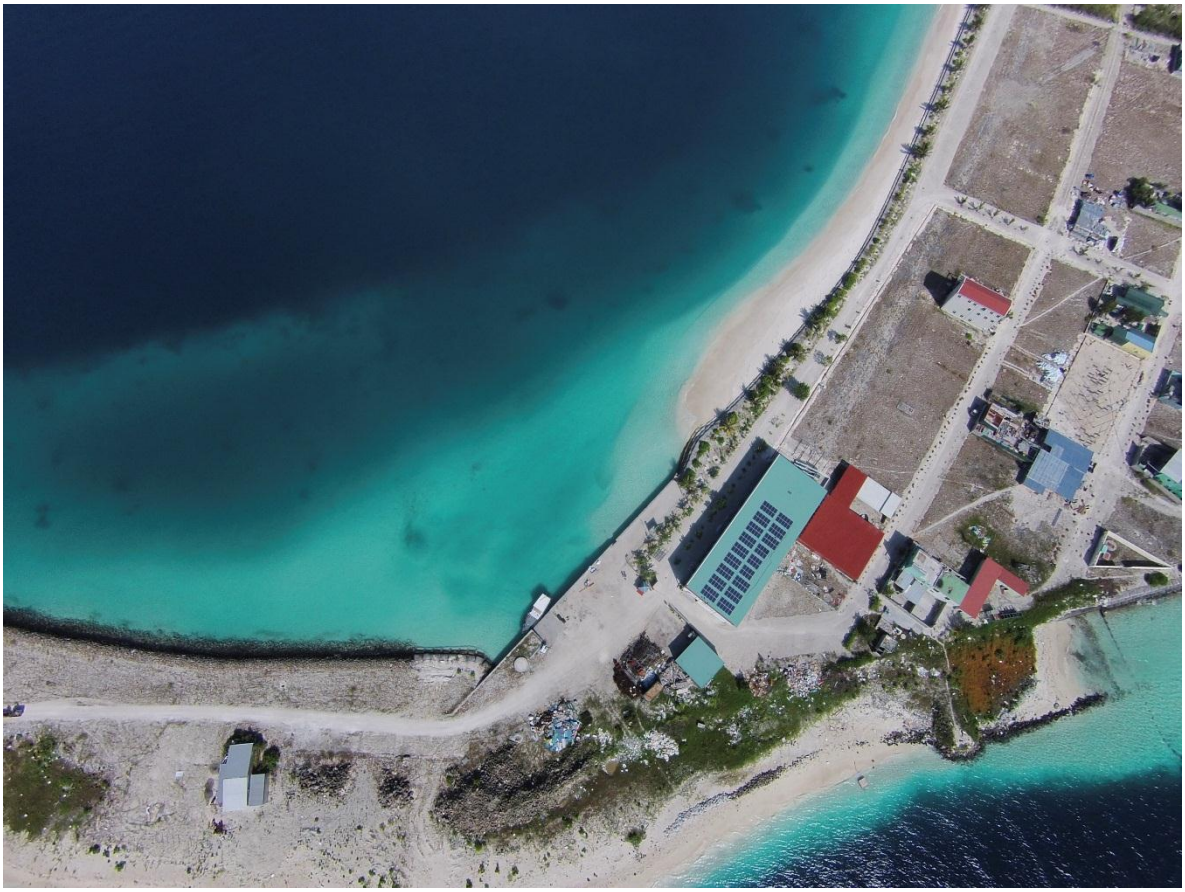
ENVIRONMENTAL IMPACT ASSESSMENT

For Undertaking Sand Dredging at Gulhifalhu Jetty Area, Gulhifalhu, Kaafu Atoll



Proposed by

Gulhifalhu Investment Ltd

Prepared by

Ahmed Jameel (EIA 07/07)

Ibrahim Faiz (EIA T06/15)

For Water Solutions Pvt. Ltd., Maldives

October 2016

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2 Declaration of the consultants

This EIA has been prepared according to the EIA Regulations 2012, issued by the Ministry of Environment and Energy. The EIA was carried out by a multidisciplinary consulting team representing Water Solutions Private Ltd. In preparing this report, no data has been manipulated. Primary data has been collected by field visit and secondary data and information from various reports and sources.

I as the lead consultant certify that the statements in this Environmental Impact Assessment study are true, complete and correct.

Name: Ahmed Jameel (EIA 07/07)

Signature: 

Name: Ibrahim Faiz (EIA T06/15)

Signature: 

3 Declaration of the proponent

As the proponent of the proposed project, we guarantee that we have read the report and that to best of our knowledge all non-technical information provided here are accurate and complete.

Name: KHADEEJA NEENA.

Designation: GENERAL MANAGER, CORPORATE SERVICES.

Signature:

On behalf of: Gulhifalhu Investment Ltd

GULHIFALHU INVESTMENT LIMITED
C-0848/2008
Republic of Maldives

4 Proponents Commitment

GULHIFALHU
INVESTMENT LIMITED
C-0848/2008

Ref: GIL/PRVT/2016/272

19th October 2016
Environmental Protection Agency,
Male,
Republic of Maldives

Dear Mr. Ibrahim Naeem,

Re: Commitment to undertake mitigation measures and environmental monitoring proposed in the EIA for the proposed sand dredging at Gulhifalhu Jetty Area.

We would like to confirm our financial commitment to the proposed mitigation measures and the monitoring programme that has been highlighted in the EIA report that has been specifically prepared for the above referred project.

Yours sincerely,

Khadeeja Neena
General Manager,

GULHIFALHU INVESTMENT LIMITED
C-0848/2008
Republic of Maldives

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بسم الله الرحمن الرحيم

ސާރާ ހުލާސާ

މިރިޕޯޓަކީ ގުޅިފަޅު އިންވެސްޓްމަންޓް ޖެޓީއެރިއާ ތައްޔާރުކުރެވިފައިވާ ރިޕޯޓެކެވެ.
މިރިޕޯޓަކީ ކ. ގުޅިފަޅުގައި ބަނދަރު ޖެހޭ ނަރުދަމާ ބޭނުންކުރާ ސަރަހައްދު ފުޅާކުރުމުގެ ގޮތުން ޕްރޮޖެކްޓްގެ
އެކުލަވާލައިފައިވާ، މިމަސައްކަތުގެ ސަރަހައްދުން ތިމާވެއްޓަށް ކުރާ އަސަރުތައް ދެނެގަތުމަށް ބޭއްވުނު ގޮތުން ވެށި
ސާވިސްއަކުން އިން ތައްޔާރުކުރެވިފައިވާ ރިޕޯޓެކެވެ. މިމަޝްރޫޢުގެ މައިގަނޑު މަގުސަދަކީ ގުޅިފަޅު ގެ
ސަރަހައްދު ފުޅާކޮށް އެސަރަހައްދުގައި ހިންގާފައިވާ އެއްގަމުގައި ފުރިހަމަ ގޮތުގައި ބަނދަރުކުރެވޭގޮތް ހެދުމެވެ.

ގުޅިފަޅަކީ މާލޭ ސަރަހައްދުގައި ބަނދަރުކުރާ އެންމެ ބޮޑު އެއް ސަރާއި ރަށެވެ. ގުޅިފަޅުން
ސަރާއި އެކައްޗާ ބަނދަރުތަކާ ބިން ކެއްދުންފައިވެ. މިގޮ ގުޅިފަޅު ވެފައިވާ މާލެ ސަރަހައްދުގައި ހަރަކާތްތެރިވާ
ގިނަ ކެންފުނިތަކުން ބަނދަރުކުރާ ބަރުދަނު ގޮތުގައިވެ. ގުޅިފަޅުން ދުނިޔެއާވާ ސަރާއި ބިންތަކަށް އެކައްޗާ
ބަނދަރުތަކަށް އަންނަ ފުރޮޅުތަކުން ބަރަށް އެބުރަތް ދުރު އަރިވާ ބާރުތަށް ބަނދަރުކުރުމުދަށް ބަރަށް އިރުމަތީ
ފުރޮޅުގައި ހުރިފައިވާ ގޮޅި ސަރަހައްދެވެ. މި ސަރަހައްދުގައިވާ ގޮތުގަނޑުތަކަށް 85 މީޓަރު އެއްގަމުތަކުން
ބިރުފައިވެ. މިހެނެހެން މިސަރަހައްދުގެ ބޮޑުބަނދަރުތަކަށް ފިރިއަރި މި ސަރަހައްދު ވަރަށްބޮޑުތަން ތިމާވެއްޓަށް، ގޮޅި
ސަރަހައްދުން މިވަގުތު ގޮތުކުރުވޭ ފަހަރު ދުނިޔެކަށ. މިކަމުގެ ސަމާލުކަން ގުޅިފަޅު ބަނދަރުތަށް ފުރޮޅުތަކަށް
ދިރުމަށް ދަތިތަކާ ކުރިމަތިވާފަދަ ހާލަތްތަކެއް ފެނެއެވެ. އަދި މިކަމުގެ ސަބަބާ ގުޅިފަޅުން ބިން ކެއްދުމުން ހިފުނުވާ
ފުރޮޅުތަކުން ކުރުބަނދަރުކަން ގުޅިފަޅު އިންވެސްޓްމަންޓް ފާހަގަކުރެވެއެވެ. ވީމާ މިކަމަށް ހައްލެއް ހޯދުމަށްޓަކައިގެ
ގޮތުން ގޮޅި ސަރަހައްދުގެ ތިރާވަޅުވާ ސަރަހައްދު ފުޅާކުރުމަށް ގުޅިފަޅު އިންވެސްޓްމަންޓްސް ޕްރޮޖެކްޓް
އެކުލަވާލައިފައިވެ.

މި ޕްރޮޖެކްޓްގެ ދަށުން ހިމެނޭ ގުޅިފަޅު ގޮޅި ސަރަހައްދު ދެދު ދިރުއަވައި 3 މީޓަރު ހުންނަ
ވަރަށް ފުންކުރުމެވެ. ގޮޅި ސަރަހައްދު ފުންކުރުމަށް ހަމަޖެހިފައިވާ އެކަށީގެންވާ އަދި ފުރަތަމަ ބޭނުން ކުރެވޭނެ
ނަވެ. މި މަސައްކަތް ގުޅިފަޅު އިންވެސްޓްމަންޓްސް ވަނީ އެމްއާރުޑީސީއާ ހަވާލުކުރެވިފައެވެ. މިގޮތުން މިތަނުންނެވޭ
ވެލި އެކައްޗާ ބަނދަރުތަކަށް ބަނދަރުކުރުން އެމްއާރުޑީސީ ތިރާވަޅު ސަރަހައްދު ގެންދިޔުން ފެނެއެވެ. މި މަސައްކަތުގެ
ސަބަބުން އުފެދޭ ކިސަލުތަކުން މިސަރަހައްދާ ކައިރި ފަރުތަކަށާ ދެރަކަމާ މަސް މާ ފެހެސަރު އަސަރުކުރުމަކީ
އެކަށީގެންވާ ކަމެކެވެ. މިގޮތުން، ކިސަލު ގަނެ ގެ ކިތަނބުގަނޑުން ކައިރު ސަރަހައްދުތަކަށް ނުރާވާފާ މަސްމަހާ
ފެހި އާބާދީ ވަގުތީ ގޮތުން ދަތިވެދާނެ އެކަށީގެންވާ ކަމެކެވެ.

މިކަންކަމުން ރިއާޔަތްކޮށް ބެލި ކަންތައްތަކުން އަދި ގޮތުން ދިރާސާތަކުން މި މަޝްރޫޢު
ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ އަސަރު ވަނީ ދެނެގަނެވިފައެވެ. ކުރުވާން ދިރާސާ ތަކަށް ބޭރުމަށްފަށް މި ޕްރޮޖެކްޓް
ގެ ސަބަބުން ތިމާވެއްޓަށް ކުރާނެ އަސަރުތަކުގެ ބޮޑުން ތަކެއް ތިޔާކަމަށް ފެނިއެވެ. މިގޮތުންފެ ނަގުތަށް
ކިސަލަ އިރު ފުރަޅި ކިސަލު ގަނޑު ގެ ސަބަބުން މިސަރަހައްދުގައިވާ ދިރުމުގެ ބާވަތްތަކަށް އަސަރުކުރުންތަކަށް ރިޕޯޓްގައި
ވަނީ ފާހަގަކުރެވިފައެވެ. އަދި މި ޕްރޮޖެކްޓްގެ ހިނގާނެ ގޮތް މިހިސާބުން ސަރަހައްދުގެ މޫދަށް ނިސްބަތްވުން ދިރާސާ ވަރަށް
މަދު ސަރަހައްދުންވެ. އަދި ކުރިން ސަރަހައްދު ކަމުގައި ސަރަހައްދުގެ ކުރިން ވަރަށް ދިރާ މުރަކަ
ހުރިކަމުގައިވިޔަސް، ސީދާ ކުރިން ސަރަހައްދުގައި އެއްވެސް ވަރަކަށް ނުރުކަން ފުރަތަމަ ކުރެވުނެވެ. ނަމަވެސް
މިފަދަ މަޝްރޫޢުއް ހިންގުމުގައިވެ ތިމާވެއްޓަށް އެއްވެސް ގެއްލުން ނުވާގޮތަށް މަސައްކަތްކުރުމަށް
ކުރިއަށްގެންދާއި ނުނުވެ. ކުރުވެސް ވަރަށް ގެއްލުންތައް ސީދާ އަދި ނުސީދާގޮތުން ފެންނަނީ ޝަރުކާއްވެސް

ށްޓަކައެވެ. އެހެންކަމުން ރިޕޯޓް ގެ އެންމެ މުހިންމު އެއް އަސާސް ކަމުގައި ގެއްލުން ކުޑަ ކުރުވުންތަކާއި ވާނީ ހިމެނިފައެވެ. މަޝްރޫއު ކުރިއަށް ގެންދިއުމުގައި މުހިންމު ކަމަކީ މިކަންތައް ތަކަށް ވީހާވެސް ބަލައިގެން މިކަން ކުރުމެވެ.

މި ޕްރޮޖެކްޓުގެ ސަބަބުން ތިމާވެށްޓަށްކުރާ އަސަރު ކުޑަކުރުމަށް އެޅިދާނެ ފިޔަވަޅުތައް ތަފްސީލުކޮށް ބަޔާންކުރެވިފައިވާނެއެވެ. އެގޮތުން ކޮންމެ މަސައްކަތެއް ހިނގަމުންދާއިރު ކުރުމާއި، ޑަސްޓް ދުވަސްވަރު މަސައްކަތް ނުކުރުމާއި އަދި ކޮންމެ ދުވަހަކު ވީހާވެސް ކުޑަ މުއްދަތެއްގައި ނިންމާލުމަކީ ވަރަށް މުހިންމު ކަމެކެވެ. މީގެ އިތުރުން ރިޕޯޓުގައި ފާހަގަކޮށްފައިވާ ވެށަށް އަންނާނެ ބަދަލު ދެނެގަންނަން ޕްރޮޖެކްޓާ އެއްގޮތަށް އަމަލުކުރުމަކީ ޕްރޮޖެކްޓުގެ ކާމިޔާބުވުމުގައި މުހިންމުކަމެއްކަން ފާހަގަކުރަމެވެ.

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ވީމާ މިމަޝްރޫއުގެ ސަބަބުން ލިބޭ ފައިދާއަށް ބަލާއިރު މަޝްރޫއު ކުރިއަށް ގެންދިއުމަކީ އެންމެ ރަނގަޅުކަމެއްކަމަށް ފެނެއެވެ. މިމަޝްރޫއުގެ ސަބަބުން ގިރުވެލި ޖެހި ސަރަހައްދަށް ބޮޑުންނުކުރާ ފަރުބަދަކަށް ނުހަނު ގިނަ ގޮތް ފައިދާކުރާނެއެވެ.

5 Non Technical Summary

This report discusses the findings of an environmental impact study undertaken by Water Solutions Pvt. Ltd. for Gulhifalhu Investment Ltd.

The project involves maintenance dredging of the Gulhifalhu Jetty area. The project aims to:

- Deepen the existing jetty basin
- Provide safety and protection to the vessels accessing the jetty area
- Increase the usable area of the jetty

Gulhifalhu is an industrial island which lease land plots for different industrial purposes. Many private vessels travel Gulhifalhu to access their sites every day. There is an existing jetty area in Gulhifalhu that is used by these vessels to access the island to load and unload materials. However, now the jetty basin is very shallow due to accumulation of sand in the basin. Some areas of the basin are less than a meter deep making it impossible to moor vessels to jetty. This project aims to dredge this area to provide a safe basin and larger accessible area. Approximate total of 9000 cbm of sand will be dreged from this area. This sand will be stockpiled temporarily in Gulhifalhu and then will be transported to Thilafushi MRDC site for later use.

Environmental impacts of this project were assessed and have been identified as resulting from the dredging works. Dredging work will be undertaken using excavators and sand pumps and this is particularly a method that creates lot of sedimentation which is a big threat to the marine environment.

Mitigation measures for the negative impacts have been identified and outlined in the report. Completing the dredging works in the shortest time frame and in low tide hours is a significant mitigation measure to minimize the impact of sedimentation on the marine environment. In addition, dredging should be avoided in bad weather conditions.

The proposed mitigation measures will have to be followed in order to minimize environmental damage. The measures proposed to minimize or mitigate environmental impacts may be considered to be appropriate, thereby minimizing the impact by about 90%. The main negative environmental impact of the proposed project would be sedimentation and destruction of the lagoon and damage to some areas of the nearby reefs, which will cause partial death of corals in other areas of the coral reef. During dredging works, the sedimentation will also affect the fish species

in the vicinity of these areas and hence, their population will drop in areas affected by sedimentation.

It is inevitable that there would be negative environmental impacts of this project. As a result, a mitigation and monitoring component has been suggested which takes into consideration, the most important elements that require monitoring, most importantly a mechanism and means to measure and value the social benefit of the project. This monitoring component will be adhered and will allow the assessment of long term changes, despite the potential negative impacts.

The dredging of Gulhifalhu jetty area does pose some threats to the marine environment of the area. There will be direct and indirect damage to marine environment in the vicinity of the project site. However there are many positive benefits of the project in long term. This project is justifiable in the light of the positive impacts.

6 Introduction

This Environmental Impact Assessment (EIA) report has been prepared to fulfil the requirements of the *Environmental Protection and Preservation Act*, law no. 4/93 in order to assess the impacts of the proposed sand dredging project. The aim of this project is to therefore gear towards providing easy access and safety for the vessels using this area.

6.1 Structure of the EIA

The report has been structured to meet the requirements of the EIA regulations 2012 issued by the Ministry of Environment and Energy. Hence, the report will provide an executive summary at the beginning. The report will then have a project description in detail, existing environmental conditions, justifications given by the proponent for undertaking the proposed project components and alternatives. Alternatives to proposed components or activities in terms of location, construction methods and technologies, design and environmental considerations would be suggested. A mitigation plan and monitoring programme before, during and after the works will be outlined at the end. The major findings of this report are based on qualitative and quantitative assessments undertaken during site visits in 27th September 2016.

The impact assessment methodology has been restricted to field data collected, consultations, data collected during various time periods, experience and professional judgment. In addition, satellite and aerial photos have been used to study the geography and environmental changes where necessary. Moreover, similar project reports have been reviewed and referred in completing this report. Below are the reports that have been referred;

- EIA for the proposed land reclamation at Thilafushi Industrial Zone Plot S8-136 (Water Solutions, 2014)
- EIA of Breakwater Construction at Coastline Thilafushi Site (Water Solutions, 2016)

6.2 Aims and Objectives of the EIA

The objective of the report is to:

- Promote informed and environmentally sound decision making.

- To fulfill the obligations of the proponent to undertake an EIA under Clause 5 of the Environmental Protection and Preservation Act of the Maldives.
- Undertake the proposed project works with minimum damage to the environment.
- Identify the real need for dredging

6.3 EIA Implementation

This EIA has been prepared by a local environmental consulting firm, Water Solutions. Water Solutions have been chosen by the proponent as the environmental consultants for this project. The team members were:

- Ahmed Jameel, B. Eng (Environmental), MSc – Environmental (EIA-07/07)
- Ibrahim Faiz, BSc - Environmental Management (EIA T06/15)
- Akeed Ahmed, BSc - Environmental Sciences

6.4 Terms of Reference

Terms of Reference for this assessment has been included in the Appendix of this report.

7 Project Setting

This section outlines the relevant environmental legislation pertaining to this project. The following table outlines a matrix of major environmental laws, guidelines, codes and standards, both local and international indicating the relevance to this project.

Name of legislation	**Area**	**relevant to this project (yes/no)**	**Linkages to this project**
Environmental protection and preservation act	Generally covering the Environment	Yes	Clause 5a states that an impact assessment study shall be submitted to the Ministry of Environment, Energy and Water before implementing any development project that may have a potentially detrimental impact on the environment. Therefore, Clause 5 is of specific relevance to this EIA. The *EIA Regulations*, which came into force in May 2012 has been developed by the powers vested by the above umbrella law. This EIA has also been prepared as per this regulation.
EIA Regulations 2012	Environment	Yes	The Ministry of Environment has issued EIA regulation on May 2012, which guides the process of undertaking the Environmental Impact Assessment in the Maldives – This guideline also provides a comprehensive outline of the EIA process, including the roles and responsibilities of the consultants and the proponents. This regulation outlines every step of the IEE/EIA process beginning from application to undertake an EIA, details on the contents, minimum requirements for consultants undertaking the EIA, format of the EIA/IEE report and many more. The guidance provided in this Regulation was followed in the preparation of this EIA report. The EIA has also been prepared by registered consultants.
National biodiversity strategy and action plan	Environment	Yes	The goals of the National Biodiversity Strategy and Action Plan are conserve biological diversity and sustainably utilize

Name of legislation	Area	relevant to this project (yes/no)	Linkages to this project
			biological resources, build capacity for biodiversity conservation through a strong governance framework, and improved knowledge and understanding, foster community participation, ownership and support for biodiversity conservation (Ministry of Housing and Environment, 2003). In implementing the proposed project activities due care would be given to ensure that the national biodiversity strategies are adhered to. The proponent has committed on conservation and protection of the environment while undertaking this proposed project. More specifically, the coral reef and generally the marine environment have been assessed in order to assess baseline values. Quantitative and qualitative surveys were undertaken to assess the biological diversity of the marine environment, especially in close proximity to the proposed project area. Practical mitigation measures and solutions have been identified to conserve and protect the biodiversity.
Waste management law and policy	Environment	Yes	The ministry of Environment has developed the framework for a national waste management policy. The key elements of the policy include; • Ensure safe disposal of solid waste and encourage recycling and reduction in waste generated. • Develop guidelines on waste management and disposal and advocate enforcing these guidelines through inter-sectorial calibration. • Ensure the safe disposal of chemical, industrial and hazardous waste. The key objective of the waste management policy would be the formulation and implementation of guidelines and means for solid waste management to maintain a healthy environment.

Name of legislation	Area	relevant to this project (yes/no)	Linkages to this project
			Waste management for the proposed project will be in line with this policy. This project will conform to this law and policy. Construction waste management details and methods have been outlined in the EIA report.
Regulation on Coral, Sand and Aggregate Mining	Coral Reef	Yes	This regulation addresses sand mining from uninhabited islands that have been leased; sand mining from the coastal zone of other uninhabited islands; and aggregate mining from uninhabited islands that have been leased and from the coastal zone of other uninhabited islands. Coral mining from the house reef and the atoll rim has been banned through a directive from the President's Office dated 26th September 1990. Under Article 7 (c) of the Regulation on Sand and Coral Mining issued by the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) on the 13th of March 2000, it is an offence to mine sand or coral from the beach, lagoon or reef of any inhabited island. No corals or sand would be mined for the implementation of this project.
Third National Environment Action Plan	Environment	Yes	The Third National Environment Action Plan is divided into principles, results and goals to achieve the results. Some of the fundamental principles prescribed in NEAP 3, which have been incorporated into this environmental impact assessment exercise include local democracy, informed decision making, continuous learning and improvement, right to information and participation and most importantly the complementing role of environmental protection in socio-economic development. The proposed project is expected to provide a learning experience in terms of effectiveness of the use of EIA as a planning

Name of legislation	Area	relevant to this project (yes/no)	Linkages to this project
			instrument and appropriate monitoring for which specific focus is laid in Objective 24.1 of NEAP 3 (Ministry of Housing, Transport and Environment, 2009). By undertaking EIA prior to developmental projects, it ensures that environmental impacts from the project activities are minimized / avoided.
Dredging and Reclamation Law	Environment	Yes	Below are the project related clause of Dredging and Reclamation Regulation issued • Clause 6, a, and c outlines the situation or cases to which dredging and permit can be given. • Clause 7 discusses the types of situations in which dredging and reclamation can be undertaken. • Clause 11 outlines the criteria's to be utilized during dredging and reclamation. • Clause 13 outlines the details conditions to be met in a borrow area. This includes, minimum buffer zone between the reef line, shore lines and also buffer zones around reef. • Clause 14 outlines the dredge spoil disposal methods and its use. • Clause 15 outlines the maximum area for dredging. • Clause 16 outlines the maximum area for reclamation. All these details are outlined in the relevant sections of the EIA report. Dredging and reclamation application will be submitted with this report.

8 Project Description

8.1 Introduction to the project

Project involves undertaking sand dredging of Gulhifalhu Jetty area to make the area more accessible as well as provide safety for the vessels using the area.

8.2 Project Proponent

This project is proposed by Gulhifalhu Investment Ltd. Gulhifalhu Investment Limited was corporatized on April 2010, with the objective of reclaiming and developing the island as an industrial hub to cater to the needs of the industries in Greater Male' Region. The objective was to offer economic benefit in terms of industry specialization and reduction of land rent compared to other locations of the region.

Gulhifalhu has awarded dredging works to Maldives Road Development Corporation (MRDC). MRDC is a state owned corporation which mainly works in road development area of industrial sector. Sand dredged from this project will be temporarily stockpiled in Gulhifalhu and will be transported to MRDC Thilafushi site.

8.3 Project Location and Study Area

The proposed location for the project is Gulhifalhu Island of North Kaafu Atoll. Gulhifalhu is located on the southern periphery of the North Male' atoll with a geographical co-ordinates of 73°27'23.52"E and 4°10'40.69"N. Gulhifalhu has a land area of approximately 29.5 hectares. It is located between Thilafushi and Villingili in North Male' Atoll. Capital city Male' is located 5km east of Gulhifalhu. The project site is located on the eastern side of Gulhifalhu. This area has an existing quaywall used by the vessels to get access to the island.

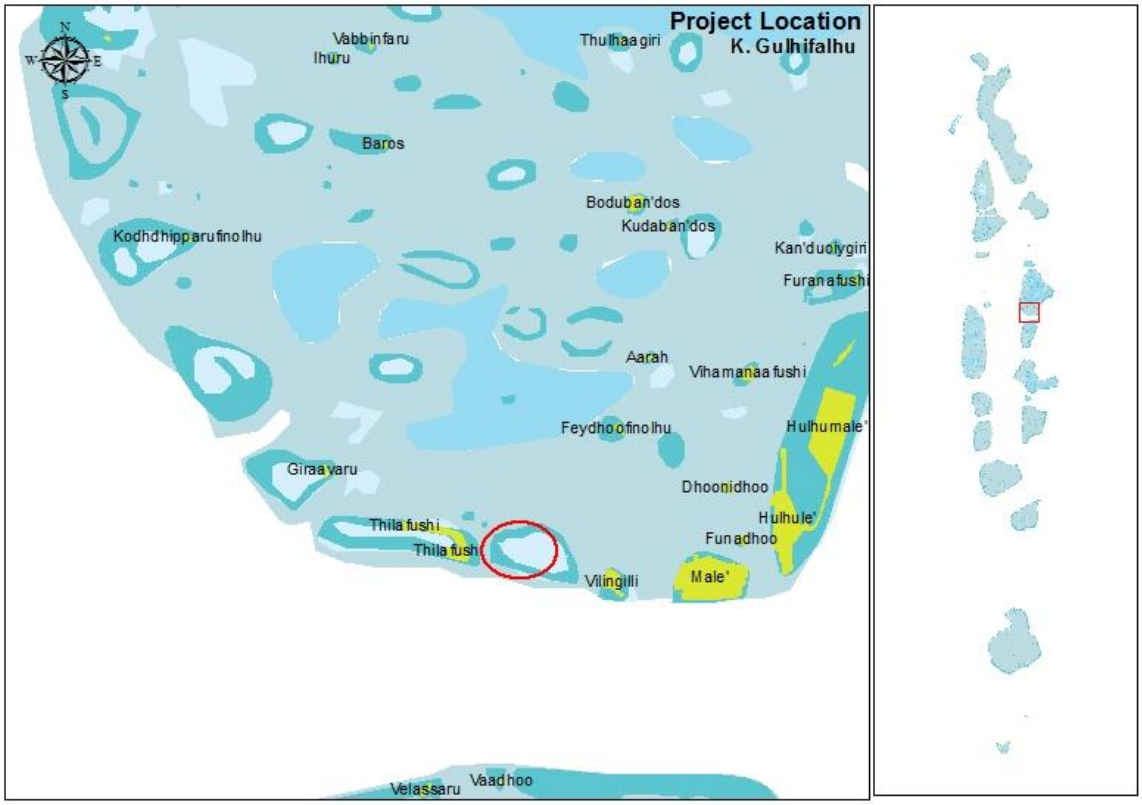


Figure 1: Project location

The following table outlines some key statistics for Gulhifalhu island.

Table 1: Some key figures for Gulhifalhu

Name of the island	Gulhifalhu
GPS Coordinates	73°27'23.52"E / 4°10'40.69"N
Area of islands/Hectares	29.5
Distance to Male'/Km	5
Is it on its own reef	yes
Is it sharing reef with other islands	no
Nearest distance to reef edge/m	12
Nearest island	Thilafushi
Nearest Resort	Centara Rasfushi Resort
Nearest Airport	Ibrahim Nasir International Airport

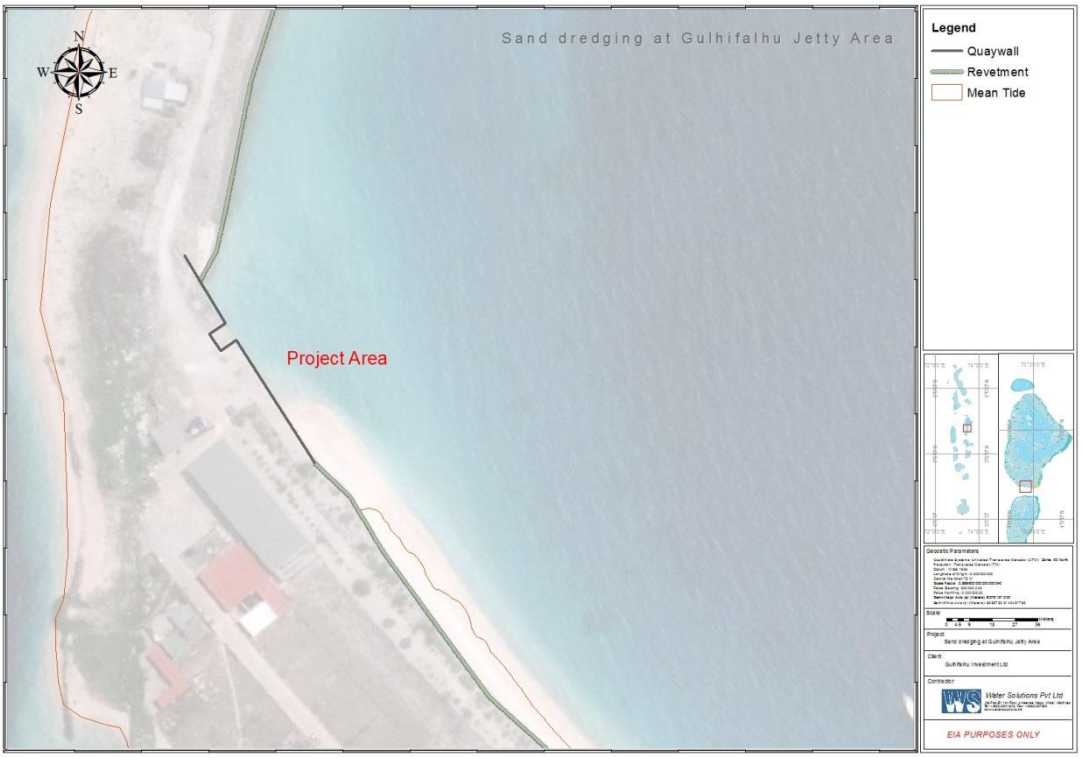


Figure 2: Project area - Gulhifalhu jetty site

8.4 Need and Justification to undertake the project

The primary objective of this project is to provide a safe mooring basin for the vessels accessing to the Gulhifalhu. Gulhifahu has been emerged as a powerhouse for the industries and one of the most strategic location for manufacturing, warehousing and for the distribution services. Gulhifalhu offers industrial plots for the business needs by providing land plots for warehousing. This has attracted many companies to Gulhifalhu. Increasing warehouses in Gulhifalhu has led to many vessels to use the jetty area for loading and unloading goods and people.

Currently the jetty area basin is very shallow and has less than a meter in some areas. Deepest area in the basin is around -2m and can only be used by a single vessel at a time. Hence vessels coming to Gulhifalhu have to wait in line to get access to the island. This includes the Thilafushi/Gulhifalhu Ferry waiting for several minutes to get people on the island. Sometimes vessels moor adjacent to each other; however it is very difficult to load and unload goods and materials from one boat to another and to jetty.

To ease this problem, Gulhifalhu Investment proposed a dredging project to deepen the basin of the jetty area. This area will be dredged up to -3m during mean sea level. Implementation of this project will make the whole quaywall accessible.

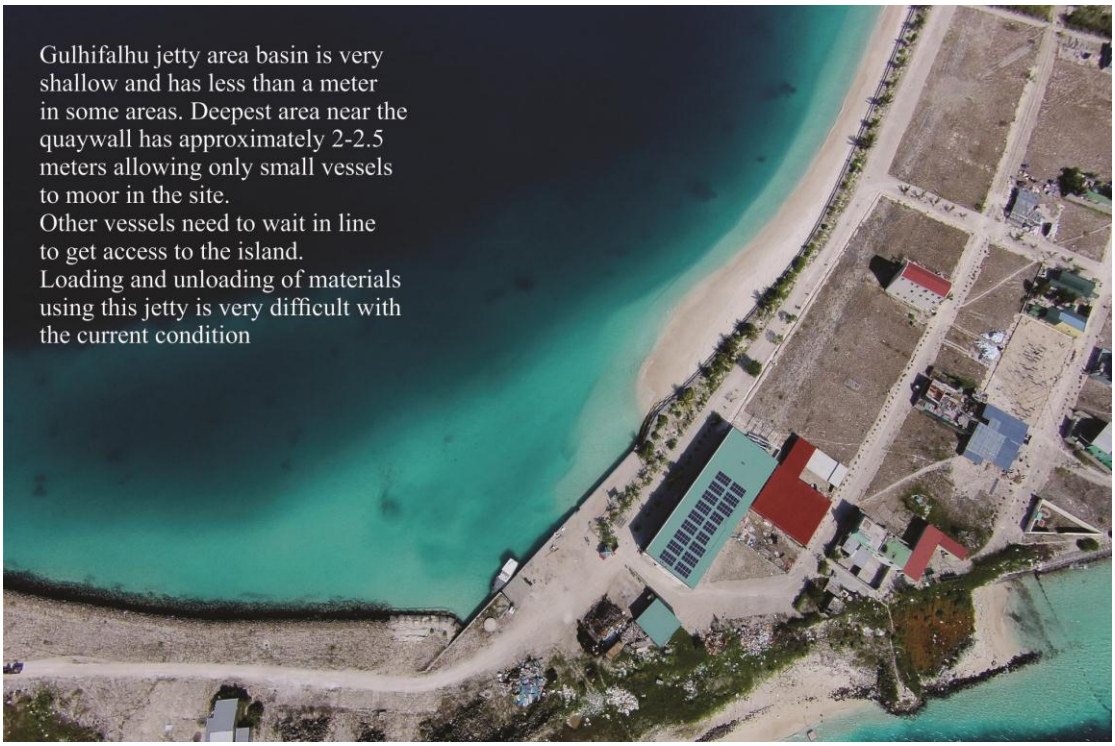


Figure 3: Sand filled jetty basin of Gulhifalhu (Photo taken on 29th September 2016)

8.5 Project boundary

The proposed project involves dredging of sand from Gulhifalhu Jetty Area. The project boundary is show in the following figure.

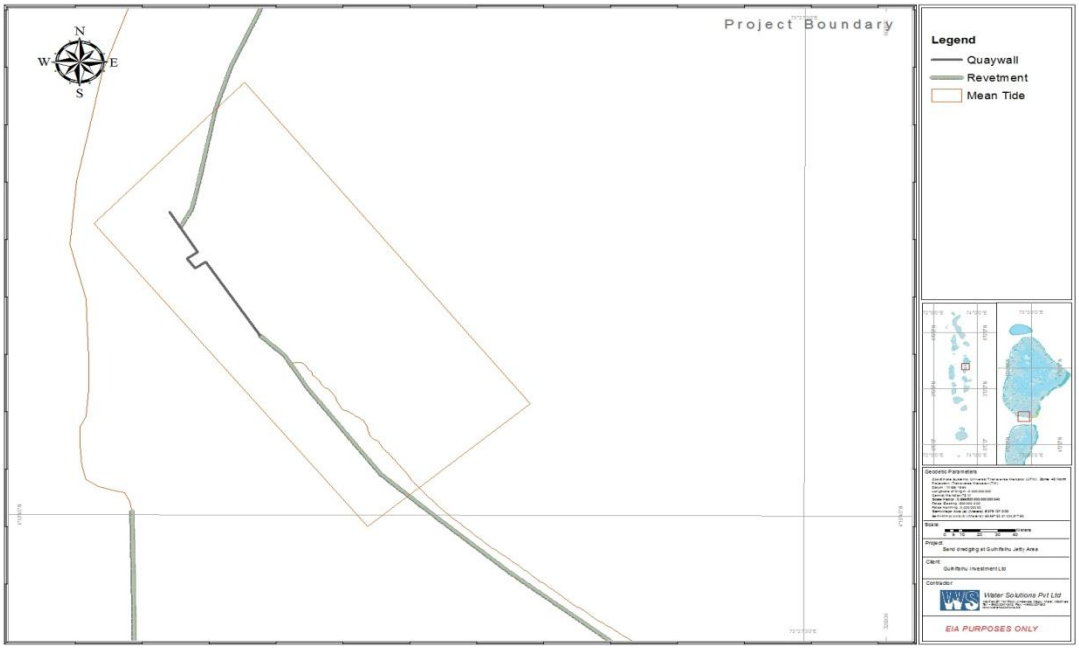
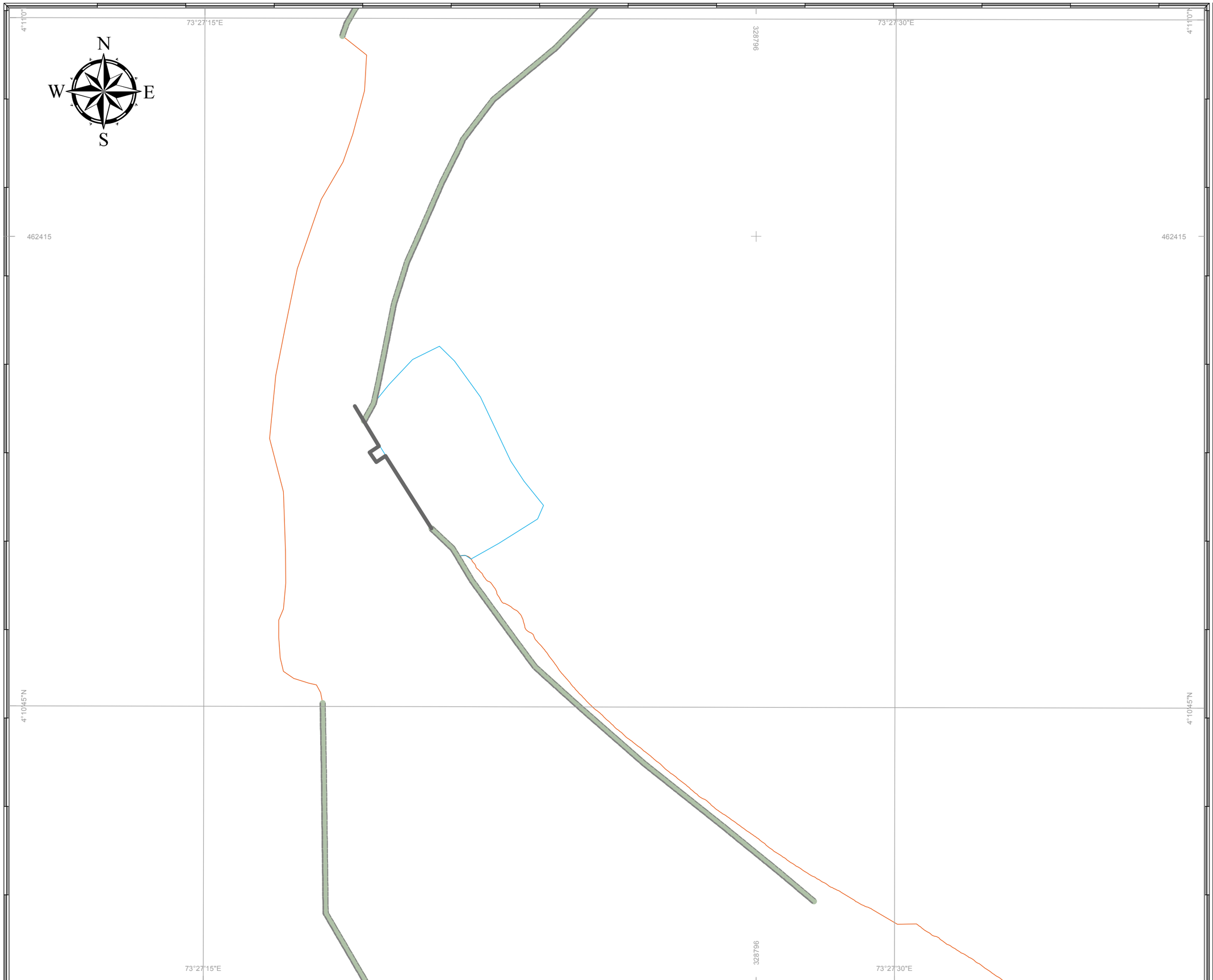
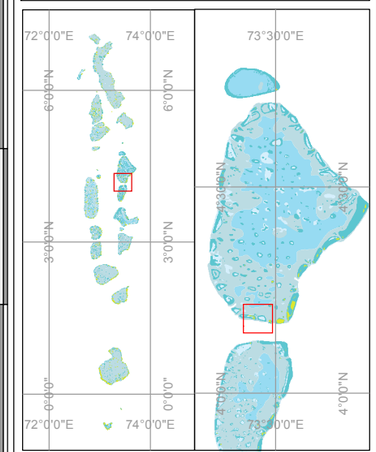


Figure 4: Proposed project boundary



Legend

- Quaywall
- Revetment
- Dredging_Area
- Mean Tide



Geodetic Parameters

Coordinate Systems :Universal Transverse Mercator (UTM) Zone: 43 North
Projection :Transverse Mercator (TM)
Datum : WGS 1984
Longitude of Origin :0.000000000
Central Meridian:75 W
Scale Factor :0.999600000000000040
False Easting :500000.000
False Northing :0.00000000
Semi-Major Axis (a) (Meters) :6378137.000
Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale:

0 10 20 40 60 80 Meters

Project:

Sand dredging at Gulhifalhu Jetty Area

Client:

Gulhifalhu Investment Ltd

Contractor:

Water Solutions Pvt Ltd
Ma.Fas Eri 1st Floor, Ameenee Magu, Male', Maldives
Tel: +(960)3341643, Fax: +(960)331643
www.water-solutions.biz

EIA PURPOSES ONLY

8.6 Project duration

The implementation of the project is planned to start as soon as the EIA is approved. The project is expected to be completed in less than 6 months.

8.7 Proposed Project

This section outlines the details of the various project components from mobilization, construction methodology to materials and machinery used.

8.7.1 Dredging

The jetty basin of the Gulhifalhu will be dredged up to -3m during mean sea level. Dredge material (sand) from this project will be stockpiled temporarily on Gulhifalhu and will be transported to Thilafushi MRDC site. It is estimated that total volume of 9000 cbm of sand will be excavated.

Figure 5: Proposed dredge area

8.7.2 Quality and characteristics of sand in the dredging area

During the EIA, visual observations and physical inspections were made on the proposed dredging area. Most areas within the proposed dredging boundary have fine sea sand. The sediment quality in this area is a mix of fine and coarse sand and the material obtained from this area will be quite fine. Refer to the following figure for borrow area location.

Figure 6: Sea bed of the proposed dredging area

8.7.3 Dredging methods

Dredging will be undertaken using an excavator and sand pumps. Special attention will be given when dredging north side of the basin where rock boulder revetments is constructed. Dredging too near to the revetment may cause a revetment failure. Therefore a buffer area will be left on this side between deep basin and revetment.

8.7.4 Justification for selected dredging method

Due to the small scale of the project, MRDC will be using sand pumps and excavators to dredge sand from jetty basin. Using a dredger will be too costly for a small scale projects such as this and will produce more sedimentation. Pumping and excavating will be done in low tide hours in favourable weather conditions to minimize environmental damage.

8.7.5 Transportation of dredged material

Dredged material from the dredging site will be temporarily stockpiled on Gulhifalhu. The stockpiled sand then will be transported to Thilafushi MRDC site on barges. During windy conditions, sand piles on barge should be covered to avoid wind generated spill or dispersion of sand into the marine environment. Existing ramp on the jetty quaywall will be used for barges to land.

Figure 7: Existing ramp on Gulhifalhu jetty: This will be used to land barge to transport sand

8.7.6 Construction of a groyne

Proponent is currently planning on the possibility of construction of a groyne on south side of jetty after the dredging works. Therefore this component is also taken into account during the EIA study. Groyne option is well studied under alternative section and is a good option to avoid sand filling the basin in the future. Geo-bags will be used to construct the groyne. Sand from the dredging project will be used to fill the bags.

8.8 Project Management

8.8.1 Project schedule

The total duration of project is expected to be 6 months. Refer to the provisional construction schedule attached as an annex.

8.8.2 Planning and Programme

The project will be implemented through a carefully managed plan. Mobilization will be initiated as soon as the EIA is approved. The Project has been programmed to be completed within 6 months from the date of commencement of the Contract.

8.8.3 Mobilization and logistics

Proper site mobilisation is critical to the success of the project. Site mobilization will be done using self-owned barges capable of carrying 3500T and tug boats. As most of the machineries are on Thilafushi, this project will only have a small scale mobilization in terms of material transport.

8.8.4 Storage and handling

The Gulhifalhu project site area will provide the storage area for all machineries and materials delivered to site. Materials will be stored within the stores that will be constructed for safe storage. All vulnerable materials / equipment will be stored in the secure containers or strategically delivered to the site to be incorporated directly into the construction without the need for storage.

8.8.5 Waste management

A waste removal strategy will be developed during the pre-commencement period. The contractor proposes that waste skips will be provided within approved site area, which will be removed and replaced on a daily basis. The contractor is also required to work towards better management of waste so the volume of waste to be disposed would be reduced. All domestic wastes from the construction activities, that is from the construction works will enter the present waste management cycle in Gulhifalhu or Thilafushi. All other wastes such as hazardous wastes like waste oil, grease and construction waste alike will be stockpiled at the project site and transferred to allocated Thilafushi waste sites regularly.

8.8.6 Dust and Debris

The site will be kept clean and tidy at all times and will accord with the safety requirements. Particular attention will be given to preventing the contamination of working areas and staff areas.

8.8.7 Safety

Full recognition and regard will be taken in the management and execution of project safety plan. Contractor and subcontractors (if any) are obliged to provide safety policies, plans and method statements and will be interviewed prior to order placement on all aspects of safety, health and welfare. All sites are subject to independent site safety checks, inspection and reports by our independent site safety inspectors and advisors.

8.8.8 Housing of temporary labour

Housing of labour will also be the responsibility of the contractor and will be based in the accommodation facilities already setup in Gulhifalhu site.

8.8.9 Emergency plan in case of spills (diesel, grease, oil)

Spillages can be an issue in this project if adequate measures are not taken. Hence, oil, grease and other fuel storage will be held on land in a temporary site that has adequate impervious flooring. Refuelling of excavators, loaders and trucks will be required to be undertaken in hard floor areas setup at the project site during the construction works.

8.9 Environmental Conditions during Implementation

The project activities will take place in end of south-west monsoon, and hence environmental conditions are expected to be mostly favourable during the construction period but it is presently difficult to predict the weather. Dredging works will be undertaken on the eastern side which will be mostly leeward side in SW monsoon; however the impact on weather would be quite insignificant. Unfavourable conditions on the project site will create more uncertainties with regard to sediment dispersion during dredging. Therefore, the strategy would be to complete the dredging with appropriate mitigation measures and within the shortest possible duration.

8.10 Risks Associated with the Project and

There are some risk factors associated with this project that could possibly have both financial and environmental implications. The most significant risk associated is damage and destruction of the lagoon and the reef caused by direct and indirect impacts. As a result of sedimentation, any live corals in the vicinity of the project footprint are at risk of being completely destroyed or at least indirectly impacted through sedimentation. Some of the corals will no doubt die of stress while others that are further away are likely to be affected at a lesser magnitude.

There is also the risk of project delays caused by bad weather. The project period falls in the period of end of southwest monsoon, but it is presently difficult to predict the weather. Hence, there could be prolonged bad weather days, frequent rains and strong winds, all of which are delaying factors.

8.11 Measures to protect environmental values during construction and operation phase

Proper care need to be taken to control and mitigate the sedimentation and siltation caused by the dredging activity. Sedimentation will be an issue but will be minimized by limiting the dredging work hours as well as undertaking work during low tide hours. Sedimentation will be an issue for the coral reefs around the dredging area despite with the greatest care; it is difficult to entirely control sedimentation. Hence, it is expected to spread to the nearby areas of the reef. Spreading of fine sediment around the vicinity of the dredging area will impact the reefs through reduction of visibility and its associated impacts. Reduced visibility caused by sedimentation will reduce fish population in the reef temporarily and also affect the recreational use of these reefs.

This risk of project delays caused by bad weather can be minimized if the works are scheduled as such that weather is taken as important aspect in the project planning. Dredging should be focused on the footprint proposed and should be completed on the shortest time frame possible.

During operational phase, proper measures need to be taken to manage the waste produced in the jetty area. Vessel operators need to be informed on how waste produced in their vessels should be managed. Dumping waste from vessels to the marine environment will not be acceptable. Bins should be kept at proper distances on the jetty area.

8.12 Project Inputs and Outputs

8.12.1 Project Inputs

The types of resources that will go into the project and from where and how these will be obtained are given in the following table.

Table 2: Matrix of major inputs during construction period

INPUT RESOURCE(S)	SOURCE/TYPE	HOW TO OBTAIN RESOURCES
Construction workers (15+)	Maldivians +foreign labours	Contractor
Water supply (construction period).	Desalinated water / mineral water / rainwater from the island	Available from Gulhifalhu
Electricity/Energy (construction period)	Form the islands power grid. Backup mobile Diesel generators will be available on standby.	Available from Gulhifalhu
Construction machinery	Tugs, Excavators, barges, general construction tools, wheel loaders, dump trucks and loader.	Contractor
Telecommunications	Mobile Phones, and radio two-way communications.	Available from Gulhifalhu
Food (during construction period)	Food prepared at the project site area.	Available from Gulhifalhu / Male’
Fuel	Diesel, Petrol, Lubricants	Available from Thilafushi and Male’

8.12.2 Project Outputs

The type of outputs (products and waste streams) and what is expected to happen to them are given in the following table.

Table 3: Matrix of major outputs of environmental significance during construction stage

PRODUCTS AND WASTE MATERIALS	ANTICIPATED QUANTITIES	METHOD OF DISPOSAL
wastewater	250/l/person/day	Waste water generated by the labour force of the contractor / disposed through existing system in

		Gulhifalhu
Waste oil and grease (hazardous waste)	Approximately 500 litres per month	Regularly transported to allocated waste sites in Thilafushi during construction period
Noise	Localized to the project site including the surrounding areas.	Unavoidable during the construction stage but will be minimized. Noise is unavoidable.
Air pollution	Limited quantities of dust, oxides of Nitrogen and sulphur from use of machinery in the construction zone.	Mainly arising as a result of emission from the construction work such as from the dredgers, excavators and machinery. Only localized but unavoidable.
Dredged material	A total of 9000 cbm from the proposed dredging area	To be dredged using an excavator.
Solid waste	3kg/person/day	Waste water generated by the labour force of the contractor / disposed to Thilafushi waste sites regularly

9 Methodology

This section outlines the methodologies used in this environmental assessment. The following table outlines a matrix of methodologies used in this project. Details of these methodologies and their descriptions are attached as an annex.

Methodology type	**Area / environmental aspect**	**Used in this project (yes/no)**
General methodologies of data collection	Generally covering the broader Environment	Yes
Mapping and location identification	Coastal, terrestrial and marine environment.	Yes
Marine Environmental survey	**Marine environment**	
20 m Line Intercept transect (LIT)	Marine environment	Yes
50 m photo quadrate analysis	Marine environment	No
Qualitative assessment of the reef	Marine environment	Yes
Permanent photo quadrate	Marine environment	No
Ref fish visual census	Marine environment	Yes
Marine Water Quality	Marine environment	Yes
Coastal Environment	**Coastal Environment**	
Shoreline mapping	Coastal Environment	Yes
Coastal structures mapping	Coastal Environment	No
Erosion and accretion areas mapping	Coastal Environment	No
Beach profiles	Coastal Environment	No
Drogues and current	Coastal Environment	No
Terrestrial Environment	**Terrestrial environment**	
Terrestrial floral survey	Terrestrial environment	No
Terrestrial faunal survey	Terrestrial environment	No
Groundwater assessment	Terrestrial environment	No
Bathymetry	Marine / Coastal Environment	Yes
Aerial Photos	Generally covering the broader Environment	Yes
Long term weather data	Generally covering the broader Environment	Yes

10 Existing Environment of Maldives

10.1 Existing general environment of Maldives

The general environmental conditions of Maldives are attached as an annex. The annex covers the overall meteorological conditions of Maldives, climate settings, temperature, and wind patterns throughout the country, rainfall, monsoon information, offshore wave conditions, tides, and other relevant information. The general environment of Maldives and Gulhifalhu is also described in many reports and literature as well as reference to the following report is made if the reader wishes to refer.

- Gulhifalhu environment is documented in "EIA for the Proposed Land Reclamation (Remaining components from Phase II and Phase III) of the Gulhifalhu Island, Kaafu Atoll (CDE Consulting, 2014)"
- General environment of Maldives is documented in "EIA of land reclamation in Maafushi Island (Water Solutions, 2013)"
- For further read of environmental conditions of Thilafushi near Gulhifalhu refer to "EIA for the proposed land reclamation at Thilafushi Industrial Zone (Water Solutions, 2016)"

10.2 Existing Marine Environment

The marine environmental survey at Gulhifalhu was focused on four sites. These sites area indicated in the following diagramme. Site selection was based on focusing on the lagoon where dredging is proposed and as well as from control sites.

10.3 Methodology of marine surveys

The methodologies used for the assessment were quantitative complimented by qualitative methods. Transects of 20 meters each was undertaken at each site. In addition, photos were also taken from these locations to support and assess the marine environment. Fish counts were also undertaken to get a snapshot of the fish population. Details of these methodologies are attached as annex.

General impression and quantitative results of the sites surveyed are described in the following pages. The following diagramme illustrates the marine survey locations and their geographical locations are indicated on the map.

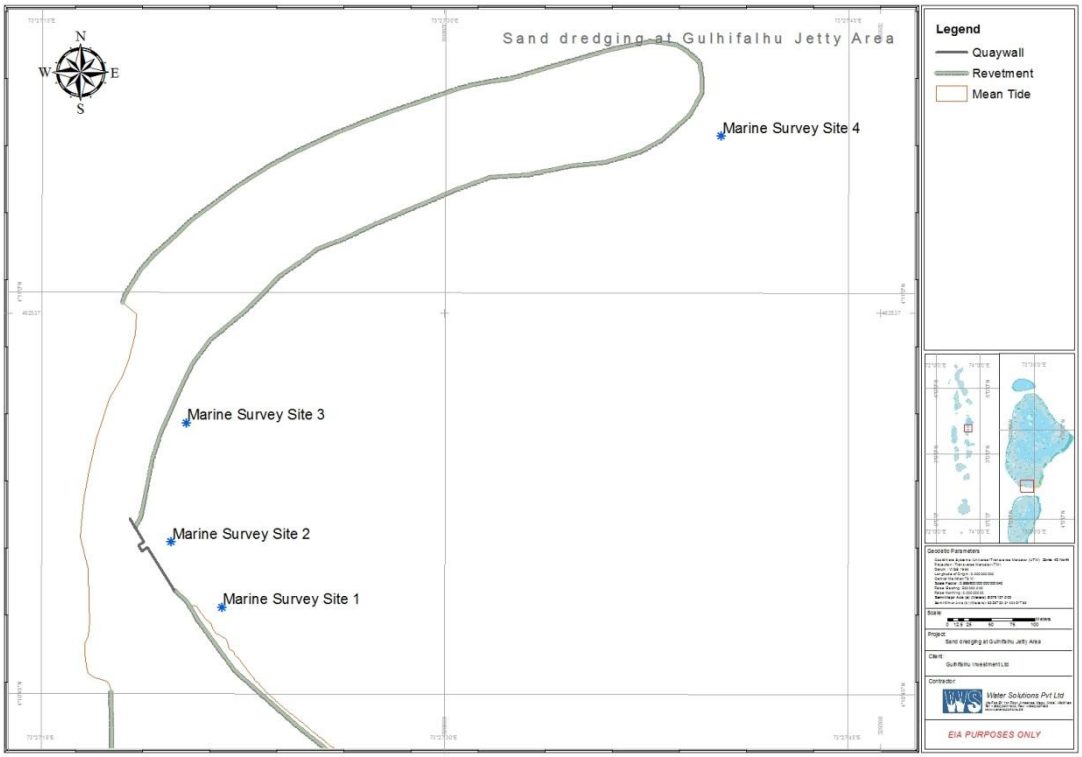


Figure 8: Marine survey location

10.4 Coral reef environment

Four sites were surveyed to assess the marine environment as baseline for reef benthic community. Detail description graphs for each location are given below.

The following are definition of benthic categories used in this survey.

- **HC:** All living coral including bleached coral; includes fire, blue and organ pipe corals
- **SC**: Include zoanthids but not anemones (OT)
- **RKC**: Coral that has died within the past year; appears fresh and white or with corallite structures still recognizable
- **NIA**: All macro-algae except coralline, calcareous and turf (record the substrate beneath for these); Halimeda is recorded as OT; turf is shorter than 3cm.
- **SP**: All erect and encrusting sponges (but no tunicates).
- **RC**: Any hard substrate; includes dead coral more than 1 yr old and may be covered by turf or encrusting coralline algae, barnacles, etc.
- **RB**: Reef rocks between 0.5 and 15cm in diameter
- **SD**: Sediment less than 0.5cm in diameter; in water, falls quickly to the bottom when dropped.
- **SI**: Sediment that remains in suspension if disturbed; recorded if color of the underlying surface is obscured by silt.
- **OT**: Any other sessile organism including sea anemones, tunicates, gorgonians or non-living substrate. Under Reef Check protocol, there is no categorization of sea grass hence, it was recorded under OT.
-

10.4.1 Status of marine environment at site 1

Site 1 is located on the south eastern side of the proposed dredging area. There are few live coral patches observed in this location. Sand dominates the benthic composition at site 1. Corals found on most of the patches are dead possibly because of sedimentation caused by the movement of fine sand in this area. The following graph outlines the status of site 1.

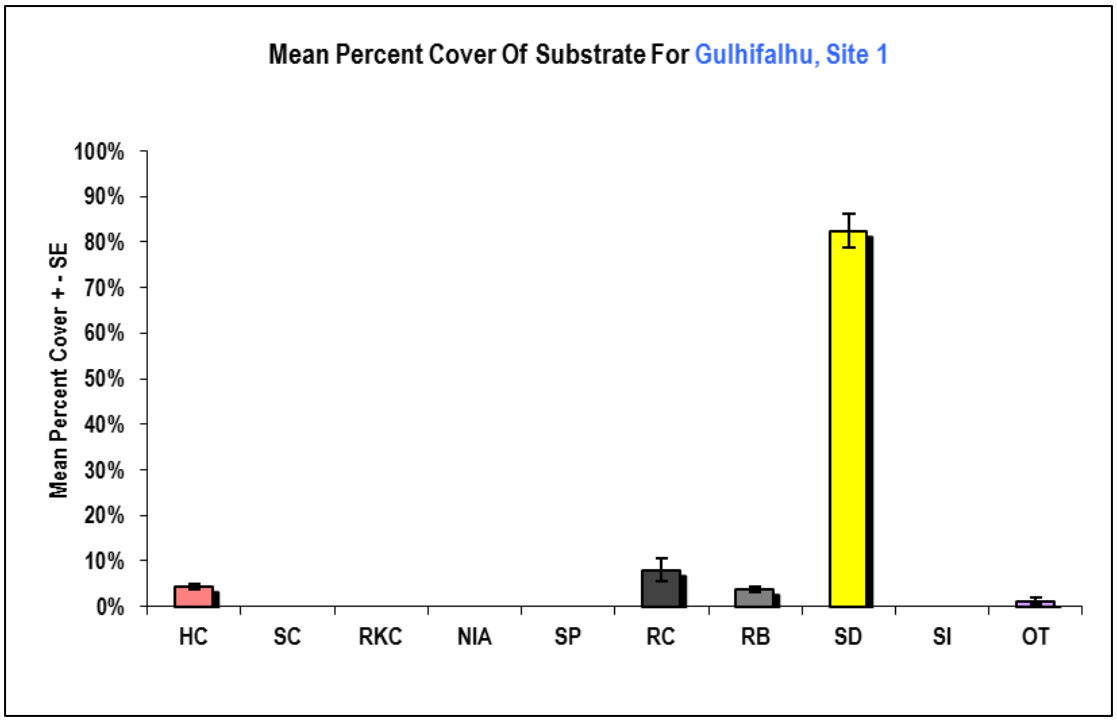


Figure 9: Percentage of bottom substrate components at site 1 (29 September 2016)

Figure 10: Photos taken from site 1 (29 September 2016)

10.4.2 Status of marine environment at site 2

Site 2 is within the proposed dredging footprint. Similar to site 1, this area has fine sand with no live corals or rocks. Whole benthos of this area is covered with sand. No fishes were observed during the survey in this site. The following graph outlines the status of site 2.

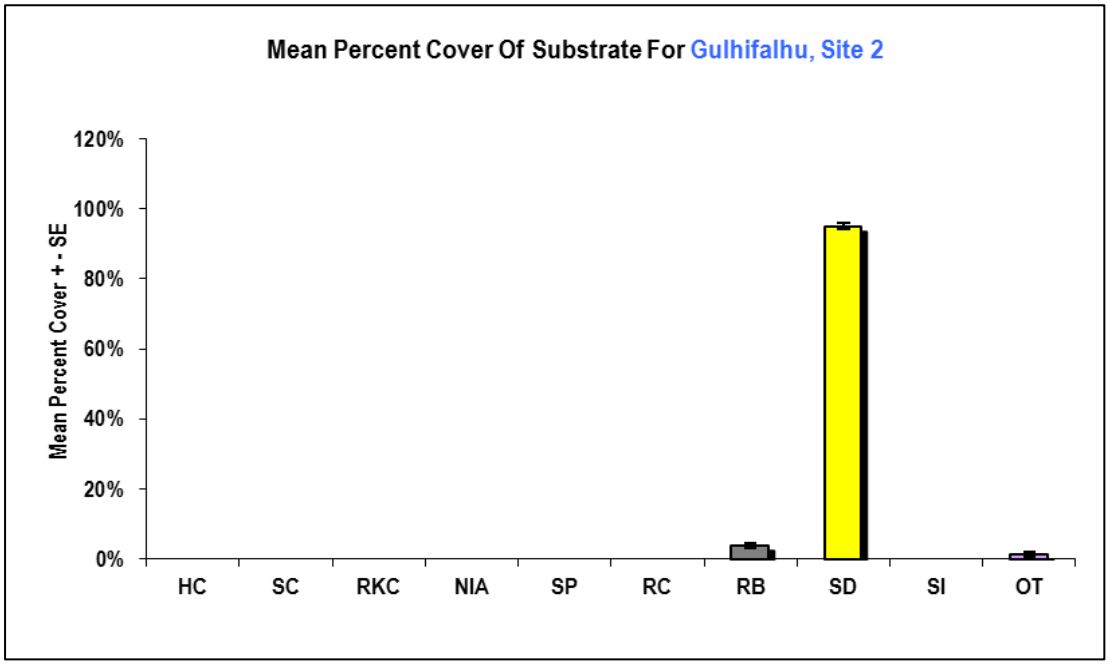


Figure 11: Percentage of bottom substrate components at site 2 (29 September 2016)

Figure 12: Photos taken from site 2 (29 September 2016)

10.4.3 Status of marine environment at site 3

Site 3 is on the north western side of the project site. This area is also covered with sand. There are coral growths observed on the rock boulders of the revetment on this side. Most of the coral observed on the rock boulders are Pocillopora sp. The following graph outlines the status of site 3.

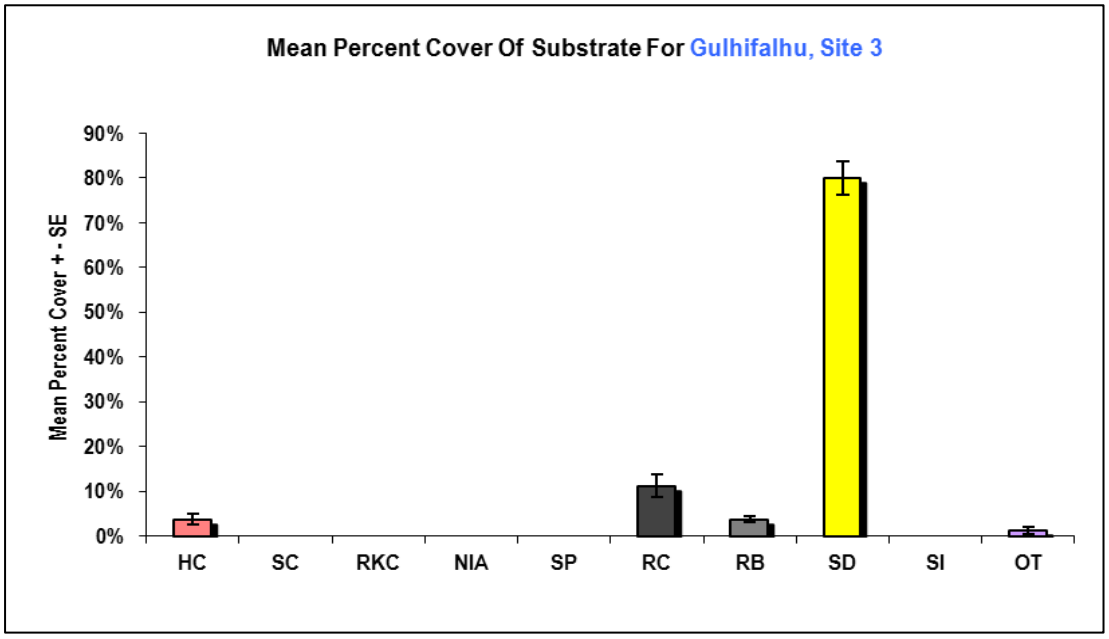


Figure 13: Percentage of bottom substrate components at site 3 (29 September 2016)

Figure 14: Photos taken from site 3 (29 September 2016)

10.4.4 Status of marine environment at site 4

Site 4 is taken as a control site on the inside of north wing of Gulhufalhu where the reclaimed area of north wing ends. Benthic composition of this site is dominated by sand and rubble. Rocks and live corals were observed on this site more compared to other sites surveyed. Some of the corals in this site are recently killed possibly because of the sedimentation caused by the fine sand movement here. The following graph outlines the status of site 4.

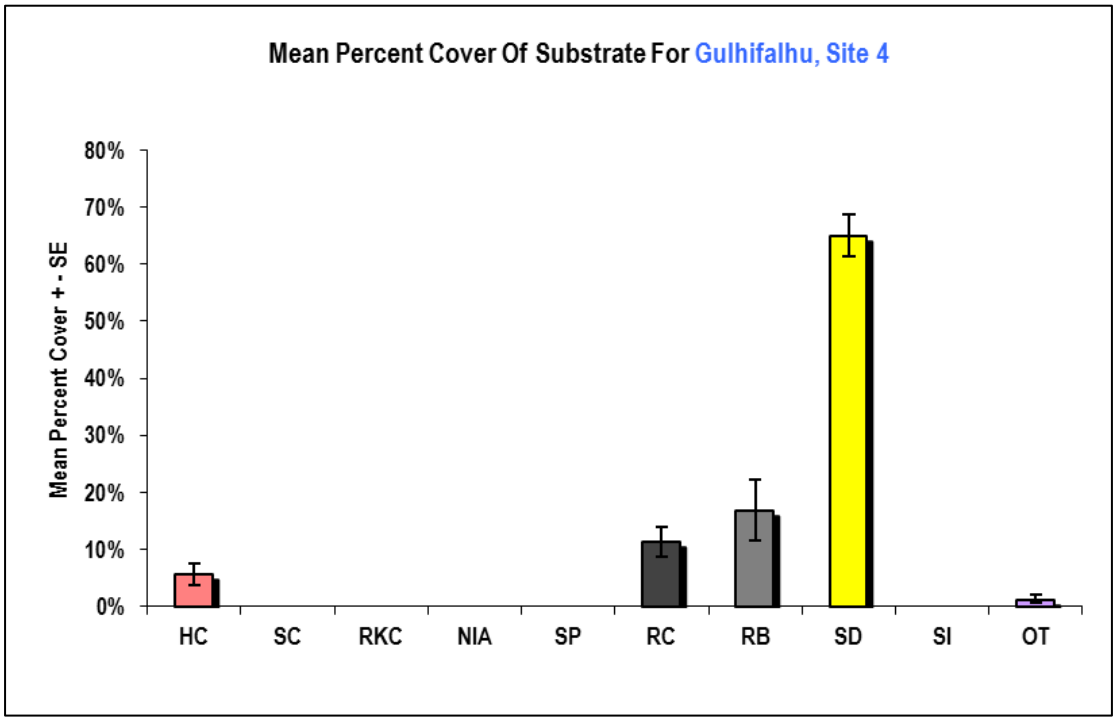


Figure 15: Percentage of bottom substrate components at site 4 (29 September 2016)

Figure 16: Photos taken from site 4 (29 September 2016)

10.5 Status of fish abundance

The amount and type of fish present at a given site can be a good indicator of the marine environment. For example, increased grazers are generally a sign of increased nutrients in the area, thus decreased coral cover and increased algal cover. The following table outlines the fish count survey at all the sites.

Table 4: Fish abundance based on the fish survey at survey sites (4 July 2016)

	Site 1	**Site 2**	**Site 3**	**Site 4**
Family				
Anthias	-	-	-	-
Butterflyfishes (Chaetodontidae)	-	-	-	R
Damselfishes (Pomacentridae)	R	-	R	-
Groupers	-	-	-	R
Hawkfishes	-	-	-	-
Rudder Fish	-	-	-	-
Moorish idol (Zanclidae)	-	-	-	-
Parrotfishes (Scaridae)	-	-	-	-
Snappers (Lutjanidae)	-	-	-	-
Soldier fish	-	-	-	-
Squirrelfishes (Holocentridae)	-	-	-	-
Surgeonfishes (Acanthuridae)	-	-	-	-
Wrasses (Labridae)	R	-	-	R
Jacks	-	-	-	R
Turtle	-	-	-	-
Shark	-	-	-	-
Ray	-	-	-	-

A= Abundant (Meaning that during the 15 minute time swim survey, species counts were recorded more than 50, hence it is difficult to count their numbers). C=Common (Meaning that during the 15 minute time swim survey, they were spotted occasionally and throughout the survey, but their numbers were less than 50). R=Rare (Meaning that during the survey, only few of these species were observed, often 1 or 2.

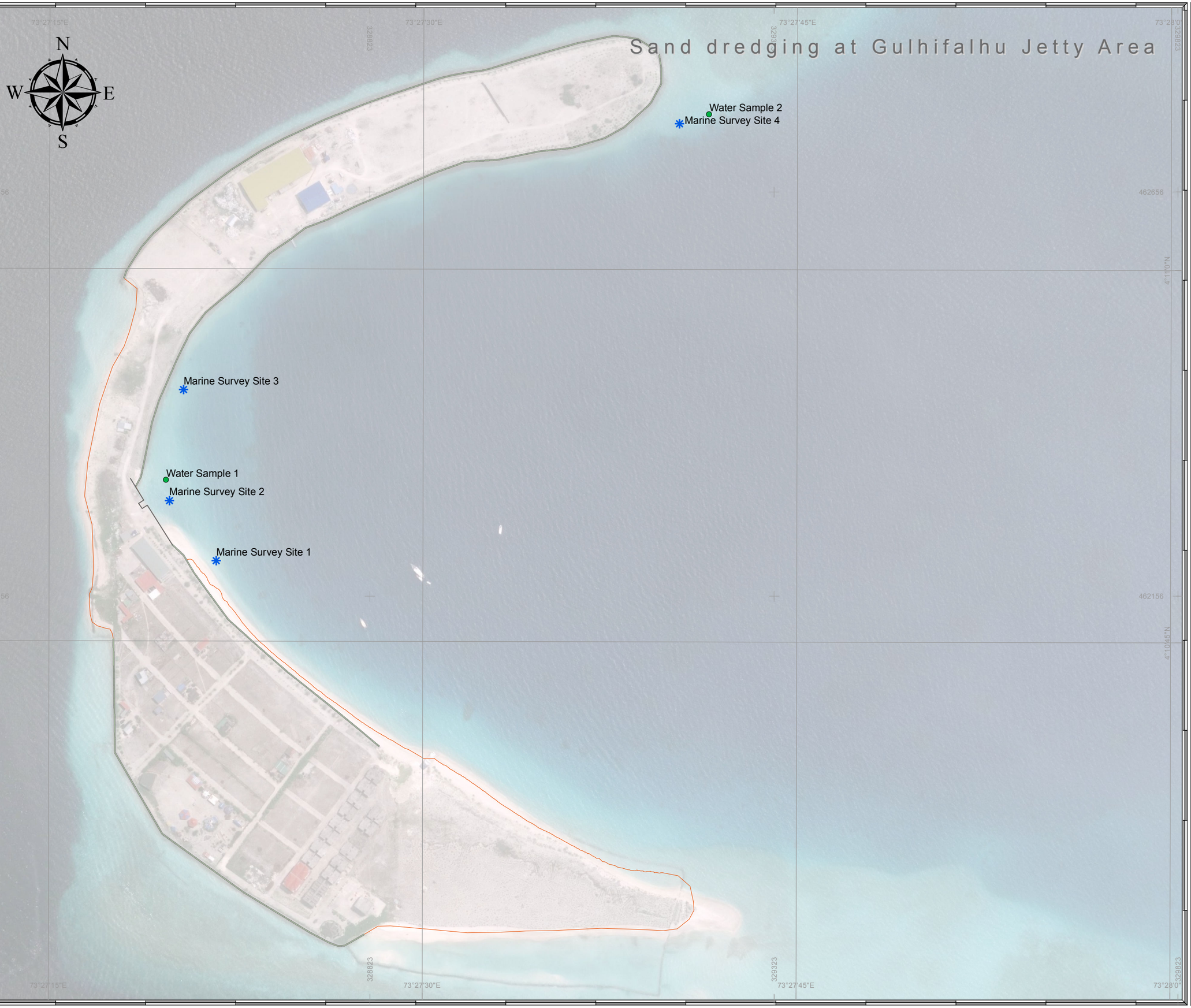
10.5.1 Marine water quality and bathymetry

The primary objective of the marine water quality sampling was to determine the baseline conditions of the marine water in the project site. Qualitative and quantitative assessments were made on seawater from two locations (from M1 and M4). The bathymetry map is attached as an annex. The following table illustrates the result of the marine water quality test undertaken onsite.

Table 5: Results of the marine water quality tests undertaken in Gulhifalhu Jetty Area

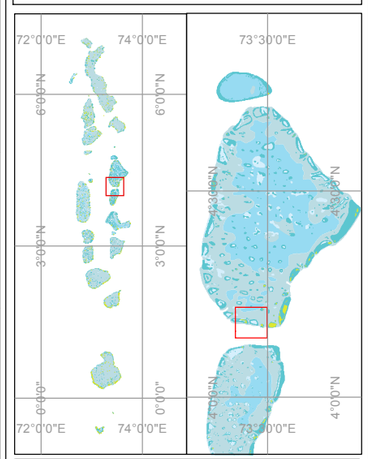
Water Quality	Site SW1	Site SW2 (Control Site)	Optimal range	Ref
Physical appearance	Clear	Clear		
Electrical Conductivity (us/cm	49400	48500		
Temperature C	27.00	25.00	18 - 32 Degree Celcius	GBRMPA 2009
Salinity (mg/l)	33400	34500	3.2% - 4.2%	GBRMPA 2010
pH	8.30	8.10	8 to 8.3. Levels below 7.4 will cause stress	
Turbidity (NTU)	0.35	0.2	3 to 5 NTU. > 5 NTU causes stress	Cooper et al 2008
Total Suspended solids (mg/l)	5	3		

Sand dredging at Gulhifalhu Jetty Area



Legend

- Contour
- Quaywall
- Revetment
- Mean Tide



Geodetic Parameters

Coordinate Systems :Universal Transverse Mercator (UTM) Zone: 43 North
Projection :Transverse Mercator (TM)
Datum : WGS 1984
Longitude of Origin :0.000000000
Central Meridian:75 W
Scale Factor :0.999600000000000040
False Easting :500000.000
False Northing :0.00000000
Semi-Major Axis (a) (Meters) :6378137.000
Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale:

0 15 30 60 90 120 Meters

Project:
Sand dredging at Gulhifalhu Jetty Area

Client:
Gulhifalhu Investment Ltd

Contractor:

Water Solutions Pvt Ltd
Ma.Fas Eri 1st Floor, Ameenee Magu, Male', Maldives
Tel: +(960)3341643, Fax: +(960)331643
www.water-solutions.biz

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10.6 Existing Coastal Environment

The coastal environment of Gulhifalhu project area consists of highly modified shoreline and a lagoon area.

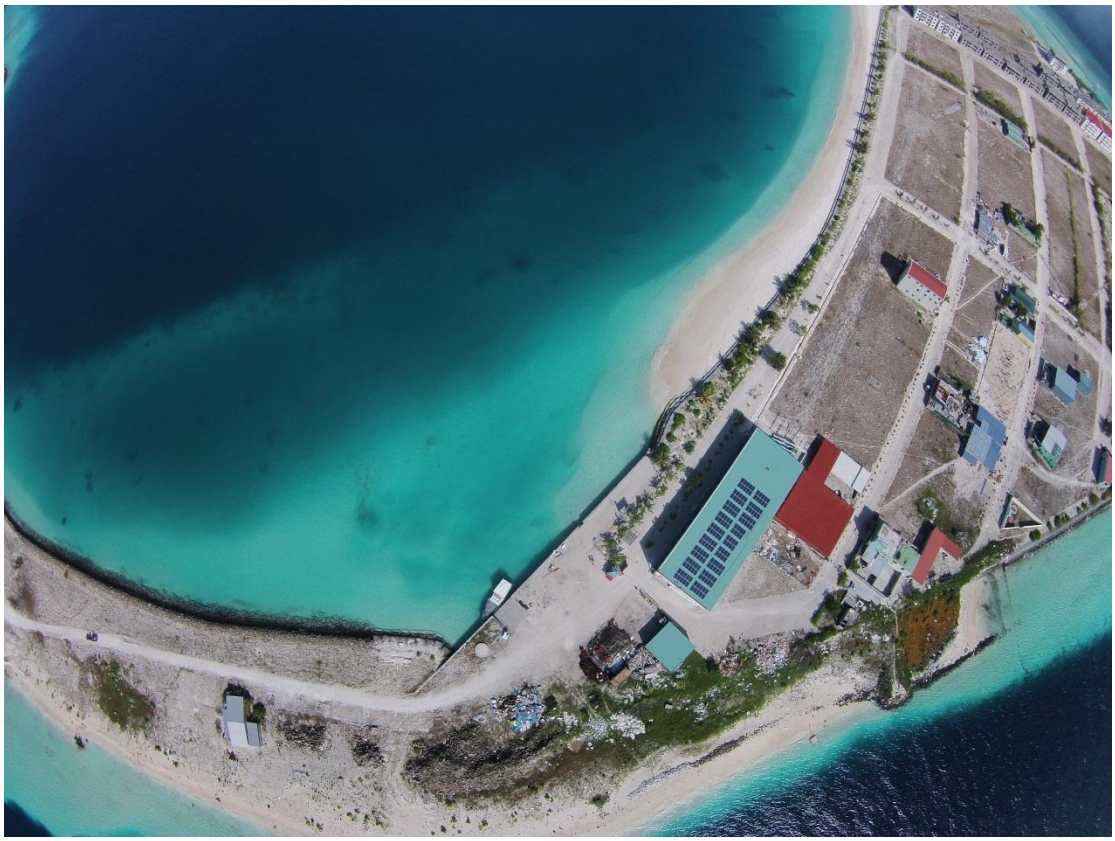


Figure 17: Aerial photo of project site taken on 29th September 2016

10.6.1 Features of the Coastal Environment

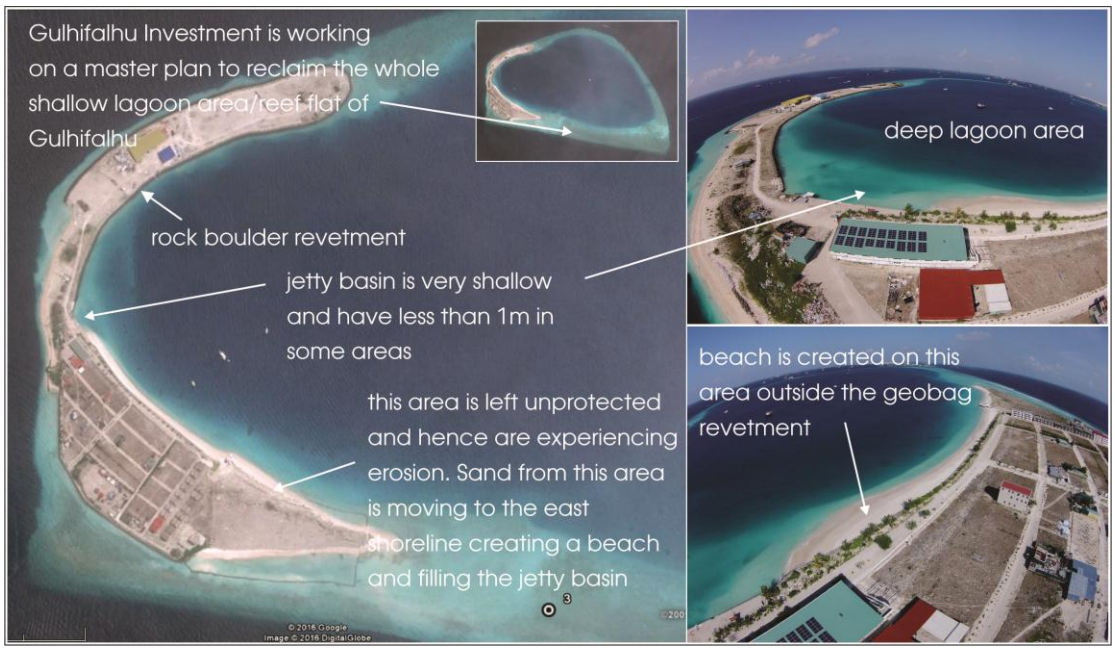
The coastal environment of the project area can be described as having the following components:

They are:

1. The natural lagoon on project area
2. Highly modified coastline

10.6.2 Lagoon

The project takes place on the eastern side of Gulhifalhu. The lagoon where the dredgin is proposed is mainly covered with sand. This area was previously dredged but now is shallow due to sand fill caused by sand movement along the shoreline. The proposed project will directly destroy the dredging footprint in lagoon environment in the east side but will bring a workable solution to Gulhifalhu jetty basin. Refer to the marine environmental survey results to assess the baseline conditions of the lagoon.



10.6.3 Currents

To understand the sediment movement around the island, current measurements should be taken over a long period of time. Currents data around specific islands are not available in the Maldives. However, during the EIA process, currents were measures around the project area to obtain a snapshot of the existing conditions prevailing and to link them with the historical and present conditions. Nevertheless, this data set does not represent the actual current patterns around the island. During the course of the day, currents change twice with the changing tide and monthly with the moon cycles. The result therefore is a very complex change in current direction. In Maldives, it has been well researched and documented that the currents are induced by wind and thus, during the two monsoons, the direction of currents is very much related to the wind direction.

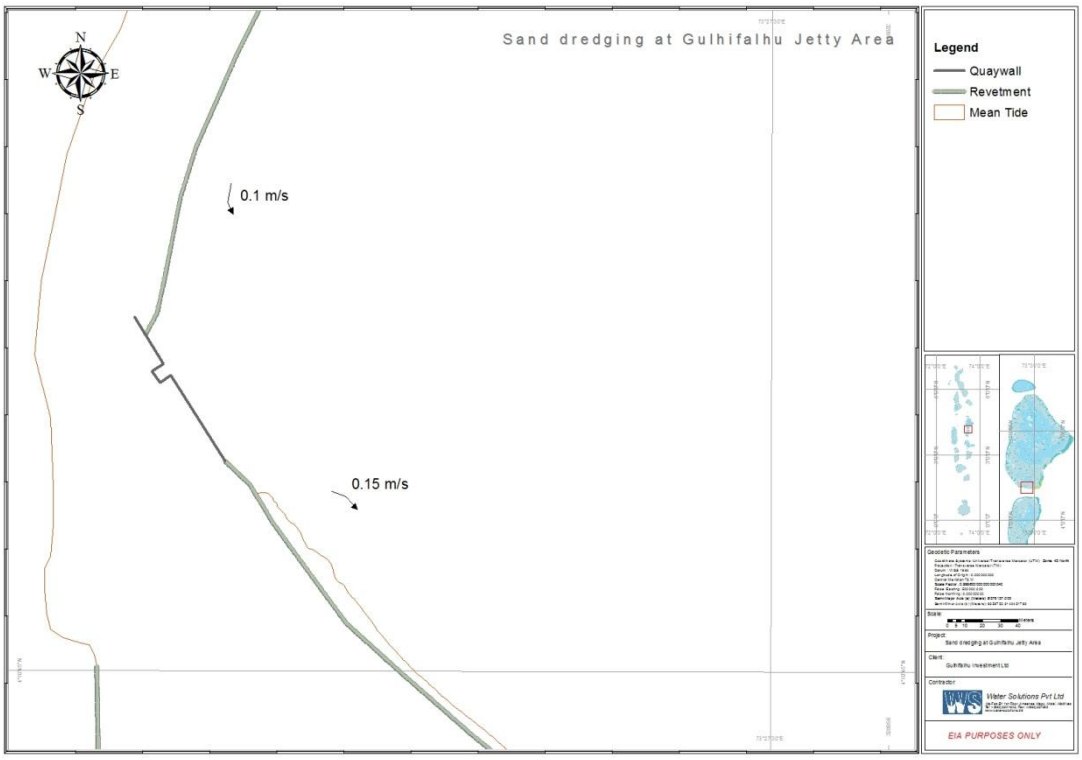


Figure 18: Current measurements recorded in project site

10.6.4 Marine Protected Areas and Environmentally Sensitive Areas

There are multiple Marine Protected Areas (MPA's) and Environmentally Sensitive Areas (ESA's) within a 10 km radius of the project site. On site in Gulhifalhu exists the MPA Gulhifalhu Kohlavaanee, which is home to a diverse range of reef fish and coral. It consists of the deep lagoon area of the island and the south house reef of Gulhifalhu Island, known as the Hans Hass Place (HP) Reef. The close proximity of the protected area to the project site suggests that the area is likely to be affected by the project work carried out at this location. Two other nearby MPA's are Dhekunu Thilafalhuge Myaruvani in neighbouring Thilafushi Island and 3.31 km West of the project site; and Kuda Haa, an isolated reef 6.07 km North-West of the project site. Both of these areas are abundant in various species of fish, while Dhekunu Thilafalhuge Myaruvani is additionally home to reef shark species. Nevertheless, the distance between the project site and these two MPA's indicates that it is less likely that they will be affected by the dredging process undertaken in Gulhifalhu.

Velassaru and Vaadhoo in South Male' Atoll are just south of the project site and have ESA's in their reefs facing Gulhifalhu. Both of these reefs are species rich areas housing multiple shark species, Eagle Ray and Hawksbill Sea Turtle populations along with numerous other marine species. However, K. Velassaru and K. Vaadhoo's sensitive areas are 6.12 km and 5.98 km away from the project site respectively, suggesting that they are also less likely to be affected by the project activities.

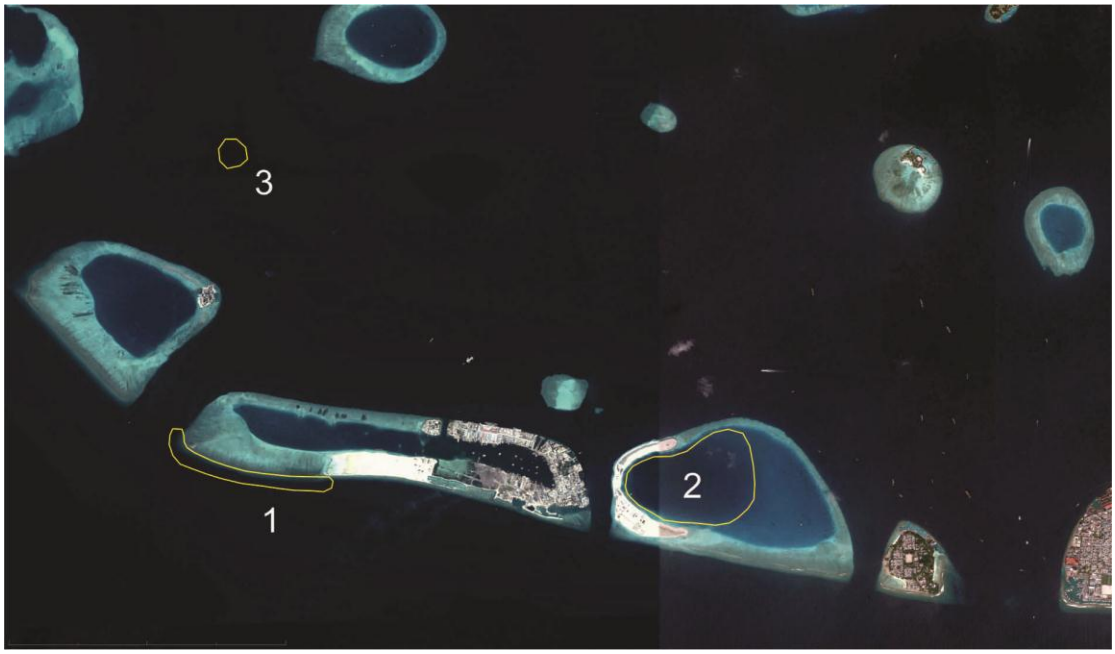


Figure 19: MPAs within 5km radius of the project site

Hence, the MPA marked as 2 in the diagram is within very close proximity of the project area, all the mitigations stated in the report should be adhered in project implementation. Project proponent should visit the project area regularly to ensure the proper project implementation.

10.7 Climate

10.7.1 Temperature

According to the latest monthly weather reports from Maldives Meteorological Service released on 5th August 2016, the highest temperature recorded in central part of Maldives during last month was 32 degree Celsius. The minimum temperature recorded for this region is 23 degree Celsius. Maximum temperature recorded during last year this period was 32 degree Celsius, same as this year. Figure below shows the temperature data for the month of August for central part of Maldives (2015 and 2016) and average 1975-2014.

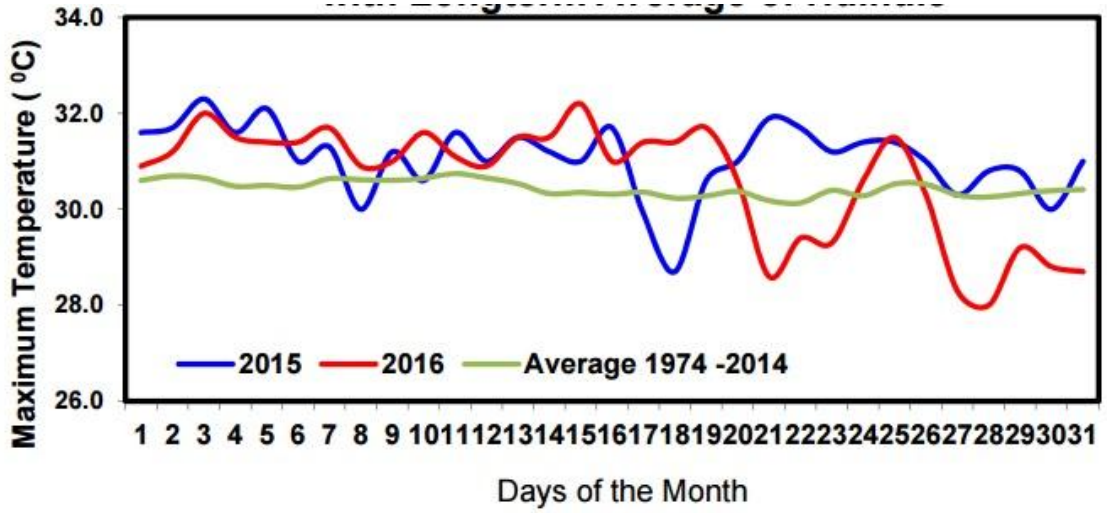


Figure 20: Comparison of August maximum temperature with long term average of Hulhule (Source: Maldives Meteorological Service, 2016)

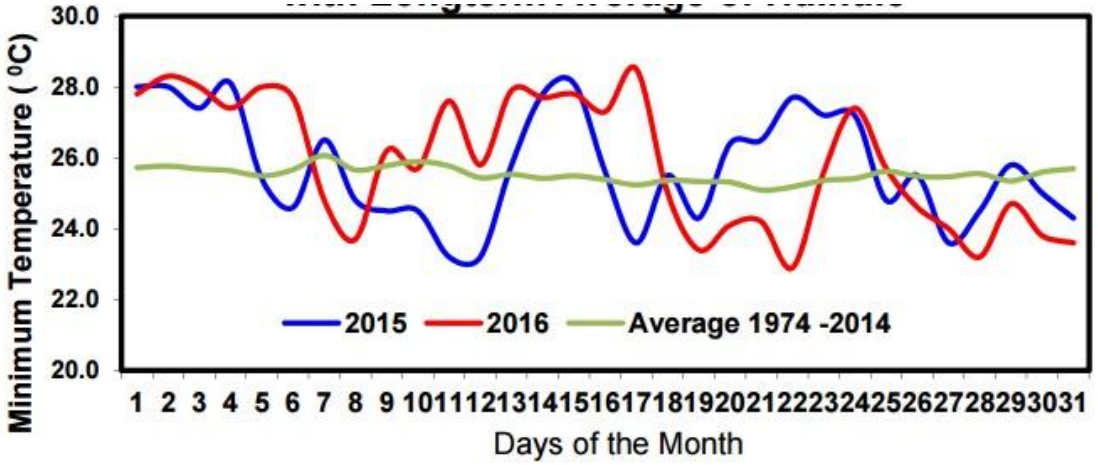


Figure 21: Comparison of August minimum temperature with long term average of Hulhule (Source: Maldives Meteorological Service, 2016)

The highest temperature recorded in Male' region last year was on April 2015. The temperature recorded was 32.2 degree Celsius. The minimum temperature recorded in this region last year was on September 2015. The temperature recorded was 25.6 degree Celsius. Figure below shows the monthly maximum, minimum and mean temperature for the year 2015. Data was obtained from Maldives Meteorological Service.

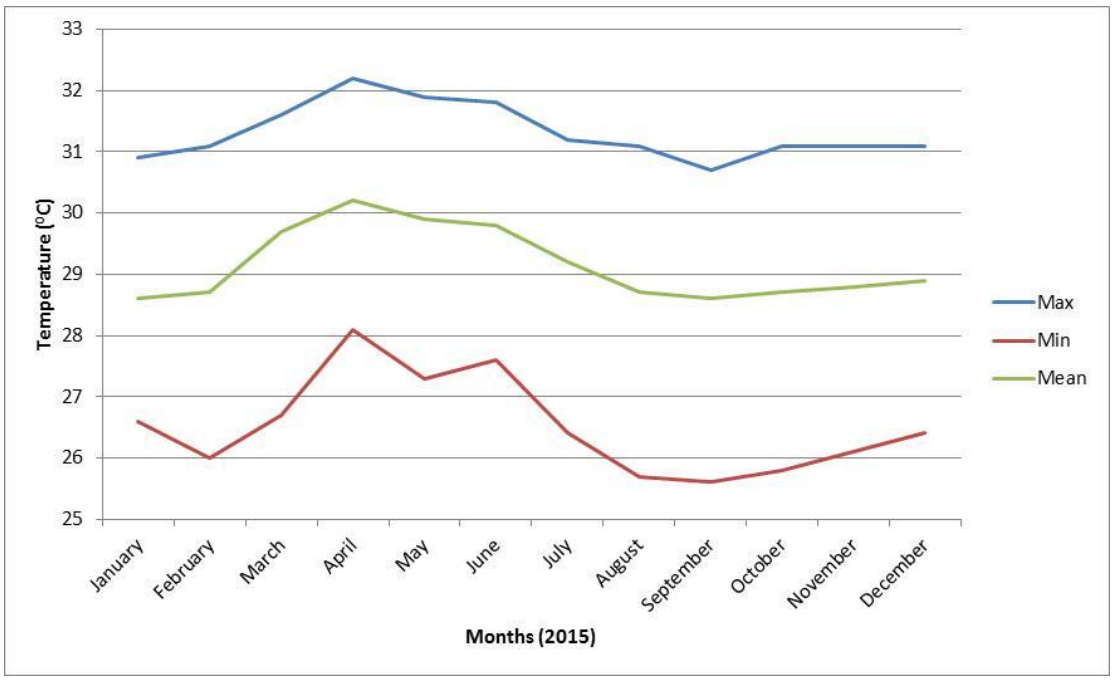


Figure 22: Temperature patterns for Male' region in 2015

10.7.2 Rainfall

According to the latest monthly weather reports from Maldives Meteorological Service released on 5th August 2016, central part of the country received a total rainfall of 310mm during last month (August 2016). However, the rainfall received in August 2016 is less compared to August 2015 (397mm). Figure below shows the daily average rainfall for the month of August for central part of Maldives (2015 and 2016) and average 1975-2014.

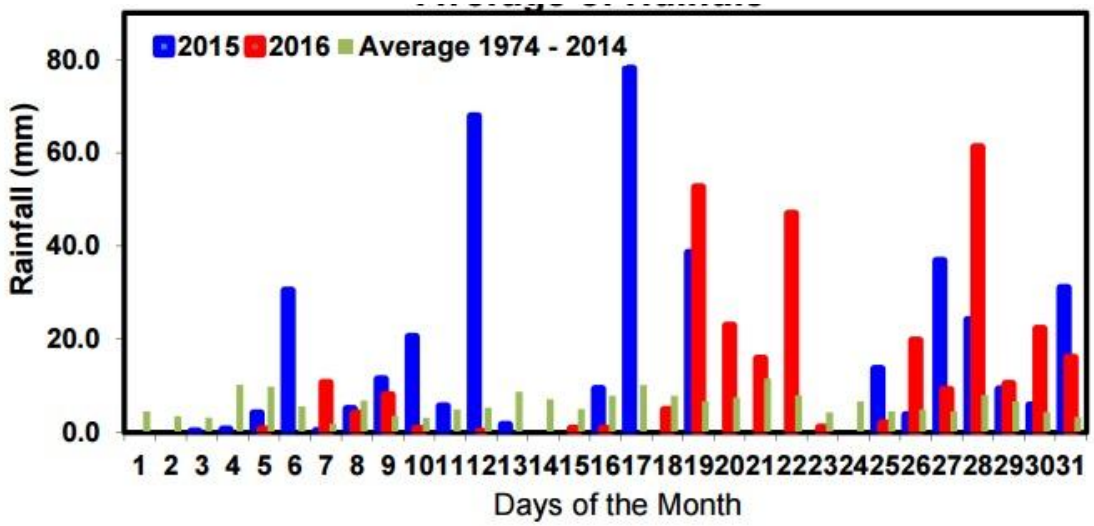


Figure 23: Comparison of August rainfall with long term average of Hulhule (Source: Maldives Meteorological Service, 2016)

Last year, for Male' region the highest rainfall recorded is 397.5mm during August and lowest rainfall recorded is 0mm during January 2015. Figure below shows

the rainfall patterns throughout last year. Data was obtained from Maldives Meteorological Service.

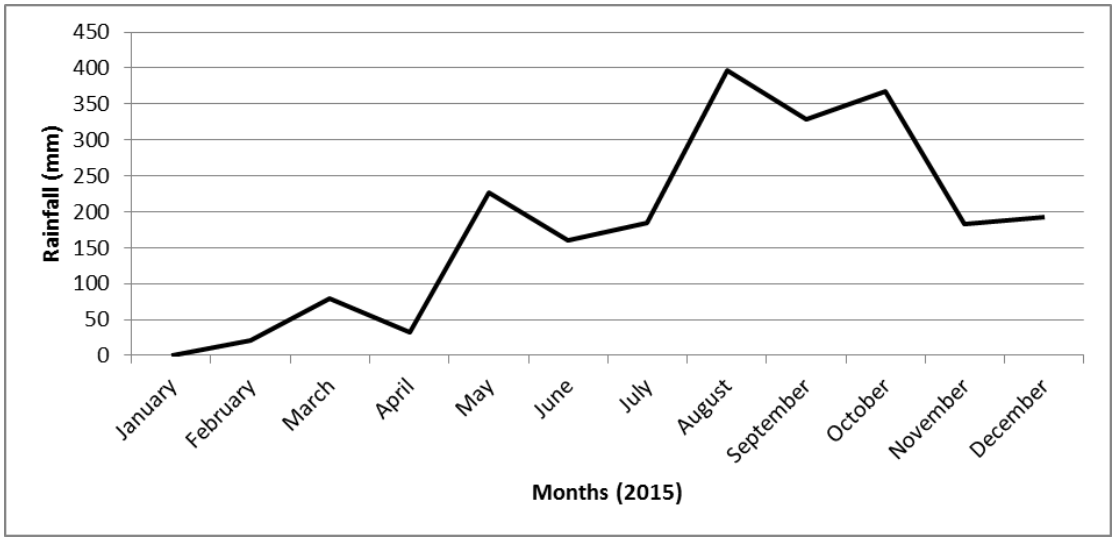


Figure 24: Rainfall patterns for Male' region in 2015

10.7.3 Wind

According to the latest monthly weather reports from Maldives Meteorological Service released on 5th August 2016, the maximum wind speed central part of Maldives experienced during the last month was 46 mph westerly wind. This is higher than the same month last year. Figure below shows the wind data for the month of August for central part of Maldives (2015 and 2016) and average 1975-2014.

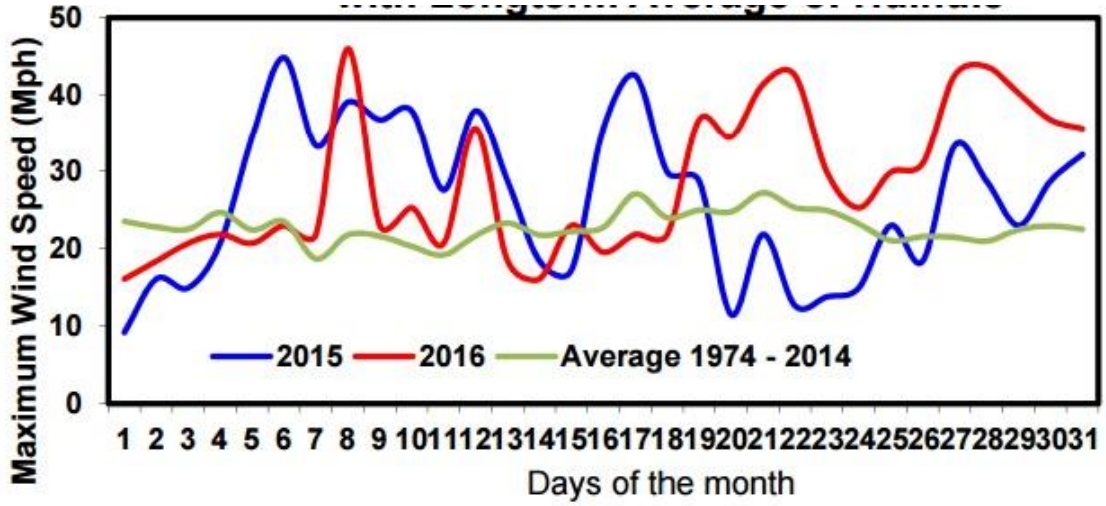


Figure 25: Comparison of August maximum wind speed with long term average of Hulhule (Source: Maldives Meteorological Service, 2016)

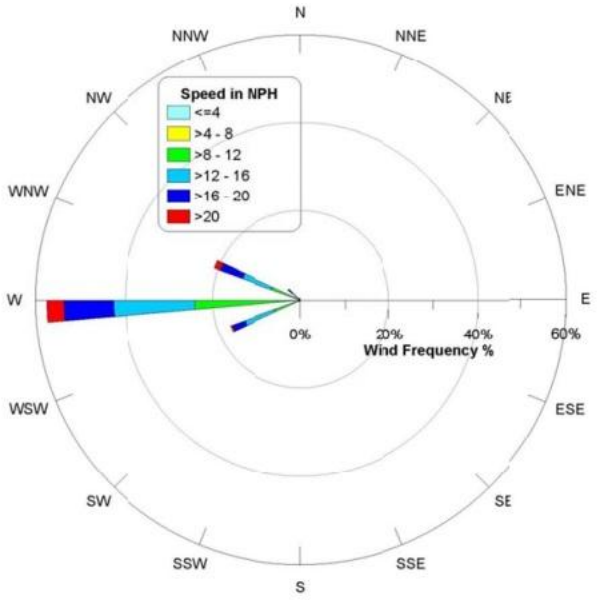


Figure 26: Wind rose diagram of Hulhule for August 2016 (Source: Maldives Meteorological Service, 2016)

Table 6: Wind data for Male' region in 2015

Month/ Year	Wind (kts)			
	Mean		Maximum	
	Dir	Speed	Dir	Speed
Jan-15	ENE	10	ENE	26
Feb-15	ENE	10	ENE	33
Mar-15	ENE	6	NE	27
Apr-15	W	5	W	25
May-15	WSW	11	W	35
Jun-15	WSW	9	W	40
Jul-15	W	9	W	46
Aug-15	W	9	W	39
Sep-15	W	10	W	39
Oct-15	SSW	6	W	30
Nov-15	W	7	NNW	32
Dec-15	NE	8	ENE	30

10.7.4 Waves

It was not possible to obtain site specific data on wave conditions due to lack of time. Studies conducted elsewhere in the Maldives have been considered as a general guide to wave conditions at Gulhifalhu.

Two major types of waves have been reported on the coasts of the Maldives: wave generated by local monsoon wind and swells generated by distance storms. The local monsoon predominantly generates wind waves which are typically strongest during April-July in the south-west monsoon period. During this season, swells generated north of the equator with heights of 2-3 m with periods of 18-20 seconds have been reported in the region. Local wave periods are generally in the range 2-4 seconds and are easily distinguished from the swell waves.

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

In addition, Maldives have been subject to earthquake generated tsunami reaching heights of 4.0m on land (UNEP, 2005). Historical wave data from Indian Ocean countries show that tsunamis have occurred in more than 1 occasion, most notable been the 1883 tsunami resulting from the volcanic explosion of Krakatoa(Choi and others, 2003).

10.7.5 Tides

Tide affects wave conditions, wave generated and other reef-top currents. Tide levels are believed to be significant in controlling amount of wave energy reaching the island, as no wave energy crosses the edge of the reef at low tide under normal conditions. In the Maldives where the tidal range is small (1m), tides may have significantly important influence on the formation, development and sediment movement process around the island tides also may play an important role in lagoon flushing, water circulation within the reef and water residence time within an enclosed reef highly depends on tidal fluctuations.

Tide data is important information in any coastal development project as it determines the elevation of the structures relative to a datum. A permanent tidal record station has been established at Ibrahim International Airport by Maldives Meteorological Service. The maximum tidal range recorded at this tide station is 1.2m. The highest astronomical tide level is +0.64m (MSL) and lowest astronomical tide level is -0.56m MSL). The following table gives a summary of the tide levels for the tide datum has been widely used in Maldives.

Table 7: Summary of the Tide Levels Hulhule Island, Male Atoll

Tide Level	**Water level referred to Mean Sea Level (MSL) (m)**
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
Mean Higher Low Water (MHLW)	-0.16
Mean Lower Low Water (MLLW)	-0.36
Lowest Astronomical Tide (LAT)	-0.56

10.7.6 Risk of storm surges and flood

The primary sources of natural hazard risks in Maldives are strong winds during monsoons or freak storms, earthquakes, island interior flooding caused by heavy rain, coastal flooding caused by high surf, storm surge, prolonged strong monsoonal wind, high astronomical tides or tsunamis, and sea level rise. Coastal flooding related flooding and wind damage can be considered as the most frequent natural hazards that occur in Maldives (see Maniku (1990), Luthfy(1994)). Most of these risk factors (apart from earthquake, wind damage and rainfall flooding), stems from the extremely low elevation of all Maldivian islands: the average elevation is 1.5 meters above sea level. In spite of the occasional natural hazards, Maldives in general is relatively from high risk natural disasters.

Spatial variations in hazards are evident across Maldives (Maniku, 1990). Northern atolls are more exposed to intense storm systems, increasing the risk of wind damage in these atolls. In comparison, southern atolls experience less storms systems, but are more exposed to flooding events, probably as a result of exposure to intense South Indian Ocean storm surges and wind-waves during south west monsoons. Southern atolls are also more likely to experience earthquakes.

11 Environmental Impacts

11.1 Assessing and identification of Impact

Environmental Impact identification has been undertaken by considering the proposed activities and examining the level of impact the proposed development will have on the environment. Each activity was then examined in detail to identify the construction methods, technology and other factors that would determine the potential impact of the various activities. The following methods were used to identify the

- Impacts of this project.
- Impact Identification Matrix (refer to the matrix)
- Expert judgment. This method relied on experience gained from similar projects in Maldives.

11.2 Impact identification matrix

This matrix was designed to help provide an assessment and screening of the potential environmental impacts of this project. The matrix considered 17 potential environmental factors. Indicators are listed for each factor and these are used as a weighing scale. The project components are then assessed against each factor, scoring them on a scale of 1 to 10. This tool was thus utilized to help provide an assessment and screening of the potential environmental impacts of this project. The matrix will identify the impact types. Once the impact types are determined, the matrix is then used to assess the impact significance together with the network diagramme and expert judgment.

This matrix contains:

- An impact assessment matrix which lists all of the 17 environmental factors and allows, for each one, to provide a score (1-10) and any additional comments. Each factor considers several sub categories (not indicated in the following matrix), depending on the project type and a total score is derived by averaging the individual scores.

- A summary of scores for each factors and the impact type, negative, positive or neutral.

All types of projects that are listed in the EIA Regulation of 2012 can be assessed using this tool. The following table outlines the impact assessment matrix and the scores for the 17 categories derived for this project.

Table 8: Impact assessment matrix for the project

		Impacts		
	Total score	**Negative (1-3)**	**Neutral (4 -7)**	**Positive (8 -10)**
Air pollution	4.00		x	
Waste	4.00		x	
Water pollution	3.00	x		
Noise/Vibration	5.00		x	
Amenity	5.00		x	
Ground water conservation	5.00		x	
Energy	5.00		x	
Energy efficiency	5.00		x	
Access to quality green space	5.00		x	
Flooding	9.00		x	
Transport	5.00			x
Biodiversity	1.00	x		
Local environmental quality	4.00		x	
Resource depletion	5.00		x	
Health gain	5.00		x	
Employment	7.00		x	

Scale Score 1-3, Negative Environmental Impact

Scale Score 4-7; Neutral Environmental Impact

Scale Score 8-10; Positive Environmental Impact

11.3 Magnitude of impacts

Environmental impacts of the proposed work have been examined through the above mentioned two processes and the results are outlined in the following pages. By using the impact assessment matrix as a tool, the magnitude of the impacts can be assessed as outlined in the following table.

Table 9: Impact magnitudes and their corresponding scores

	Scores based on the impact assessment matrix									
	< Negative Impacts >			< Neutral Impacts >				< Positive Impacts >*		
	1	2	3	4	5	6	7	8	9	10
Magnitude of impacts.	Major adverse	2, Minor adverse 3, Moderate adverse		4 &5 Minor, 6 & 7 Negligible				Good	Very good	Excellent

This EIA identifies and quantifies the significance of impacts on the environment from the proposed project. Impacts on the environment were identified and described according to their location/attribute, extent (magnitude) and characteristics (such as short-term or long term, direct or indirect, reversible or irreversible) and assessed in terms of their significance according to the following categories:

- Negligible – the impact is too small to be of any significance;
- Minor– the impact is minor;
- Minor adverse – the impact is undesirable but accepted;
- Moderate adverse – the impact give rise to some concern but is likely to be tolerable in short-term (e.g. construction phase) or will require a value judgment as to its acceptability;
- Major adverse – the impact is large scale giving rise to great concern; it should be considered unacceptable and requires significant change or halting of the project.

Positive – the impact is likely to bring a positive change in the sense that it is aimed at further minimizing the impacts as a result of the proposed actions.

11.4 Uncertainties in Impact Prediction

Environmental impact prediction involves a certain degree of uncertainty as the natural and anthropogenic impacts can vary from place to place due to even slight differences in ecological, geomorphologic or social conditions in a particular place. There is also limited data and information regarding the particular site under consideration, which makes it difficult to predict impacts.

However, the level of uncertainty, in the case of this project at Gulhifalhu is expected to be low as such works on a larger scale have been undertaken in Gulhifalhu previously.

Despite this, in the marine environment, there is a higher degree of uncertainty as the marine environment is more sensitive in extreme cases such as severe weather conditions. The proposed project area is the east side lagoon with very less or zero percentages of live corals in the project area. However, few live coral patches are found in deep lagoon area. The proposed dredging will therefore have impacts on the overall health of the corals in close vicinity of the project site. However, in terms of coral damage, the project site is expected to have no or low impact. Dredging works will completely destroy and alter the lagoon bottom in the target zone as well as cause indirect impacts through sedimentation.

Dredging activities are developments that had been undertaken in other parts of the Maldives and their impacts are well known and have been well documented. Therefore, there is very little uncertainty involved in this project. It is certain that dredging of even a small area in the lagoon will cause significant amounts of sedimentation, even after taking the appropriate mitigation measures.

The following matrix outlines the impacts and mitigation measures and their significance.

The following tables outlines the impacts and mitigation measures proposed as well as the matrix of impacts and their characterization. Reference to the matrix was derived from (Hoepner, 1999).

Sand dredging at Gulhifalhu Jetty Area

N
W E
S

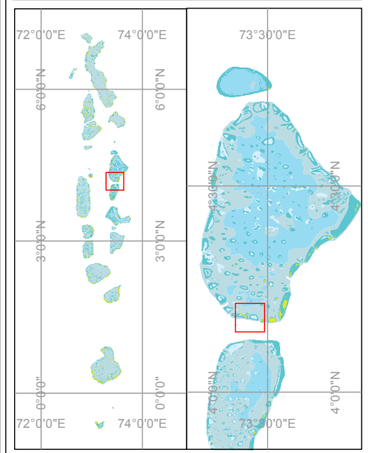
4°11'0"N
73°27'15"E
73°27'30"E
328796
462415
4°10'45"N

Direct impact zone

Indirect impact zone

Legend

- Quaywall
- Revetment
- Mean Tide



Geodetic Parameters

Coordinate Systems :Universal Transverse Mercator (UTM) Zone: 43 North
Projection :Transverse Mercator (TM)
Datum : WGS 1984
Longitude of Origin :0.000000000
Central Meridian:75 W
Scale Factor :0.999600000000000040
False Easting :500000.000
False Northing :0.00000000
Semi-Major Axis (a) (Meters): 6378137.000
Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale:
0 10 20 40 60 80 Meters

Project:
Sand dredging at Gulhifalhu Jetty Area

Client:
Gulhifalhu Investment Ltd

Contractor:

Water Solutions Pvt Ltd
Ma.Fas Eri 1st Floor, Ameenee Magu, Male', Maldives
Tel: +(960)334164, Fax: +(960)331643
www.water-solutions.biz

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11.5 Impacts on the Environment and their mitigation measures

Activity	Potential Impacts	Mitigation measures	Cost of Mitigation
Energy generation	Energy for dredging works Use of energy for construction activities has an indirect negative impact on the environment through consumption of fuel.	Energy generation will be controlled and monitored. Contractor will be required to use the power from the site grid to avoid separate generator sets specifically for this project, which will increase emission of greenhouse gases as much as possible and in practical situations where it can be used.	Cost included in the project
Site mobilization	Some of the project impacts will be felt through mobilization works. No land clearing will be required and there will not be any need for the construction of large-scale temporary structures.	1. If additional machinery is to be mobilized, mobilize only the required materials. 2. Only required workforce and machinery to be mobilized to the site. 3. Designate one location to store fuel, machinery and other construction related materials. 4. Contractor should share the project schedule with Gulhifalhu Investment.	No cost, but the contractor will be required to follow proper protocols.
Impact of the temporary workforce	During the construction stage, the increase number of workforce and their behavior could have significant impact on the environment. It is not expected that any damage would be caused by workers fishing or walking on the lagoon, as the environment does not encourage such behavior. Improper and indiscriminately dumping solid waste to sea can impact the marine environment, such as throwing garbage, plastics etc.	Appropriate signs will be placed to keep the site clean. Fines and discharges for not obeying the environment protection rules. Workers will be briefed about proper disposal of litter and avoid damaging the surrounding environment.	Cost included in the project

Activity	Potential Impacts	Mitigation measures	Cost of Mitigation
Noise and air pollution	Noise impacts will be localized and will affect the areas that are close to the Jetty Area. In addition, the movement of machinery and construction materials on the site will generate high level of noise.	Noise may be expected to be a concern due to the intermittent nature of noise sources such as excavators and other construction heavy vehicles. However construction workers, who are prone to high noise levels such as machinery operators, will be provided with proper personal protection equipment's (PPE) such as ear muffs.	No cost
Dredging	<u>Sedimentation</u> Dredging on lagoon will permanently alter the seabed and disperse sediment plumes to the lagoon and reef area in the target area. This is an inevitable result of dredging component of the project. Corals can tolerate sedimentation to a certain extent. However, coral growth and recruitment will be affected in the moderate term. Prolonged exposure will eventually lead to death of the corals. The impacts of excessive sedimentation on corals include; • Direct physical impacts like smothering of corals and other benthic organisms, • Reduced light penetration reducing the productivity and growth, calcification and reproduction rates of corals. • Formation of false bottoms characterized by shifting of sediments. • Eutrophication due to increased fine sediments leading to algal blooms. • Formation of anoxic (black) bottoms under the fine sediments. Impact of project activities on live corals in this project is expected to be low as the dredging is done on a sandy lagoon where there are no live corals. The	The following mitigations measures are proposed 1. Proper timing of dredging works, most importantly the dredging to be carried during low tide. 2. Dredging works should be carried in the lowest time frame possible. 3. Limiting the dredge area to exactly what is proposed.	Cost included in the project. Contractor to follow the mitigation measures, including bund wall and silt curtain.

Activity	Potential Impacts	Mitigation measures	Cost of Mitigation
	project site is also enclosed with the reclaimed land. However, coral colonies on the deep lagoon may impact from sedimentation.		
Dredging / groyne construction	Impact on hydrodynamics When areas of the lagoon are dredged, there will be a huge impact on near-shore current and wave patterns, as well as bottom hydrodynamics. This can lead to. • Erosion of shoreline at the low energy areas during either monsoons. (In the case of Gulhifalhu, erosion will not be a significant problem as the large area of the shoreline is modified with revetments) • Sedimentation and turbidity resulting in poor water quality which negatively impacts vitality of marine organisms. • Alteration of bottom substrate topography. • Degradation of sea water quality due to turbidity. • Continual re-suspension of dredged sediments leading to sedimentation and formation of dredge silts. • Degradation of sea water quality due to alteration to littoral sediment transport regime causing turbidity. Construction of a groyne will alter the existing sand movement along the shoreline.	There are not many options that can be undertaken to reverse effects of dredging on hydrodynamic regime. However the following mitigation measures will help and will be undertaken. 1. Undertake work in low tide hours. 2. Avoid work during bad weather. 3. Educate the workers and create awareness about good waste management and responsible behavior with regard to environmental care.	Cost included in the project.
Dredging / groyne construction	Habitat loss Dredging and groyne will lead to direct loss of habitat for corals and marine organisms in the target area. The habitat will be modified permanently. Direct habitat loss to corals is nil as the percentage of live corals in the dredging area is almost nil.	1. Only the required area is to be dredged in order to limit the direct impact foot print. 2. Designate one location to load and unload goods, materials and machinery rather than using a large area.	No cost. Mitigation measures are procedural in nature.

Activity	Potential Impacts	Mitigation measures	Cost of Mitigation
Dredging/groyne construction	<u>Deterioration of marine environment and water quality</u> Transportation of equipment, heavy machinery, people and sand for the site and materials all require transportation processes which increases the following risks; • Accidental spillage of sand. • Accidental oil and other chemical spills, including oil leaks from vehicles etc. • Pollution of the lagoon and reef system can be caused by waterborne and windblown debris escaping from the site as well as accidental oil/chemical spills. Waste and residue arising from the project activities can also affect the marine environment. These can include hazardous waste such as used filters, empty lube-oil cans and oil filters as well as various solid wastes arising from humans and construction activities. Re-suspension of fine sediments and dispersal of sediments induced by erosion of fill area can lead to turbidity and deterioration of water quality in the immediate vicinity of the project site.	1. Undertake work in low tide hours. 2. Avoid work during bad weather. 3. Educate the workers and create awareness about good waste management and responsible behavior with regard to environmental care.	No cost
Dredging works	<u>Material Handling</u> Materials such as fuel for excavators and trucks have the potential to damage to the marine environment. Since fuelling is required for the machinery, spillage would be a possibility. Therefore, appropriate care has to be taken in handling fuel. Fueling will be required during fill process for excavators, loaders and other machinery.	1. Fuel will be handled with care at all times 2. No waste fuel will be disposed into the marine environment. 3. Designate a separate area for fueling. 4. Fuel handling area will be kept free from spills and every effort must be made to minimize spills. 5. Fuel handling area to have a hard impervious floor surface. 6. All fuel storage and fueling to be undertaken in the same location. 7. Designate a separate person to manage fueling and refueling as well as maintain the fueling area to ensure that	No additional cost

Activity	Potential Impacts	Mitigation measures	Cost of Mitigation
		unnecessary spillages do not take place.	
Waste management	This can be detrimental to the marine and the terrestrial environment if they are not managed properly. Solid waste generated during the construction stage will include organic, inorganic and hazardous materials and all of which require adequate disposal.	Work force will be provided with RO water for drinking thereby reducing the need for mineral water and hence reducing the impact of plastic bottles and their management and disposal. Furthermore, workforce will be based in Gulhifalhu site which is very near to Thilafushi and therefore waste generation at construction site will be transported to Thilafusi waste disposal site regularly.	
Socioeconomic impact	Dredging of a jetty basin will make the basin more accessible and safe to vessels.		

Table 10: Matrix of specific impacts and their characterization

Impact indicator	Impact type (NEG or POS) +	Significant (H/M/L)*	Direct	Indirect	Maginitude # (N/M/MA/ MoA/MaA)	Short term	Long term	Unavoidable	Reversible	Irreversible	Cumulative	Mitigation Required
Environmental Impacts												
Energy for dredging works	Neg	L	X	X	N	X		X			X	X
Site mobilization	Neg	L	X		M			X	X			X
Impact of the temporary workforce	Neg	L	X	X	N	X		X				X
Noise and air pollution	Neg	L		X	N	X		X				X
Sedimentation of the lagoon and the coral reef	Neg	H	X		MaA	X		X	X			X
Changes to the hydrodynamic regime	Neg	H	X		MaA		X			X	X	X
Habitat loss	Neg	H	X		MaA		X			X	X	X
Deterioration of marine environment and water quality	Neg	H	X		MA		X			X	X	X
Impact of Material Handling	Neg	L	X		MA		X			X		X
Impact of solid waste	Neg	L		X	M			X	X			X
Socio-economic Impacts	POS	H	x				x					

+ POS = positive impacts, NEG= negative impacts
* H=high, M=Moderate, L=Low
# N=Negligible, M=Minor, MA=Minor Adverse; MoA= Moderate adverse; MaA=Major Adverse
# N=Negligible, M=Minor, MA=Minor Adverse; MoA= Moderate adverse; MaA=Major Adverse

12 Stakeholder Consultations

For the purpose of this project, stakeholder consultations were limited to the following groups. Methodology for undertaking these discussions was through meetings and discussions.

12.1 Consultation with Ministry of Housing and Infrastructure

As part of the consultations, Ministry of Housing and Infrastructure (MHI) was consulted. Representatives from MHI, proponent and consultant were present at the meeting. Proponent shared project information with MHI. Following are summary of the discussion points.

- Development of Gulhifalhu is now under the mandate of Gulhifalhu Investment Private Limited
- Ministry of Housing and Infrastructure has no objection or issue regarding the proposed project.
- Since the preparation of master plan to reclaim Gulhifalhu is ongoing, MHI requested Gulhifalhu Investment to share any reclamation project information with them as soon as it is finalized to align the project with other MHI projects in the region to avoid any issues or problem.
- Gulhifalhu Investment assured that any future reclamation of Gulhifalhu will be well discussed with MHI before the project starts. Gulhifalhu Investment is planning to reclaim Gulhifalhu once the 5 year master plan is completed. They forecast reclamation will start in next 2 or 3 years.

12.2 Consultation with Proponent

As part of the consultation, Gulhifalhu Investment was consulted. Following are the points discussed during the meeting.

- According to proponent, project implementation will start as soon as the EIA is approved
- Land plots from Gulhifalhu are leased to many private companies and they have complained that there is no enough space on the jetty area to operate their vessels.

- Currently the jetty area is very shallow and there is only a very small space with enough depth to operate vessels.
- It has been 4-5 years since this area is last dredged. It takes usually very longtime to fill the jetty area basin as it is now.
- Gulhifalhu Investment feels that dredging this area is not a permanent solution but something that they have to do at the moment to provide enough space and safety to vessels using Gulhifalhu.
- Gulhifalhu Investment feels that future reclamation of Gulhifalhu will solve this problem permanently.
- Preparation of 5 year master plan is ongoing at the moment which includes reclamation of Gulhifalhu shallow lagoon area. It is estimated that reclamation project will come to effect in 2-3 years.

12.3 Consultation with MRDC

As part of the stakeholder consultation, MRDC was consulted through a meeting held at MRDC office. Below are the main discussion points.

- MRDC will be dredging the sand from Gulhifalhu jetty area
- Excavators and sand pumps will be used to excavate sand from the project site
- Sand dredged will be stockpiled temporarily near the jetty area of Gulhifalhu
- Sand stockpiling will be done in an empty space nearest possible to jetty to avoid inland transportation.
- Sand piles will be later transported in bulk to Thilafushi MRDC site on barges. Existing ramp of the jetty will be used to land barge.

12.4 List of people consulted from the island council

A list of people consulted as part of the stakeholder consultations is attached below.

Name	Title	Organisation	Contact
Abdulla Fazeel	MD	Gulhifalhu Investment Limited	7774577
Khadeeja Neena	GM / CS	Gulhifalhu Investment Limited	9997441
Ibrahim AR. Haleem	MD	MRDC	7785882
Amir Musthafa	Engineer	MHI	7981711
Nafha Aujaz	Env. Analyst	MHI	7721554
Anoosha Hashim	Asst. Project Officer	MHI	3004327
Yamin Abdul Wahhab	Asst. Manager	MRDC	9108899
Mohamed Shauya	Surveyor	MRDC	7993499
Ibrahim Abdulla	Senior Production Officer	MRDC	7535353
Ali Mohamed	Financial Controller	Gulhifalhu Investment Limited	7940302
Areen Ahmed	Asst. General Manager	Gulhifalhu Investment Limited	7779598
Hussain Waheed	Procurement Manager	MRDC	7465059

13 Alternatives

EIA Regulation requires alternatives to be suggested for such projects and therefore two alternatives have been suggested in addition to the no project alternative. These alternatives are discussed below:

13.1 No Project Option

The no project option considers the following.

1. No dredging will be done on Gulhifalhu Jetty Area
2. Accessibility to Gulhifalhu remain as it is .
3. Less cost to the proponent.
4. No further damage to the lagoon from dredging works.

The following table outlines the advantages and disadvantages of the no project option.

Table 11: Advantages and disadvantages of the no project option

Strategy	Advantages	Disadvantages
No dredging	Environmental damage related can be avoided. No capital costs to the proponent, short term benefit. No direct and indirect effects on the lagoon through sedimentation.	Accessibility problems will continue. Vessels have to wait in line or use another jetty to get access to Gulhifalhu. Laoding and unloading of goods and other materials will be difficult.

13.2 Machinery Alternative (A1)

There are few machinery alternatives available to remove sands from the jetty area. These are using excavators, dredger, sand pump and manual method using spades. Manual method is not practical in case of this project as the area needs to be deepened upto-3m during mean tide and it will take very long time to manually dredge an area. Using a dredger is also not the best option for this project as this project involves only small scale maintenance dredging. Therefore feasible machinery options for this project are to use either an excavator or to use a sand pump.

13.3 Construction of a groyne to avoid sand filling into jetty basin (A2)

Construction of a groyne on south side of the jetty area is an option to avoid sand depositing into the jetty basin. According to the site supervisor sand accumulation started after the reclamation of the south end of Gulhifalhu. This area has been reclaimed and left without any shore protection. Sand from this area is now accumulating on the east side of Gulhifalhu creating a beach outside the Geobag revetment on the east side. Some of this sand is filling the jetty basin. According to the site supervisor and Gulhifalhu Investment, the sand accumulation at the jetty basin is a very slow process and it took almost 4 years to fill the jetty basin to the level it is now.

Construction of a groyne to stop sand movement is an alternative temporary solution to avoid basin filling. However, construction of a groyne on the jetty area was not considered by the proponent as there is a reclamation project planned to reclaim the shallow lagoon area of whole Gulhifalhu. The reclamation project will provide a more permanent solution to the jetty area.

Figure 27: Alternative concept (A2): Construction of a groyne could provide temporary solution to basin filling problem

13.4 Alternative Analysis Matrix

For this project, an alternative analysis was carried out on the basis of various biophysical and socioeconomic parameters including:

- Technical feasibility,
- Economic viability and
- Environmental acceptability of the project and
- Social benefits

Based on the above four factors, an alternative analysis matrix was developed with scores given for each factor from 1 to 5. This analysis provides information about the advantages and disadvantages of each alternative considered with regard to its technical, economic and environmental factors. The purpose of this matrix is to obtain a favourable implementation of alternatives proposed by considering alternatives in terms of site selection, design and operational methods, the project scale and timing of project. The total for all factors gives an overall score for a given alternative. The highest total score provides the most desirable and preferred alternatives and vice versa.

The following table outlines the various alternatives proposed for this project, their economic, technical, environmental as well as social factors taken in to consideration.

Table 12: Alternative analysis matrix for the project

No.	Alternatives proposed	Technical feasibility	Economic viability	Environmentally acceptable	Social benefits
Alternative materials for the revetment					
A1	Alternative machinery	Using alternative machinery than excavator and sand pump maybe technically feasible but will be more challenging compare to proposed method.	The cost of using a dredger will be high compared to sand pump or excavator	As far as the environmental damage footprint is concerned, it is equally as damaging as using the proposed method. However, using large dredgers in this area may create more sedimentation	Socially no concerns as long as the basin is deepen
A2	Alternative design – construction of a groyne	Technically this is feasible, but construction of a long groyne could be challenging as the deep lagoon area is very close to beach with a very steep slope and has a depth of more than 8m.	Construction of a groyne will be an additional component, and the cost of the project will go higher.	As far as the environmental damage footprint is concerned, damage will be more as the scale of the project increase.	A groyne will protect the basin from filling or atleast slowdown the filling process meaning jetty users will have a safe basin.

13.5 Alternative analysis score

The following table outlines the results of the alternative analysis scores calculated for this project. The scores are given from 1 to 5, 1 being the least and 5 the most desirable.

Table 13: Alterative evaluation scores

No	Alternatives proposed	Technical feasibility	Economic viability	Environmentally acceptable	Social benefits	Total scores
A0	Proposed project	5	5	3	3	16
A1	Machinery alternative	3	2	2	3	11
A2	Groyne	4	4	2	5	15

Based on the analysis, proposed project and alternatives 2 are feasible and scored similar marks.

13.6 Preferred Alternative

The preferred method and design for this project is to implement the project as proposed. Proponent is also planning to construct a groyne at the end of the dredging project to avoid sand filling the basin in future.

13.6.1 Mitigation Measures for the Preferred Alternative

The following mitigation measures are proposed for the preferred alternative.

1. Good construction practice and ensuring that the construction works are done in accordance to measures proposed in this report.
2. Dredging to be done during low tides.
3. Appropriate sediment control measures outlined in the impacts and mitigation section

For further details for mitigation measures, refer to the impact and mitigation measure table of this report.

14 Environmental Management and Monitoring Plan

14.1 Introduction

Environmental monitoring is essential to ensure that potential impacts are minimized and to mitigate unanticipated impacts. Monitoring will be carried out as part of the environmental impact assessment and monitoring requirements addressed in this EIA report.

14.2 Cost of Monitoring

The proponent has committed fully for the monitoring programme outlined in this report. The total cost of undertaking the regular monitoring is estimated in the following table. Cost of monitoring includes all data collection and reporting to the client and to the relevant government agencies.

14.3 Duration of Monitoring

Monitoring will include marine and coastal aspects. The proposed scheduled for monitoring has been prepared for 6 months during the construction period as well as for 1 year following the completion of the project. Monitoring will be undertaken by subcontracting the work to an independent consultant or a consulting firm.

Table 14: Summary of Monitoring durations and report numbers

	Duration in Months	Frequency of monitoring report	No of monitoring reports
Monitoring during construction period	6	Every 2 months	3
Monitoring after the construction period for 1 year	12	Every 6 months	2

14.4 Methods of Monitoring

Environmental monitoring will be undertaken using standard methods described in the Methodology section (refer to annex for details). Monitoring is recommended for marine and coastal environment only.

14.5 Monitoring Responsibility

Monitoring responsibility will be with the client and financial provisions will be made in the project to undertake the monitoring.

14.6 Monitoring Report

A detailed monitoring report should be compiled after the completion of the civil works. During the construction period, summary monitoring reports must be

provided every two months and final report should be provided at the end of the construction stage and should adhere to EIA Regulations, 2012. During the operational stage (after the completion of the project), regular monitoring reports should be provided in six months for a year. This report will be submitted to the relevant government agencies for compliance. The report will include details of the site, data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed.

The following table outlines the monitoring schedule proposed during both construction and after the completion of the works.

Table 15: Schedule for environmental monitoring for the first 8 months of the construction period as well as during operation period

Monitoring Attribute	Indicator	Methodology	Monitoring Frequency		Cost during (construction phase)	Cost during (operational phase)
			Construction stage	Operational stage		
Marine environment						
Visual water quality	Visibility of water	Through visual inspections and logs to be kept on site.	Every other day during work.	-	No cost. Contractor to keep the logs on site.	
Marine water quality at survey site	Physical appearance, turbidity, pH, Suspended Solids.	Onsite or Lab analysis	Every two months during construction period.	Every three months for the first year and then yearly for the next 2 years.	$500.00	$150.00
Live Coral cover at survey sites 1 and 4	Percentage live cover	Qualitative & Quantitative	-	Every 6 months		$3,500.00
Diversity and abundance of fish communities at sites 1, and 4	Number / percentage of selected fish	Qualitative & Quantitative	-	Every 6 months		$1,500.00
Coastal Environment						
Current	Near shore currents.	Drogue on project area	Every two months	Every two months for the first year and then yearly for the next 2 years.	$300.00	$200.00

Table 16: Schedule for submission of monitoring report

	Construction period (Months)							**Operational years for 2 years (months)**			
Constriction period	1	2	3	4	5	6		3	6	9	12
Summary monitoring report 1											
Summary monitoring report 2											
Final monitoring report											
Operational stage											
Monitoring report 1											
Monitoring report 2											

15 Conclusion

This EIA report has identified the main impacts of the proposed dredging works in Gulhifalhu jetty area. It has been assessed that the project will have its main negative impact on marine environment.

Gulhifalhu jetty is a busy mooring area for the vessels coming to access leased industrial plots of Gulhifalhu. The project involves dredging of Gulhifalhu jetty area. Approximately 9000 cbm sand will dredged from this area when the basin is deepened to -3m during mean sea level. It is proposed to use excavators or sand pump to deepen the basin.

As mentioned earlier, major impacts of this projects will be felt on the marine environment. Sedimentation caused dredging will be the most serious impact as it will impact other areas than the project area. Therefore as mitigation measures need to be undertaken for dredging works to minimize the sediments dispersing to a larger area.

During the construction phase and operational phase regular monitoring should be undertaken as highlighted in the report. Proponent is responsible to conduct the monitoring as proposed in the report.

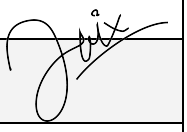
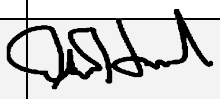
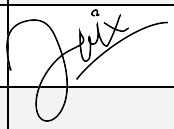
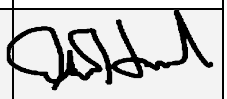
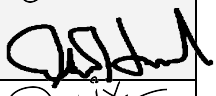
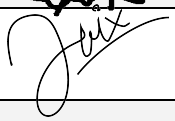
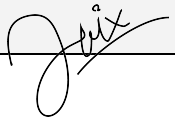
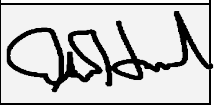
This project will have unavoidable environmental impacts on the marine environment of Gulhifalhu, especially near the project area. In addition to this, if the mitigation measures proposed are not implemented, the project may impact the nearby reefs. However it is justifiable to implement this project in the area proposed.

16 Recommendations

Following are some of the recommendations based on this EIA assessment. Recommendation:

- The contractor needs to control the sediment plume to a minimum area during the dredging work. The dredging plume shall not be visible for more than 1 km radius of the dredging site. The turbidity inside 1 km radius of the dredging site shall not exceed 100% of the background turbidity level. Monitoring mechanism need to be established by the contractor to monitor the turbidity level.
- Controlling sedimentation: The contractor needs to control the sedimentation as such that it has the least impacts on nearby coral reefs. Hence, dredging should be done in low tide hours and should be completed within the shortest time frame possible. Dredging should not be dne in bad weathers.
- Environmental monitoring is essential to ensure that potential impacts are minimized and to mitigate unanticipated impacts. It is recommended that environmental monitoring to be carried by the contractor to monitor the impact of sedimentation at the dredging location. The monitoring program needs to be implemented by the contractor during the implementation of the project. It is recommended that this activity would be carried out as per the proponent's committed for this development. Some of the monitoring works can be easily undertaken by the contractor, such as visual inspection and keeping logs of water clarity during the works. This has also been included in the monitoring program.

17 People who have assisted in the preparation of this report

Chapter	Page number	People who assisted in data collection and report writing	EIA registration number (only for those registered consultants)	Signature
Introduction	17	Ibrahim Faiz	EIA T06/15	
Project Description	23	Ibrahim Faiz	EIA T06/15	
		Hamdhulla Shakeeb		
Project Setting (Legislative section)	19	Ahmed Jameel	EIA 07/07	
Existing Environment	36	Ibrahim Faiz	EIA T06/15	
		Hamdhulla Shakeeb		
		Akeed Ahmed		
Impact and Mitigation	56	Ahmed Jameel	EIA 07/07	
		Ibrahim Faiz	EIA T06/15	
Stakeholder Consultations	67	Ahmed Jameel	EIA 07/07	
		Ibrahim Faiz	EIA T06/15	
Monitoring	75	Ibrahim Faiz	EIA T06/15	
Recommendations and conclusion	79	Ibrahim Faiz	EIA T06/15	
		Ahmed Jameel	EIA 07/07	

18 Acknowledgements

Various people have assisted the consulting team in preparing this report, name and their designations are listed below. CV's of the field assistants are attached as an annex. Water Solutions would like to thank their support and assistance provided in completion of this report.

1- Mr. Ahmed Jameel, EIA consultant

2- Mr. Abdul Aleem, EIA consultant

3- Mr. Ibrahim Faiz. Junior Consultant

4- Hamdhulla Shakeeb, Surveying Assistant, Water Solutions.

5- Akeed Ahmed, Junior Consultant, Water Solutions

6- Gulhifalhu Investment

7- Water Solutions staff

19 Reference

(Lamer Pvt Ltd, 2014). EIA Soft Coastal Measure at Western Shoreline of Thinadhoo, GDh Atoll EIA of shore protection in Maafushi Island (Water Solutions, 2015)

(Water Solutions, 2015). EIA for shore protection at Maafushi Island, Kaafu Atoll

Allison, W. (15: 215-218). Snorkeler damage to reef corals in the Maldive Islands,. *Coral Reefs*.

English, S., & Wilkinson, C. a. (1997). *Survey Manual for Tropical Marine Resources.* Australian Institute of Marine Science.

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Jameel, A. (2007). Developing a Disaster Profile for Maldives, A thesis for the Masters Degree. Chirstchurch, New Zealand: University of Cantebury.

Services, M. m. (2010). *Maldives meteorological Services*. Retrieved from www.meteorology.gov.mv

Water Solutions. (2013). *EIA of land reclamation in Maafushi Island.* Male': Water Solutions.

Water Solutions Pvt.Ltd,. (2008). *Maps of Maldives, the complete guide to the Atolls and Islands of Maldives.* Male': Water Solutions Pvt.Ltd.

Annex: Terms of reference

TOR No: 203-EIARES/GIZL/2016/1

Terms of Reference for Environmental Impact Assessment for Undertaking Sand Dredging at Gulhifalhu Jetty Area, Gulhifalhu, Kaafu Atoll

The following is the Terms of Reference (ToR) following the Scoping meeting held on **31st August 2016** for undertaking Environmental Impact Assessment for the proposed Dredging at Jetty Area at Gulhifalhu, Kaafu Atoll. The proponent of the project is **Gulhifalhu Investment Limited**

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 and justification for the proposed components and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary. Identify the donors and the institutional arrangements relevant to this project.

2. **Study area** – Submit a minimumA3 size scaled plan and a location plan with indications of the proposed activities. 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. Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – Identify and number tasks of the project including preparation, construction and decommissioning phases.

Task 1. Description of the proposed project – Provide a description and justification of the changes that had been made to the project. Discuss these changes in terms of marine environment. The following should be provided (all inputs and outputs related to the proposed activities shall be justified):

- Justification to undertake the project;
- Measures to protect environmental values during construction and operation phase
- Project management.

Dredging

- Quantity, quality and characteristics of dredge material;
- Method and equipment used for dredging
- Justification for selecting the methods and equipment;
- Labour requirements and (local) labour availability;
- Method and equipment used for dredging, including description of positioning system, depth control system and operational control procedures;
- Justification for selecting the methods and equipment;
- Duration of dredging activity;

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Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

Project Management

- Specify materials, equipment, heavy machinery, staff estimate (quantity and period of time), key personnel positions, intermittent technical expertise required;
- Project management: Include communication of construction details, progress, target dates and duration of works, construction/operation/closure of labor camps (if any), access to site, safety, equipment and material storage, waste management from construction operations (mainly earth material), power and fuel supply;

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

The baseline data will be collected before construction. All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points, reef transects, vegetation transects and manta tows sites for posterior data comparison. Information should be divided into the categories given below.

If data from the original EIA report is to be used in any of the following sections, please provide reference and include the information in this report where relevant.

Geology and geomorphology

- Bathymetry of dredging areas (use maps);
- (Seasonal) patterns of coastal erosion and accretion

Hydrography/hydrodynamics (use maps)

- Wind induced currents/current patterns
- Sea water quality measuring temperature, pH, salinity, turbidity and total suspended solids from proposed location.

Ecology

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

Hazard vulnerability:

- Vulnerability of area to flooding and storm surge.

ENVIRONMENTAL PROTECTION AGENCY Male', Rep of Maldives

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. Identify whether any additional requirements are need to be met due to the proposed changes.

Task 4. Determine the Potential Impacts of the Proposed Project-"Identify impacts related to the proposed project and its components in relation to their size, scale and duration. Distinguish between significant impacts that are positive and negative, direct and indirect (= triggering), and short and long term. Identify impacts that are cumulative, unavoidable or irreversible. Identify any information gaps and evaluate their importance for decision-making.

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

Task 5. Analysis of Alternatives to the Proposed Project- Describe the alternatives examined for the proposed project that would achieve the same objective including the no action alternative.

Task 6. Mitigation and Management of Negative Impacts- Identify measures to minimize significant negative impacts associated proposed activities of the project. Mitigation and management of negative impacts shall be discussed in the context of the information and discussions provided in the project description (Task 1). Any additional impacts that may arise from the proposed activities shall be separately discussed. Financial commitment to undertake the mitigation measures must be provided.

Task 7. Development of a Monitoring Plan- Identify areas and issues requiring monitoring to ensure compliance to mitigation measures are identified. Provide impact management and monitoring plan during and after completion of the project giving emphasis on the impacts and their mitigation measures.

Task 8. Stakeholder Consultations- Consultations need to be made with the project contractor regarding the details and justification for the proposed activities. Consultations need to be made with:

- Ministry of Housing and Infrastructure
- MRDC

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

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

....

31st August 2016

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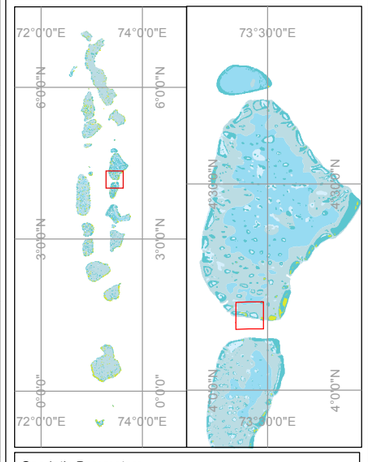
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

Annex: Bathymetry of the lagoon

Sand dredging at Gulhifalhu Jetty Area

Legend

- Quaywall
- Revetment
- Dredging_Area
- Mean Tide
- contour



Geodetic Parameters

Coordinate Systems :Universal Transverse Mercator (UTM) Zone: 43 North
Projection :Transverse Mercator (TM)
Datum : WGS 1984
Longitude of Origin :0.000000000
Central Meridian:75 W
Scale Factor :0.999600000000000040
False Easting :500000.000
False Northing :0.00000000
Semi-Major Axis (a) (Meters): 6378137.000
Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale:

0 4.25 8.5 17 25.5 34 Meters

Project:
Sand dredging at Gulhifalhu Jetty Area

Client:
Gulhifalhu Investment Ltd

Contractor:

Water Solutions Pvt Ltd
Ma:Fas Eri 1st Floor, Ameenee Magu, Male', Maldives
Tel: +(960)3341643, Fax: +(960)331643
www.water-solutions.biz

EIA PURPOSES ONLY

Annex: Gulhifalhu Shoreline

Sand dredging at Gulhifalhu Jetty Area

73°27'15"E 328643 73°27'30"E 329143 73°27'45"E 329643

462654 462654

4°11'0"N 4°11'0"N

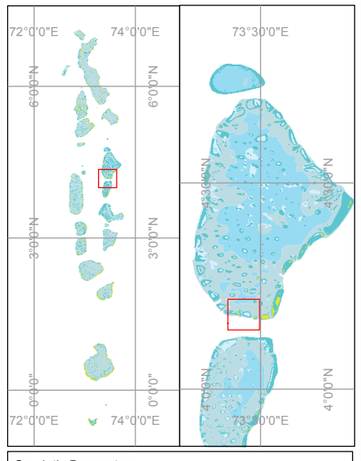
462154 462154

4°10'45"N 4°10'45"N

73°27'15"E 328643 73°27'30"E 329143 73°27'45"E 329643

Legend

- Quaywall
- Revetment
- Mean Tide



Geodetic Parameters

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False Northing :0.00000000
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Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale:

0 15 30 60 90 120 Meters

Project:
Sand dredging at Gulhifalhu Jetty Area

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Tel: +(960)3341643, Fax: +(960)331643
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Annex: CV's of unregistered consultants

1.	**PROPOSED POSITION**	:	**Surveyor**
2.	**NAME**	:	Hamdhulla Shakeeb
3.	**CONTACT DETAILS**		M.Araaraiykuri, 4th Floor Blookiyaa Magu Male' Maldives Mobile:+(960) 7567075
4.	**DATE OF BIRTH**	:	26th Feb 1988
5.	**NATIONALITY**	:	Maldivian
6.	**EDUCATION**	:	**General Certificate of Education (GCE) Ordinary Level** Cambridge University, 2005 **General Certificate of Education (GCE) Advanced Level** Cambridge University, 2008 **Certificate in Surveying,** University of Moratuwa, Sri Lanka, 2009
7.	**OTHER TRAINING**	:	PADI Open Water Diver Reef Check Eco Diver Program Leica GNSS Training Program Advance Certificate in Computing Multi Beam Training

8. LANGUAGE & DEGREE OF PROFICIENCY :

	Speaking	Writing	Reading
English	Excellent	Excellent	Excellent
Dhivehi	Mother tongue	Mother tongue	Mother tongue

9.	**MEMBERSHIP IN PROFESSIONAL SOCIETIES**	:	-
10.	**COUNTRIES OF WORK EXPERIENCE**	:	Maldives & Sri Lanka
11.	**EMPLOYMENT RECORD**	:	

FROM: **1st August 2008** To: Present
EMPLOYER Water Solutions Pvt Ltd
POSITION HELD AND DESCRIPTION OF DUTIES Surveyor
Undertake field surveys required for environmental studies, development and monitoring. Produce CAD drawings of completed surveys and other drawings required for environment and sewerage projects

PROFESSIONAL EXPERIENCE

Project Name : **Setting out all Structures in L.Olhuveli**
Client : Evason Laamu Financing:
Period : 2008 Time Spent: 2 months
Position Held : Assistant Surveyor
Duties : Setting out of water villas

Project Name : **Bathymetric Survey of K.Summer Island**
Client : Summer island Financing:
Period : 2008 Time Spent: 2 days
Position Held : Assistant Surveyor
Duties : Bathymetric Survey

Project Name : **EIA Survey - redevelopment of in K.Giraavaru**
Client : TBI
Period : 2008 Time Spent: 1 day
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA for Coastal Protection of Embudu Village**
Client : Embudu Village
Period : 2008 Time Spent: 2 days
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey – Redevelopment of Bolifushi Resort**
Client : Jumeirah Maldives
Period : 2008 Time Spent: 2 Weeks
Position Held : Assistant Surveyor
Duties : Mapping the Existing structures

Project Name : **Environmental Monitoring B.Muhdhoo**
Client : Coastline Group
Period : 2008 Time Spent: 1 week
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **K. Thulusdhoo Huraagadu**
Client : Island Community
Period : 2009 Time Spent: 1 week
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic survey of Bolifufushi Resort**
Client : Eon Resorts
Period : 2009 Time Spent: 5 months
Position Held : Surveyor
Duties : Setting Out the all the strucures

Project Name : **AA. Moofushi**
Client : Constance Hotels
Period : 2009 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Gdh. Madaveli Land Reclamation EIA**
Client : MHTE
Period : 2009 Time Spent: 1 week
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Ghd. Hoadehdhoo Land Reclamation EIA**
Client : MHTE
Period : 2009 Time Spent: 1 week
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Environmental Monitoring of Gdh.Meradhoo**
Client : Jumeirah Maldives Financing:
Period : 2009 Time Spent: 2 days
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey of Lh.Felivaru**
Client : Northern Province Office Financing:
Period : 2009 Time Spent: 1 month
Position Held : Surveyor
Dties : Mapping the structures

Project Name : **Topographic Survey of Sonevafushi**
Client : Sonevafushi Financing:
Period : 2010 Time Spent: 1 day
Position Held : Surveyor
Duties : Mapping the structures

Project Name : **Topographic and Bathymetric Survey of K.Baros**
Client : Baros Financing:
Period : 2010 Time Spent: 1 day
Position Held : Surveyor
Duties : Collecting depths and mapping the island

Project Name : **Coral Planting in K.Boduhithi**
Client : Sunland Financing:
Period : 2010 Time Spent: 3 days
Position Held : Surveyor
Duties : Coral Planting

Project Name : **EIA Survey of K.Summer Island**
Client : Summer Island
Period : 2010 Time Spent: 2 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Conventional Centre in Addu City**
Client : MHE Financing:
Period : 2010 Time Spent: 2 days
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Maradhoo Football Ground**
Client : - Financing:
Period : 2010 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Halaveli**
Client : Halaveli
Period : 2011 Time Spent: 2 Weeks
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Environmental Monitoring of AA.Nika Island**
Client : Nika Island Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Nolhivaramfaru**
Client : MHE
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA survey of Sh.Vagaru**
Client : Viceroy Maldives
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA survey of Bandos Island Resort**
Client : Bandos Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA survey of AA.Maafushivaru**
Client : Maafushivaru Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey of Evasaon Laamu Olhuveli**
Client : Evason Laamu Financing:
Period : 2011 Time Spent: 2 Weeks
Position Held : Surveyor
Duties : Mapping Existing Beach Villas and corrected the map

Project Name : **EIA Survey of Hulhumale' Marina**
Client : HDC Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Ha.Kela Sewerage project**
Client : DCP Financing:
Period : 2011 Time Spent: 2 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Fihaalhohi**
Client : Fihaalhohi Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey of K.Summer Island**
Client : MOOKAI Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Setting out of breakwaters and reclaim area

Project Name : **EIA for 8 island Harbour Project**
Client : MHE Financing:
Period : 2012 Time Spent: 14 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Halaveli Coral Rehabilitation Project**
Client : Halaveli Resort Financing:
Period : 2013 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Bathymetry Survey of Kihaadhu Resort**
Client : HM Lulu Pvt Ltd Financing:
Period : 2013 Time Spent: 2 days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Land Survey of Adh.Thelaveligau**
Client : Thelaveligau Retreat Pvt Ltd Financing:
Period : 2013 Time Spent: 4 days
Position Held : Surveyor
Duties : Field data collection for the Land Survey Report

Project Name : **Bathymetry Survey of Jumerah Dhevanafushi(Meradhoo)**
Client : EON Financing:
Period : 2014 Time Spent: 3 weeks
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Land Survey of Ga.Innahera with 4 islands**
Client : SIMDI Pvt Ltd Financing:
Period : 2014 Time Spent: 6 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name : **Land Survey of Sh.Ekasdhoo**
Client : SIMDI Pvt Ltd Financing:
Period : 2014 Time Spent: 4 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name : **Bathymetry Survey of Maavarufalhu (Faafu Atoll)**
Client : Boston Consulting Group(BCG) Financing:
Period : 2014 Time Spent: 4days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Topographic Survey of Rihiveli Resort**
Client : Castaway Financing:
Period : 2014 Time Spent: 7 days
Position Held : Surveyor
Duties : Setting out of all structures

Project Name : **Bathymetry Survey of Rihiveli Resort**
Client : Castaway Financing:
Period : 2014 Time Spent: 4 days
Position Held : Surveyor
Duties : Field data collected for the Bathymetric Survey

Project Name : **Bathymetric Survey of Kuramathi Resort**
Client : Universal Enterprises Pvt Ltd Financing:
Period : 2015 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Bathymetric Survey of S.Gan Bathymetry(Near Main Jetty)**
Client : Blue Logisitics Pvt Ltd Financing:
Period : 2015 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Bathymetry Survey of Maafalhu Survey**
Client : WATG Financing:
Period : 2014 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name: **Land Survey of B.Muthaafushi**
Client : Well land Investment Pvt Ltd Financing:
Period : 2015 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name: **Land Survey of B.Dhandhoo**
Client : Well land Investment Pvt Ltd Financing:
Period : 2015 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name : **Land Survey Demarcation of 8 Islands**
Client : LSA Financing:
Period : 2016 Time Spent: 1 month
Position Held : Surveyor
Duties : Setting out of Blocks

CERTIFICATION:

I, THE UNDERSIGNED, confirm that:

(i) To the best of my knowledge, this CV correctly describes myself, my qualifications, and my experience
(ii) I have given my full consent to be included in this Proposal
(iii) I am available for the assignment as indicated/scheduled in this Proposal.

Hamdhulla Shakeeb

AKEED AHMED

Mobile: +960 7631136 Email: akeed.ahmed.9@gmail.com

I am a self-motivated and confident individual who is committed to and passionate about environmental work and sustainable development. I have had past experience in the field and in a working environment with an NGO and consultancy work. Through my experience in work and at university, I have produced diverse and in-depth socio-economic and scientific articles, group reports and campaign initiatives, developing robust analytical, communication and organizational skills, and have gained a sound and scientific understanding of contemporary environmental consequences as well as their causes.

EDUCATION

University of East Anglia, United Kingdom 2013 – 2016
BSc (Hons) Environmental Sciences *(Upper-Second Class Honours)*

Centre for Higher Secondary Education, Maldives 2011 – 2013
Edexcel Advanced Level Examinations: Chemistry, Physics, Mathematics (B); Biology (C); Islam, Dhivehi (D)

Dharumavantha School, Maldives 2008 – 2010
*O Level Examinations: 6 A*s; Dhivehi (B); Islam (C)*

Key modules

Climate Change – Science and Policy: develops skills in scientific and socio-scientific analysis of climate change using an integrated approach of latest IPCC emission scenarios, models, economics and politics.

Environmental and Natural Resource Economics: examines core principles in economics and applies them in addressing a wide range of environmental issues. Demonstrates that environmental problems can be solved through executing policies with careful implementation of economic reasoning.

Sustainability, Society, and Biodiversity: analyses sustainable development in an economic, social, and ecological perspective. Introduces a range of concepts to develop an understanding of balancing societal development, economic growth and environmental protection.

Independent Project: a 10,000-word dissertation on public perceptions of sea level rise in the Maldives, involving survey work and qualitative analysis.

Low Carbon Energy: focuses on decarbonisation of the energy supply through implementation of renewable energy and improving energy efficiency.

Main skills developed

Written communication and advanced research - synthesizing information from research papers across numerous environment and development related subjects into essays and reports have developed my advanced skills in research, analysis and reasoning.

Verbal communication – researched, prepared, and presented successful presentations to audiences of lecturers and students alike, confidently communicated arguments as an individual and in groups.

Leadership and project management – built on teamwork and leadership skills through working in small groups on complex issues whilst taking a lead role, delegating tasks, and promoting discussions.

Organization and time management - met frequent, often successive deadlines without fail, while having to allocate time to different projects on a daily basis.

WORK EXPERIENCE

Junior Operations Associate May – September 2015

Kanbili Guest House, K. Himmafushi, Maldives

- Calculating and reassessing capital and running costs of the project
- Liaising with guests and staff in order to maximise guest satisfaction
- Evaluating, managing and amending online content and booking system

Intern July – September 2014

Consultancy for FAO (UN) Low Emission Climate Resilient Development programme, Maldives

- Successfully compiling data from official reports
- Discuss current issues faced in agriculture with stakeholders
- Producing numerous infographics for reports

Voluntary Staff Member February – May 2011

Society for Health Education, Malé, Maldives

- Carrying out inter-departmental communications
- Designing effective awareness pamphlets and posters for health education
- Communicating and coordinating efficiently with other agencies in event management

EXTRA-CURRICULAR ACTIVITIES

- **Youth Summit 2010,** *Washington D.C., USA* – Three-week summit inciting robust leadership skills and essential character building qualities. I got exposure to contemporary issues in society and environment today, and was given opportunities to take a hands-on approach and volunteer.
- **Volunteering** – I have done volunteer work in promoting HIV and cancer awareness with the Society for Health Education, taken part in Community Based Theatre in putting context to real-world social and welfare problems, and been a part of youth reef cleaning events

AWARDS & ACHIEVEMENTS

- **University of East Anglia 50th Anniversary Scholarship** – 2013
- **Cambridge Outstanding Achiever Award** – 2010: 10th highest mark in the world in GCSE Biology

LANGUAGES & SKILLS

- **Microsoft Office** – Word, Excel, PowerPoint
- **Graphics and Design** – Adobe Photoshop and Corel Photopaint (Proficient)
- **Statistics** – Statistical Package for the Social Sciences (SPSS)
- **Geographic Information System** - ArcGIS
- **Languages** - English and Dhivehi (Fluent)

REFEREES

Dr. Dorothee Bakker (Academic advisor)
Research Officer
School of Environmental Sciences
University of East Anglia
Norwich, United Kingdom
Tel: +44 (0) 1603 59 2648
Email: d.bakker@uea.ac.uk

Ibrahim Shabau (Former employer)
Secretary General
Malé City Council
Malé, Maldives
Tel: +960 7796141
Email: shabau@gmail.com

Annex: Methodologies used

1.1 Introduction

The annex describes detail methodologies used to collect data on the existing environment for EIA studies in the Maldives. For EIA studies in the Maldives, various methodologies are used and the type and methods vary for different projects. Almost all projects will utilize some general data collection methodologies in combination of various other methods. The following section outlines the data collection methodologies that are used in Maldives and their description.

1.2 General Methodologies of Data Collection

In this method, the condition of the existing environment is analyzed using appropriate scientific methods. The environmental components of the study area are focused for terrestrial, marine and coastal environment depending on the specific projects. In general, for any project that requires the study of the marine environment, the marine environment of the island is studied including the coral reef and the lagoon. Focus is given on specific areas of the island's reef which is expected to have the greatest impact as a result of the proposed project. Coastal environmental data collection involves mapping the shoreline, taking beach profiles from selected locations, identifying and mapping costal defense structures and assessing the coastal environment for erosion or accretion. Terrestrial data collection usually includes creating a terrestrial map of the island or a specific area.

1.3 Mapping and Location Identification

The island, lagoon, reef or specific areas of islands or a project site is mapped, including shore line, vegetation line, reef lines, existing mature trees, coastal defense structures or other significant topographic features. Mapping is undertaken using hand held differential GPS and available aerial photos. The location of data collection sites are marked using handheld GPS. These data collection points includes marine water sampling locations, marine survey locations, existing groynes and sea walls, mature trees, breakwaters, protected or archaeological sites, erosion prone areas, sand spits, beach rocks etc.

1.4 Marine Environment Surveys

Marine environmental surveys were conducted to collect data on key environmental components (i.e. the coral reef system and the lagoon), that will be impacted due to the project. Four methods are primarily used to collect data, namely:

- Line Intercept transects (LIT's)
- Detail photo quadrate analysis,
- Fish census and
- Visual observations.

Purpose of the survey is to define and establish marine environmental baseline conditions for impact evaluation during and after a project. Surveys are based on standard marine environmental surveys so that they can be repeatedly carried out to monitor and record changes and assess possible impacts on the marine environment from the proposed work activities. Surveys include quantitative and qualitative methods. In addition, photos are taken along the reef survey sites and the length of the lagoon.

1.5 Line Intercept Transects (LIT)

Line Intercept Transect (LIT) surveys are carried out to assess the benthic types and species at the survey sites. This method uses life form categories to assess the benthic sessile community of reefs and it is possible to incorporate taxonomic data as well. LIT surveys can be used to evaluate the community structure of corals in terms of species composition and

diversity patterns in different zones on a reef. LIT method also provides a rapid estimate of percent cover of corals, algal cover, and cases of other prominent organisms as well as bare substratum.

Quantitative percent cover of the reef community can be obtained using this method and it can be repeated over time to obtain changes over a period of time. Disadvantages of this method include difficulty in standardizing the life form categories and the limitation of the data collected, to information on percent cover and relative abundance (English et al. 1997). LIT surveys produce valuable data even though they are time consuming and require considerable effort and skills to record notes underwater (Segal & Castro 2001). A line transect of 20m length is normally used, but transect lengths can vary depending on the surveyor.

1.6 Photo quadrate analysis

Photo transect coral reef survey method is used to quantify the data of coral reef benthic communities i.e. live corals and their types, other benthos, dead corals and other reef substrate. This method is used to support the LIT surveys or as an alternative to line transect. A series of photographs are taken along the transect line (usually 20 m each) using an underwater camera. These photographs are combined to form a photo-composite. Photo-composite of the mapped area of the reef are then analyzed using computer software. It provided a detail record of individual corals, sandy or rubble area and other benthos to a mapped area. The photographs not only allowed speedy collection of data in the field, but also provided a permanent record of the transect line, which is useful for long-term monitoring of growth, mortality and recruitment.

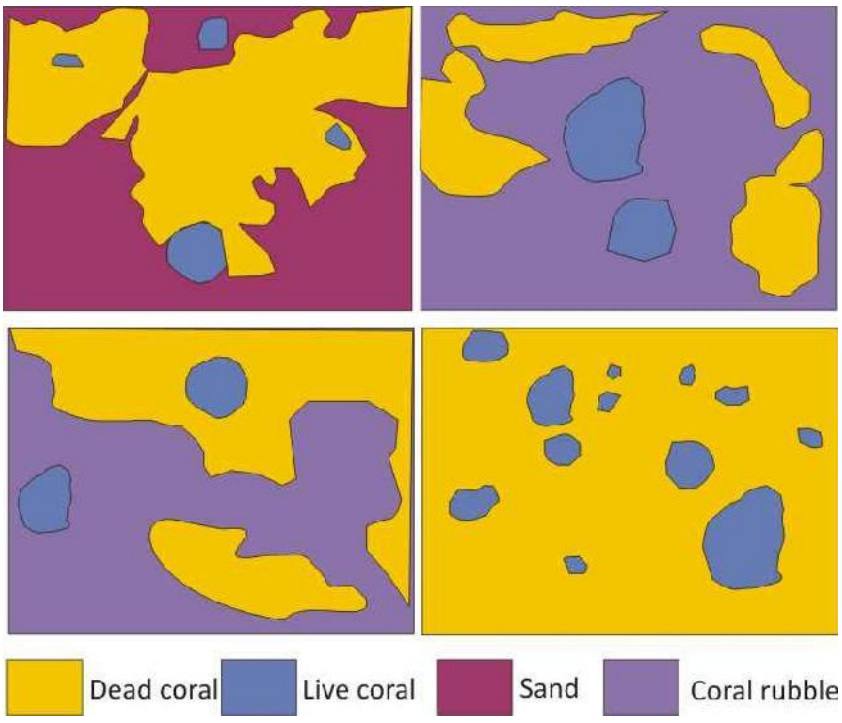

Figure 1: Typical photo quadrate analysis

1.7 Qualitative assessment

Qualitative assessment of the reef or lagoon is based on visual observation by snorkeling and then comparing the result with underwater photos and aerial photographs.

1.8 Permanent Photo Quadrats

This method involves taking still photographs of a fixed quadrat that are analyzed in the lab. It is useful to determine temporal change in shallow macrobenthos communities. Permanent photo-quadrats can also complement LITs and are suitable for small-scale questions and to follow the fate of individual colonies. Detailed temporal change can be determined for individual corals for biological condition, growth, mortality and recruitment. Data can be used to estimate percent cover, species diversity, relative abundance, density and size. Percentage cover of target organisms can be determined in the lab by either point sample methods by placing a grid cover the quadrat or by digitizing the image (digitizing is more expensive, time-consuming, requires special software and expertise). The precision depends on the apparatus used and the ability to take photo from exactly the same spot as well as observer differences for analysis.

On each designated Impact Sites squares of 50x50cm side length are placed randomly along the coral patches in about 1,5m depth. Still photos are taken and analyzed using the software CPCe 3.4 (Kohler and Gill 2006) with an equally spaced grid overlaid in 10 columns and 10 rows (100 points) per 50x50cm quadrat. Substrate categories are recorded and described. Statistical analysis is then undertaken using PAST software (PAlaeontological Statistics ver. 1.90, Øyvind Hammer).

All quadrats at the survey sites are permanently marked with square plastic markers for further monitoring studies. In addition, when possible, sub-surface buoys are installed at each Site close to the quadrats.

1.9 Reef fish Visual Census

Under water counts of reef fishes or underwater visual census (UVC) method is used to assess the fish population at an Impact Site and a Control Site. Visual counts appear to give reasonably reliable results provided that they are applied to fish that are non-cryptic and either diurnally active or at least evident by day. In this method, the surveyor swims along the transect paths above the reef, counting fish that were observed within 1,5m either side of the transect and above up to the water column. The same transects line as for the Visual Quadrat survey is normally utilized to carry out the fish census. Fish are counted along the 20 m transect path (that is in a belt of 1.5 m on either side and up to the water surface). To count the fish, the surveyor swims slowly along, counting fishes that are seen within the defined band transect, 20m long by 3m wide (i.e. one with a total area of 60m²). All fish encountered are recorded at least up to family level, some up to genus and species level, noted on the underwater slate immediately after they are seen. Counting any fish more than once is avoided by training and experience. Speed at which the path swum is controlled so as to standardize the efficiency of search. If the surveyor swims too fast it is easy to miss fish, especially of smaller species, that may be temporarily obscured by corals or rock or be taking shelter. Experience shows that the slower the surveyor swims, more fish that is recorded up to a point. However, the highest number recorded by moving along very slowly may actually be an over estimate of fish density. Hence it is necessary to standardize swimming speed to a slow but not too slow pace. The standard speed of swimming practiced is at a mean rate of 8m a minute. For results, only the most abundant fish families are taken into account, each representing one of the following functional groups: herbivores (Acanthuridae, Scaridae), omnivores (selected Labridae), corallivores (Chaetodontodae) as well as habitat specialists (Pomacentridae).

1.10 Marine Water Quality

One of the main environmental components that is affected by implementing a number of projects in Maldives is the marine water quality. Water quality is assessed during the field trip by collecting samples and testing them at National Health Laboratory. Water quality is

assessed from multiple locations depending on the project. The locations, frequency and parameters to be monitored are given in the EIA report.

1.11 Coastal environment

1.12 Shoreline and vegetation line mapping

The island's shore line and vegetation lines are mapped during low, high and mid tides using a handheld GPS assisted by aerial photos. The data is then entered in to a GIS database and maps are generated.

1.12.1 Coastal structures mapping

Similar to the island's shore line and vegetation lines, all the coastal infrastructures such as groynes, sea walls, revetments, offshore and near shore breakwaters are mapped using a handheld GPS assisted by aerial photos. The data is then entered in to a GIS database and maps are generated.

1.12.2 Erosion and Accretion areas mapping

Areas where severe erosion and accretion occurring are mapped using a handheld GPS. The data is then entered in to a GIS database and maps are generated and compared with previous available maps and satellite photos.

1.12.3 Beach Profiles

Dumpy levels were also used to survey around selected locations around the island and beach profiles were generated from these data. The location along the which the beach profiles were taken was marked using a GPS for future monitoring. When selecting locations, a permanent structure or object such as a building corner, larger mature tree or any other similar benchmark were identified for future reference. The final beach profiles are corrected to MSL and graphs developed.

1.12.4 Drogues and currents

Nearshore currents in the lagoon or reef were measured by deploying a handheld GPS in a watertight casing with a fin attached at the bottom. The GPS is deployed for a period of minimum 15 minutes during which time its displacement from the original position are recorded as a line. After 15 minutes, it is removed and deployed at another location. Once the data is collected, currents in a particular area is calculated by measuring the distance it has travelled by 15 minutes.

1.13 Terrestrial environment

1.13.1 Terrestrial floral survey

The baseline terrestrial environment of the project location is studied in detail by counting trees existing in the area, and gathering information available from island office or from other available sources. The survey concentrates on identifying vegetation types, their abundance and occurrence in a given area. The methods used to assess the tree types and abundance are using line transects. A measuring tape is used to set up the transect line which is selected randomly from within the project boundary. The surveyor measures and records the type of trees and their average heights. Average heights are estimated and so there is a greater degree of error in estimating the tree heights. The results are then tabulated to calculate the

percentage of different trees. In addition, records from island office / resort or other sources are also used to cross check the figures.

1.13.2 Terrestrial faunal survey

In depth faunal survey is not assessed but the types of fauna encountered during the floral transect is identified and recorded. Focus in given on specific fauna such as turtles, fruit bats, sea birds and other sensitive birds. Birds and their habitation patterns are also observed and recorded during the survey.

1.13.3 Ground Water Assessment

Groundwater quality is assessed by collecting samples from given locations selected randomly or from available points within the island using YSI 6820 multi parameter handheld water quality meter. In addition, water quality is also tested at the National Health Laboratory.

1.14 Coastal Environment

Data collected on coastal environment includes beach profiles, existing coastal structures (sea walls, breakwaters, groyns etc.), beach composition, beach width, shore line and vegetation line. All beach profile locations are marked on GPS maps and their geographical coordinates are marked on a map. Beach profiles are taken as baseline data to make comparisons during monitoring programme so that any changes resulting from the coastal or any other component of a project can be assessed accurately. Beach profiles are measured using auto levels, GPS and a staff.

1.15 Bathymetry

Bathymetric survey are undertaken in the lagoon or reef using Echosounder attached to a boat. The levels are then corrected for mean sea level and represented in a map. Bathymetric maps provide accurate estimates of depths in a particular lagoon or a reef.

1.16 Aerial photos

Aerials photos provide useful information such as assisting the analysis of marine environment, identifying wave patterns and changes to shoreline and also vulnerable areas of the island for all kinds of projects. Aerial photos are purchased from DigitalGlobe.

1.17 Available long term weather data

Long term available weather data is obtained from the nearest weather station to a project in Maldives, which is based in Male' International Airport (Male' atoll), Hanimaadhoo (Haa Dhaal Atoll), Kaadehdhoo (Gaaf Dhaal atoll and Gan island in Seenu atoll. These data sets are used to develop a regional model in ArcGIS to assess the vulnerable areas of the island or any other project during both monsoons, thus helping the EIA team to assess the vulnerable areas of the island for erosion and various other weather related issues.

Annex: Project schedule

Temporay Schedule for Gulhifalhu Jetty Area Sand Dredging Project

	Months						Duration / Days
Description	**1**	**2**	**3**	**4**	**5**	**6**	
Preliminary works							7
Mobilization							7
Site setup							10
Dredging							90
Groyne Consytruction							30
Out survey							7
Site clearance							5
Demobilization							3

Annex: Consultation attendace sheet

Water Solutions Pvt. Ltd. Reg No: C-344/2005
Ma. Shaah, Dhidhi Goalhi, Male', Maldives

Project: Sand Dredging at Gulhifalhu Jetty Area

Date: 17th October 2016

Meeting with MRDC

Stakeholder Meeting Attendance Form

	Name	Designation	Office	Contact No.	Email	Signature
1						
2	Yamin Abdul Wahhab	Asst. Manager - BD	MRDC	9108899	yamin.a.w@mrdc.com.mv	
3	Mohamed Shaniya	Surveyor	MRDC	7993499	Mohamed.shaniya@mrdc.com.mv	
4	Ibrahim Abdulla	Senior Production officer	MRDC	7535353	ibrahim.Abdullah@mrdc.com.mv	
5	Ali Mohamed	financial controller	GIL	7940302	Ali@gil.MV	
6	Areen Ahmed	Assistant General Manager Business Development	GIL	7779598	areen@gil.mv	
7	Khadeeja Meeru	GM/ CS.	GIL	9997441	heena@gil.mv	
8	Abdulla Fazeel	MD	GIL	7774577	md@gil.mv	
9	Ibrahim AR Haleem	MD	MRDC	7785882	haleem@mrdc.com.mv	
10	Hussain waheed	Procurement manager	MRDC	7961059	hussain.waheed@mrdc.com.mv	
11						
12						

بسم الله الرحمن الرحيم

Water Solutions Pvt. Ltd. Reg No: C-344/2005
Ma. Shaah, Dhidhi Goalhi, Male', Maldives

Project: Sand Dredging at Gulhifalhu Jetty Area

Date: 27th September 2016

Meeting with Ministry of Housing and Infrastructure

Stakeholder Meeting Attendance Form

	Name	Designation	Office	Contact No.	Email	Signature
1	Amir Musthafa	Engineer	amir.musthafa@housing.gov.mv MHI	7981711	amir.musthafa@housing.gov.mv	
2	Nafha Aujaz	Environment Analyst MHI	nafha.aujaz@housing.gov.mv	7721554	nafha.aujaz@housing.gov.mv	
3	Anoosha Hashim	Asst. project officer	MHI	-	anoosha.hashim@housing.gov.mv	
4	Khadeeja Neena	GM/CS.	Gulhifalhu Investment ltd	9993441	neena@gil.mv	
5	Ibrahim Faiz	Consultant-	Water Solutions	7679443	faiz@water-solutions.biz	
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Annex: Letter from city council

بسم الله الرحمن الرحيم
Water Solutions Pvt. Ltd. Reg No: C-344/2005
Ma. Fas Eri, Ameenee Magu, Male', Maldives

WS/LTR/2016/109 :ނަންބަރު

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ވަފާތް ވާނެ ގޮތަށް ދުޢާ ކުރަމެވ.

(ކ.ގދ.ދ) ގެ ގެނެވޭ ބަދަލު

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19 ނޮވެމްބަރ 2016 ވ.

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ކ.ގދ.ދ ގެ ގެނެވޭ ބަދަލުގެ ތަފްޞީލު.

ކ.ގދ.ދ ގެ ގެނެވޭ ބަދަލު:
1. ފުރިގަނޑު ބަދަލު ވަނުމުގެ ކުރިން ހިންގާ ކަންތައް ހިންގުމަށް (ކ.ގދ.ދ) ގެ ގެނެވޭ ބަދަލުގެ ދަށުން ބާއްވާ ބައްދަލުގައި ބަލައި ގަނެ ނިންމުން ދިނުމަށް

ތައާރަފް ކުރެވުނު ގޮތް: .....

ދާއިރާ: .....

ތަފާތު ގޮތް: .....

ތާރީޚް: 20-10-2016 ..... ގަޑި: 9:07

ސޮއި: ..... ސިއްލު: