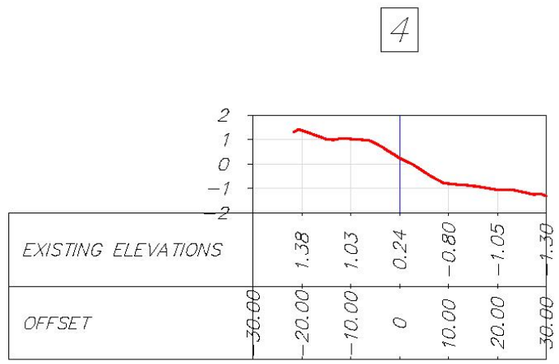
7.5 ISLAND MORPHOLOGY

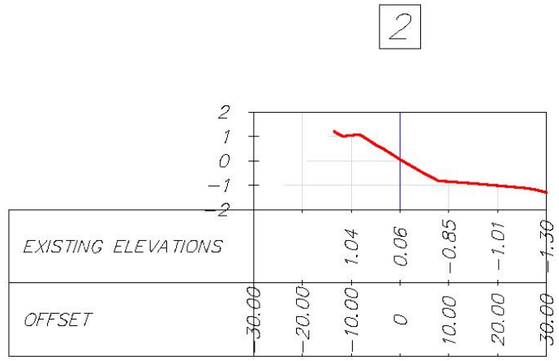
7.5.1 Beach profiles

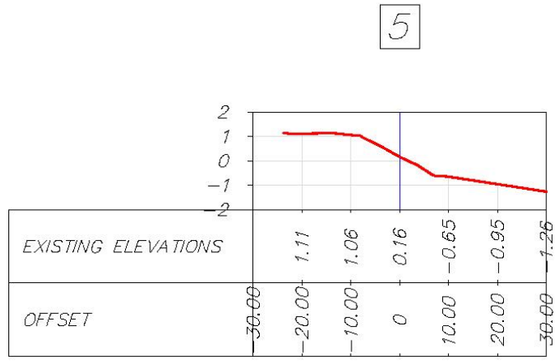
The beach profiles around the jetty shows that the elevation of the beach around this area is about 1m from mean sea level (Figure 19). The visual observation made during the field visits showed no sign of severe erosion at these areas. The beach extent becomes larger from profile 1 to profile 6 (south-north) which is assumed as a result of movement of sand along the shore to the north of the island.

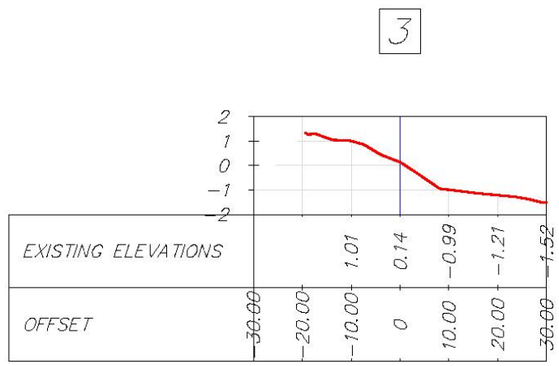


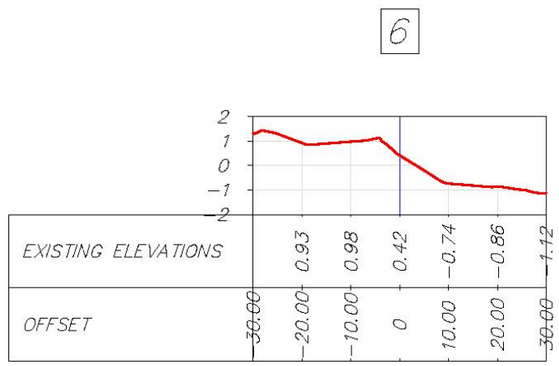












MEECO
2nd Floor, Aaikaiyago-1, Galolhu
Alikilegefaanu Magu
Male', 20129
Republic of Maldives
(960) 301-0855
(960) 301-0844
info@meeco.com.mv

Key Plan

Notes :

- All measurements are in meters
- 0 line is the shore line at the time of survey.

LEGEND

	SHORE LINE

SCALE :	Ver. 1: 200 Hor. 1:1000
SURVEYED BY :	HASHIKA GUNARATNA (SURVEYOR)
DATE OF SURVEY :	17/12/2015
DRAWN BY :	HASHIKA GUNARATNA (SURVEYOR)
CHECKED BY :	HASHIKA GUNARATNA (SENIOR SURVEYOR / ENGINEER)
DATE OF SUBMIT :	07/01/2016

LOCATION
FOHDHOO
NOONU

PROJECT : PROPOSED JETTY FOR FOHDHOO

DRAWING TITLE : DRAWING OF BEACH PROFILES

DRAWING No :2015/0023

SHEET No : 05 of 06

REV	DESCRIPTION	BY	DATE

Figure 19. Beach profiles at six locations near proposed jetty area.

7.5.2 Shoreline dynamics

Both southern and northern tips of the island appear to be highly dynamic, with sand spits constantly changing in response to monsoonal conditions (Figure 20). All the imagery available for analysis were acquired in the northeast monsoon, when recession of the beach is most likely to occur on the eastern side of the island due to dominant wind from eastern direction. However, a detailed analysis of temporal changes between the two seasons were not possible for the island due to unavailability of seasonal imagery. Hence exact mechanism of the shoreline movement or the observed differences in shoreline between the analyzed three years are not properly understood. Nevertheless, the observed beach dynamics at the island, especially on the northern end of the island provide a reasonably good basis to demonstrate the dynamic movement of sand at the shoreline of the island and to assess any likely changes or impacts it may have on the proposed project. A proper long-term long-shore current dynamics study along with analysis of satellite imagery over two seasons would be required to fully understand the shoreline dynamics at the island. Such analysis are, however, not possible due to time constrained EIA studies.

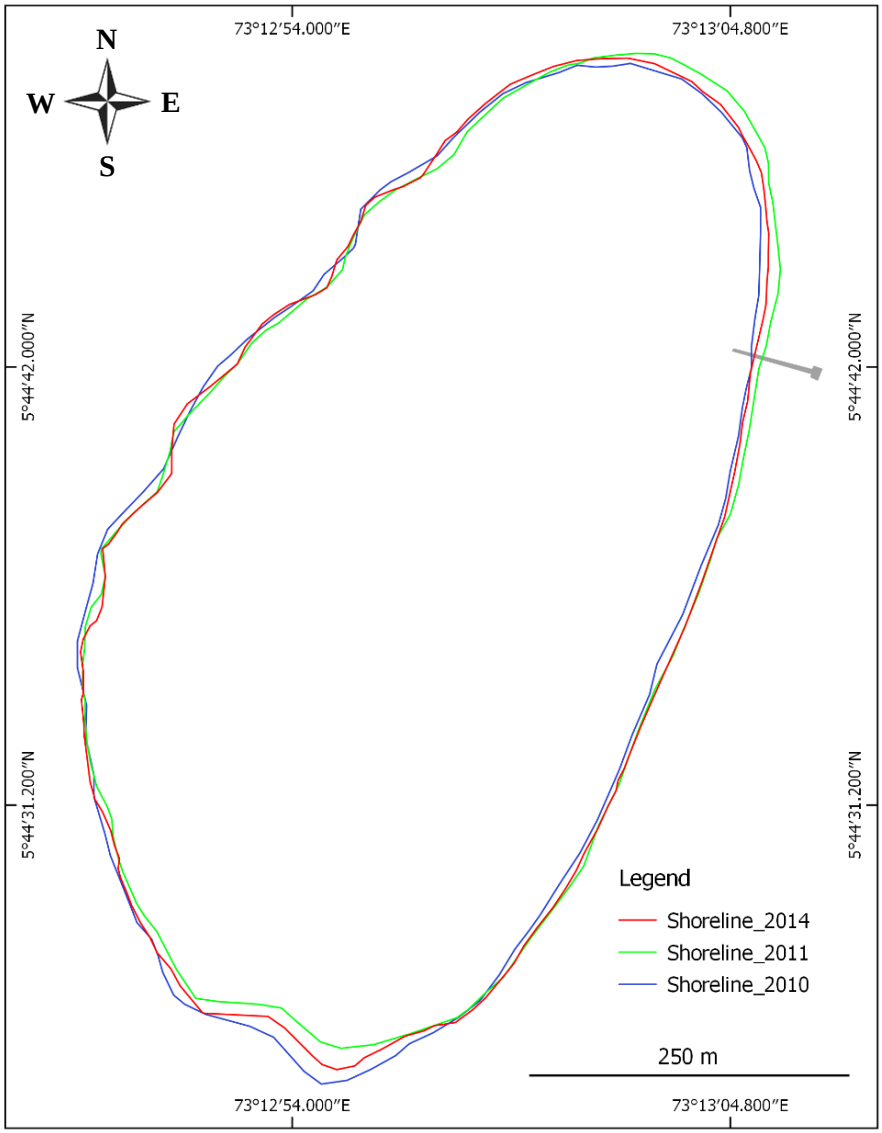


Figure 20. Shoreline changes of N. Fodhdhoo

7.6 TERRESTRIAL ENVIRONMENT

The area identified by the island council for construction camp built up had 50 trees. This includes 34 large coconut palm trees, 14 small coconut palm trees (less than a meter in height) and two small country almond trees (*Midhili).* A close up of this area and the location of trees are shown in the Figure 21 below.

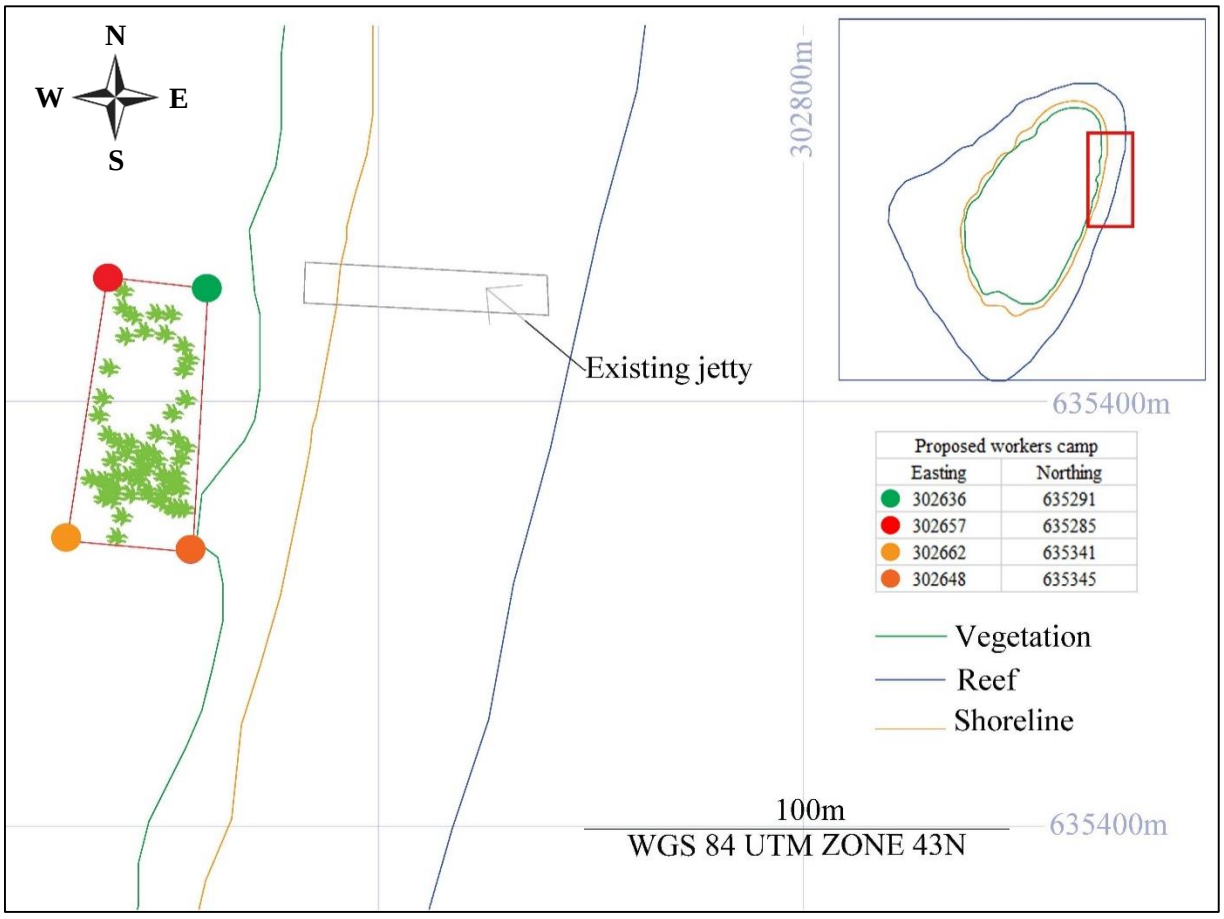


Figure 21. Vegetation present at the proposed camp site

7.7 LAND SURVEYS

The results of the road elevations for the two cross-sectional surveys indicate that these two roads are relatively level. The beach end of both of these sections are approximately 2m from mean sea level with elevation being lower in the middle section. This probably would channel water to the middle section of these roads during high rainfall events. The higher elevation at the ends will very likely provide protection from wave surges reaching into the island. The other small road sections profiled for leveling had a low elevation compared to rest of the roads surveyed at it was estimated that 431 m^3 of sand would be required to level these roads. However, the household adjacent to these roads had no boundary walls, hence impacts of leveling was assessed basing on this existing condition.

The results of the land surveys are attached in Annex 12 of this report.

7.8 SOCIO-ECONOMIC SETTING

7.8.1 Population

According to the preliminary results of the 2014 census (NBS 2014), the resident population of the island is 215 people (Figure 22) comprising 100 males and 115 females. There were further 13 expatriates at the island at the time of 2014 population census survey. The island of Fodhdhoo has the lowest population in Noonu atoll, contributing only about 2% to the total resident population of the atoll. The population of Fodhdhoo was relatively stable between 2006 and 2014 census, having only observed an annual average growth rate of 0.85 between these two census surveys.

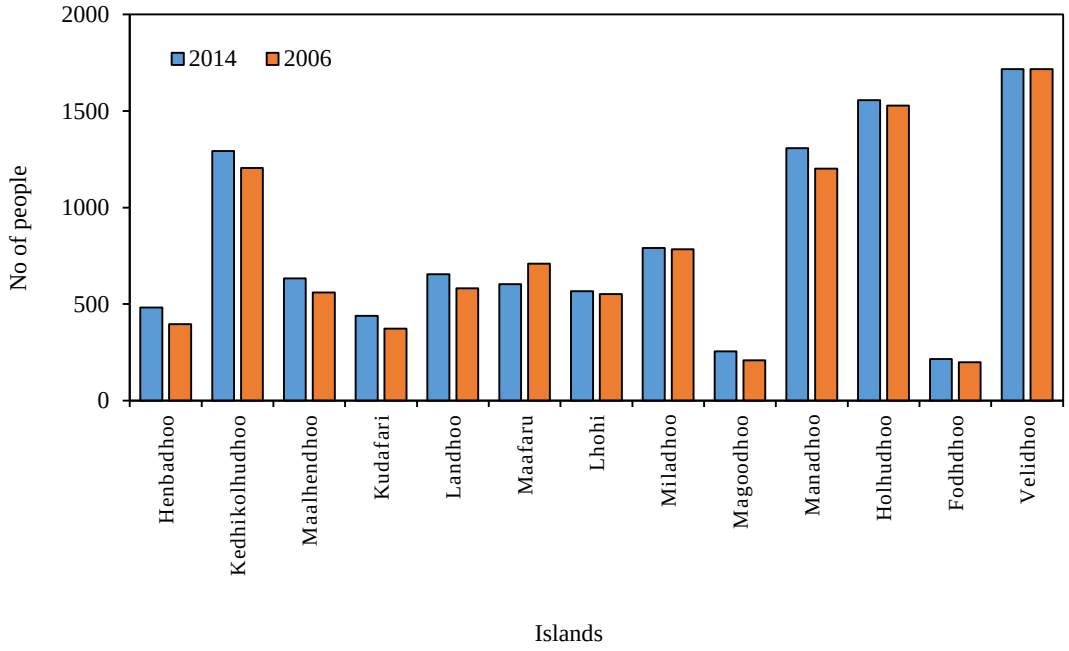


Figure 22. Population of Noonu atoll. (Source: NBS 2014)

According to the information provided by the island council (Annex 7), the total registered population of the island as of December 2015 is 460 people, comprising 233 males and 227 females. About three quarters of the island's registered population consists of people over the age of 18 years. The comparison of the 2014 census data with the registered population of the island indicate that almost half of the population have migrated from the island. This is further validated by the fact that almost half of the houses/land given for housing (47 out of 91) were not occupied by people. According to the island council, people mainly migrate from the island in search of better education and employment opportunities. As of 2014 census the island's population density is 8 people per hectare of land. The island's population density would have been double the 2014 figure if the total registered population resided in the island.

7.8.2 Education

Only Pre-school and Primary education from grade 1 to 6 is available from the island with very few number of students studying at these two levels in Fodhdhoo School. As of December 2015, only 20 students were enrolled in Pre-school and 31 students enrolled in grade 1 to 6. The Figure 23 below show the total number of students enrolled at each grade, with breakdown on gender.

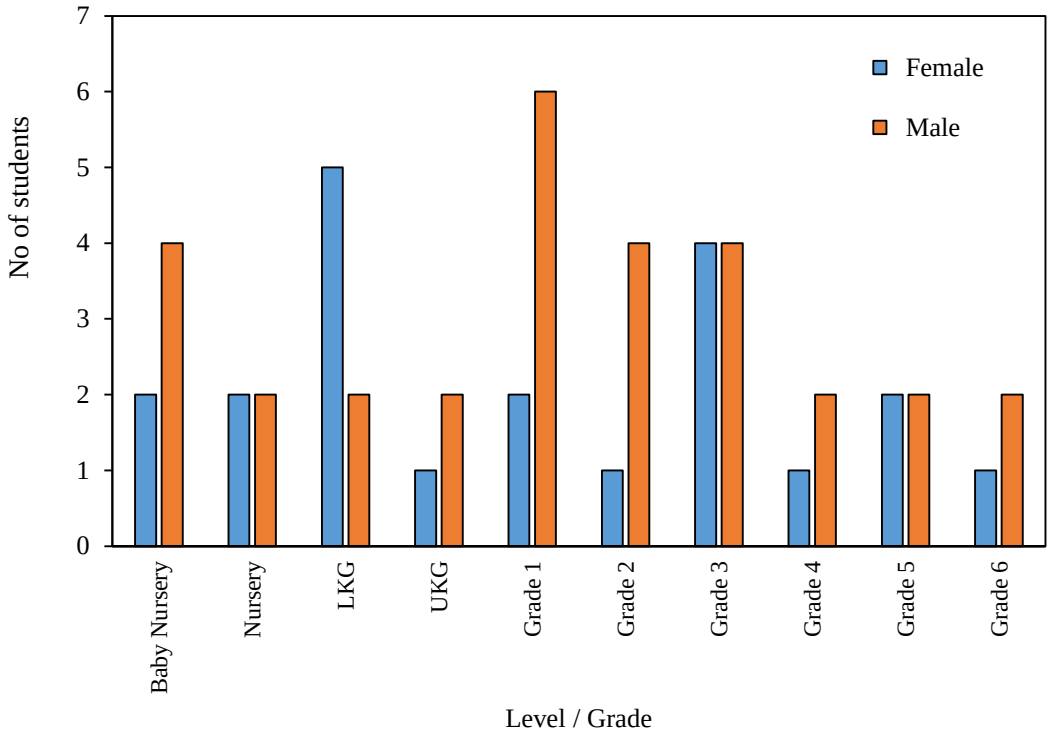


Figure 23. Number of students enrolled in different levels/grades at Fodhdhoo School (Source: Fodhdhoo Council)

7.8.3 Economic activities

The livelihood of Fodhdhoo people depend on public sector employment, carpentry, thatch work, agriculture, reef fishery, operation of retail shops and construction works. The government institutions which provide public sector employment opportunities at the island include N. Fodhdhoo Council Office, Fenaka Co. Ltd.'s Powerhouse, Health Centre, School, Magistrate Court and State Trading Organization's Pharmacy. The other income earning activities, such as carpentry, agriculture, thatch work etc., are carried out at a very small scale at the island. These activities are mainly known to be driven by the demand at the island level with the exception of thatch work, which is carried out for demand from tourist resorts.

A guesthouse is currently being constructed at a local residence which have the potential to improve local economy of the island once it comes into operation. The council have also identified plans to introduce guesthouse tourism to the island, in their land-use plan (Figure 24), by leasing land on the southern side of the island. These developments, if properly implemented and become successful, have the potential to greatly improve the economic landscape of the island.

The land-use plan developed by the island council indicate their intention to developed agriculture on the southern side of the island as well as providing land from the island for industrial purposes (Figure 24). This initiative from the island council demonstrate the planned developments at the island that could potentially enhance the islands economy in the future.

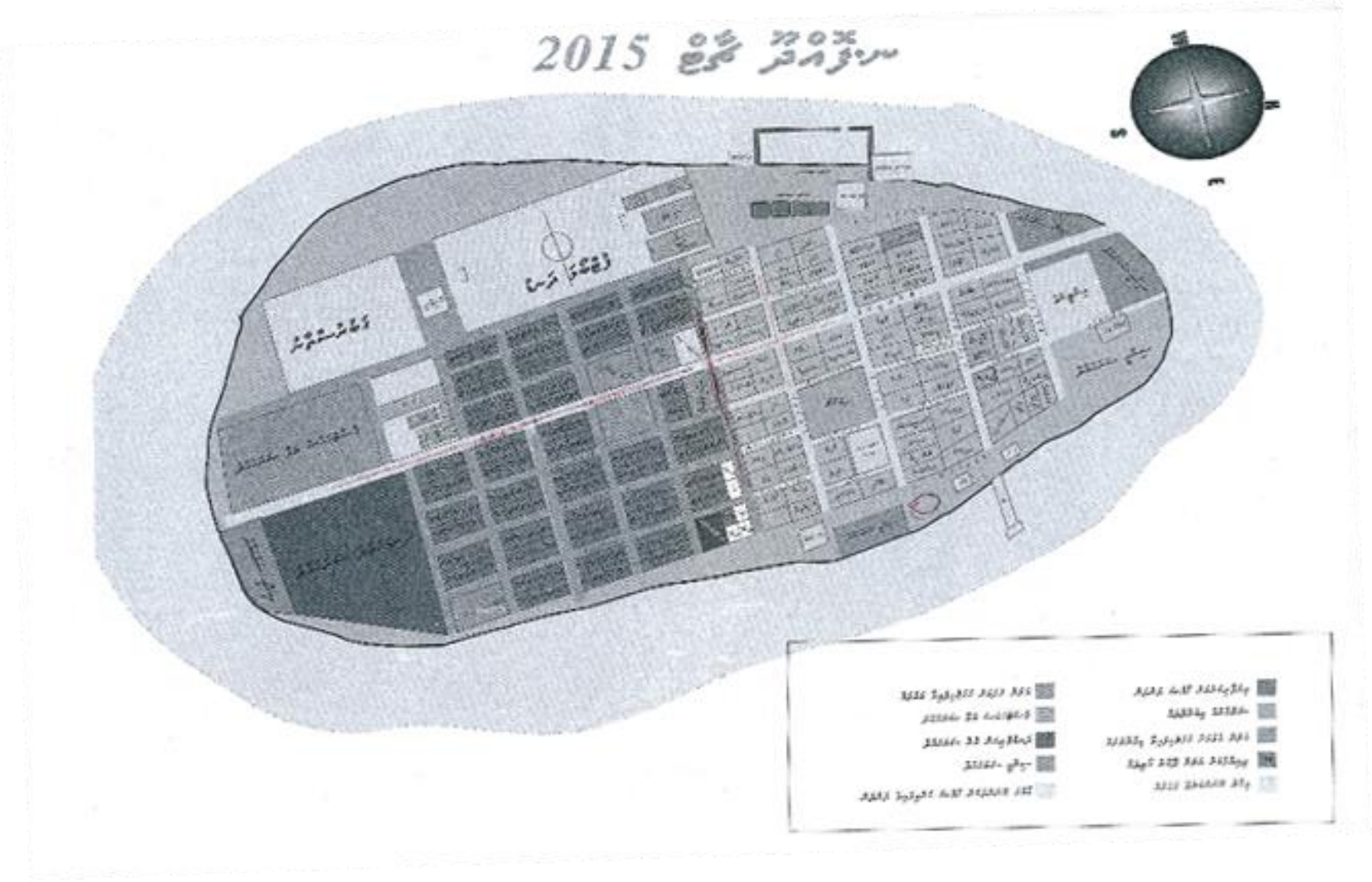


Figure 24. Land use plan developed by the island council (Source: Island Council)

7.8.4 Services availability and quality

The general services availability at the island and a brief description about these services and quality are presented in the Table 14 below. Overall, it can be said that the basic needs of the people are met by the available services but the island council noted degrading/low ground water quality at the island, highlighting the practice of sewage disposal into the ground as the cause.

Table 14. Availability of services at the island and their description.

Service	Availability	Description
Electricity	Yes	• 24 hours electricity is available at the island through a powerhouse operated by Fenaka Co. Ltd. • At present, the powerhouse has a generator capacity of 148kWh (a 100kW and 48kW generator), though the island's average usage only reach about 40 kWh according to Fenaka representative consulted.
Court	Yes	• A magistrate court is present at the island.
Healthcare	Yes	• The health Centre present at the island employs a doctor, nurses and other support staffs. • An ambulance vehicle is also available at the Centre. • A pharmacy operated by STO is also present at the Centre.
Education	Yes	• Pre-school education and primary school education up to grade 6 are available at the island. • Total of 51 students were studying at both levels at the Fodhdhoo School as of December 2015.
Banking	No	• A proper banking facility is not present at the island, but the Bank of Maldives vessel visits frequently to the island to provide bank services to the people. • A local retail shop also offers withdrawal of a set limit of cash per a cash card per day.
Water and sewerage	No	• No water and sewerage service available at the island. • Sewer problem was identified as a concern by the council members as they have been observing degrading quality of ground water
Waste management	No	• At present, no waste management facility exist at the island, but a facility is being developed at the island. • The facility is planned to be used as a temporary stocking place of segregated waste which will then be transported to R. Vandhoo Regional Waste Management Centre. • The facility is also designed in a way that will allow composting of organic wastes.

Transport facility / transportation	Yes	• The only transportation facility present at the island is the existing damaged jetty • An atoll ferry operate within the atoll, visiting the island each day except on Friday.
Telecommunication	Yes	• Network of both the telecommunication operators are available at the island but the network reception of Ooredoo is poor with reception only available at very few locations.
Internet	Yes	• Apart from mobile network internet, a private company offers Wi-Fi service at the island. The company has pre-set data packages for customers.

8. STAKEHOLDER CONSULTATIONS

8.1 FODHDHOO COUNCIL

The stakeholder consultation with the island council was conducted on 17th December 2015 at the N. Fodhdhoo council secretariat. The island council assured the consultants that they have consulted the general public regarding the jetty construction project. This consultations were carried out by calling a general meeting by the council where public express their views on the proposed development. Basing on the aforementioned consultation, council expressed the views and concerns of the public as well as provided further information on the proposed project. The points listed below are the main points highlighted by the council during the consultation and the list of people participated in the consultation are provided in Annex 8.

1. The existing jetty at the island is damaged beyond safe use, hence need a facility which can provide safe access to the island.
2. Vessels cannot anchor on the eastern side of the island, near the jetty, or safely access the jetty, during southwest monsoon to northeast monsoon transition period and during early days of northeast monsoon due to rough conditions prevailing on the eastern side of the island. During such periods vessels need to be moved and anchored on the western side of the island.
3. Vessels cannot access the existing jetty during low tide hours.
4. Island council identified the lack of a proper facility to safely access the island as a major obstacle for social and economic development of the island.
5. The island council has plans to develop local tourism at the island. A guesthouse is currently being built at a local house but the council have plans to lease land for guesthouse tourism on the southwestern side of the island (Annex 4). However, according to the council, this land-use plan is yet to be approved by Ministry of Housing and Infrastructure.
6. Tourist staying at guesthouses in N. Velidhoo are frequently taken to Fodhdhoo, usually 25 tourist per trip and two trips per month, for excursion as well as to enjoy the beach of the island.
7. Tourists from Velaa Private Island resort were once taken to the island for excursion but they have now ceased carrying out excursion trips to the island. The island council is currently in discussions with the resort to resume the island excursion program of the resort.
8. The damaged and unsafe conditions of the existing jetty is a concern very frequently raised to the council officials by the excursion trip operators.
9. The island council also raised the difficulty in transfer of people from jetty to vessels in rough conditions and during low tide hours. This difficulty present particular risks when transferring patients in emergency cases. According to council members, it sometimes takes hours to transfer patients to sea ambulance, hence losing very critical hours of the patient.
10. In some cases, large passenger vessels travelling between Noonu atoll and Male' cannot access the jetty at the island. In such cases, people are taken in small boats (*Bokkura*) to the passenger vessel. This, however, is very difficult and unsafe. Additionally, during such conditions, transfer of cargo to and from large vessels also present difficulty and safety concerns.
11. General jetty users; Passenger and cargo vessels travelling between Noonu atoll and Male', Atoll ferry, small vessels of the island, large fishing vessels that visit the island to sell fish, and other vessels that visit the island (People from nearby islands frequently visit the island to have picnics as Fodhdhoo has extensive beach areas).
12. According to the council members, the general public were not pleased to know that the initial harbour construction project has been changed to a jetty. As a result, the general public meeting was not very successful due to divided ideas. According to the council members, the public still prefers a harbour over a jetty.

13. The council members proposed some modifications for the jetty design to address some of the concerns they currently have. Firstly, council members want to have a breakwater structures on either side of the dredge area (see Annex 9), to block/minimize current flow inside the dredged area and near jetty. This, according to council members, will greatly improve the condition near jetty, even during some of the rough conditions. They also note that, in presence of these structures, vessels will be able to moor near the jetty during rough days of northeast monsoon without having to move to the western side of the island. Secondly, council members want to have revetments or another type of erosion control structures for the shoreline of the dredge area (See annex 9). Council proposes to have these structures, as they believe that without such structures, the shoreline is very likely to erode taking all the sand into dredged basin, hence making the dredged area shallower over time. Their reason for anticipating this scenario is due to the already observed movement of beach near the jetty area.
14. A Waste Management Centre is being constructed at the island which council believe will be finished and operational by January 2016. The waste management centre will have a composting area and holding area for segregated wastes. All the segregated non-biodegradable waste are planned to be transferred to the R. Vandhoo Regional Waste Management Centre.
15. Council highlighted that if waste management centre comes into operation in January, then they will have the capacity to accommodate general solid waste generated by the workers during their stay though accommodating construction waste will not be possible. This construction wastes includes the dismounted structures of the existing jetty.
16. Council also highlighted that it will be difficult to provide accommodation for workers and space for storage of equipment/materials at local houses and they suggested that the best way is to build a workers camp near the jetty work area.
17. However, the person in charge of the Fenaka powerhouse at the island, assured that the powerhouse will have the capacity to provide electricity to workers camp and for any other project purpose. At present, Fenaka power house has a recently installed generator with a capacity of 100kWh and another older one with a capacity of 40kWh.
18. When requested by consultants to identify two areas for dredge material disposal, the initial areas proposed by the council were on the beach area on either side of the jetty (Annex 10). However, later during the consultation, council officials indicated that it might not be ideal to place dredged sand on these areas as the shoreline of these areas are already known to change during different seasons. Especially, the beach on the northern side of the jetty is well known for its movement to western side when wind approach from east for prolonged periods and again move to the eastern side when wind reverses and prolonged west dominated wind occur. Hence council members instead proposed to level the roads using the dredged material. According to the council members, the roads that they identified for leveling are known to form pools of water during rainy days as most of the water are channeled to these low lying areas of the island.
19. If dredge material are in access after leveling the roads, the council members proposes to place them in an accessible area so that it can be offered to locals for construction purposes.

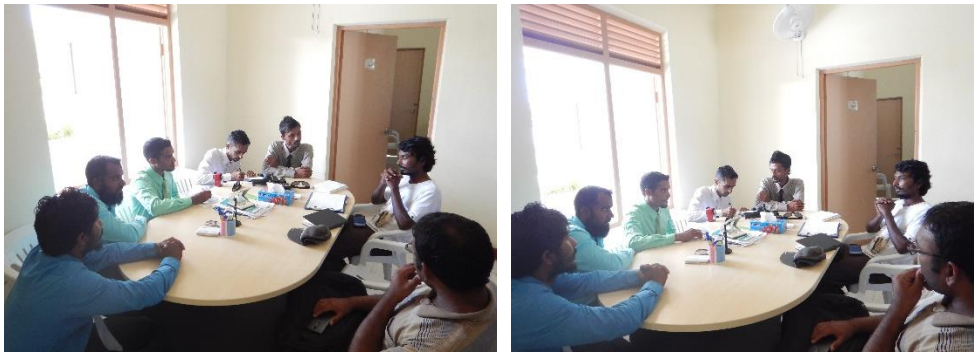


Figure 25. Consulation with N. Fodhdhoo Council at Fodhdhoo Council Sectretariat Office.

8.2 FODHDHOO PUBLIC

The consultations with public of Fodhdhoo were carried out through phone conversations between 3rd and 7th January 2015. A total of five people were consulted, who were chosen randomly from a list of 10 people provided by the island council. An introduction of the project with an overview of the proposed design were given to each person before gathering their views on the proposed project. In general, people were asked about their overall perception of the project, appropriateness of the design concept (e.g. size, location etc.), alternative location for the project and possible useful ways of managing dredge material. They were also given the opportunity to raise any additional concerns, issues, or opinions about the project. The list of people consulted is provided in the Annex 11 of this report.

1. The people consulted highlighted the great need of an improved access facility at the island.
2. All the people highlighted the rough conditions experienced at the existing jetty area during early northeast monsoon period. They noted that such conditions will restrict the use of the new jetty with the current design, similar to what they have been experiencing from the existing jetty. However, most of them said they were satisfied with the overall design, since it is an improvement over the existing jetty, though they noted the requirement to have some modification to the design. Most of the design alterations proposed were to shield the proposed dredge area or the inner side of the cargo loading/unloading area from strong waves and currents and, provide protection for vessels that are moored near the jetty.
3. There were different alternative design modification proposed by people to address the aforementioned issue, since they believe that the full benefits of the jetty can only be realized with these modifications. Listed below are the proposed modifications by the consulted people

   - Shield the inner side of the cargo loading/unloading deck with sheet piling on the sides of this area
   - Need protection for the jetty by sheet piling from the middle of the access deck and to all the other structures on the seaward side.
   - Provide protection for the jetty area by constructing breakwater on either side of the jetty as proposed by the island council.

4. Some people highlighted that without such measures, the only options for vessel owners is to anchor on the western side of the island during rough conditions that occur in the northeast monsoon. However, it was noted that this would present difficulties as large vessels cannot use the western side during low tide hours. According to some, such difficulties have discouraged people from owning large vessels due to high risks for their property. One noted that, he along with other vessel owners have to stay awake overnight to look after their vessels when vessels are not able to anchor near jetty and such difficulties have led two speed boat owners to sell their boats. It was also noted that if this scenario exist after the construction of the jetty (i.e. without the wave/current shielding measures), the overall local economy could have negative impacts due to several issues. The highlighted issues include that likelihood of people not investing in owning vessels, low development of anticipated guesthouse tourism due to transport difficulties and local businesses having to pay twice for cargo charges or hire a vessel to carry the cargo from a nearby islands (e.g. Male'-Holhudhoo, Holhudhoo-Fodhdhoo), if cargo transportation vessels cannot excess the jetty and instead unloads the cargo at harbour in a nearby islands.
5. It was noted by one that the proposed dredge area will not be sufficient for vessels to move through indicating that only one vessels will be able to access at a time.
6. The proposed location of the jetty was considered by the people consulted as a sensible and good location for the jetty since it is the location of the island expected to have the best protection for much of the year. However, one noted that the western side would be more appropriate if a harbour is planned to be built on that side, which he believed is the long term plan of the island council. He also noted that this being on the land use plan developed by the council.

7. One person highlighted that dynamic nature of the shoreline near the jetty location could present some issues during the operational face of the jetty. According to him, the sand movement along the shore will be taken into the dredge area, which according to him, will cause the dredged basin to become shallower within approximately a year. It was highlighted that this may make the depth of this area shallower than what is required for vessels to access the jetty. Hence he propose to provide shore protection at the shoreline area near the dredge boundary. However, another person noted that sand movement along the shoreline as very important for the dynamic nature of the shoreline of the island, hence he believe design of the jetty should not block these sand movements along the shore.
8. On use of dredge material, most of the people agreed that there is a need to level the priority road identified by the council. Upon informing that that operation could potentially cause sand/water to move into house nearby the proposed road without boundary walls, one noted that such complication will have to be solved by the council through consultation of house owners. Use of excess material after leveling roads for construction purposes at the island were also seen as a good option but one noted that excess can be used to level other roads. However, no use of rock/consolidated sediment that is expected within dredge material were identified.
9. It was proposed by one to create an area for hauling vessels onto the shore, through the proposed project.

8.3 PROPONENT AND CONTRACTOR

A meeting with the proponent and the contractor were held on 6th January 2016 at MoHI to gather information on the project and discuss the concerns and proposed modifications raised by the council and public with the proponent and the contractor. The points below highlights the discussions carried out during the meeting and list of the people from both the sides are provided in annex 13.

1. The contractor noted that the protection on the inner side of the cargo loading/unloading area can be provided by several means. By completely blocking the cargo loading/unloading area by using structures typically used for quay walls on all the sides and filling in the inside. Inside of this area can either be filled using dredge material or concrete removed from existing jetty or using mix of both. According to the representatives from contractor, this method would be cheaper than the presently jetty design.
2. The proposed side breakwaters or the shore protection can be built using the removed concrete structures.
3. Representatives from the contractor highlighted that the final decision to bring in changes to the project lies with the proponent and requested them to explore feasible options.
4. The contractor highlighted that they usually avoid moving into the island, especially into residential area, unless necessary and required by the project, when working on coastal development projects. This is because, movement of large heavy load vehicles have caused issues in many islands, such as breakage of underground septic tanks or pipes and formation of cracks on wall of houses. According to them, locals are sometimes unhappy to experience such indirect impacts from projects, hence may create social problems.
5. When highlighted by the contractor that the council have indicated possible arrangement of workers camp near the jetty due to unavailability of local houses for rent, representatives from contractor clarified that their standard practice is first announce at the island for renting houses to provide accommodation for workers. If such attempts fails, there only available option is to construct workers camp with adequate facilities for workers accommodation. They highlighted that they will proceed the same way at the Fodhdhoo for the proposed project.
6. According to the contractor,
   - Equipment and other machineries will be based at the construction camp.
   - Use of cutter suction dredger not feasible for the proposed project due to small space for operation.

- General waste are segregated at camp site and if not disposed at the island, they are taken to Thilafushi at the end of the project.
- Waste transfer are generally carried out only if there is enough space on barge or other carries after placing equipment, machinery and other items.
- In some cases, waste such as empty bags are collected for reuse in other projects or construction works
- All the raw materials required for the project and other supplies required for workers will be bought from Male' and transported to the island. Although, depending on availability, some of the supplies required for workers, may be sourced from the island.
- Main type of hazardous waste expected from the project are; hydraulic oil, lubricants and used batteries.
- Approximately 10 barrels of oil would be burnt to transport materials to the island.

7. When highlighted that the island council proposed to build the breakwater using rock boulders, the proponent highlighted that such modification would be costly and would not be financially viable under designated budget for the project.
8. The meeting was concluded with the understanding that the proponent will explore the options discussed and inform possible modifications to address the concerns raised by council and public.

9. POTENTIAL IMPACTS AND MITIGATION OPTIONS

9.1 INTRODUCTION

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 hydrodynamics due to coastal modification from dredging and reclamation projects as coral reefs are very vulnerable to immediate changes that will be sustained from most of the development activities. 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 from proposed project both during construction and operation phases of the jetty.

9.2 UNCERTAINTY

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. This aspect proved particularly difficult for this EIA as the closest long term monitoring station to the project site is situated very further away. For this reason, data from the Hanimaadhoo were assessed with an assumption that the conditions would be similar at the project island since both roughly falls on the northern region of the Maldives. However, this assumption would hold some degree of uncertainty in analysis, as such, all the other inferences from these data would represent some uncertainties. 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. The observed shoreline dynamics indicate complex coastal process in operation which will require long term assessments to fully comprehend the mechanisms causing such dynamism in shoreline. However, given the time and budgetary constraints, the study of existing environment and impact predictions to a large extent 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 to be reasonable for the purpose of this EIA, as the project scope is small and experience from coastal development work carried out in many islands and resorts in the Maldives is readily available.

9.3 POTENTIAL IMPACT ASSESSMENT MATRIX

As this is a coastal development project, majority of the impacts of the project are expected during the construction stage. This phase includes mobilization of machinery and vehicles, workforce, removal of existing jetty, construction of the jetty, dredging and proposed road leveling dredge waste disposal.

This Section of the report identifies the potential environmental impacts and possible issues that could arise from construction and operational phase. Their identification as potential impacts does not mean that they would necessarily occur or that they could not be successfully mitigated.

The assessment of environmental impacts (positive and negative) had been carried out during EIA process and the resulting RIAM matrix is given in Table 15 and Table 16.

Table 15. Impacts assessment for the construction phase

		I	M	P	R	C	ES	RS
PC1	Coastal morphology	1	-1	3	3	1	-7	-B
PC2	Water quality	1	-3	2	2	3	-21	-C
PC3	Air quality	1	-1	2	2	1	-5	-A
PC4	Hydrodynamics	1	0	0	0	1	0	N
PC5	Hazardous waste	1	-1	2	3	1	-6	-A
PC6	Ground water	1	-1	2	2	2	-6	-A
BE1	Coral reefs	1	-3	3	3	2	-24	-C
BE2	Seagrass beds	0	0	0	0	0	0	N
BE3	Coastal vegetation	1	0	0	0	0	0	N
BE4	Eutrophication	0	0	0	0	0	0	N
SC1	Aesthetic and cultural values	1	-1	2	2	2	-6	-A
SC2	Income	1	-1	2	2	2	-6	-A
SC3	Employment	1	-1	2	2	2	-6	-A
SC4	Public health and safety	1	-1	2	2	2	-6	-A
SC5	Waste management	1	-2	2	3	2	-14	-B
EO1	Infrastructure	1	-2	2	2	2	-12	-B
EO2	Transportation	1	-1	2	2	2	-6	-A
EO3	Navigation	1	-1	2	2	2	-6	-A
EO4	Fishery	1	-1	2	2	2	-6	-A

Table 16. Impact assessment for the jetty operation after reconstruction

		I	M	P	R	C	ES	RS
PC1	Coastal morphology	1	-1	3	1	3	-5	-A
PC2	Water quality	1	0	1	1	1	0	N
PC3	Air quality	1	0	1	1	1	0	N
PC4	Hydrodynamics	1	-1	3	1	3	-7	-A
PC5	Hazardous waste	1	0	1	1	1	0	N
PC6	Ground water	1	0	1	1	1	0	N
BE1	Coral reefs	1	0	1	1	1	0	N
BE2	Seagrass beds	0	0	1	1	1	0	N
BE3	Coastal vegetation	1	0	1	1	1	0	N
BE4	Eutrophication	1	0	1	1	1	0	N
SC1	Aesthetic and cultural values	1	1	3	1	1	5	A
SC2	Income	1	2	2	2	2	12	B
SC3	Employment	1	1	2	1	3	6	A
SC4	Public health and safety	1	2	3	1	2	12	B
SC5	Waste management	1	0	1	1	1	0	N
EO1	Infrastructure	1	2	3	3	2	16	B
EO2	Transportation	1	2	3	2	2	14	B
EO3	Navigation	1	2	3	2	2	14	B
EO4	Fishery	1	1	3	2	2	7	A

Range of values (RS) given in the table in alphabetic are as follows

E = Major positive change;
D = significant positive change;
C = moderate positive impact;
B = positive impact;
A = slight positive impact;
N = no change/Status quo/not applicable;
-A = slight negative impact;
-B = negative impact;
-C = moderate negative impact;
-D = significant negative impact; and
-E = major negative impact.

Table 17. Class totals for major categories of impacts during jetty construction

Class	-E	-D	-C	-B	-A	N	A	B	C	D	E
PC	0	0	1	1	2	1	0	0	0	0	0
BE	0	0	1	0	0	3	0	0	0	0	0
SC	0	0	0	1	4	0	0	0	0	0	0
EO	0	0	0	1	3	0	0	0	0	0	0
Total	0	0	2	3	10	4	0	0	0	0	0

Table 18. Class totals for major categories of impacts during jetty operation after construction

Class	-E	-D	-C	-B	-A	N	A	B	C	D	E
PC	0	0	0	0	2	3	0	0	0	0	0
BE	0	0	0	0	0	4	0	0	0	0	0
SC	0	0	0	0	0	0	2	2	0	0	0
EO	0	0	0	0	0	0	1	3	0	0	0
Total	0	0	0	0	2	8	3	5	0	0	0

The assessment of impacts by RIAM matrix indicate that no major negative impact (-E = 0) is expected to occur during the construction phase of the proposed project and during jetty operation after reconstruction. However, moderate (-C) to slight negative impacts (-A) are expected to occur during construction phase. On the other hand, impacts are mostly positive during the operation phase of the jetty with only two slightly negative impacts expected to occur.

9.4 POTENTIAL IMPACTS AND MITIGATION OPTIONS

9.4.1 Impacts on coastal morphology

The shoreline of the island is not planned to be altered under the proposed project, though some indirect impacts on shoreline dynamics may arise from modification of coastal environment through the project. The proposed plan to dredge an area around the jetty with its landward boundary approximately 7m away from the shoreline may bring some changes to near-shore current as well as to the longshore current dynamics. An optimal buffer zone between the shoreline and dredge area to reduce such likely changes cannot be confidently identified without long term detailed current surveys. Conducting such surveys and nature of temporal changes in current dynamics cannot be predicted to certainty due to limitations in available secondary historical data and short period of time available for the study. Although, analysis of satellite imagery indicate that shoreline near the proposed jetty construction area is very dynamic with accretion and recession of beach. The dredge area may increase the strength of wave action on the shoreline due to absence of reef to reduce wave energy as well due to absence of wave protection structures in the current proposed design. The 'T' structures formed through the cargo and passenger deck may provide some level of protection to the shoreline near the dredge area, however not for the other regions of the dredged area. Waves tend to break when it reaches a critical ratio of wave height to water depth (Woodroffe 2002). Abrupt change in depth between the dredged boundary and the shoreline may cause the incident waves to reach the critical point at which they break. Such breakage of waves with high energy during northeast monsoon period could potentially alter the current dynamics at these regions and strong backwash that is expected may alter sediment movement. Hence it can be roughly predicted that dredging may alter long-shore current dynamics at these areas under current proposed conditions. Precautionary measures, which could have the potential to shield the shoreline from strong wave action, is hence recommended below to reduce impacts on shoreline dynamics.

Mitigation measures

1. Consider alternative design option proposed under section *10.2.5*.
2. Increase the buffer zone between shoreline and dredge area while ensuring sufficient dredged space is available for vessels to move around near the jetty.

The impacts on coastal morphology, specifically on shoreline dynamics, that is expected after dredging will be similar for both construction phase and operational phase as explained above.

9.4.2 Impacts on water quality

Dredging operations will have an immediate major negative impact on water quality at and near the project sites since these operations heavily disturb the settled bottom sediments causing them to suspend in the water column. In the case of the proposed project, the negative impact on the water quality will be highest during the planned 2 months dredging period. During this period, a large area of the sea floor around the existing jetty will be disturbed by the action of the toothed-bucket of the excavator. The degradation of water quality within the dredge boundary during the dredge operation is expected to be above the threshold of tolerance for marine biota, however, the most detrimental impact on the marine biota found within the dredge boundary will not be due to loss of water quality but will be due to direct destruction of benthic community and, loss of habitats for fishes and other organisms during the dredge operation.

The other construction works under the proposed project, especially placement of precast foundation blocks and, movement of the tug boat and the barge is expected to disturb the bottom sediment during the construction phase. Though sediment suspension from these operations will be lower than dredging operation, it would significant enough to consider sediment control measures for protection of adjacent areas.

The negative impact of the degraded water quality will be most endured by the corals and other organisms found on the immediate area at northern and southern side of the proposed dredge area, where background turbidity level was recorded to be 0 NTUs during field surveys. Movement of suspended sediment plumes into these environments could put enormous stress on corals as well as other organisms found in the ecosystem. Prolonged exposure to high turbidity levels or resettling of suspended sediments on corals could cause abrasion, inhibit their growth or potentially kill them. High turbidity levels could also reduce the penetration of light into the water, limiting photosynthesis, hence primary production of the ecosystem.

The limitations of the hydrodynamics study limits accurate modeling of current movement around the island. Though basing on the most likely current dynamics around the island for the northeast monsoon, it is expected that in absence of a proper sediment control measures, the sediment movement will be highest to the immediate area south of the dredge area. However, the split current observed on the northern side of the island during the field work indicate that some amounts of sediments could potentially be taken northward of the dredging area, which was an area seen to be rich in fish abundance and was also the area where the Manta ray, young Napoleon wrasse, dolphins and Spotted eagle ray were seen. Even though the project location is seen to be reasonably protected during the southwest monsoon period waves and swells, the areas on northern and southern of the dredge area could potentially be subjected to sediment stress if sediment movements are not controlled during this monsoon as well.

Since sediment movement, and its possible consequences are identified as one of the biggest negative impacts on the environment during the construction phase of the project, it is recommended that dredging works should only be carried out with proper control measures in place. The consultant, hence propose to implement the following mitigation measures throughout the construction phase of the project.

Mitigation measures

1. Place silt screens on northern and southern side of the dredge boundary prior to starting any work in the marine environment. Silt screen must run from shore, perpendicular to the shoreline to the reefs edge on both the sides.
2. Silt screens should be regularly monitored for any damage. In case of damages, the silt screens should be replaced immediately.
3. Dredging should be carried out during calmer conditions at the dredge area.

The aforementioned mitigation options should be carefully implemented as the negative impacts on water quality and its resultant impacts on marine biota can be significantly reduced by following the proposed mitigation measures. Placement of sand bunds was considered as an alternative sediment control measure, though it is believed that sand bunds would prove inefficient in the open setting of the proposed project. Continuous wave action sand bunds could disperse sediments to the adjacent reef area. Hence, silt screens is considered the most practical sediment control measure for the proposed project.

The operational phase of the jetty is expected to lower the water quality near the jetty due to propeller action of vessels using the jetty, as loose sediments in the dredged basin will be disturbed. However, these effects may be very minimal as traffic of vessels at the jetty is expected to be considerably low. Additionally, waves will interact with the sea floor when it reaches the shallow regions where it would disturb the sediment (Woodroffe 2002). This is sediment suspension through this process is expected to be highest during northeast monsoon when waves are directly approaching the northeastern side of the island. Hence, some level of sedimentation may occur due to waves and which could escape into adjacent area. However, this process is only expected for a limited period of time during northeast monsoon.

9.4.3 Impacts on air quality

The emission of greenhouse gases (GHGs), mainly carbon dioxide, from the use of machinery and equipment are expected to slightly contribute to loss of air-quality. However, this is will be very minor as

only handful of machinery and equipment will be used for the implementation of proposed project. Additionally, no alternative equipment that does not emit GHGs are used in Maldives or for major construction works elsewhere.

Mitigation measures

1. Use of fuel efficient machinery and/or use of equipment in good condition
2. Properly service the equipment at required intervals during the project period.
3. Minimized idle time for the vehicles and machineries.

Since this impact only occurs during construction phase, it will not have any significant (positive or negative) impact during the operational phase of the jetty.

9.4.4 Impacts on hydrodynamics

The proposed project is expected to some negative impacts on the hydrodynamics near the island, both during construction and the operational phase. The design of the jetty structure is not expected to hinder near shore dynamics too much as the base of the jetty is proposed to be built with concrete blocks placed with spacing in between. This is expected to allow nearshore current to move through, similar to what is now observed at the existing jetty. However, slight changes to near-shore current dynamics may occur due to deepening of the area around the jetty.

The proposed design could potentially alter the long-shore currents after dredging as explained under section *9.4.1*. The current buffer extent between shoreline and dredged basin and, potential exposure of the shoreline to strong wave action may alter the long-shore currents. This may have some negative implications on shoreline dynamics on the island. The mitigation measures for reduce impacts on hydrodynamics is same as that proposed for impacts on coastal morphology.

Mitigation measures

1. Implement the recommended mitigation measures under section *9.4.1*

The operational phase of the jetty is expected to have similar impact to hydrodynamics of the island under current jetty design.

9.4.5 Impacts on coral reefs

The impacts on the coral reef is found to be the most damaging from all the identified impacts from the proposed project. A large area (122m x 50m) of coral reef will be permanently lost during the dredging works of the proposed project, with it all the sessile benthic organisms found within the area and habitat of many organism. It has is estimated that only 2% of live coral cover will be lost from the island's reef system through the dredging works of the proposed project. The coral reefs on the adjacent area to the project site will also endure indirect negative impacts from degraded water quality as explained under section *9.4.2*, if proper mitigation measures are not put in place during the project. The direct loss of coral reef from dredge area is inevitable under the proposed project but impacts on adjacent area from degraded water quality can be mitigated by placing silt screens as proposed under section *9.4.2*.

Mitigation measures

1. Place silt screens and implement the project as recommended under mitigation measures in section *9.4.2*
2. Carefully conduct all the operations, especially dredging operation to avoid any unnecessary damage of coral reef at the areas adjacent to proposed dredge area.
3. Use machinery and vehicles in good condition to avoid unnecessary delays in dredging works and finish dredging as soon as possible.

4. Carry dredging works during calmer conditions.
5. Communicate with Ministry of Fisheries and Agriculture to identify a best way for managing Giant clams found within the dredge area, so as to avoid any regulatory conflicts. Consider relocation of giant clams along with live coral to with permission from relevant authorities.

9.4.6 Impacts on coastal vegetation

The proposed project will not have any impact on the coastal vegetation of the island during construction and operational phase of the jetty. Though the construction camp set up is proposed by the island council to be based near coastal vegetation, the project do not require removing of any trees or part of coastal vegetation. Nevertheless, contractor should take all precautionary measures to avoid any unforeseen impacts to vegetation that may arise from unexpected incidents / accidents during the project construction phase.

Mitigation measures

1. Do not remove any trees that is growing within 15m from the last tree that growing nearest to the shoreline.

The operational phase of the jetty is not expected to cause any impacts to the coastal vegetation of the island.

9.4.7 Impacts on ground water quality

Dredged sand placed at roads would have high levels of salt, and these salts could get leached into the ground water layer, hence having the ability to contaminate the water quality of at and around level roads. However, due to the small scale of leveling that is expected under this project and localized placement of sand, hence on a very small area of expected ground water lens (small surface area of the identified roads compared to total land area of the island) it not likely that significant leaching of salt which can have adverse impacts on ground water quality will occur. Recharge of ground water layer during high rainfall events would also dilute and reduce the impacts of salt on water quality. Nevertheless, following precautionary mitigation measures are proposed to reduce the likely but possibly minimal impacts on ground water quality.

Mitigation measures

1. Avoid placement of dredged sand onto the roads, right after being removed from the seabed. Keep the sand collected at the area identified by council for excess sand, for atleast 2-3 days before being transferred to leveling roads.

The proposed project is not likely to have any impacts on ground water quality during operational phase.

9.4.8 Impacts on aesthetic and cultural value

The construction phase of the proposed project will have temporary negative impacts on the aesthetic look of the island. The aesthetic look of the island will deteriorate during the construction phase due to the presence of machinery, construction works at the project site and placement of dismantled structures from the existing jetty. Additionally, the enactment of temporary facilities at the camp site and marking of the construction camp and site boundary will create an undesirable look at the project area. Furthermore, construction works will create noise pollution that could potentially be of a nuisance to the general public.

Mitigation measures

1. Mark a clear site boundary in a way that blocks the view of construction operation being carried out.
2. Avoid carrying out any construction work during night time, especially work that are expected to create loud noises.
3. Do not carry out any work that create loud noise during the prayer times.
4. Dismantled all the temporary facilities enacted during the project and properly clean the project area at the decommissioning phase of the project.

The impact on the aesthetic and cultural value is expected to improve greatly once the construction is over and the machineries and all other temporary establishments are removed from the project area. The improved jetty will further improve the aesthetic look of the island, hence operational phase of the jetty is expected to have positive impacts for the island.

9.4.9 Impacts on employment and income

The construction phase of the proposed project is expected to have some negative impacts on employment and income earning opportunities at the island. No negative impact is expected to be felt by people employed in the public sector but considerable difficulties is expected to be faced by people involve in construction works, fisheries and operation of retail shops. It is because, the proposed project will have to restrict access to the only existing facility that is used for easy access to the island. Construction workers and people who operate retail shops could face the difficulties in transporting construction raw materials and goods to the island in the absence of the jetty. In a very similar way, fishers will have to use another area when setting out for fishing trips and unloading their catch.

Mitigation measures

1. Avoid unnecessary delays during the project by proper planning (e.g. by making sure all required raw materials are available at the site for all the components of the project), so that the improved jetty is made available for use sooner.
2. Jetty users can temporarily use the western side of the island for anchoring their vessels and other purposes. However, use of the western side could be problematic during southwestern monsoon as western side is expected to get very rough during this period. Additionally, large vessels may not be able to anchor or be anchored at this side during low tide hours. Therefore, vessel owners needs to be warned about the expected conditions and advised about possible risks of using the western side of the island.
3. Carryout the work during northeast monsoon period when western side is more preferable in terms of conditions and to access the island.
4. Ensure that all vehicles and machineries are in good condition, so that no unexpected delays would occur for the project.

The operational phase of the project is expected to improve employment opportunities and income at the island as the improved new jetty will significantly ease the use of the jetty facility, hence having an overall positive impact on the economic activity of the island.

9.4.10 Impacts on public health and safety

The construction phase of the proposed project will pose threats to public health and safety if construction operations and other works are carried without proper precautionary safety measures. The use of large machinery, both on land and at reef in near the jetty will present unsafe conditions if the area is accessible for people other than workers involved in specific operations. In addition, the workers involved in the project should also follow safety guidelines and contractor should arrange all required safety materials/equipment for the workers during the construction phase.

The restriction of access to the jetty construction area will present particular risk from the proposed project for critically ill patients when being transferred from the island to hospitals in other island. The council members have already identified the damaged condition of the existing jetty as major difficulty in such cases. Therefore, proper mechanisms, as identified in the mitigation measures below, should exist during the construction phase of the project if such a case arise.

Mitigation measures

1. Workers safety instructions shall be clearly made visible at the project site
2. Site accessibility (public access) shall be carefully controlled, instruction signs placed at the construction site to avoid unauthorized access.
3. Mark construction boundary
4. Protective gears shall be available at the site and worn by workers.
5. First aid kits shall be available at the construction camp
6. Only certified workers shall be allowed to operate machinery and vehicles
7. Do not smoke or use naked flames near fuel storage, while refueling the machinery or when handling flammable oil
8. All marine based machinery, even excavators/lorries on barges, shall have fire extinguishers
9. If transfer of patients from the eastern side is found to be the most fastest way of transferring patients to sea ambulance/vessels, then construction operations shall be brought to a halt and mechanisms (such as moving vehicles and machineries away from the path) to transfer patients to sea ambulance/vessels.

The operational phase of the jetty is not expected to have any negative impact on public health and safety but is expected to improve general health and safety conditions.

9.4.11 Impacts on waste management

The proposed project is expected to generate considerable amounts of waste during the construction phase. This include, hazardous waste, solid waste from general use, construction waste (e.g. used cement bags), considerable amounts of dismantled structures (both from removal of existing jetty and temporary facilities) and consolidated sediment rock from dredging.

Most of these waste cannot be disposed at the island, since the island council members have identified that it would not be possible to accommodate the management of waste generated from the project (except the solid waste produced by general use of workers) through the Waste Collection Centre currently being built at the island nor through existing mechanisms. Therefore, it is recommended that waste generated from the project is transferred from the island to Thilafushi at the end of the project.

Mitigation measures

1. Segregate the waste and store them safely at the project site.
2. Waste collection area shall be properly marked, fenced and contained.
3. Storage of used lubricant oils/batteries must be kept at a location away from the shore to prevent accidental spills into marine environment.
4. Area designated for storage of hazardous waste shall have flooring as per the specifications set under Waste Management Regulation.
5. Any hazardous waste produced during the project shall be stored inside a closed container at the project site and transported sealed inside these containers.
6. Access to hazardous waste site shall be carefully controlled.
7. Proper signs, as per Waste Regulation, shall be placed at Hazardous waste site.

8. Concrete wastes produced from removal of existing jetty and dredged consolidated sediment rock material shall be placed at one place.
9. Construction wastes generated throughout the project shall be segregated and stored at one place.
10. All the waste shall be transferred to Thilafushi at the end of the project.
11. The vessels used for transferring waste shall adhere to conditions set under Waste Management Regulation.
12. Develop and implement a waste management mechanism at the jetty for operational phase.

The operational phase of the jetty is not expected to create any impacts on waste management of the island. The present level of jetty usage may not produce considerable waste during the operational phase. Nevertheless a proper waste management shall exist at the jetty area as proposed above during operational phase. This is to ensure that facilities exist for the vessels using the jetty to properly dispose of their general waste, as well to initiate a waste management mechanism that can be used and developed in the future for anticipated increase in jetty users.

9.4.12 Impacts on infrastructure

The construction phase of the project will have some negative impacts on the infrastructures of the island. The main impact on infrastructure will be on the existing jetty, since it will be removed under the proposed project. However, this impact is temporary and is not considered as a major problem since an improved jetty will be built during the project. Since electricity is expected to be sourced from the island, it will increase the electricity usage from the island's existing powerhouse. However, basing on the consultation with island council, it is expected that it will not burden the facility to an extent that will impact electricity usage of the residents.

The operation of leveling the roads proposed by the council could potentially present damaging negative impacts on the infrastructures of the island. Some of the houses near the proposed roads for leveling do not have boundary walls built, hence it is very likely that rain water collected at these roads and fill material placed at the roads could potentially get channeled into the premises of the houses. Secondly, movement of heavy load vehicles into the island to access the roads and compacting operation during leveling could potentially create cracks on walls of buildings / boundary walls or may cause sewage pipes / wells laid underground to burst due to high load. Also, movement such heavy load vehicles could compact the access roads, hence lowering infiltration capacity of these roads. These concerns were also raised by the contractor during consultation with them. Lastly, only leveling of roads is not likely to solve the issue of water puddle formation at the identified roads as there is no way to understand the quality of dredge material and their infiltration capacity after being compacted. However, it can be said that compaction could lower the infiltration capacity, hence in such a case, water collected at these compacted areas during high rainfall events will be channel to nearby low elevation areas, which are the private premises adjacent to the roads. These issues arising from the proposed project will not only present infrastructure damage but could also potentially create social and environmental issues.

Mitigation measure

1. Contractor shall limit movement of heavy load machineries into the residential area of the island.
2. It is recommended that the proponent consider alternative option presented in section 10.2.7 of keeping fine unconsolidated sediment (sand) for construction purposes at the island.
3. Leveling shall be carried out with proper surveys of existing levels at the island and proponent shall ensure leveling is carried to the levels of existing roads around the area and premises.
4. Proponent shall ensure that public is made aware of likely impacts while also providing information to them on how damages on infrastructure will have to be addressed.

The operational phase of the jetty is expected to have a positive impact on the infrastructure due to the presence of an improved jetty at the island.

9.4.13 Impacts on transportation and navigation

The construction phase of the proposed project is bound to have inevitable negative impacts on transportation and navigation at the island due to the restricted access to the jetty facility. As indicated, this impact is inevitable but necessary to provide an improved jetty to the people of Fodhdhoo. The mitigation measures that can be taken to ease these difficulties are similar to that proposed under subsection *9.4.8*.

The operational phase of the improved jetty will significantly improve the conditions of transportation and navigation at the island. Though, as understood from public consultation and through assessment of expected wind driven waves and swell waves, the jetty will experience rough conditions during northeast monsoon which may restrict use of the jetty during this period. Therefore a mitigation measure is proposed to address this concern.

Mitigation measures

1. Follow the mitigation measures as proposed under subsection *9.4.8*
2. Consider alternative designs option proposed under section *10.2.5* and incorporate the recommended design into the project.

9.5 SUMMARY

In summary, the proposed project will have some negative impacts, both environmental and socio-economic during the construction phase of the proposed project. However, most of these impacts are temporary while few others can be mitigated by following the recommended measures. On the other hand, some impacts, such as loss of coral cover from the proposed dredge area and subsequent loss of habitat for marine organisms inhabiting in these areas, are unavoidable and is considered as an inevitable environmental costs of the proposed project.

The improved jetty that will be built under the proposed project, and its operation is expected to improve the socio-economic condition of the island and eliminate the difficulties faced both from the condition of the existing jetty and during the construction phase. Overall, the project is expected to have a positive impact from a socio-economic perspective, but like any other coastal development project, will have some unavoidable environmental negative impacts. Hence mitigation measures are recommended to limit these impacts as much as possible to ensure that the project is conducted in a manner that will have least impact on environment but achieve the desired objective of the project.

10. ALTERNATIVES

10.1 NO DEVELOPMENT OPTION

The no development option means that the jetty construction project at the N. Fodhdhoo will not be implemented. The implication of this is that no impacts (positive and negative) arising either from the construction phase of the proposed project or the operational phase of the improved jetty will occur. In such a case, the islands already damaged jetty may degenerate beyond conditions acceptable for safe access and mooring of vessels. Additionally, the residents of the island is set to lose the expected socio-economic benefits if the jetty construction project is not carried out.

However, on the positive side no environmental impact, though mostly identified as localized, temporary and possible to mitigate, will not occur during the construction phase of the project.

Since the short and long term socio-cultural and economic benefits outweigh the short term negative impacts on the environment, choosing not to go forward with the proposed project is not considered as a reasonable option.

10.2 DEVELOPMENT OPTIONS

This section explore alternative development options for the proposed project and assess their feasibility and effectiveness against proposed methods.

10.2.1 No dredge option

The proposed project can minimize loss of coral reef by choosing not to dredge a basin around the jetty. This will greatly reduce the impacts on environment from the proposed project since loss of corals reef from the dredge area and subsequent loss of habitat for species present in this area, is identified as a main and an irreversible environmental impact from the proposed project. Additionally, the likely impact on shoreline dynamics could also be averted by this option. Even though environmental impacts of the project can be minimized by choosing this option, the implication that it will have on the objective of the proposed project will be negative. If the area around the jetty is not deepened, it is then very likely that large vessels cannot reach close to the jetty, especially during low tide hours. Hence such conditions will not improve the transportation to and from the island and the people will have to experience similar difficulties and safety issues they currently face from the existing jetty. Therefore, despite the reduced environmental damage anticipated by choosing this option, removal of dredge component from the scope of the proposed project is considered as unacceptable to achieve the desired objective of the proponent.

However, in the face of the expected impacts on coastal morphology, as explained in section *9.4.1*, it is recommended that the increase of buffer zone as proposed as a mitigation measure is implemented.

10.2.2 Dredging method

A bucket excavator is proposed to be used for the dredging works of the project. An alternative option for dredging would be use of a cutter suction dredger which may be more suitable in terms of controlling the sediment. However, use of a cutter suction dredger over bucket dredger would incur additional costs. Furthermore, the limited working space for the dredger and the small area required for dredging could cause significant logistical and operational difficulties for the cutter suction dredger. On these basis, a bucket excavator, with sediment control measures put in place, is considered as the most suitable and feasible option to be used in dredging works of the proposed projects.

10.2.3 Alternative protective measures for the dredged area and shoreline

The proposed breakwaters and shoreline protection may provide a relatively calmer environment around the jetty than surrounding areas, by limiting current movement, and prevent movement of sand from shoreline area to the dredged basin, as noted by the council and public, but it may potentially bring significant changes to near-shore and long-shore currents, resulting in changes of shoreline dynamics of the island. However, it should be noted that these impacts are assumed by relying on qualitative judgements based on expected current dynamics around the island through secondary data. A comprehensive understanding of near-shore current and long-shore currents with information on temporal changes will be required to make a more confident assessment of expected changes to the shoreline dynamics. Such detailed island specific assessments are not possible through available historical data in the Maldives, or through long term monitoring which is impossible under a time constrained EIA process. Therefore, in such uncertain conditions, it is recommended that an alternative precautionary option, which is less likely to alter present shoreline dynamics, is explored to address the concerns of the council and general public.

An alternative option, that may have a relatively low impact on near-shore and long-shore current dynamics, hence on shoreline dynamics, could be implemented by building a rock boulder breakwater on the seaward edge of the dredged basin. A concept plan of these breakwater is shown in the Figure 26 below. Placement of these two breakwaters is expected to shield the jetty area to some extent from northeast monsoon wind driven waves and swells, hence providing a relatively calmer condition around the jetty. The waves breaking on the breakwaters is expected to lower the wave energy significantly which would otherwise hit directly on the shoreline on the landward edge of the dredged basin (see section *9.4.1* for likely impacts on shoreline from proposed design). Additionally, placement of breakwaters parallel to the shoreline on the seaward boundary of the dredged basin may have a lower influence on near-shore and long-shore currents than building perpendicular breakwaters and arresting shoreline using shore protection structures.

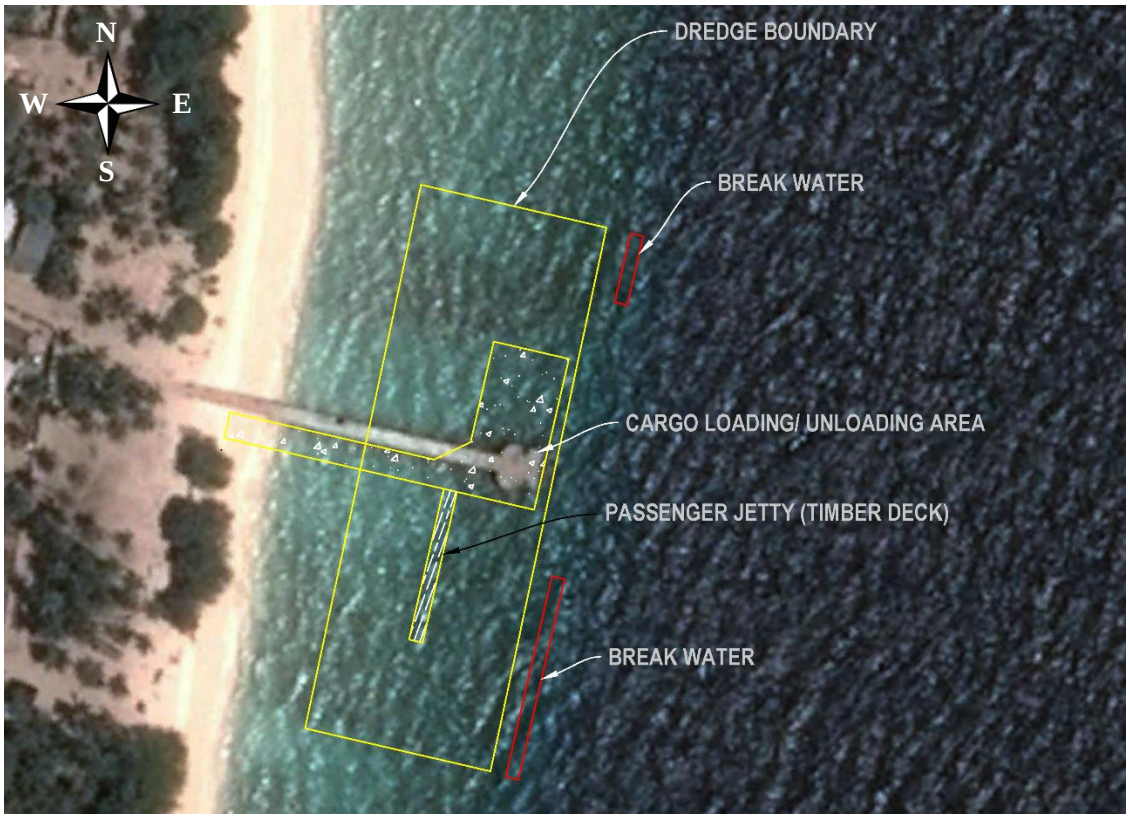


Figure 26. Proposed alternative design concept for protection, for basin and shoreline

10.2.4 Construction of a section along the outer edge of the cargo deck

The expected difficulty in accessing the jetty and keeping the vessel safely moored near the jetty during rough conditions that is expected to occur during northeast monsoon, as highlighted by the public, can be addressed by building a section adjacent to the outer edge of the cargo loading/unloading area (Figure 27). The design of this section will require structures that can block waves and resultant current flow into the inner side of the cargo loading/unloading section. Two structural options that can be utilized for the additional section could be closely packed sheet piles or building of concrete slabs typically used for quay walls. Such blockages on the outer section will not have significant changes to near shore currents that move parallel to the shoreline. On the other hand, it will only block waves/currents moving towards the shore, near the cargo loading/unloading area. It would also provide some level of protection to shoreline as it will lower the energy of waves at a small section.

This modification would provide some level of ease to jetty users during rough conditions, since it will create calmer conditions on the inner area of the cargo loading/unloading area relative to the outside. This is also important to ensure that the jetty is accessible throughout the year. However, this design will still not provide a significant protection to the shoreline area.

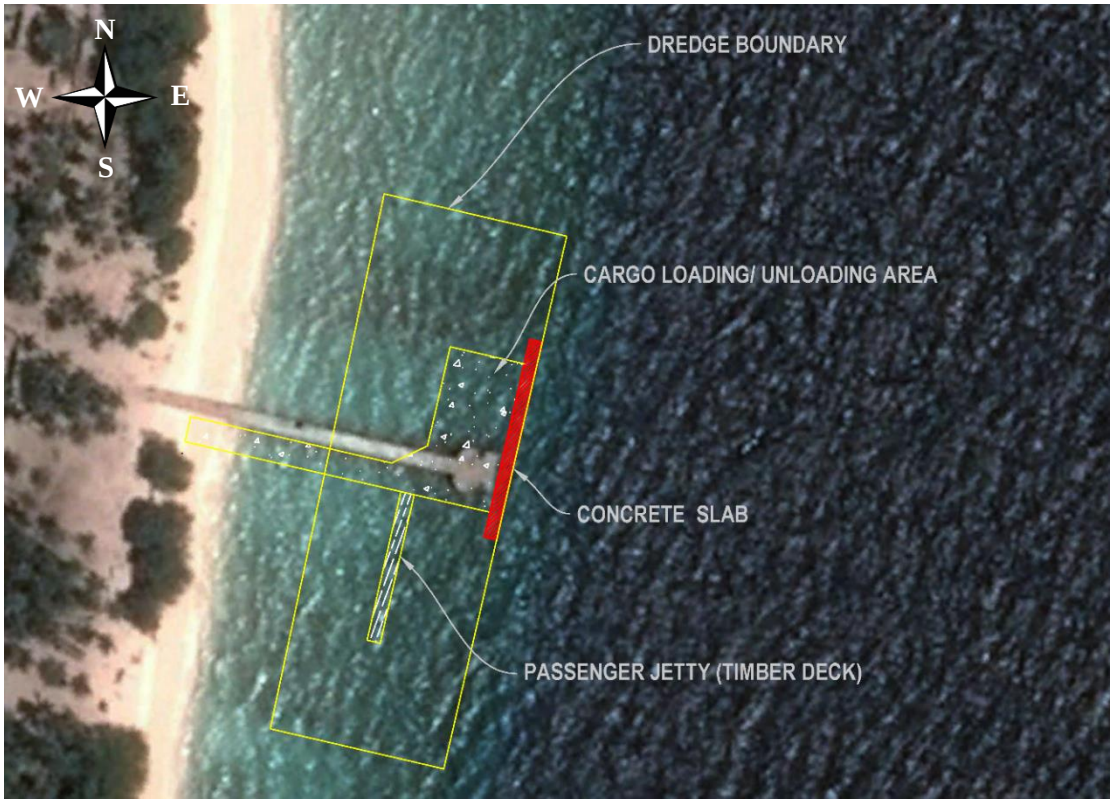


Figure 27. Proposed alternative design concept to ease access to jetty during rough conditions.

10.2.5 Sheet piling of the cargo deck along with construction of breakwaters

An alternative design, which is to some extent a combination of the two previous concepts given in section 10.2.3 and section 10.2.4 is explored here.

Sheet piling of all sides except the area in connection with the access deck of the cargo loading/unloading area is expected to create calmer conditions on the inside of the cargo deck during rough conditions encountered in northeast monsoon. Such a modification would address the concerns raised by the public

about the proposed design not being able to block the impact of waves. However, such blockage of waves would result high energy waves breaking directly on the cargo loading area and the structure absorbing most of the energy. These high energy impacts could damage the structure or reduce the lifetime of these structures if not built with high structural integrity. Sheet piling is considered for this modification as it is expected to be the most durable for the exposed area. However, the proponent may use a similar structure that would block waves, therefore it is recommended that the proponent explore other alternatives which would serve the desired function.

Since the above modification do not fully address the high energy waves reaching the shoreline area, a breakwater structure, using rock boulders, on the outer edge of the dredge boundary is still preferred as the most protective measure that can be placed to protect the shoreline from wave impacts. The breakwater can be placed on the outer edge, on both side of the dredge area, with approximately a 30m opening between the jetty and the breakwater to allow space for vessels to move through. This concept is demonstrated in the figure 28 below. The placement of the two breakwater could potentially restrict movement of vessels inside the dredge basin, though the breakwaters can also function as a mooring facility for the vessels. Removal of the passenger or shortening of the passenger jetty may also ease the movement of vessels on the southern side but such modifications could also be less appealing for the public. Hence it is recommended that the proponent explore the engineering and financial feasibility (strength, size, design of structures etc.) and include these breakwaters and cargo area design modification for the design of the proposed project in a way that will ensure that no operational difficulties arise from the modifications.

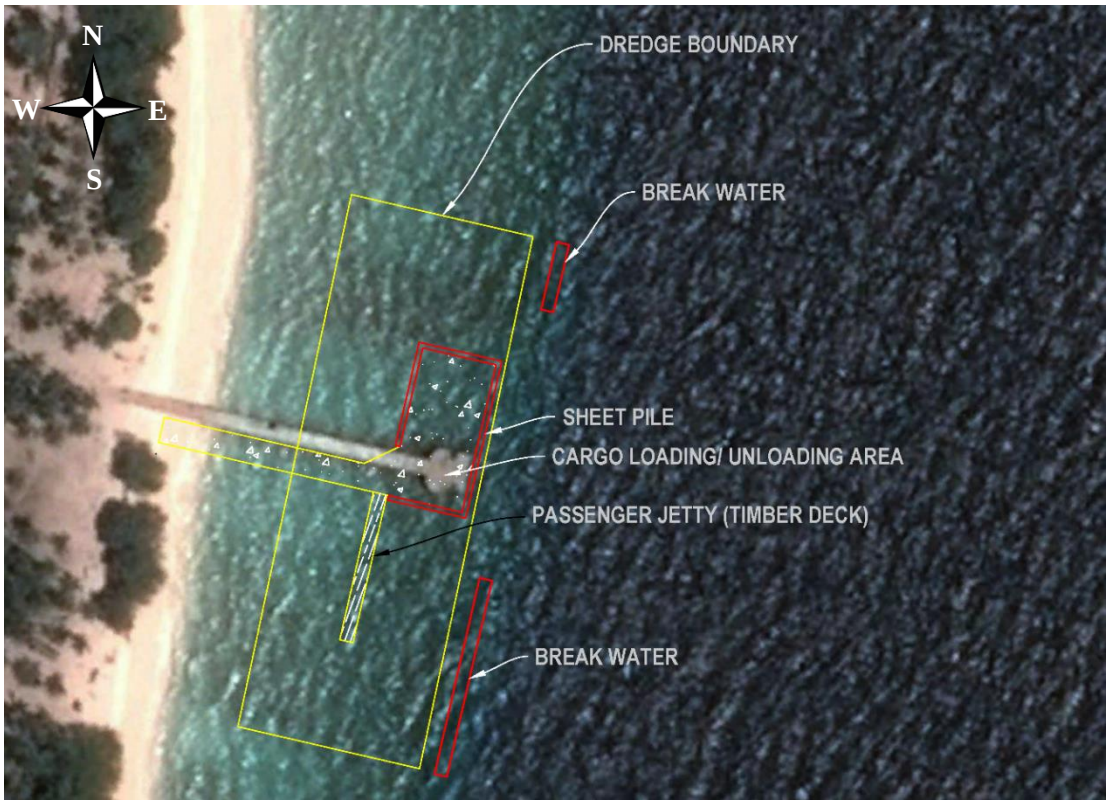


Figure 28. Proposed alternative design to ease berthing and to protective measures for shoreline and basin.

10.2.6 Construction of the jetty on western side of the island

The western side of the island was considered as an alternative location to construct the proposed jetty design as this side is currently being used as a vessel anchoring area and also because this side have been previously proposed for constructing a harbor. However, it was found that building the jetty on the western

side may not be a reasonable choice as it is expected that more environmental impacts could occur and the period of easy accessibility to the jetty could potentially be limited if built on the western side. Building the jetty on the western side will require either extending the jetty and dredge basin or dredging a channel to access the jetty if the present design is to be implemented. Either choice will increase the footprint of the project, hence would have more impacts on the environment through direct and indirect impacts. Additionally, the western side of the island is completely exposed to the open sea (*Ali huras kan'du*), hence wind driven and swell waves during southwest monsoon may potentially create very rough conditions on this side, which could limit easy access to the jetty. The rough conditions in southwest monsoon in western side is expected to persist longer than rough conditions that will be faced in northeast monsoon in eastern side of the island. Therefore, constructing the jetty on the eastern side is considered as more reasonable than moving the jetty to the western side of the island.

10.2.7 Dredge material disposal

The proposed method of managing dredge material disposal through road leveling may present some issues that could potentially have negative socio-economic and environmental impacts. These impacts are identified under section 9.4.11 with an alternative option proposed to mitigate these impacts. During consultation with the island council, it was suggested that any excess sand (fine dredged sediments) after leveling the roads could be made available for residents of the island to use for construction purposes. An area of on the eastern side of the island, as indicated on the map given in section *5.4.5*, has been identified by the council, during the consultation, to place excess sediments until it is used by the locals. Hence it is recommended that this option can be considered as reasonable alternative for managing excess sediments. However, this excludes large rocks and consolidated sediment rocks that will be generated from the dredging and is considered as a waste from the proposed project. The council identified no use for such large rocks, hence it is recommended that these materials are transported to Thilafushi along with construction and other wastes at the end of the project.

10.3 SUMMARY

The no development option is considered as unjustifiable to achieve the desired objective of the proposed project. It is believed that a dredge area will be required for the as proposed under the design to fully realize the desired objective of the project. Additionally, the method of the proposed dredging operation is justifiable given the small scale of the project. Construction of jetty on the eastern side of the jetty is also believed to be the most reasonable choice as it is expected to have the least environmental impacts and easy accessibility for a longer period than constructing the jetty on the western side of the island. Additionally, option 10.2.7 is considered as the best way to manage dredged material from this project.

Though dredging is considered as a requirement for achieving the desired objective of the proposed project, it may present some impacts on the shoreline dynamics if the dredge area is fully exposed to the wind driven and swell waves that is expected to approach the jetty area during the northeast monsoon. The nature of the proposed design also may present operational difficulties for jetty users during rough conditions expected at the jetty in northeast monsoon. The spaced blocks currently proposed for support of cargo deck will allow wave generated currents to pass under the deck, hence creating unfavorable conditions at the inner side of the cargo deck. Such condition may hinder effective use of the jetty as vessels may not be able to properly moor at the jetty. To address these concerns, several design modifications have been assessed basing on likely conditions at the jetty during northeast monsoon. Among the three alternatives, it is believed that the option presented under *10.2.5* is the most preferable option to reduce the likely impacts which will also ease the expected operational difficulties during northeast monsoon. It is therefore highly recommended that the proponent incorporate this design under the proposed project. However, it is also recommended that the proponent explore the engineering feasibility (strength, size, design of structures etc.) and financial of the proposed design modification, while also ensuring that inclusion of these modifications will not present operational difficulties of the jetty.

11. ENVIRONMENTAL MONITORING PLAN

Environmental monitoring is essential to ensure that construction phase and operational impacts are known and eliminated in a timely manner. Dealing with impacts earlier would save money and also help planning and operationalize the process.

The parameters that are most relevant for monitoring the impacts that may arise from the proposed project are included in the monitoring plan. These include water quality (turbidity, TDS and BOD), sediment deposition on corals.

The environmental monitoring plan (EMP) presented here is in outline form. The purpose of the EMP is to monitor or control the environmental effects of the dredging process. It should be based on compliance, verification, feedback, and know-how. It is therefore suggested that the environmental consultants are recruited for proper implementation of the EMP during the construction and operational phase. In the case of the proposed dredging works, environmental monitoring is particularly necessary to ensure that suspended sediments generated during excavation, do not adversely affect the health of the coral reef ecosystem.

Since the project works is related to the dredging of marine sediments and building of coastal structures, environmental monitoring is particularly necessary to ensure that these activities do not adversely affect the health of the coastal ecosystems in vicinity of the project environment. In addition to undertaking the EMP outlined in the report, good project planning, preparations, are important to avoid delays during the construction phase. Unnecessary delays in project implementation has the potential to create serious negative perception of the project causing not only environmental damages but also financial losses. The following measures shall be ensured prior to the onset of the construction phase;

1. Use of appropriate dredging equipment for the dredging;
2. Clear demarcation of the dredging to ensure dredging does not go beyond what is required;
3. Adequate materials supplied to the site so at avoid delays;
4. Ensuring skilled labor availability for the operation of the dredger and operating other machineries; and
5. Good workmanship applied in all project related activities.

Table 19 and 20 below show the details of the proposed monitoring aspects including the monitoring parameters, indicators, baseline, proposed methods, frequency and estimated costs.

Table 19. Monitoring of the marine environment

Parameter / Method	Locations / Frequency of Monitoring	Purpose	Estimated cost (USD)
Benthic cover by general categories (live coral, dead coral, rubble and sand). Method shall include, visual inspection of the selected sites, photography and line intercept transect to assess the benthic cover.	Monitoring shall be conducted at least once during construction and post construction on northern and southern side of the dredge boundary. Operational phase monitoring shall be conducted one year after the operation begins from the same locations. Benthic cover of the reef area on northern and southern side of the dredge boundary (figure 29) shall be monitored every two weeks during the dredging phase, by taking random photographs of the benthos.	Indicative of the changes in the benthic cover of the reef	1500 / trip
Fish population / visual census	Visual fish census will have to be carried out along with benthic reef monitoring surveys except when the photographic survey are carried out during the dredging phase.	To assess broad scale changes in the ecological status of the coral reefs (increase / decrease of herbivores, etc.)	

Table 20. Monitoring of the seawater quality, shoreline, waste audit and equipment maintenance

Type	Parameters	Locations	Frequency	Estimated cost (USD)
In situ monitoring / sampling and testing from a laboratory	Dissolved oxygen (DO), Turbidity, Total Suspended Solids, pH, Salinity	Sediment levels in the water column shall be monitored daily at the reef area on the northern and southern side of the dredge boundary. Samples from at least 2 locations on each side (Figure 29) shall be tested for the required parameters.	Daily records shall be kept in order to demonstrate compliance. Daily summary reports shall be prepared and be made available to the proponent. Water monitoring will also need to be carried out after six months from	5000

			completion and after a year, coinciding with reef monitoring program	
Shoreline dynamics	Shoreline	Shoreline of the eastern side of the island, especially the area near the proposed jetty construction location (figure 29).	Shoreline shall be mapped after completion of the project as well as after a year from completion of the project.	2500
Waste management	All waste generated shall be documented and logs maintained. Any waste sent to the disposal site will have to be measured (its quantity or volume) and accounted for through paper audits. Project site shall be kept clean at all times with waste bins placed at locations easily accessible to workers.	Construction site	Logs updated daily	-
Equipment and vehicle maintenance	Equipment and vehicles shall be regularly maintained to avoid unnecessary breakdown to avoid delays and accidental leaks.	Construction site	Frequency to be determined by the engineers. Logs to be maintained	-

The areas to be survey under the proposed monitoring program is presented in the figure 29 below

Figure 29. Proposed areas for marine environment and shoreline monitoring.

11.1 MONITORING COSTS

The proponent's commitment to undertake the proposed Environmental monitoring plan is given in Annex 15.

11.2 REPORTING

The proponent must make necessary arrangements to carry out the aforementioned monitoring plan. The daily reports/photos shall be made available to the proponent by the designated monitoring personal/environmental consultant at the project site and by surveyors/environmental consultants for other less frequently monitoring surveys. The proponent shall share the daily reports, especially the water monitoring results with EPA on a daily basis during the dredging phase, to ensure that parameters being tested are within acceptable ranges of EPA. The photographs of the benthic cover taken during the dredging phase shall also be shared with EPA along with the daily water quality monitoring results. A comprehensive report shall be prepared basing on all the monitoring information available, by a designated environment consultant upon completion of the project and after a year from completion. These reports shall be submitted to EPA within at least two months from the stated periods.

12. CONCLUSIONS AND RECOMMENDATIONS

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 of relevant stakeholders incorporated in to the EIA where appropriate.

The proposed jetty construction project at N.Fodhdhoo has been identified as an important and a justifiable project from a socio-economic perspective as well as to achieve the government's objective of facilitating easing transport to and from the island. The existing jetty at the island is seriously damaged, presenting various operational difficulties and safety concerns to frequent jetty users. The construction of the proposed jetty at the island will greatly improve the only transportation facility at the island.

This EIA found no evidence of any major significant negative environmental impact or change that are of importance at national/international level from the proposed project. However, the project is expected to have some temporary and permanent negative environmental impacts and temporary socio-economic impacts during the construction phase of the project. Most of the expected adverse environmental impacts can be minimized by following the measures proposed in this EIA, except for the permanent loss of coral reef from the proposed dredge area. The temporary socio-economic impacts during the construction phase will present difficulties to the residents of the island, though some can be effectively mitigated by following the measures proposed, while all these issues are expected to be resolved once the jetty comes into operation. Overall, most of the impacts are expected to be short-lived and only significant during the construction phase of the project. On the other hand, the socio-economic factors will greatly improve during the operational phase of the jetty as a result of the improved facility.

It is strongly recommended to ensure that the proposed mitigation measures are implemented and avoid undertaking any extra works that is not addressed through this EIA. Furthermore, the proponent and the contractor shall facilitate and plan the operation of the proposed project effectively to avoid unnecessary delays and to ensure that the project is completed within the initially planned duration. The consultant also stresses on the importance of constructing strong structures of high structural integrity to avoid any major construction work in the future that would put additional stress on the environment.

Based on the results of the assessments, the EIA study concludes that with proposed mitigation in place, the project would be environmentally acceptable and is in compliance with the relevant environmental legislations and regulations. With implementation of the recommended environmental mitigation measures, no unacceptable adverse residual impacts from the project are anticipated. This EIA recommends a comprehensive Environmental Management Plan (EMP) to assess the effectiveness of proposed mitigation measures and to safeguard the environment from any unanticipated impact. The monitoring programme will be implemented to check the implementation of mitigation measures and environmental compliance and to take necessary precautionary measures in the event of an unforeseen environmental impact. The monitoring programme is also be associated with a proper reporting mechanism to inform relevant government agencies.

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13. REFERENCES

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14. ANNEXES

Annex 1. Terms Of Reference (TOR)

"Dhivehin" – Always Maldivian, Forever Independent

Environmental Protection Agency

203-EIARES/138/2015/299

Terms of Reference for Environmental Impact Assessment forConstruction of a jetty at Fohdhoo, Noonu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on 28December 2015 for undertaking the EIA of the proposed construction of a jetty at ***Fohdhoo Island, Noonu Atoll***. 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 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 donors and the institutional arrangements relevant to this project.

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

3. **Scope of Work**
   Identify the number of the tasks of the project including preparation, construction and decommissioning phase.

Task 1.Description of the proposed project – Provide a full description and justification of the relevant parts of the dredging works, using maps at appropriate scales where necessary. Information on the following activities should be provided where appropriate:

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

- Location of the jetty/basin on scaled map
- Design parameters of the jetty/basin (size, depth, profile of channel)
- Design parameters of the supporting coastal infrastructure and reclamations
- Justification for the location of jetty / basin
- Methods for dredging and dredge disposal at appropriate site(s),
- Clearing dredged material from temporary site(s), if applicable

- Project management (include scheduling and duration of the project [component wise scheduling] and life span of facilities; communication of construction details, progress, target dates, labour requirement, local labour availability, housing of temporary labour construction/operation/closure of labour camps. Emergency plan in case of spills [diesel, grease, oil etc.] access to site, safety, equipment and material storage, fuel management),
- In addition, an emergency plan to mitigate negative impacts on the environment from events such as unavailability of material in time for construction.

Dredging/Excavation

- Location and size of jetty basin, reef entrance and other dredge area(s) on a scaled map,
- Justification for the selection of the location, depth and size of dredge area(s),
- Equipment used for dredging and justification, including equipment capacity and description of positioning system (where appropriate), depth control system and operational control procedures,
- Exact method and process(es) of dredging/excavation (e.g. details of the use of sand beds or use of barge mounted excavation)
- Dredged material disposal/usage details, e.g. for land reclamation, beach replenishment or coastal protection works,

The EIA report should investigate possibilities for alternatives

- Alternative methods/equipment for dredging
- Alternative borrow area locations: have these been considered and if so, give arguments why these alternatives have not been selected, and

Dredge material disposal

- Design of the disposal/reclamation area(s), including justification(s) (from a socio-economic and environmental perspective) for the choice of design criteria,
- Quantity, quality and characteristics of dredged material,
- Method and equipment for transport (including distance) of fill material and hydraulic filling,
- Justification and location of temporary stockpile(s) if required,
- Location and design of the containment measures,

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

- Description of safety measures during the construction phase and justification and design of drainage measures if required.

The EIA should investigate possibilities for alternative:

- Alternative disposal sites.
- Alternative containment measures.

Coastal Structures

- Locations and designs of the jetty
- Locations and designs of additional coastal protection measures (if required)
- Method and equipment used for construction of coastal structures

Extra Works

- Ary extra civil works deemed necessary by the community should be included in this EIA including but not limited to:
  - Location of the roads to be levelled and reason for levelling
  - Construction of any new roads to access the jetty
  - Dredging and reclamations specifications for boat yard areas
  - Vegetation clearings other than from jetty foot print

Task 2. Description of the Environment

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

The baseline data will be collected before construction and from at least two benchmarks. All sampling/survey locations shall be geo referenced including but not limited to water sampling points, reef transects/photo quadrats, vegetation tansects, soli profiles, and manata tows sites for monitoring data comparison. Information may be divided into the categories shown below:

Climate

- Temperature, rainfall, wind and waves

- Natural Hazard Risks including storm surges

Geology and geomorphology

- Island geomorphology including presence of beach rocks and any special characteristics (use maps)
- Bathymetry of all dredging and reclamation sites (use maps)
- Seasonal patterns of coastal erosion and accretion, and
- Characteristics of seabed sediments to assess direct habitat destruction and turbidity impacts during construction

Hydrography/hydrodynamics (use maps)

- Tidal ranges and tidal currents
- Wave climate and wave induced currents
- Wind induced (seasonal) currents
- Sea water quality measuring the following parameters;
  - pH
  - Salinity
  - Turbidity
  - Total Suspended Solids

Ecology

- Identify marine protected areas (MPAs) and sensitive sites such as breeding or nursery grounds for protected or endangered sites (e.g. coral reefs, spawning fish sites, nurseries for crustaceans or specific sites for marine mammals, sharks and turtles). Include description of commercial species with potential to become nuisance or vector
- Benthic and fish community monitoring around the island (should cover all impact zones).
- Landscape integrity.

Socio-economic environment

- Demography: total population, sex ratio, density, growth and pressure on land and marine resources;
- Income situation and distribution
- Economic activities of both men and women (e.g. fisheries, home gardening, fish processing, employment in industry, government)
- Seasonal changes in activities
- Land use planning, natural resource use and zoning of activities at sea
- Accessibility and (public) transport to other island
- Services quality and accessibility (water supply, waste/water disposal, energy supply, social services like health and education)
- Community issues/concerns with respect to the project

Hazard vulnerability

- Vulnerability of area to flooding and storm surge

Absence of facilities in the country to carry out the water quality tests will not exempt the proponent from the obligation to provide necessary data. The report should outline the detailed methodology of data collection utilized to describe the existing environment.

Task 3. Legislative and regulatory considerations

Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. The EIA report should clearly identify the different applicable clauses and articles of the legislative and regulatory requirements. Include permits and approvals in the EIA document:

Task 4. Potential impacts (environment and socio-cultural) of proposed project, including all stages

The EIA report should identify all the impacts, directs and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following

Impacts on the natural environment

- Changes in flow velocities/directions, resulting in changes in erosion/sedimentation patterns, which may impact shore zone configuration/coastal morphology
- Loss of marine bottom habitat, both in the borrow area as well as due to enlargement of the island, resulting in loss of bottom life, which may impact fish stocks and species diversity and density of crabs, shellfish etc.
- Sediment dispersal in water column (turbidity at the dredging site [overflow], 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.
- Impacts of noise, vibration and disturbance
- Impacts on ground water table and quality (leaching of salts in the deposited sediments and change in ground water quality)
- Impacts on unique or threatened habitats or species (coral reefs, sea turtles etc.)
- Impacts on landscape integrity/scenery, and
- Impacts on the environment should the project be held up due to unforeseen circumstances

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

Impacts on the Socio-economic environment

- Benefits and impacts of the works in fishing activities
- Impacts of the dredging and reclamation works on resource users (adjacent businesses, nearby resorts and dive sites)
- Impact on employment and income, potential for local people to have (temporary) job opportunities (and what kind) in the execution of the works
- Impacts of the reclamation works (diminished) access to groundwater and risks of covering up hazardous materials
- Level of protection against hazards like sea level rise, storm surges, etc.
- Employment and economic opportunities and diversification
- Increased demands on natural resources and services (domestic water supply, waste water disposal, treatment systems, solid waste disposal systems, energy supply, etc.)
- Social destabilization of the island community, and
- Monitoring of socio-economic and demographic development

Construction related hazards and risks

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

The method 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 action option" should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This should include alternative location of jetty, dredge disposal sites and dredging methods etc. environmental, social and economic factors should be taken into consideration. Alternative protective measures to be taken till the rock boulders are been brought. The report should highlight how the location was determined. All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options should be specified for each component of the proposed project.

Task 6. Mitigation and management of negative impacts

Identify possible measures to prevent or reduce significant negative impacts to acceptable level. These will include both environmental and socio-economic mitigation measures. Mitigation measures to avoid or compensate habitat destruction. E.g. temporal sediment control structures, coastal protection structures to reduce erosion, coral reconstruction, temporary docking jetty and MPA replacement areas. Measures for both construction and operation phases shall be identified. Cost 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 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 effect shall be given.

Task 7. Development of monitoring plan

Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for coastal modification, beach morphology, sediment movement around the island. Ecological monitoring will be submitted to the EPA to evaluate the damages during construction, after project completion and every three months thereafter, up to one year and the one yearly basis for five years after. The baseline study describe in task 2 of section 2 of this TOR is required for data comparison detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and method of undertaking the monitoring program must be provided. Monitoring is required in;

- Coastal erosion around the island
- Water quality assessment (seawater quality)
- Marine ecosystems monitoring (coral reef, seagrass and fish and invertebrates communities), and
- Socio-economic monitoring for project success or improvement requirements

Task 8. Stakeholder consultation, Inter-Agency coordination, public and civil society's participation)

Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders. In this respect consultation shall be undertaken with the following stakeholders and any other relevant stakeholders identified during the preparation of the EIA report:

- FohdhooCouncil
- Fohdhoo public

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

Details of the consultative meetings including summary outcomes, participants, date, time and location should be described. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes. The EIA report should be submitted to the atoll council and evidence of which included in the EIA report.

4. Presentation

The EIA report to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for 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 EIA Regulations 2012 and the relevant amendments.

5. Timeframe for submitting the EIA report

The developer must submit the completed EIA report within 3 months from the date of this TOR.

28th December 2015

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

Environmental Protection Agency

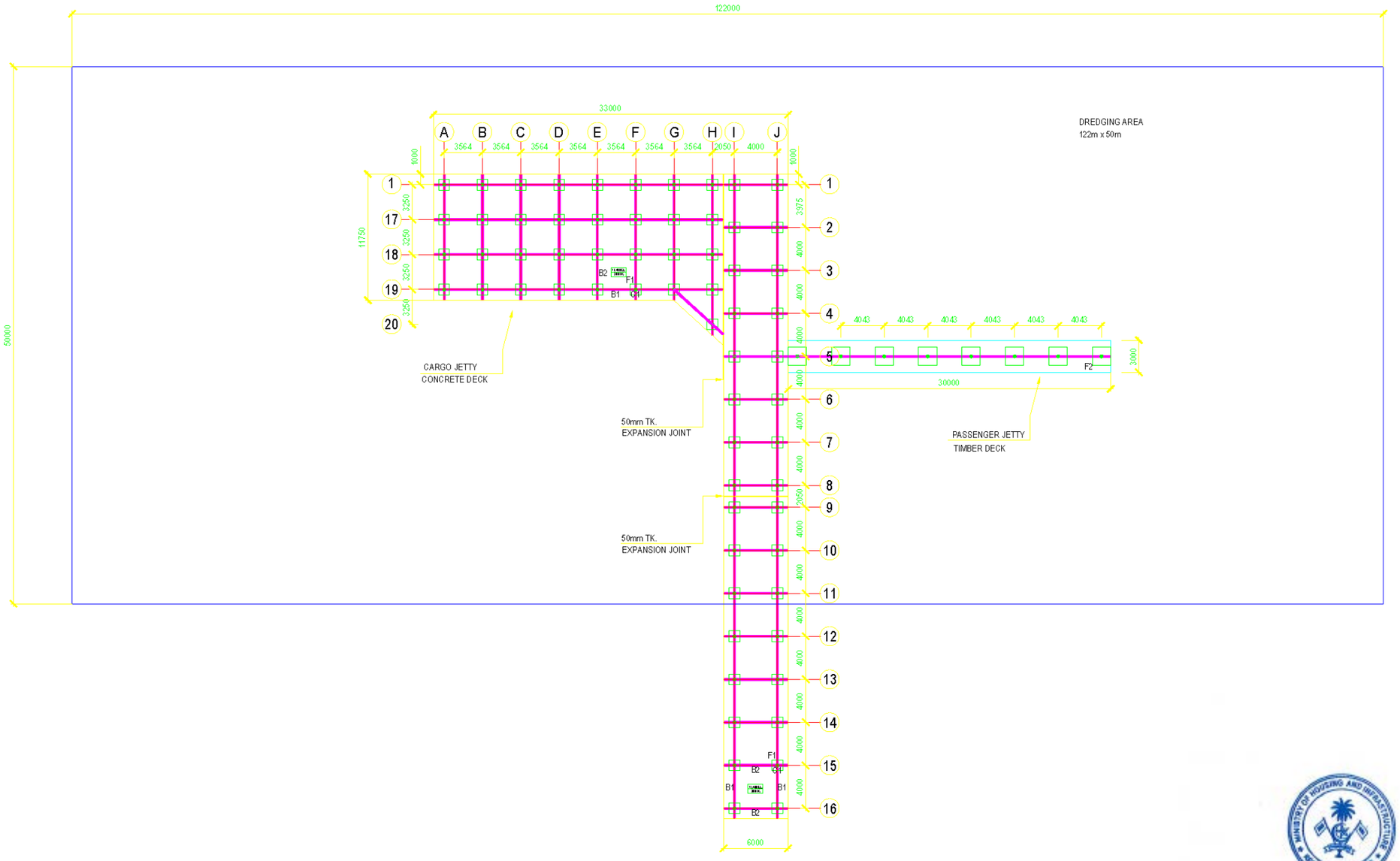
Male', Rep of Maldives

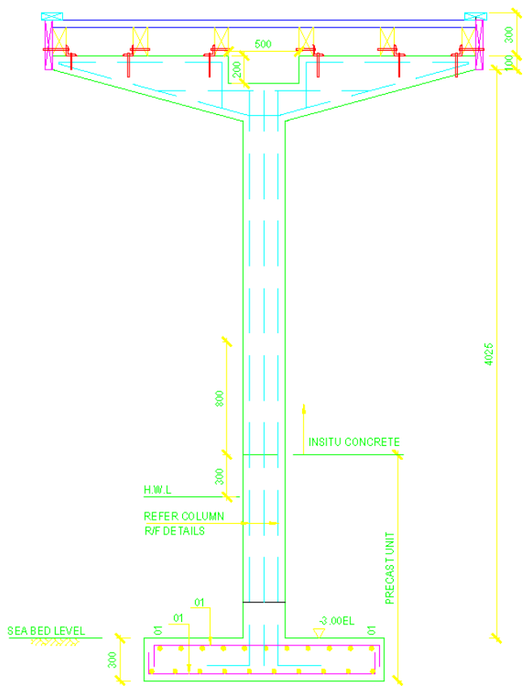
Meeting: N. Fodhdhoo Jetty construction
Date: ~~28~~ 28/12/15
Time: 10:00

ATTENDANCE FORM

	Name	Designation	Office	Email	Phone No.	Signature
01	ALI HAMMADH	R. Assistant	MEECO	ali.hammadh@meeco.com.mv	7433241	
02	MOHAMED SHIMAL	~~EO~~ ENV CONSULTANT	MEECO	mohamed.shimal@meeco.com.mv	9639065	
03	HAMDHOON MOHAMED	EIA CONSULTANT	MEECO	hamdhoon.mohamed@gmail.com	988-8891	
04	Ahmed Jamaal	Councilr	Fodhdhoo	—	7860788	
05	Amir Musthafa	Engineer	MHT	amir.musthafa@housing.gov.mv	7981711	
06	Hashim Nabeel	Asst. Oceanographic observer	EPA	hashim.nabeel@epa.gov.mv	7687188	
07	Gafa Ahmed	Asst. Director	EPA/ECA			
08						
09						
10						

Annex 2. Engineering details of the jetty





SECTION 1

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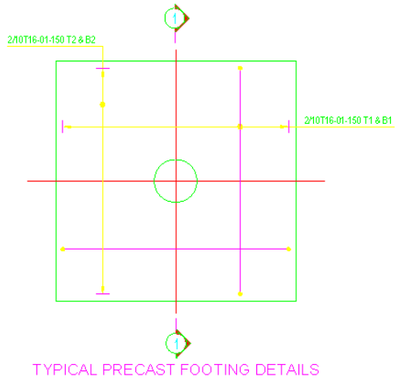
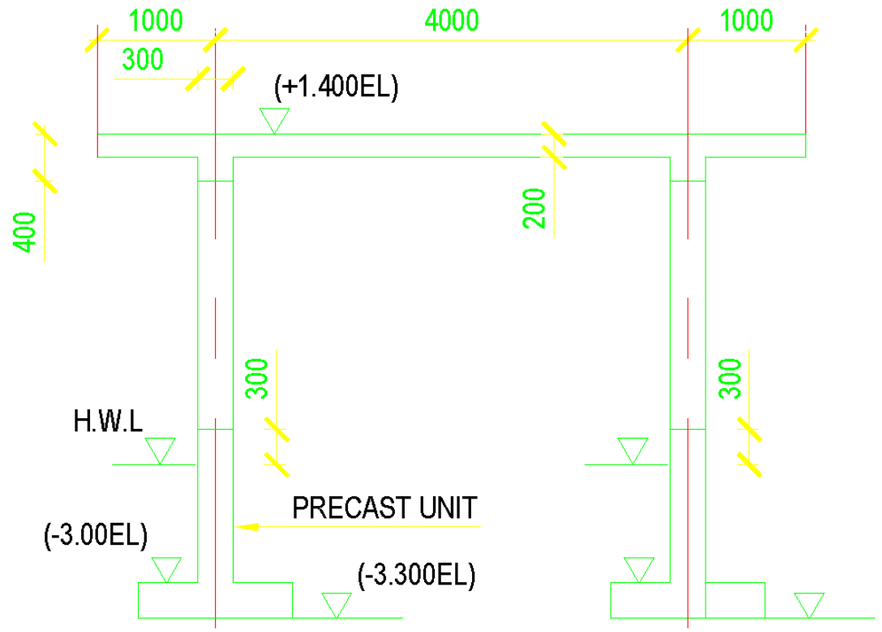


TYPICAL PRECAST FOOTING DETAILS

SCALE :- 1:20



SECTION 1

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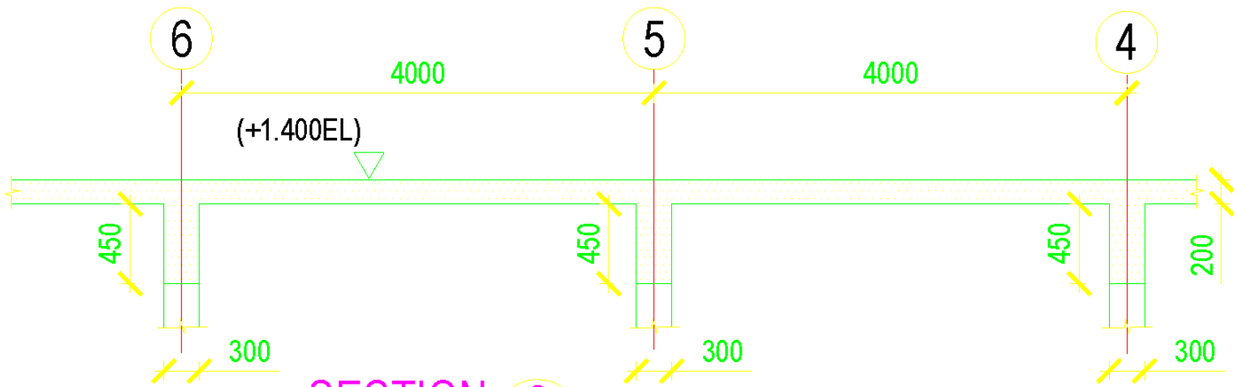

SECTION 2

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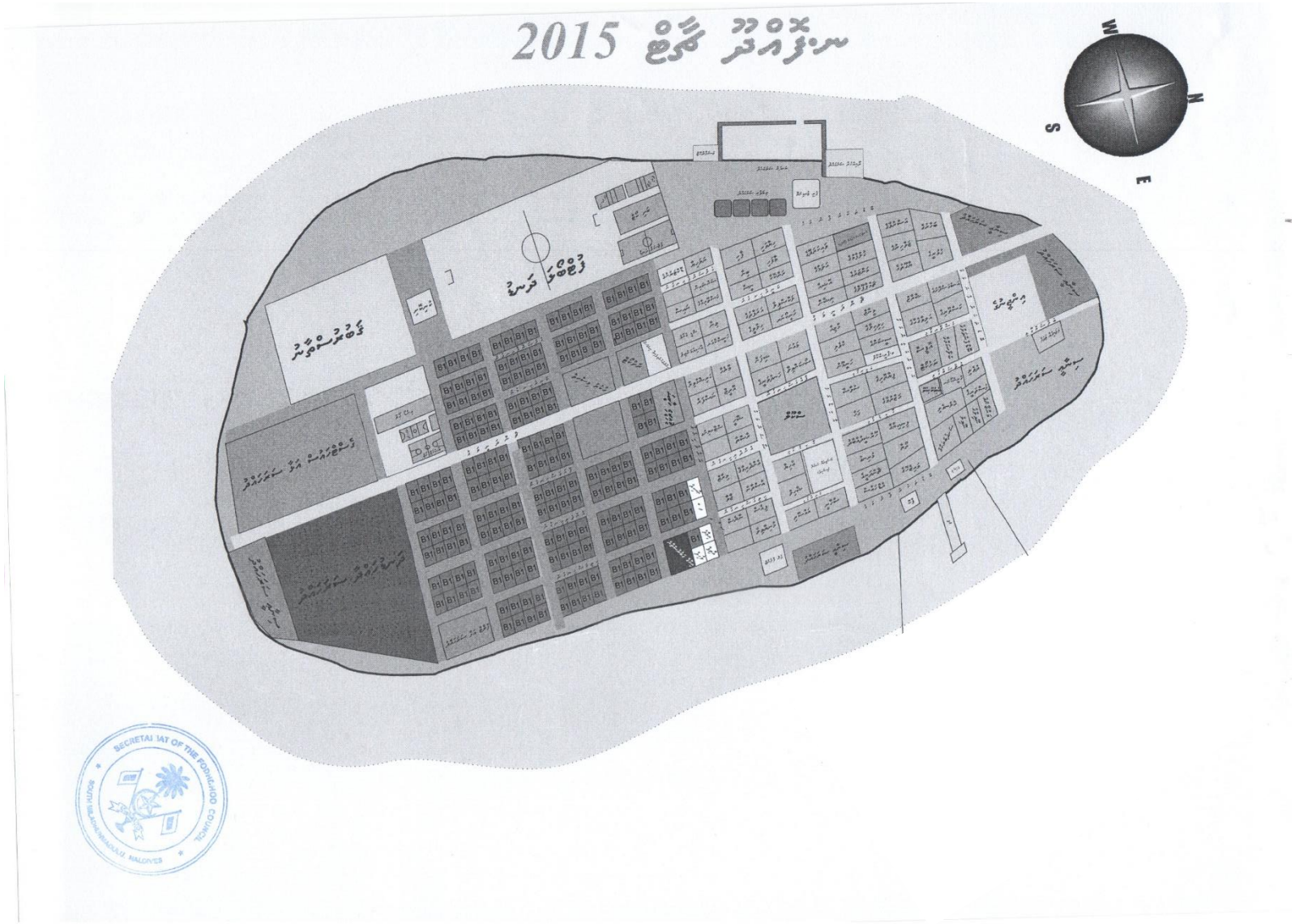
Annex 3. Land use plan developed by Fodhdhooo Island Council



Annex 4. History of hazards/disasters at the island (response from council)

MEECO
Reg. No: C-0333/2014

2nd Floor, Aakakaage-1, Galolhu,
Alikilegefaanu Magu, Male', 20129,
Republic of Maldives.

ފުވައްމުލައް ކަނޑުއަޅާ ތަރައްޤީ ޕްރޮޖެކްޓް

ތަކުރާ ނަންބަރ:

ތާރީޚް: 06 ސެޕްޓެމްބަރ 2016

ކަންތައް	ތާރީޚް	ތަފްޞީލް
1. ބޮޑެތި ބިންދުރުން		
2. ގޯނާވުން	—	ނެތް
3. ބަންޑާގެ ބުރުން		ނެތް.
4. ގަދަވާރުގެ ވިނާސަކަށް	2007 ، 2009	
6. ބަރު ބުރުން	—	
7. ގޮނަވަށައިގެ ތަކެތި ގެންދިއުން	—	ނެތް.
8. ބޮޑެތި ލޮޑުގެ ބޯޓު ބަލިވުމާ ގުޅިގެން	—	ނެތް

ފުވައްމުލައް ކައުންސިލްގެ ފުރަތަމަ ކައުންސިލް ދައުރުގެ ތެރޭގައި ކަނޑުއަޅާ ތަރައްޤީ ކުރުމަށް ބޭނުންވާ ބިން ހޯދުމަށް ކައުންސިލް ކުރިމަގުވެ ގެންދިޔަ ކަންތައް ތަކާ ގުޅިގެން ލިޔެ ހުށަހަޅާ ލިޔުން.

ތަކުރާ ކުރިން ފުރިހަމަ ކުރި ފަރާތް:

ސޮއި:

ފުރިހަމަ ކުރި ތާރީޚް:

ނޯޓް: ފުވައްމުލައް ކައުންސިލްގެ ހުށަހެޅުންތަކާ ގުޅޭ ތަފާތު ބަދަލުތަކެއް ހުރިނަމަ ކައުންސިލް ދަފްތަރުން ލިބިގަނެ ބަލައިގަނެވޭ ގޮތަށް ހުށަހަޅާ ލިޔުން.

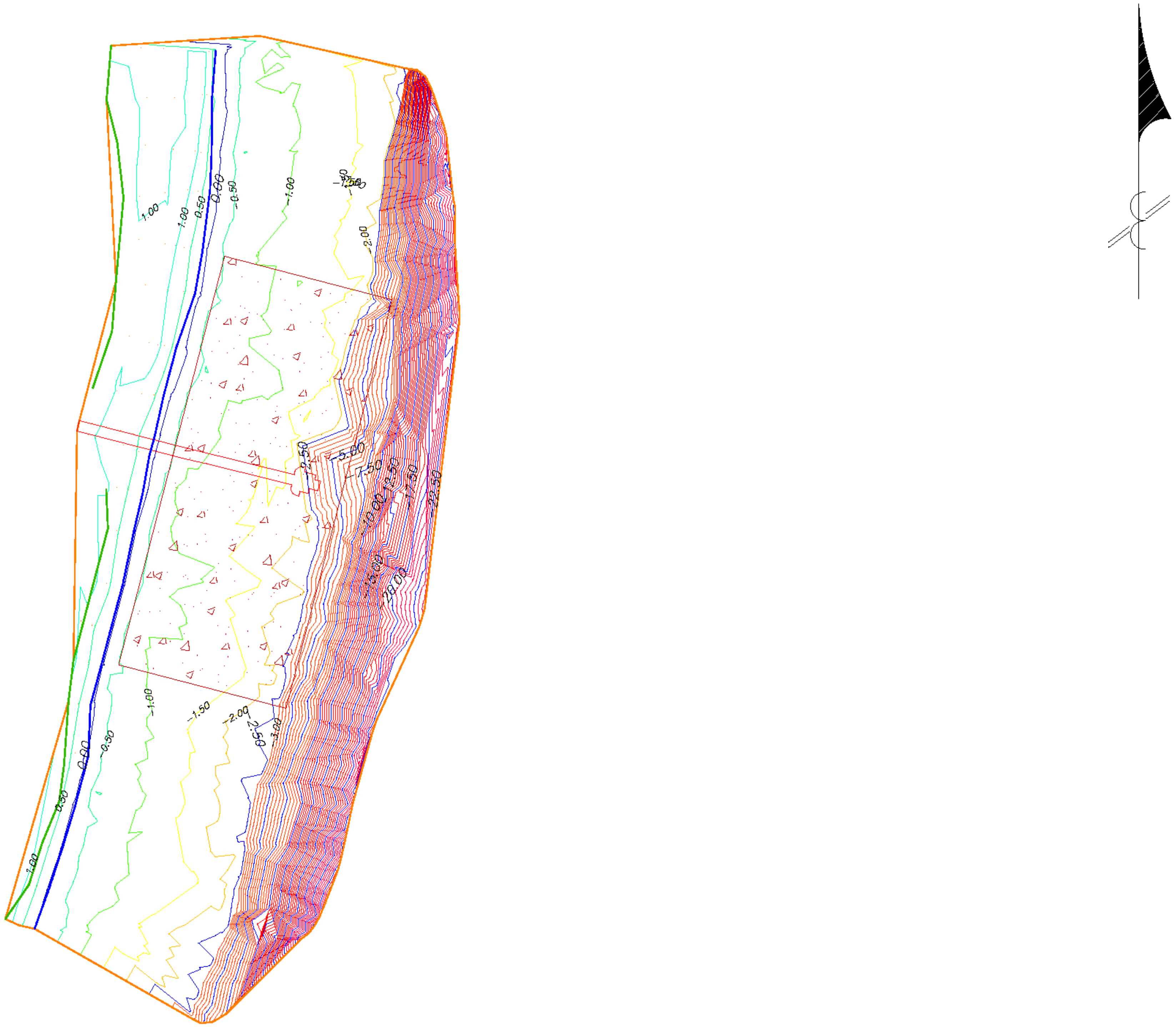
ފ - ފުވައްމުލައް info@meeco.com.mv
ފޯނު ނަންބަރ 301 0844

SECRETARIAT OF THE FODHDHOO COUNCIL
SOUTH MILADHUMADULU, MALDIVES

MEECO

ފުވައްމުލައް ކަނޑުއަޅާ ތަރައްޤީ ކުރުމުގެ ކަންތައް

Annex 5. Bathymetric map of the proposed project area



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 :

- All measurements are in meters
- All the coordinates are in UTM 43N (WGS 84)
- Contour interval is 0.5 m
- Total dredge volume from the given construction area is 9200 Cu.M.

LEGEND

	SURVEYED AREA
	SHORE LINE
	VEGETATION LINE
	DREDGE AREA

SCALE :	1:1250
SURVEYED BY :	HASHIKA GUNARATNA (SURVEYOR)
DATE OF SURVEY :	17/12/2015
DRAWN BY :	HASHIKA GUNARATNA (SURVEYOR)
CHECKED BY :	HASHIKA GUNARATNA (SENIOR SURVEYOR / ENGINEER)
DATE OF SUBMIT :	07/01/2016

LOCATION
FOHDHOO
NOONU

PROJECT : PROPOSED JETTY FOR FOHDHOO

DRAWING TITLE : BATHYMETRY OF PROPOSED JETTY AREA

DRAWING No :2015/0023

SHEET No : 04 of 09

REV	DESCRICTION	BY	DATE

Annex 6. Water quality test results report from MWSC

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

بسم الله الرحمن الرحيم

MWSC

WATER QUALITY TEST REPORT

Test Report No: 301032/2016/02

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

Date: 11/01/2016

Sample Description / Location~	Western Side of Fodhdhoo SW1	Eastern Side of Fodhdhoo SW2	Eastern Side of Fodhdhoo SW3	TEST METHOD	UNIT
Sample Type~	Sea water				
Sampled Date~	3/1/2016				
Sample Received Date	4/1/2016				
Test Requisition Form No.	900162737				
Sample No.	821181	821182	821183		
Date of Analysis	5/1/2016 -10/1/2016				
PARAMETER	ANALYSIS RESULT				
Physical Appearance	Clear	Clear	Clear	Visual	-
pH	8.27	8.21	8.26	Method 4500-H$^+$ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
Salinity	33.63	33.57	33.67	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
Total Suspended Solids (TSS)	<5 (LoQ 5mg/L)	<5 (LoQ 5mg/L)	<5 (LoQ 5mg/L)	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Turbidity	0.280	0.292	0.488	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

Keys:

UNITS: mg/L: Milligrams per litre, **NTU:** Nephelometric Turbidity Unit, **‰:** Parts per thousand

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**********

Annex 7. Population, households and school statistics

Secretariat of the Fodhdhoo Council, South Miladunmadulu
N. Fodhdhoo, Rep. of Maldives

ދިވެހިރާއްޖެ ދެކުނުމިލަދުންމަދުލު ފަދޫ ރަށުމަތީ ކައުންސިލްގެ ލިޔަންފަރާތް
ފަދޫ، ދ. ދިވެހިރާއްޖެ

ތަކުލަ ރަށުގެ ތަފްޞީލް

(2015ވަނަ ސެންސަހުގެ ގޮތުގައި)

227				ހުރިހާ ބިން
233				ވިއްކާ ބިން
331				18 ހަދާ ގޭގެ
129				18 ހަދާ ފަރާ
91				ތަކުލަ ދާއިރާ ކަމުގައި ބަލާ ގޭގެ
44				ފަދޫ ދިވެހިން ގޭގެ
47				ފަދޫ ދިވެހިން ކުލަ ގޭގެ
31	6 ވިއްކާ ބިން	2 ހުރިހާ ބިން	1 ގ.ގެ	ކުލަ ހުންނަ ބިން
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	4 ވިއްކާ ބިން	4 ހުރިހާ ބިން	3 ގ.ގެ	
	2 ވިއްކާ ބިން	1 ހުރިހާ ބިން	4 ގ.ގެ	
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	2 ވިއްކާ ބިން	1 ހުރިހާ ބިން	6 ގ.ގެ	
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20	2 ހުރިހާ ބިން	4 ވިއްކާ ބިން	ކ.ގ.ގެ	ކުލަ ނުހުންނަ ބިން
	2 ވިއްކާ ބިން	2 ހުރިހާ ބިން	ދ.ގ.ގެ	
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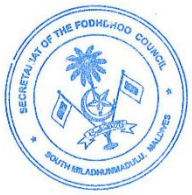
460				ތަކުލަ ޖުމްލަ ގޭގެ

Annex 8. Council consultation meeting attendance

List of Councilors consulted for the EIA of Fodhdhoo Jetty construction Project

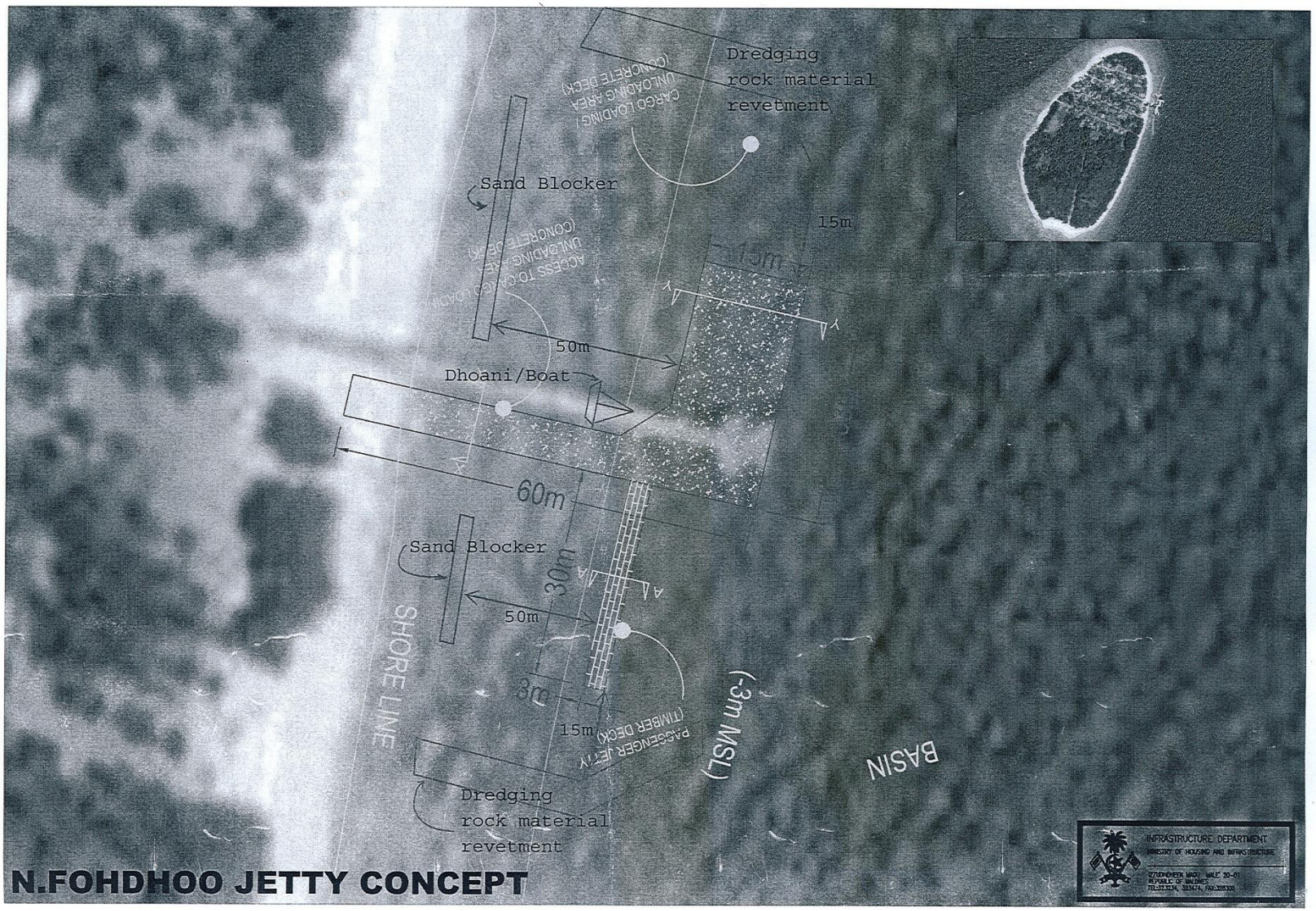
Name	Designation	Contact no	Signature
Mohamed Sanee	Council President	7907933	
Ahmed Farish	V. President	7668189	
Ahmed Jamaal.	Councilr	7860788	
Ahmed Shaheem	councilor	7730193	
Ali Faaiq	Councilor	7550755	
~~Hashika Gunaratna~~	~~Chief Surveyor (MEECO)~~	~~7449301~~	



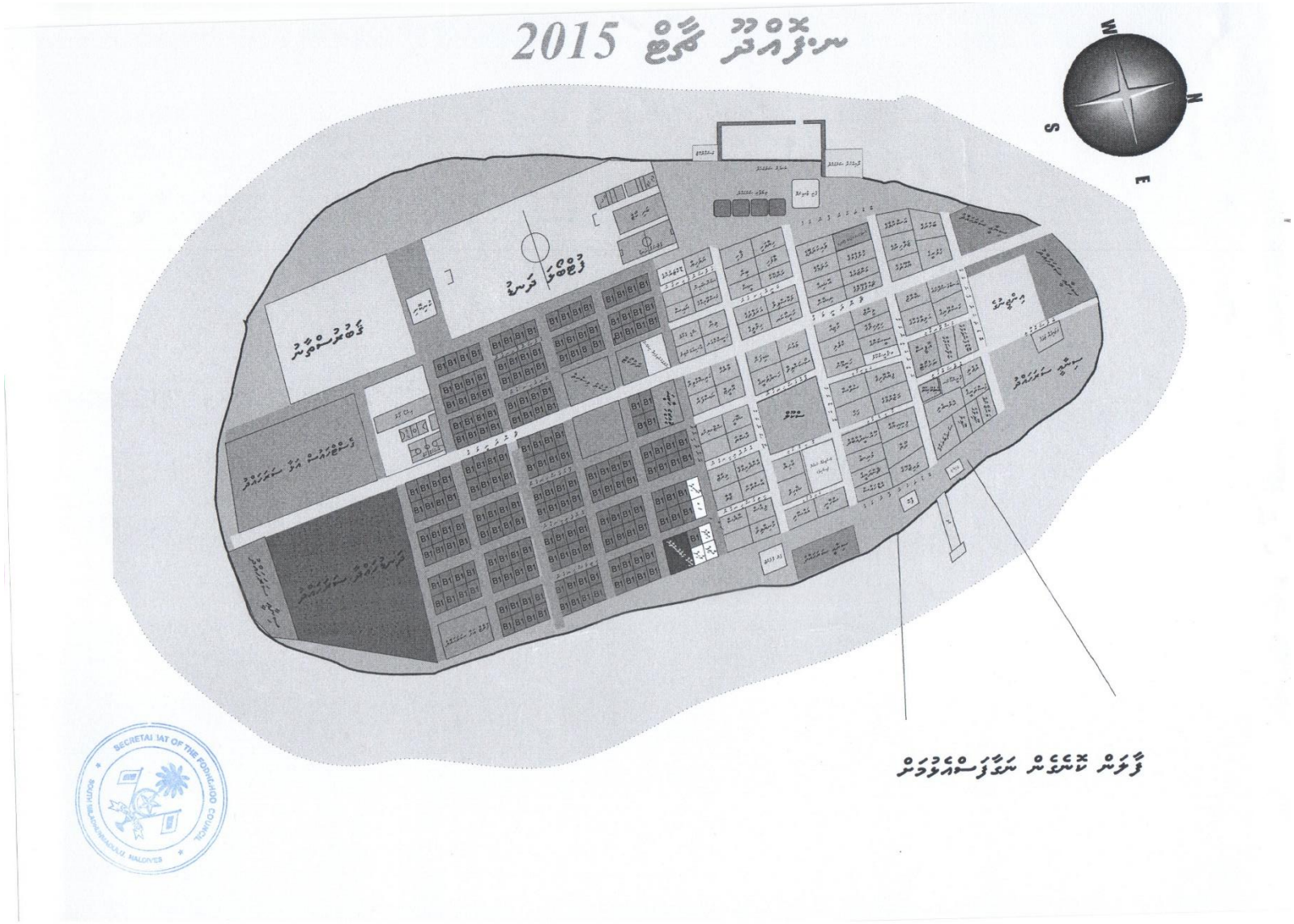
List of people Consulted for the EIA of Fodhdhoo Jetty construction Project

Name	Designation	Contact no	Signature
Moosa Ajeel	Admin. officer / FENAKA	7986503	

Annex 9. Design changes proposed by Fodhdhoo Island Council



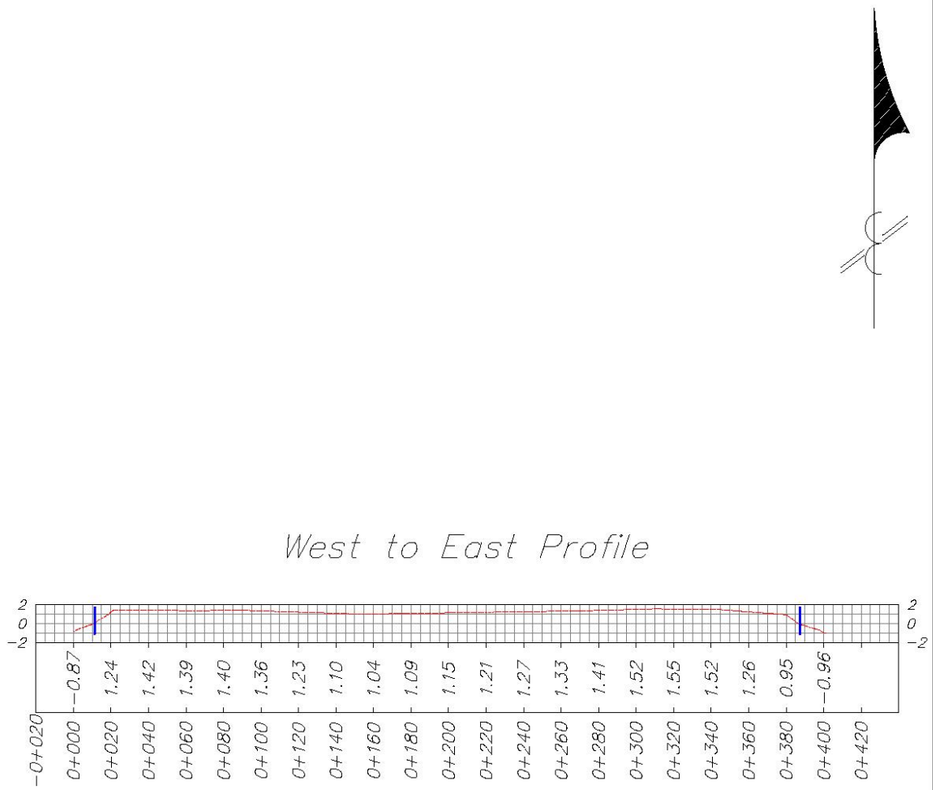
Annex 10. Initially proposed areas for placing dredge sand

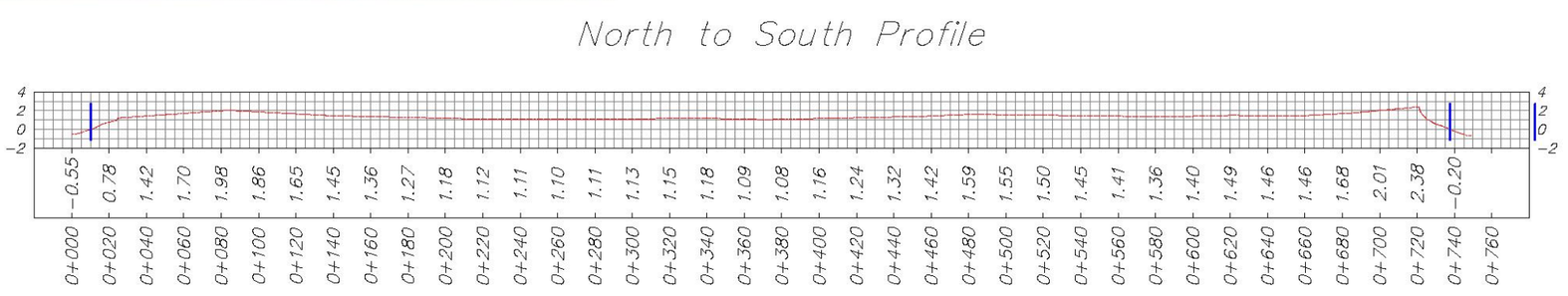


Annex 11. List of people contacted for public consultation

Name	Contact No
Imran Ali	7991185
Hussain Zahidh	7511457
Ahmed Haneef	7947964
Mohamed Saeed	7601244
Ahmed Firaq	7657774

Annex 12. Results of road level surveys





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

Key Plan

Notes :

- All measurements are in meters
- All the coordinates are in UTM 43N (WGS 84)

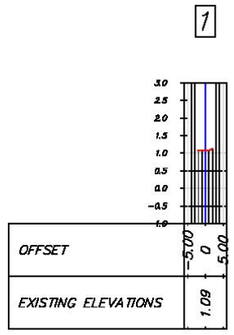
LEGEND

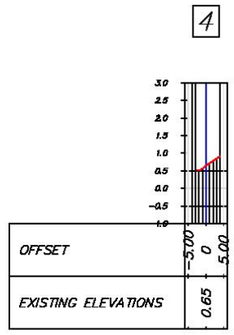
	SHORE LINE

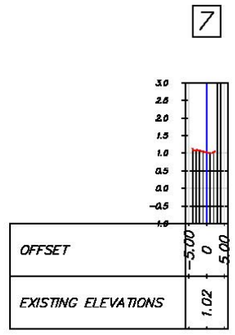
SCALE :	Ver. 1: 500 Hor. 1:2500
SURVEYED BY :	HASHIKA GUNARATNA (SURVEYOR)
DATE OF SURVEY :	17/12/2015
DRAWN BY :	HASHIKA GUNARATNA (SURVEYOR)
CHECKED BY :	HASHIKA GUNARATNA (SENIOR SURVEYOR / ENGINEER)
DATE OF SUBMIT :	07/01/2016

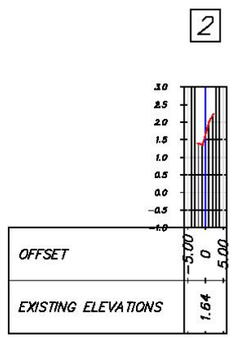
LOCATION	PROJECT : PROPOSED JETTY FOR FOHDHOO	
FOHDHOO NOONU	DRAWING TITLE : PROFILES OF MAIN ROADS OF THE ISLAND	DRAWING No :2015/0023 SHEET No : 06 of 06

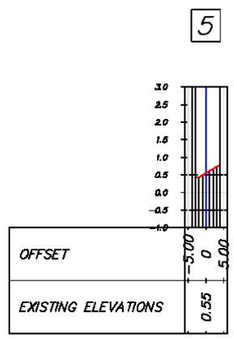
REV	DESCRICTION	BY	DATE

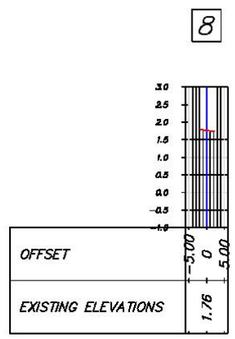


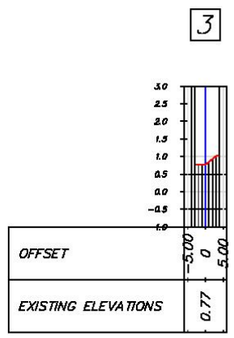


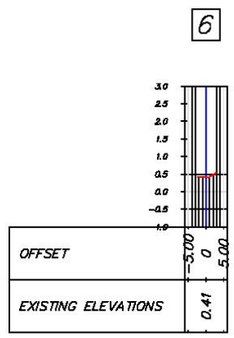












MEECO

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

Key Plan

Notes :

-All measurements are in meters
-0 line is the shore line at the time of survey.

LEGEND

	EXISTING ROAD LEVEL

SCALE :	NTS
SURVEYED BY :	HASHIKA GUNARATNA (SURVEYOR)
DATE OF SURVEY :	17/12/2015
DRAWN BY :	HASHIKA GUNARATNA (SURVEYOR)
CHECKED BY :	HASHIKA GUNARATNA (SENIOR SURVEYOR / ENGINEER)
DATE OF SUBMIT :	07/01/2016

LOCATION
FOHDHOO
NOONU

PROJECT : PROPOSED JETTY FOR FOHDHOO

DRAWING TITLE : DRAWING OF ROAD PROFILES

DRAWING No :

SHEET No :

REV	DESCRICTION	BY	DATE

Annex 13. Stakeholder consultation with proponent and contractor

MEEC
Reg. No: C-0333/2014

2nd Floor, Aakakaage-1, Galolhu
Alikilegefaanu Magu, Male', 20129.
Republic of Maldives

Meeting With : MTCC

Date 6 01 2016
Time 1:00 pm
Venue
Subject Re: N.Fohdhoo Harbour Development

Name	Post/Organisation	Contact Number	Signature
Nafha Anjaz	Environmental Analyst / MHI	7721554	
Hameethaan	surveyor/mtcc	9966191	
Rinaz Abdulla	Project coordinator	7715543	

Annex 14. Information obtained from Council prior to field work

MEECO
Reg. No: C-0333/2014

2nd Floor, Aakakaage-1, Galolhu,
Alikilegefaanu Magu, Male', 20129,
Republic of Maldives.

س. ގަވާދ ފޯރުކުރުމަށް ސ.ގެ.ކ. ކައުންސިލަށް ތަކުރުރުކުރެވޭ ތަފާސީލު ދަންނަވާ ފޯމް

ތަކުރުރުގެ ނަން:	س. ގަވާދ	ތަކުރުރުގެ ދިގުމިން:	459
ތަކުރުރުގެ ފުރިހަނ ހުދުގެ ބޭނުން:	02	ތަކުރުރުގެ ފުރާނަ ބޮޑުމިން:	50 ސެ.ޕ
ތަކުރުރުގެ ކުރިން ހިފާ ބޭނުން ކުރާ ގޮތް:	ތަކުރުރުގެ ކުރިން ، ތަކުރުރުގެ ފަހަތުން ، ކައުންސިލަށް ދަންނަވާ ކަމެއް ނެތް.		

ގަވާދުގެ ތަފާސީލު:

ގަވާދު ހޯދާ ތަން:
ގަވާދު ދަތުރުކުރާ ވާހަކަ ދަންނަވާ ތަން:
ތަކުރުރުގެ ތެރެއިން ގަވާދ ނެގުމަށް ބޭނުންކުރާ ގޮތް (ހިލަ، ވެލި، ކަނޑު): —
ގަވާދު ހޯދުމުގެ ކުރިން ކުރަންޖެހޭ ކަންތައް: (ތ. ސަރަހައްދުގައި ތަކުރުރުގެ ދާދި ގޮތް ބަލައި ދިނުން)
ގަވާދު ދަށަށް ގެންދާ ގޮތާ ގުޅޭ ތަފާސީލު: ތަކުރުރުގެ ކުރިން ކައުންސިލަށް ދަންނަވާ ކަންތައް ، ތަކުރުރުގެ ފަހަތުން ކައުންސިލަށް ދަންނަވާ ކަންތައް .
ގަވާދު ހޯދުމުގެ ތެރެއިން ކައުންސިލަށް ދަންނަވާ ކަންތައް (ތަކުރުރުގެ ދިގުމިން ، ފުރާނަ ، ހުދު ، ބޭނުން ، ކަނޑާ ގުޅުން ، ކަނޑާ ދުރު ، ކަނޑާ ގުޅުން ، ކަނޑާ ދުރު ، ކަނޑާ ގުޅުން ، ކަނޑާ ދުރު ، ކަނޑާ ގުޅުން ، ކަނޑާ ދުރު ، ކަނޑާ ގުޅުން ، ކަނޑާ ދުރު ،)
ގަވާދު ދަށަށް ގެންދާ ގޮތާ ގުޅޭ ތަފާސީލު ތަކުރުރުގެ ކުރިން ، ތަކުރުރުގެ ފަހަތުން ، ކައުންސިލަށް ދަންނަވާ ކަންތައް .

+(960) 301 0855 +(960) 301 0844 www.meeco.com.mv info@meeco.com.mv /meeco.com.mv @meeco_mv

MEECO

ފޯމުގެ މަޝްވަރާގެ ސަފްހާއަށް ނުކުމުނު އެއްވެސް މައްސަލައެއް އޮތްނަމަ އެކަމުގެ ތަފްސީލު:

—

ފޯމުގެ އީ.އައި.އޭ.ގެ މަސައްކަތްތަކާ ގުޅޭގޮތުން މަޢުލޫމާތު ދެއްވަން ހުށަހަޅާ ބޭފުޅާގެ

ނަން: [illegible]	މަޤާމު: ކައުންސިލްގެ ރައީސް	ފޯނު ނަންބަރު: 7907933

މި ފޯމު ފުރިހަމަ ކުރި ފަރާތުގެ މަޢުލޫމާތު:

#		ނަން	މަޤާމު	ފޯނު ނަންބަރު
1		[illegible]	[illegible]	6560016

މި ފޯމު ފުރިހަމަ ކުރުމުގައި ބައިވެރިވި *ކައުންސިލަރުންގެ މަޢުލޫމާތު:

#	ނަން	މަޤާމު	ފޯނު ނަންބަރު
1	[illegible]	ކައުންސިލްގެ ރައީސް	7907933
2	[illegible]	ކައުންސިލްގެ ނައިބު ރައީސް	7668189
3	[illegible]	ކައުންސިލަރ	7860788
4	[illegible]	ކައުންސިލަރ	7550755
5	[illegible]	ކައުންސިލަރ	7730193

* މި ފޯމު ފުރިހަމަ ކުރުމުގައި ހުރިހާ ކައުންސިލަރުންނާއި އެކު މަޝްވަރާ ކުރުމަކީ މި ކުންފުނީގެ ވަރަށް ބޮޑު އެދުމެކެވެ.

މި ފޯމު ފުރިހަމަކޮށް 17 ޑިސެމްބަރ 2015ވާ ބުދަ ދުވަހުގެ ހެނދުނު 10:00ގެ ކުރިން މިކުންފުނީގެ އީމެއިލް info@meeco·com·mv އަށް ފޮނުއްވުމަށް ނުވަތަ މި ކުންފުނީގެ ނަންބަރު 3010844 އަށް ފެކްސް ކުރެއްވުމަށް ދަންނަވަމެވެ.

Annex 15. Commitment Letter from the proponent

بسم الله الرحمن الرحيم

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

ހިސާބުދާރީ ތަރައްޤީއާ ހެދުމާއި ބިނާކުރުމުގެ ވަޒާރާ
ދަތުރު، ދިވެހިރާއްޖެ.

Date: 26th January 2016

No: 138-PIS1/203/2016/31

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

Sub: EIA to the Proposed Construction of N.Fodhdhoo Jetty:

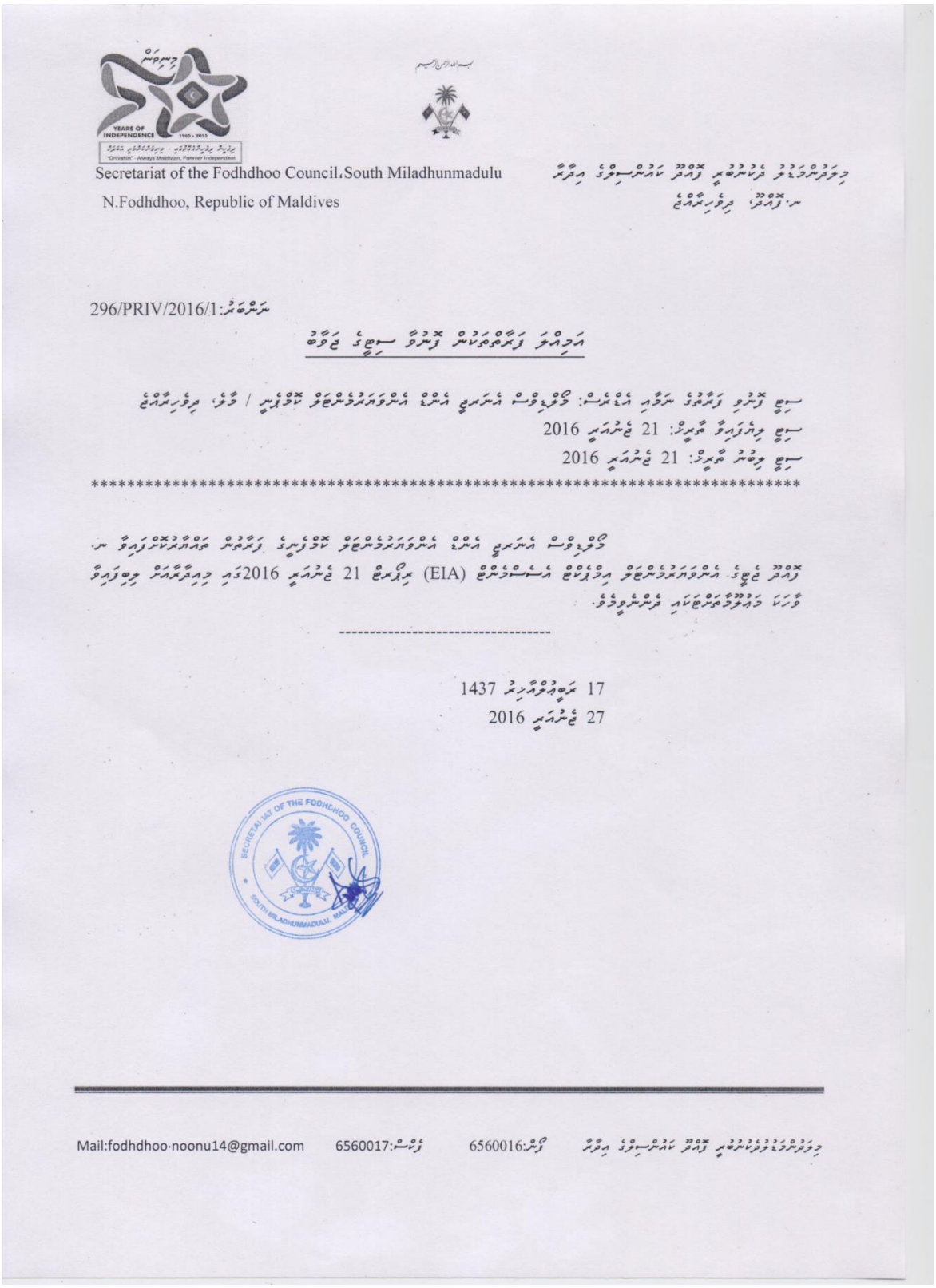
As the proponent of the project, we guarantee our commitment to finance and implement all mitigation and the monitoring program as specified in the report.

Signature:

Fathimath Shaana Farooq
Director General

Ameenee Magu, Maafannu, Male', 20392, Republic of Maldives. ،ދިވެހިރާއްޖެ، 20392، ފަތުރު، ފަށަނޑު، އަމީނީ ފޮތް
+(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

Annex 16. Letter of confirmation of receipt of EIA report from N. Fodhdhoo Council



بسم الله الرحمن الرحيم

Secretariat of the Fodhdhoo Council،South Miladhunmadulu
N.Fodhdhoo, Republic of Maldives

ދިވެހިރާއްޖެ ފަނާކުރެވޭ ދެމިއޮންނަ ދިވެހި ދިވެހިރާއްޖެ
ދ. ފޮދޮ، ދިވެހިރާއްޖެ

296/PRIV/2016/1:ނަންބަރު

ތަރުޖަމާ ފައިލްތައް ފޮނުވާ ސިޓީ ފޮނުވުމާ

ސިޓީ ފޮނުވާ ފަރާތް: ފުލުހުން ހަނގުރާމަ ހިންގާ ހަންނާ ދާއިރާ / ފ. ފޮދޮ، ދިވެހިރާއްޖެ
ސިޓީ ލިބުނު ތާރީޚު: 21 ޖެނުއަރީ 2016
ސިޓީ ލިޔެފި ތާރީޚު: 21 ޖެނުއަރީ 2016
****

ފުލުހުން ހަނގުރާމަ ހިންގާ ހަންނާ ދާއިރާ ފ. ފޮދޮ
ފޮނުވާ ސިޓީ ހަމައަށް ހަމަޖެހިގެން ތިބެއްޖެ ތަރުޖަމާ ފައިލްތަކާ ގުޅިގެން (EIA) ދިވެހިރާއްޖެ 21 ޖެނުއަރީ 2016ގައި ފ. ފޮދޮ ދަތުރުފަތުރު ލިބުނު
ފާހަގަ ކުރެއްވުމަށް ދަންނަވަމެވެ.

---

17 ރަބީޢުލްއައްވަލް 1437
27 ޖެނުއަރީ 2016

SECRETARIAT OF THE FODHDHOO COUNCIL
SOUTH MILADHUNMADULU, MALDIVES

Mail:fodhdhoo·noonu14@gmail.com ފޯނު:6560017 ފެކްސް:6560016 ދިވެހިރާއްޖެ ފަނާކުރެވޭ ދެމިއޮންނަ ދިވެހި

Annex 17. Email of confirmation of receipt of EIA report from Noonu Atoll Council

On Wed, Jan 27, 2016 at 10:30 AM, Noonu Council <admnhr.noon@gmail.com> wrote:

---------- Forwarded message ----------
From: **Farah Amjad** <farah.amjad@meeco.com.mv>
Date: Tue, Jan 26, 2016 at 12:38 AM
Subject: EIA for the Construction of Fohdhoo Jetty
To: admnhr.noon@gmail.com
Cc: "Mohamed Shimal(Mohamed)" <mohamed.shimal@meeco.com.mv>, Ahmed Saleem <ahmed.saleem@meeco.com.mv>

ނ. އަތޮޅު ކައުންސިލް އިދާރާގެ ރައީސް އަށް،

ވީދުން ސަލާމަށް ފަހު ދަންނަވަމެވެ.

މި އީމެއިލާ އެކު އެޓޭޗް ކުރެވިފައިވަނީ، ނ.އަތޮޅު ފޮއްދޫ ބަނދަރު ހެދުމަށް ތައްޔާރު ކުރެވިފައިވާ އީ.އައި.އޭ ރިޕޯޓެވެ.

ވީމާ، ތިޔަ ކައުންސިލުގެ ހިޔާލު ހުރި ގޮތެއް ހިއްސާ ކޮށްދެއްވުން އެދެމެވެ. އަދި ރިޕޯޓް ތިޔަ ކައުންސިލަށް ލިބިވަޑައިގެންކަން އަންގަވާ ލިޔުމެއް މި ގޮތުގައި އެޓޭޗް ކޮށްދީފައިވާ ފޯމުގައި ރައްވާދެއްވުން އެދެމެވެ.

Farah Amjad
Research Assistant

MEECO
Aakakaage, Galolhu, Alikilegefaanu Magu, Male', 20129, Maldives.
Mobile: +(960) 768 8861 | Tel: +(960) 301 0855 | Fax: +(960) 301 0844 | http://www.meeco.com.mv/

============ Forwarded message ============
From : Noonu Council<land.noon@gmail.com>
To : <farah.amjad@meeco.com.mv>
Date : Wed, 27 Jan 2016 14:21:14 +0500
Subject : Re: EIA for the Construction of Fohdhoo Jetty
============ Forwarded message ============

ވީދުން ސަލާމަށްފަހު ދަންނަވަމެވެ.

އެރިޕޯޓް 26 ޖެނުއަރީ 2016 ވަނަ ދުވަހުގެ 12:38 ގައި މިއިދާރާއަށް ލިބިފައިވާ ވާހަކަ ދަންނަވަމެވެ.

ޝުކުރިއްޔާ!

[illegible]

ނ. އަތޮޅު ކައުންސިލްގެ އިދާރާ

On Wed, Jan 27, 2016 at 10:30 AM, Noonu Council <admnhr.noon@gmail.com> wrote:

---------- Forwarded message ----------
From: **Farah Amjad** <farah.amjad@meeco.com.mv>
Date: Tue, Jan 26, 2016 at 12:38 AM
Subject: EIA for the Construction of Fohdhoo Jetty
To: admnhr.noon@gmail.com
Cc: "Mohamed Shimal(Mohamed)" <mohamed.shimal@meeco.com.mv>, Ahmed Saleem <ahmed.saleem@meeco.com.mv>

Annex 18. Photos of marine environment at the project area.

Annex 19. CVs of contributing Authors and surveyors

Curriculum Vitae

Mohamed Shimal

Permanent Address:	Malas, H.Dh Vaikaradhoo, Republic of Maldives
Present Address:	M.Nicosia, 1st Floor, Male', Republic of Maldives
ID card No:	A229368
Contact No:	9639049
Email:	m11.shimal@gmail.com

Education

2012 – 2014	**Bachelor of Environmental Science (Wildlife conservation and biology),** Charles Darwin University, Darwin, Northern Territory, Australia.
2007 – 2009	**Advanced Level Edexcel and Higher Secondary Certificate (HSC) Examinations,** Center for Higher Secondary Education (CHSE), Male', Republic of Maldives.
2004 – 2006	**Cambridge GCE O-level, IGCSE and, Secondary School Certificate (SSC) Examinations,** H.Dh Atoll School, H.Dh Vaikaradhoo, Republic of Maldives.

Employment History

Mar 2014 – present	• **Senior Research Officer** at Reef fisheries unit of Marine Research Centre. *Responsible for monitoring and assessing of reef fisheries in the Maldives and conduct relevant research for sustainable management of reef fisheries in the Maldives.*
Jan 2010 – Dec 2012	• **Assistant administrative officer** at Civil and Electrical Engineering Department of Maldives Ports Limited.

Professional Development and Leadership

2015	• Completed 2 months training on 'Sustainable use of fisheries resources through diversification of fisheries-based livelihood in island countries', offered by Japan International Cooperation Agency, in Okinawa, Japan.
2015	• Assisted Catlin Seaview Survey survey team from University of Queensland, Australia in facilitating their coral reef research in Maldives.
Nov 2013 – Nov 2014	• Served one term as a Student Representative in the Charles Darwin University Student Association's committee.
2012	• Completed 100 hours of voluntary work in Mangrove Blue Carbon research project conducted by Le Bai at Charles Darwin University's Research Institute of Environment and Livelihood.

Skills and Experience

- Working knowledge of ArcGIS, QGis, eCognition, ENVI classic and AutoCAD.
- Terrestrial and marine environmental surveying.
- Diving (PADI open-water license).
- Successfully completed an independent research project in species level mapping of mangroves using remote sensing as part of the Bachelor of Environmental Science course

References

Dr. Carla Eisemberg
Research Associate, Wildlife Ecology
Research Institute for the Environment and Livelihoods
School of Environment, Charles Darwin University
Darwin, Northern Territory, Australia
Email: carla.eisemberg@cdu.edu.au
Ph: +618 91926141

Le Bai
Institute for Applied Ecology New Zealand
School of Applied Science
WL Block, 110A
31-33 Symonds Street
Auckland City, New Zealand
Email: Lebai123@gmail.com

Cathy Jones
President
Charles Darwin University Student Association
Charles Darwin University
Darwin, Northern Territory, Australia
Email: cdusa@cdu.edu.au
Ph: +61426610749