ENVIRONMENT IMPACT ASSESSMENT

FOR THE PROPOSED

SEAGRASS REMOVAL AT MAAFARU ISLAND, NOONU ATOLL

August 2017

Prepared for

Noonu Maafaru Council

Consultant

CDE Consulting, Maldives

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List of Abbreviations

COADS	Comprehensive Ocean-Atmosphere Data Set
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPPA	Environment Protection and Preservation Act
IPCC	Intergovernmental Panel on Climate Change
MEE	Ministry of Environment and Energy
MHI	Ministry of Housing and Infrastructure
MWSC	Malé Water and Sewerage Company
NEAPII	National Environmental Action Plan II
NAPA	National Adaptation Programme of Action
ToR	Terms of Reference
TSS	Total Suspended Solids
UNFCC	United Nations Framework Convention on Climate Change
WMR	Waste Management Regulation

Acknowledgements

The lead author of this report is Dr. Ahmed Shaig.

Additional assessments were undertaken by the following team members.

Mr. Ahmed Nashwan Abdul Matheen (Coastal Assessment)

Mr. Mohamed Faizan (Marine Assessment)

Ms. Shahdha Shiyam (Stakeholder Consultations)

Field assistance was provided by the following members

Mr. Ali Moosa Didi (Surveying)

Mr. Mohamed Ali (Marine Surveys)

Mr. Ahmed Haiman Rasheedh (Marine Surveys)

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

Lead Consultant's Declaration

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

Dr. Ahmed Shaig

Proponent's Declaration

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Please Refer to Appendix I

Executive Summary

This document is submitted to the Environment Protection Agency, by the proponent to fulfil the requirement of an EIA under the Environmental Protection and Preservation Act (EPPA) of the Maldives (4/93). This report provides the background to the proposed project components as well as an assessment of their likely environmental and social impacts, both beneficial and adverse. The proposed enhancement and mitigation measures are outlined where necessary together with an environment management plan and a monitoring programme.

The project involves the removal of seagrass colonies from the eastern side of the island next to the existing settlement. The aim is to create a safe recreational swimming area for the local community. At the moment, Maafaru Island contains the largest seagrass colony in the northern Maldives and covers almost all coastal areas around the existing settlement. Locals are currently reluctant to use the lagoon for swimming as the seagrass is not conducive for standing upon and swimming. The low visibility also makes it risky for swimmers with chances of stepping on poisonous creatures such as urchins and rays.

Project activities will be in conformance to the laws and regulations of the Maldives, and relevant international conventions that Maldives is party to. The key laws and regulations applicable to this project are: *Environmental Protection and Preservation Act, Environmental Impact Assessment Regulation 2012, Dredging and Reclamation Regulation, Waste Management Regulation 2013,* and the *Environmental Liability Regulation*. The project parameters cannot adhere to the dredging reclamation regulation as is states that no dredging can be undertaken within 500 m form the ocean side reef edge and 50 m from vegetation line. The island's eastern shoreline is located within 500 m of the ocean side reef edge and proposed swimming area covers areas within 50 m of the shoreline. Therefore, discussions must be held between the proponent and the Ministry before the commencement of the project in order to solve this issue.

The assessment shows that the proposed development involves major impacts on the marine environment particularly temporary loss of benthic organisms, and potential changes to coastal hydrodynamics and beach stability.

Key mitigation measures for the construction stage include undertake construction works during calm weather conditions as much as possible particularly when wave activity is calmer, and carrying out the activities in as short a time period as possible to allow normal conditions to re-establish in the area as soon as possible.

Operational stage impacts are limited to potential erosion arising from changes to the coastal hydrodynamics. The changes to the beach will likely occur as the new beach system tries to

achieve equilibrium with the changed coastal conditions. However as it is not possible to determine beforehand whether this will occur, no specific erosion prevention measures are proposed but appropriate action will be decided after monitoring the changes.

The alternatives were evaluated for the project but the current designs and methods have been preferred due to the significant advantages that the proposed design has over alternatives. An alternative location which was considered on the South East section of the island was rejected due to the practical, financial, and environmental limitations. Other locations could not be considered as significant developments have been proposed for locations both to the North and South of the existing community. The only feasible location is the proposed location on the North West of the island. Silt screens were considered as an alternative sedimentation control measure. However given the small size of the project area, the use of the proposed bund walls is preferred as it is more financially feasible.

Monitoring of the project is crucial particularly the changes to hydrodynamics, shoreline, water quality, and lagoon benthos recovery. Particular attention should be given to monitor the erosion patterns along the Eastern section of Maafaru island.

The management plan for this project is designed to produce a framework for anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions. In addition provide evidence of compliance to legislation, policies, guidelines and requirements of relevant authorities.

In conclusion, the project provides significant socio-economic benefits for the local community.

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1 INTRODUCTION

1.1 Purpose of the EIA

This Environment Impact Assessment (EIA) report is an evaluation of the potential environmental, socio-economic and natural impacts of the proposed seagrass removal project at Maafaru island in Noonu atoll.

This document is submitted to the Environmental Protection Agency, by the proponent to fulfil the requirements under the Environmental Protection and Preservation Act (EPPA) of the Maldives (4/93), specifically clause 5 of the Act which states that a report should be submitted before implementation of any project that may have a potential impact on the environment.

1.2 Project Proponent

The proponent of this project is the Noonu Maafaru Council. The Council is responsible for the planning and implementation of development activities on Maafaru island. The address and contact information for the proponent is as follows:

Noonu Maafaru Council
Secretariat Of Noonu Maafaru Council,
Karankaa Magu,
Maafaru Island, Noonu Atoll
Republic of Maldives
Phone: +960-6560005
Email: noonumaafarucouncil@gmail.com

1.3 Project Scope

The project comprises of the removal of a patch of seagrass along a North Eastern section of the coastline of the island. The main activities of this project are:

- Mobilisation
- Removal of seagrass
- Disposal of seagrass
- Finalising and demobilisation

See next chapter for details

1.4 Project Background and Rationale

Maafaru island has been experiencing significant seagrass growth for a number of years. The presence of seagrass has a detrimental effect on the aesthetics of the island as large sections of the island's coastline are covered in seagrass. Firstly, the beaching of dead seaweed has significantly reduced the quality of the beach with a noticeable odour when the material is beached. Secondly, the locals are reluctant to use the lagoon for swimming as the seagrass is not conducive for standing upon, and the dark sea bottom makes them vary of potential sea creatures such as sting rays and baby sharks which are common along the island's coastline. Finally, seagrass overgrowth has led to discoloration of the lagoon. These issues have resulted in a number of complaints from the local community. Therefore, seagrass removal has become a priority for the island.

1.5 Aims and Objectives

The aim of this project is to create a safe recreational swimming area for local community. The objective of this project is to remove a section of the seagrass along the North Eastern section of the island in an area close to the local community.

1.6 Consultants, Contractors and Government Institutions

All the EIA related work is undertaken by consultants from CDE Consulting. Design criteria and technical specifications have been developed by CDE Consulting.

No donor agencies are involved in this project. The project will be financed by the proponent.

The seagrass removal work will be undertaken by contractors.

1.7 Project Financing

The project is financed by Noonu Maafaru Council.

1.8 Scope and Terms of Reference of EIA

The scope of this EIA is broadly based on the Environmental Impact Assessment Regulations 2012. The assessment more specifically adheres to the Terms of Reference (ToR) issued by the Environmental Protection Agency on 13th June 2017. The ToR is based on scoping meetings held between the stakeholders at the EPA on 12th June 2017. A copy of the ToR is attached in Appendix A.

The EIA report contains the following main aspects:

- A description of the project including the need for the project, how the project will be undertaken, full description of the relevant parts of the project, implementation schedules, site plans and summary of project inputs and outputs (Chapter 1&2).
- A description of the pertinent national and international legislation, regulations and policies that are relevant and applicable to the project and a demonstration of how the project conforms to these aspects (Chapter 3)
- Information on the baseline environmental condition of the project site; this includes information on marine flora and fauna, marine water quality, marine environment near the project site (Chapter 4)
- An assessment of the potential impacts during both construction and operational stages of the project as well as identification and cost of the potential mitigation measures to prevent or reduce significant negative impacts during both construction and operation stages of the project (Chapter 5 & 6)
- Assessment of alternatives for the proposed project (Chapter 7)
- Details of the environmental management and monitoring plan (Chapter 8 and 9)
- Stakeholder consultation (Chapter 10)
- Potential gaps in information (Chapter 11)
- Main conclusions (Chapter 12)

1.9 Assessment Methodology

1.9.1 General Approach

This EIA is broadly guided by the EIA regulations 2012.

This report has been prepared to ensure that the significant environmental and social impacts of the proposed project at the preconstruction, construction, operation and demobilising stages have been considered and assessed at the project planning phase.

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

In order to conduct a broad based and inclusive study, the proponent and the consultant have from the onset ensured the exercise is participatory. As such, discussions have been held with community members in the projects area and relevant stakeholders with the assistance and coordination of the proponent.

1.9.2 The Study Area

The area impacted by projects like these can be quite wide particularly when the socio-economic impacts are considered. The study area of this project considers that the North Eastern section of the island and the reef system of the island will be affected by the development, and that Maafaru Island will experience the bulk of the socio-economic change.

Based on the results of the initial scoping of potential environmental impacts and the identification of sensitive aspects of the environment we have identified the following geographical areas likely to be affected at the various stages of the Project:

- During construction temporary and permanent impacts will occur primarily on Maafaru Island's beach and its reef system. The most direct physical impact will be on-site in the area of the actual physical interventions. To ensure the impacts are fully covered, the entire North Eastern section of Maafaru Island is studied.
- During operation of the island most impacts will be confined to the area that will be affected by construction impacts.
- There will also be induced development impacts due to the project, mainly in the form of positive socio-economic benefits to Maafaru Island.

Study area boundary is presented in Figure 1-1 and survey locations map for the project is attached in Appendix D.

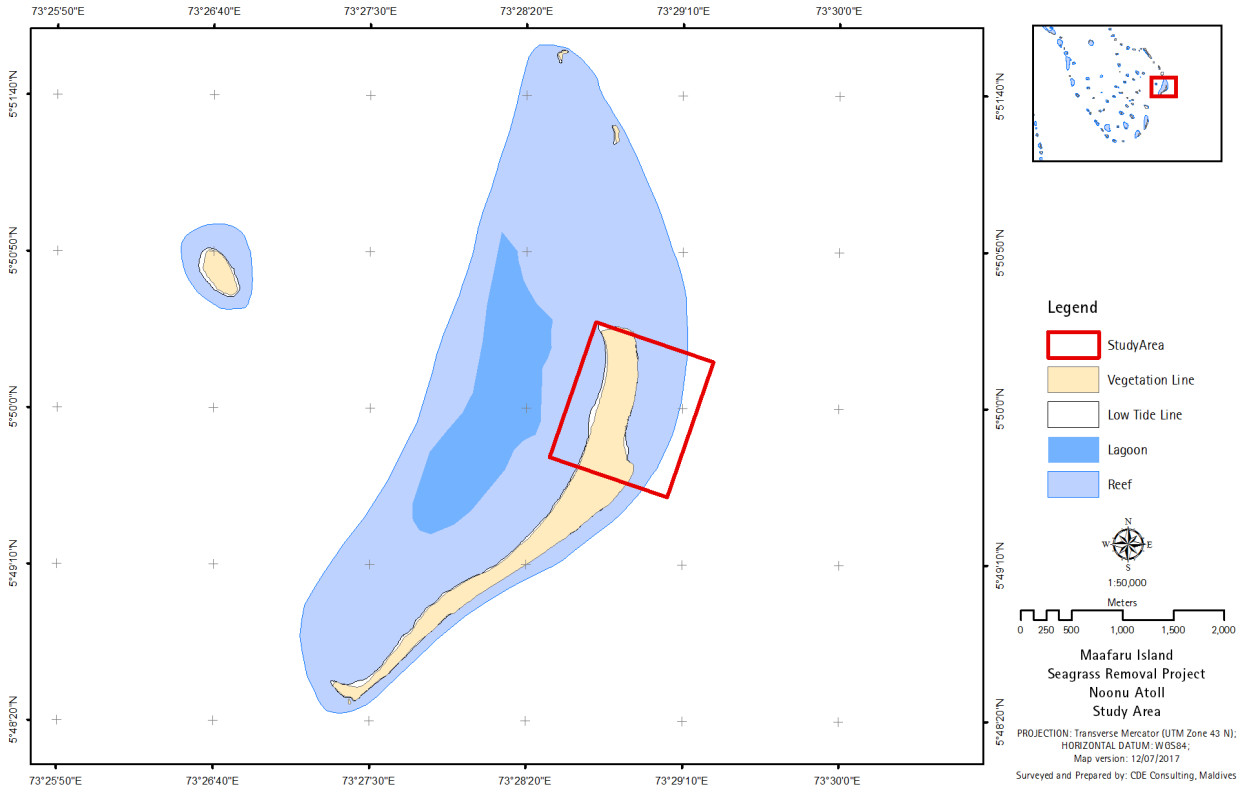

Figure 1-1: Study Area Boundary

1.9.3 Field Observations

Field assessments were undertaken at Maafaru on 27th April 2017. Field visits mainly covered water quality, marine life, and beach conditions of the proposed project sites. In addition, stakeholder consultations were carried out at the Ministry of Housing and Infrastructure on 12th July 2017.

Coastal Processes

Beach profiles were taken from designated locations around the island using standard levelling techniques. These profile locations are marked in Appendix D. The measurement of beach profiles involves standard practice of surveying with a staff and a dumpy level. Measurements were taken along the beach profile line at different intervals, wherever there occurred a distinctive morphological feature, such as beach ridge, high water mark, an erosion scarp, dip, rise, or other significant break in the beach slope up to a minimum distance of 30 m from the Benchmark. Other beach attributes such as beach rock were marked using handheld GPS.

Lagoon currents were measures using drogue method. 4 measurements were undertaken at every site and an average value is determined.

Tide data has been taken from Velana International Airport Tide Gauge.

Wave patterns have been estimated using secondary studies and visual field assessments.

Marine Assessments

Snorkelling Visual Survey

Snorkelling visual surveys were carried out at selected locations of the lagoon, to qualitatively determine the main benthic composition and the general status at these areas. This method allows for a quick assessment of the sites.

Fish census

Fish and invertebrate species assemblages and abundance was surveyed using 50 m line transects, whereby the surveyor swam along the transect line and recorded the number and the different species of fish and invertebrates observed within 2.5 m on either side of the transect line.

A category based methodology was adopted to estimate fish abundance and the mean number of fish per category and observation was extracted to estimate species and family abundance. The categories used to estimate abundance is displayed in Table 1-1.

Table 1-1: Categories used to estimate abundance of fish at a location

Category	Number of fishes
1	1
2	2 – 4
3	5 – 16
4	17 – 64
5	65 - 256

Photo Quadrat Survey

The composition of the substrate was assessed by taking ten high-resolution images every 5 m (pictures covering 0.5 m^2 of the seabed) along the same transect line used for the fish surveys. These were later analysed using CPCe. CPCe, or Coral Point Count with excel extension, developed by the National Coral Reef Institute, is software designed to determine coral community coverage and diversity using transect photographs. Underwater photographic frames are overlaid by a matrix of randomly generated points, and the fauna/flora of species or substrate type lying beneath each point is identified. 25 random points per picture were analysed to characterize the substrate composition (sample size: 250 points per transect).

Water Quality

Water quality was assessed from MWSC laboratory. Water quality samples were taken at three different locations: two marine water samples and one groundwater sample, which were selected based on the proposed development. Parameters measured include Physical Appearance, turbidity, nitrates, phosphate, and Total Suspended Solids (TSS). Water samples were collected at mid depth using clean PET bottles.

1.9.4 Desk Study Review

A literature review was conducted to acquire background information on the site and its environment as well as to identify possible environmental impacts of similar developments in island settings. In this context, the EIA Regulations 2012, best practices from similar development activities, scientific studies undertaken in similar settings around Maldives and previous documents/historical publications was considered.

The literature review comprised of, but is not limited to the following:

- EIA for the regional airport development at Maafaru island, 2014
- EIA for the Harbour Expansion at Maafaru Island, 2014
- EIA for the coastal maintenance works at Canareef Resort Maldives, 2016
- EIA for the regional airport development at Maafaru island, 2017

1.9.5 Public and Key Stakeholder Consultation

Stakeholder consultations were undertaken with the Ministry of Housing and Infrastructure.

1.9.6 Data Analysis

The EIA experts used their experience and knowledge in their respective fields to analyses the data from the previous studies and field visits in order to determine the potential impacts of the proposed projects, the severity of effects arising from these impacts and how any adverse impacts can be best mitigated and positive impacts enhanced. This analysis provides the framework for the recommendations on corrective actions and remedial measures and provides the basis for the formulation of the environmental management plan which forms part of this repo EIA

1.9.7 Report Format

The report format and structure presented here follows the report formatting guidelines issued by EPA.

1.10 Study Team Members

The team members of this EIA are:

Dr. Ahmed Shaig (EIA and coastal environment Specialist)
Mr. Ahmed Nashwan Abdul Matheen (Coastal Assessment)
Mr. Mohamed Faizan (Marine environment assessment)
Ms. Shahdha Shiyam (Stakeholder Consultations)
Mr. Ali Moosa Didi (Surveying & Mapping)
Mr. Mohamed Ali (Marine Environment Specialist)
Mr. Ahmed Haiman Rasheed (Field Assistant)

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

2 PROJECT DESCRIPTION

2.1 Project Location

Maafaru is located on the eastern rim of Miladhunmadulu Dhekunuburi Atoll (see Figure 2-1), where the administrative capital is Manadhoo island. Maafaru is approximately 4.5 km long, 500 m wide at the widest point, and has a land area of approximately 120 Ha. The island is located 180 km from the national capital Male', and 50 km from the nearest Airport on Ifuru Island in Raa atoll. The nearest inhabited island is Landhoo which is located approximately 6 km North of Maafaru.

As shown in Figure 2-2, there is only one Environmentally Sensitive Area: Landhoo, within the vicinity of Maafaru island.

2.2 Project Outline and Project Site Plan

The proposed site plan is presented in Appendix B. A Reduced version of the site plan is provided in Figure 2-3 below. The areas potentially affected by the project are presented in Figure 2-5.

The project mainly involves the removal of seagrass from the proposed site using an excavator, and the transport of the dredged material to a specified dredge disposal site, using a dump truck.

The next section provides the details of the project components.

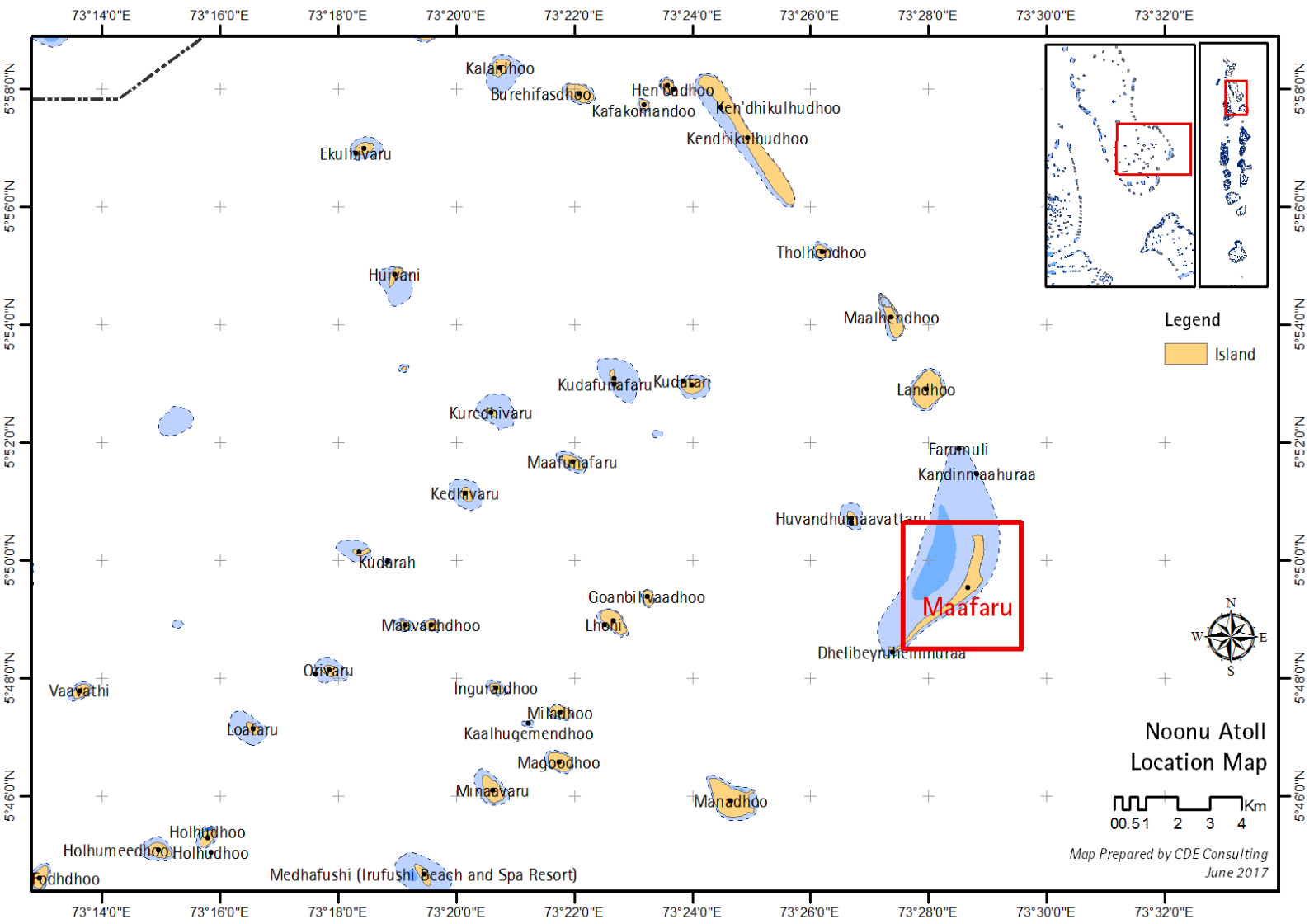

Figure 2-1: Location of Maafaru Island

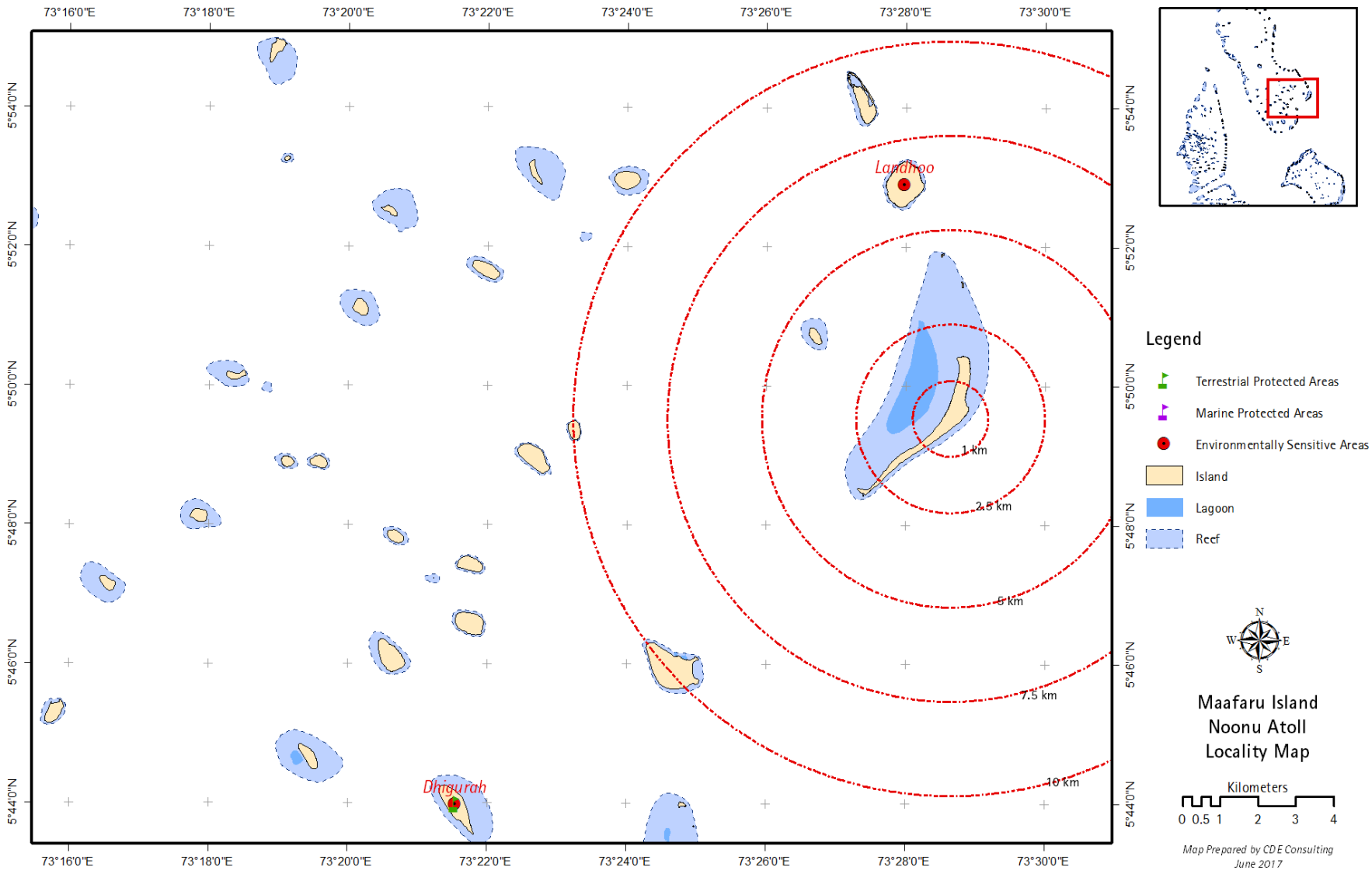

Figure 2-2: Locality map and environmentally sensitive zones in the vicinity

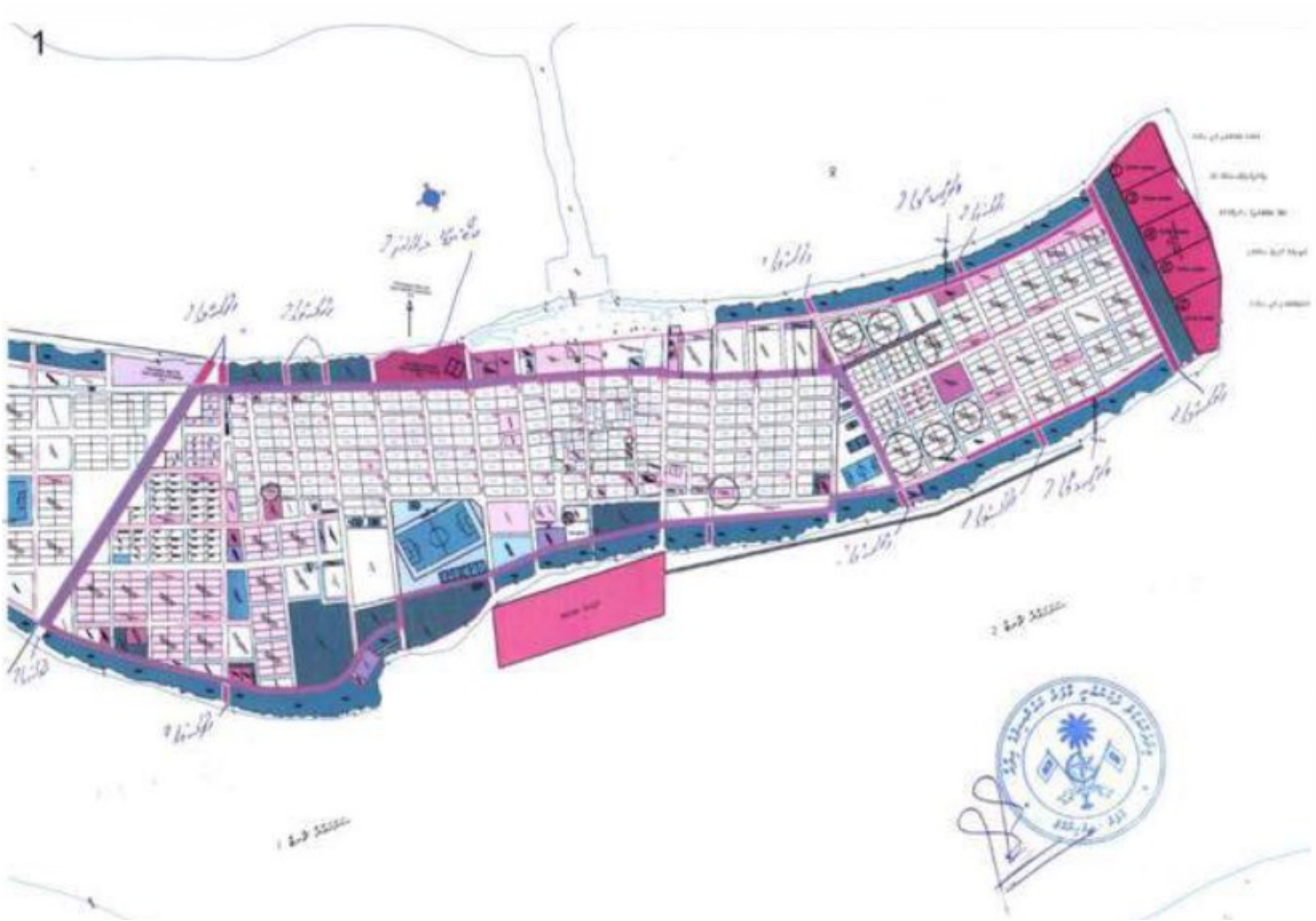

Figure 2-3: Approved Site Plan

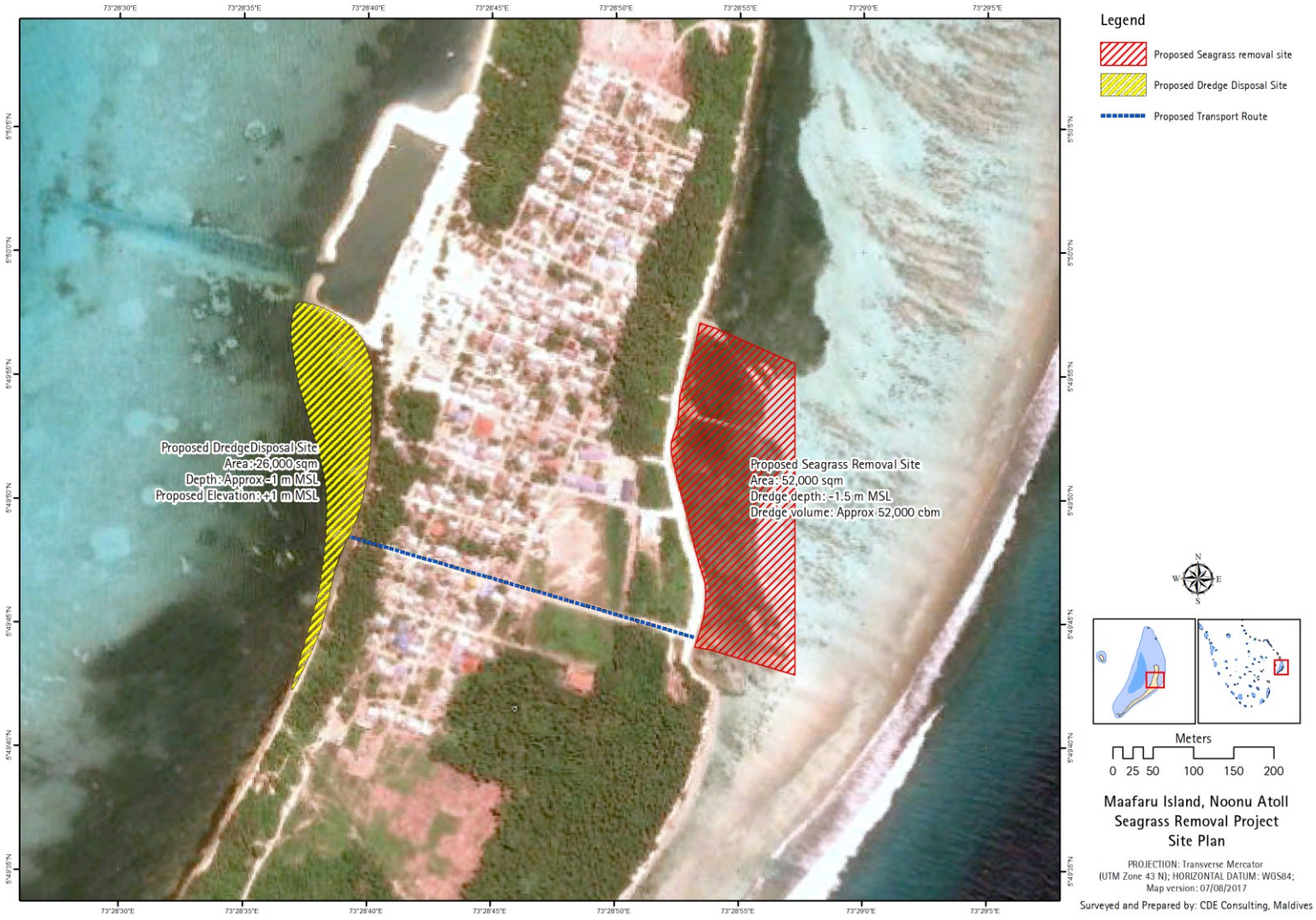

Figure 2-4: Site Plan

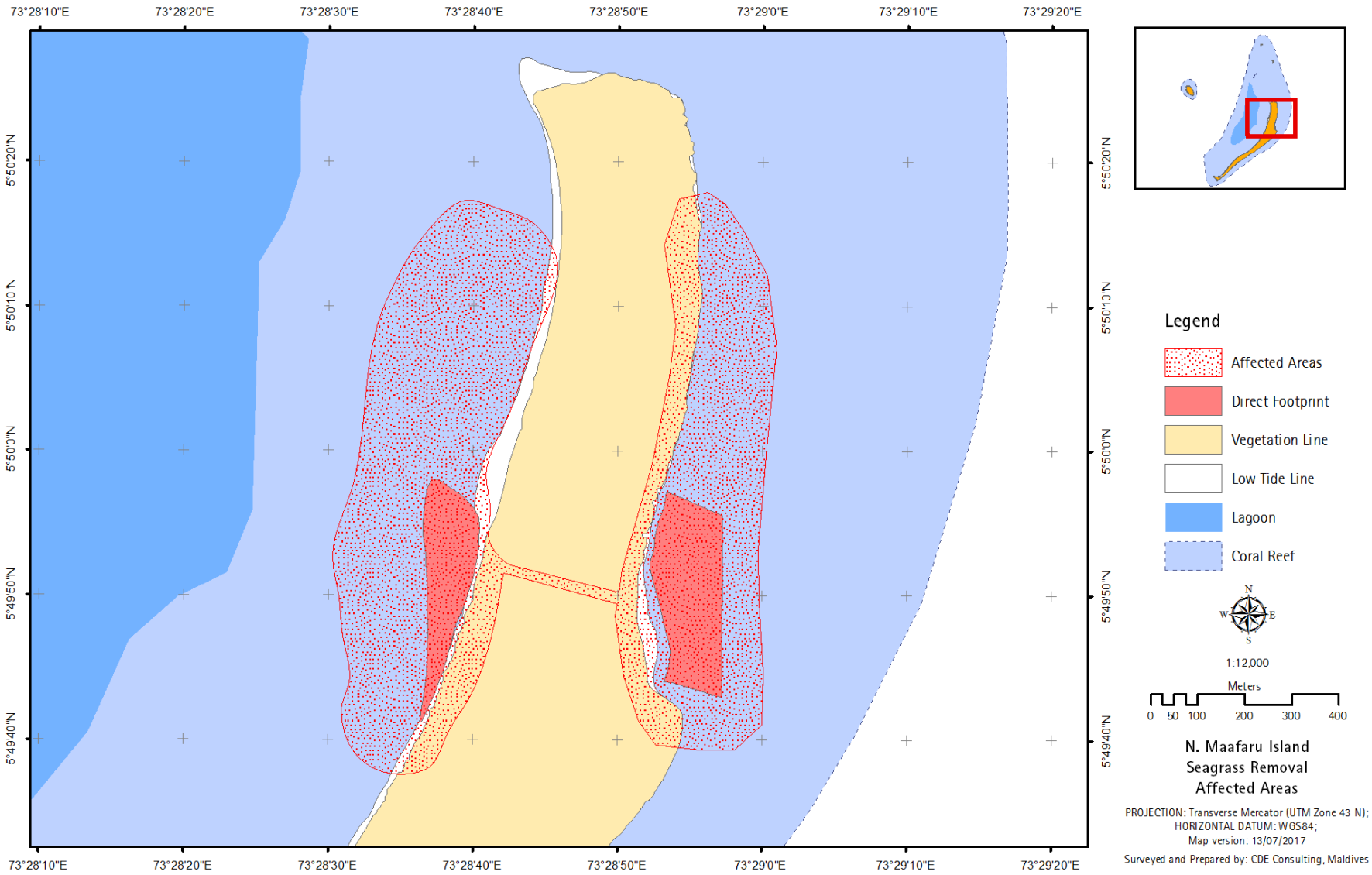

Figure 2-5: Potential Affected Areas Map

2.3 Detail Project Outline and Work Methodology

2.3.1 Seagrass removal

Scope of Works

At present the immediate lagoon around the island has a significant over growth of seagrass. The density of the seagrass bed makes it difficult to use the lagoon for swimming, is an aesthetic issue, and leads to seagrass beaching. This has led to a number of complaints from locals, and in some cases locals have taken it upon themselves to clear small areas of the lagoon.

It would be impractical and environmentally not acceptable to remove the entire seagrass bed. It is proposed to remove seagrass along the section specified in Figure 2-4, over an area of approximately 52,000 sqm to a maximum distance of approximately 150 m from the shoreline.

Justifications

The seagrass is an aesthetical issue, and has prevented locals from carrying out recreational swimming activities due to safety concerns. Firstly, the beaching of dead seaweed has significantly reduced the quality of the beach with a noticeable odour when the material is beached. Secondly, the locals are reluctant to use the lagoon for swimming as the seagrass is not conducive for standing upon, and the dark sea bottom makes them vary of potential sea creatures such as sting rays and baby sharks which are common along the island's coastline. Finally, seagrass overgrowth has led to discoloration of the lagoon. These issues have resulted in a number of complaints from the local community.

Equipment

It is proposed that the project will use excavators mounted on temporary sand beds. It is likely that one excavator and a mini dump truck will be used for this project. However, it should be noted that the proponent has at the time of writing this report, not finalised a contractor to carry out the work and the contractor's opinion will likely influence the method and equipment used.

Design Details

The approach for this project is to minimise environmental impacts while ensuring the method is financially feasible. Temporary sand beds will allow the excavator and mini dump trick access to the entire site proposed for seagrass removal. The excavated material will be transported to the disposal site via the most direct route using the dump truck.

Dredge Area and Volume

A summary of the seagrass removal area details are presented in Table 2-1 below.

Table 2-1: Seagrass removal specifications

Feature	
Removal Method	Excavator mounted on temporary sand bed
Dredge depth from lagoon bed (Max)	1.5 m
Area	52,000 sqm
Volume of dredged waste (Max)	52,000 cbm

Dredge waste and its disposal

The dredged waste will be loaded onto the mini dump truck and transported to the proposed waste disposal site directly south of the harbour which is under construction. As backfill is required for the shore protection around the harbour it is proposed that the dredged material which will mostly be sand, is used for this purpose. As shown in Figure 2-4, the most direct route from the seagrass removal site to the disposal site will be used to transport the material in order to minimise environmental impacts as well as disturbances to the local community.

Work Methodology

Sea grass will be removed using excavators mounted on sand beds. For the proposed removal site identified in the site plan, a sand bed will be constructed perpendicular to the shoreline, along its width to access the site. A second dynamic bed parallel to the shoreline will be created to access the length of the site. Sand beds will be shifted as work progresses. Once seagrass has been removed from a section of the site, the parallel bed will be moved further out and the process repeated. This method allows the excavator and dump truck to access the entire site to carry out the work.

2.4 Project Schedule and life span

Mobilisation of the project will begin immediately after a contractor is confirmed by the proponent. The proponent has proposed to finalise the contractor once the EIA is approved. It is anticipated that the completion of the project will take approximately 12 months to complete.

The preliminary work plan is provided in Table 2-2. The actual details will be dependent on the final contractor.

Table 2-2: Summary work plan for the project

		Year 1			
No	**Activity Description/Weeks**	**M1**	**M2**	**M3**	**M4**
1	Preliminaries	X			
2	*Mobilisation*		X		
3	*Site preparation*		X		
4	*Sea grass removal*		X	X	
5	*Contingency*				X
6	Demobilisation			X	

2.5 Environmental Management, Logistics and Safety Measures

2.5.1 Workforce and Services

It is estimated that ten staff members will be required to carry out this project. Accommodation and food for the staff will be provided by the Noonu Maafaru Council based on leased houses.

2.5.2 Utilities

Existing island infrastructure will be utilised. Electricity, water and sanitation facilities will be provided for construction workers from the existing facilities on the island.

2.5.3 Construction Waste Management and Disposal

Small amounts of waste oil may be generated from the operation and maintenance of vehicles. All waste oil will be disposed as per the approved standards of the Environment Ministry. Waste generated from excavation during the seagrass removal will be deposited at the proposed waste disposal site. Other municipal waste generated during construction will be handled using the island's local waste management facilities.

2.5.4 Pollution and Emission Control Measures

The following measures will be taken to ensure minimal pollution during construction stage.

- Machinery will be properly tuned and maintained to reduce emissions and minimize risk of spills/leaks.
- All paints, lubricants, and other chemicals used on site will be stored in secure and bounded location to minimize risk of spill.

- Fuel storage will be bunded
- Spill kits will be maintained around island to handle any liquid spills

2.5.5 Sediment Containment and Turbidity Control Measures

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

- Use bundwalls, where practical, to control sediment dispersion in the seagrass removal area. Bundwalls will be removed after the sediment has been adequately settled within the lagoon.
- Undertake work during calm weather conditions.

2.5.6 Health and Safety Measures

- The contractor would ensure that Health and Safety procedures are complied with at all times.
- Seagrass removal activities would be carried out under the supervision of a suitably experienced person.
- All reasonable precautions will be taken for the safety of employees, and equipment will be operated by competent persons.
- Warning signs, barricades or warning devices will be provided and used. Necessary safety gear will be worn at all times.
- Fire extinguishing equipment would be readily available and employees will be trained in its use. In general, water-based fire extinguishers would be used.
- Oxygen, acetylene or LPG bottles will not be left free-standing. All welding and cutting will be done in accordance to high safety regulations by experienced personnel.

2.6 Summary of Project Inputs and Outputs

The types of materials that will go into the development and from where and how this will be obtained are given in Table 2-3 and the type of outputs (products and waste streams) and what is expected to happen to the outputs are given in Table 2-4.

Table 2-3: Major Project Inputs

Input resource(s)	Source/Type	How to obtain resources
Site supervisors	Local and foreign	Contractor's employees
Water supply (during construction)	Maafaru FENAKA facilities	Existing desalination plant on the island
Electricity/Energy (during construction)	Maafaru FENAKA facilities	Existing electricity generator on the island
Machinery	Excavator and dump truck	Contractor's machinery or hire locally where available
Maintenance material	Maintenance parts and fluids required for the machinery and piping.	Import or purchase locally where available
Food and Accommodation	Existing houses	Arranged by proponent. Proposes to rent existing housing.
Fire fighting equipment	Fire Extinguishers...etc.	Contractor's equipment
Fuel	Light Diesel, LPG Gas, Petrol, Lubricants	Local suppliers
Telecommunication	Mobile phones, fax machines and internet facilities	Contractor's equipment
Food and beverage bottles	Mainly imported sources except a few locally available products.	Import and purchase locally

Table 2-4: Major project outputs

Products and waste materials	Anticipated quantities	Method of disposal
Waste oil	Small quantities	Barrelled and sent to Thilafushi site during demobilisation.
Hazardous waste (diesel)	Small quantities	Barrelled and sent to Thilafushi site during demobilisation.
Noise	Only localised	Excavator and dump truck operation will be noisy. No option available.
Food waste	Small quantities	Managed under existing waste management system of the island.
Plastic and packaging wastes	Small quantities	Managed under existing waste management system of the island.

2.7 Demobilization

The proponent advocates a phased demobilization plan to commence in the last week of the contract. Machinery transported from Malé will have to be demobilized on one specific date.

3 POLICY AND LEGAL FRAMEWORK

These legal and policy provisions have to be fully respected in carrying out the proposed development. All contractors and sub-contractors will be informed of these requirements. This project conforms to all relevant laws and regulations of the Maldives.

3.1 Relevant Legislation

3.1.1 Environment Protection and Preservation Act (Act no. 4/93)

The Environmental Protection and Preservation Act (*4/93*) enacted on 19 March 1993 is the framework law related to environment protection in the Maldives. The authority responsible for the Environment Act is the Ministry of Environment and Energy.

Articles 2, 4, 5, 6, 7, and 8 of the law are relevant to the resort development Project.

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

The project developers and contractors shall abide by any guidelines or advice given by the concerned Government authorities for the project.

Article 4 states that the Ministry of Environment shall be responsible for identifying protected areas and natural reserves and for drawing up the necessary rules and regulations for their protections and preservation.

The project developers and contractors shall ensure that there is no negative impact from the proposed project on any protected areas.

According to Article 5 (a) of the Act, an Environmental Impact Assessment study shall be submitted to the Ministry of Environment before implementing any development project that may have a potential impact on the environment.

According to Article 5 (b), The Ministry of Environment shall formulate the guidelines for EIA and shall determine the projects that need such assessment as mentioned in paragraph (a) of this clause.

This report is prepared to fulfil this clause.

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

All project developer and contractors shall be aware of this provision and contractors shall take all practical measures to ensure there is no irreversible and significant negative impact of the projects on the environment.

Article 7 of the EPPA (4/93) states that any type of waste, oil, poisonous gases or any substances that may have harmful effects on the environment shall not be disposed within the territory of the Maldives. In cases where the disposal of the substances becomes absolutely necessary, they shall be disposed only within the areas designated for the purpose by the government. If such waste is to be incinerated, appropriate precaution should be taken to avoid any harm to the health of the population.

All project contractors shall comply with the Environmental Management Plan presented in this report, which specifies how the wastes, oil and gases generated by the project will be disposed.

Article 8 of the EPPA (4/93) states that Hazardous/ Toxic or Nuclear Wastes that is harmful to human health and the environment shall not be disposed anywhere within the territory of the country.

Any hazardous wastes that may be generated from this project shall be transferred to the designated waste site in Thilafushi for disposal according to Government regulations and standards. It should not be disposed on the Island, as it does not have the necessary facility.

3.2 Relevant Regulations and Guidelines

3.2.1 Environmental Impact Assessment Regulations 2012

Environmental Impact Assessment regulations were issued by Environment Environmental Impact Assessment regulations were issued by Environment Ministry on 8 May 2012. The first step in environmental assessment process involves screening of the project to be classified as one that requires an EIA or not. Based on this decision, the Ministry then decides the scope of the EIA, which is discussed with the proponent and the EIA consultants in a “scoping meeting”. The consultants then undertake the EIA starting with baseline studies, impact prediction and finally reporting the findings with impact mitigation and monitoring programme. This report follows the principles and procedures for EIA outlined in the EIA regulations.

The EIA report is reviewed by MEE following which an EIA Decision Note is given to the proponent who will have to implement the Decision Note accordingly. As a condition of

approval, appropriate environmental monitoring may be required and the proponent shall have to report monitoring data at required intervals to the Ministry. The project proponent is committed to implement all impact mitigation measures that are specified in this EIA report. Furthermore, the proponent is committed to environmental monitoring and shall fulfil environmental monitoring requirements that may be specified in the EIA decision note as a condition for project approval.

This report complies with the EIA regulations.

3.2.2 Regulation on Sand and Coral Mining

Regulation on sand mining covers 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 house reef and atoll rim has been banned through a directive from President's Office dated 26 September 1990.

Sand should not be mined from any part of an existing island. Sand should also not be mined from within 100 ft. of the shoreline of the existing Maafaru Island. Please see regulation on dredging and reclamation for further controls.

3.2.3 The Environmental Liability Regulation (Regulation 2011/R-9)

This law is pursuant to Article 22 of national constitution that states that protection, preservation and maintenance of the Maldivian natural environment, the richness of the living species, the natural resources and the beauty of the Maldives for the present generations as well as for the future generations is a basic obligation of the Maldivian government. The government shall enforce that the activities conducted in order to gain economic and social development should be of sustainable nature that protect the environment and such activities shall not deteriorate the environment, endanger any species, damage the environment, and shall not waste any natural resources.

This regulation is also pursuant to Environment Protection and Preservation Act of Maldives (4/93). The regulation is aimed at maintaining equal standards for reprimanding and enforcing environmental liabilities, fines for those who violate the rules and regulations and give guidance to those who are involved in the implementation process of the regulations pursuant to Preservation Act of Maldives (4/93).

One of the key objectives of the environmental liability regulation is also to practice polluter-pay-principles in the Maldives.

All project developer and contractors shall be aware of this provision and contractors shall take all practical measures to ensure that all relevant laws and regulations, and the EMP proposed in this EIA is followed.

3.3 Regulation on Dredging and Land Reclamation

The regulation of Dredging and Land Reclamation was published on 2 April 2013 with the aim of minimising environmental impacts associated with dredging activities in islands and reefs across Maldives.

- The regulation defines the rationales acceptable for dredging as those related to approved development activities on inhabited islands and economic islands. It defines that those activities should be if utmost necessity for dredging to be considered.

- All dredging and reclamation activities must be approved by EPA in writing. The process includes the submission of project information to EPA along with a scaled before and after map.

- The regulation defines rationales for reclamation as those absolutely necessary for social, economic or safety purpose.

- Beach replenishment is restricted from 10 m of the registered shoreline in resort islands.

- Dredging is restricted in the following areas:
    - 500 m from the ocean side reef edge
    - 50 m from any island vegetation line
    - An environmentally sensitive site

- Land reclamation is restricted within 200 m of a sensitive area.

- Land reclamation cannot exceed 30% of the house reef area

The proposed dredging design falls within two restricted area identified in this regulation: 500 m of the ocean side reef edge, and 50 m of the island vegetation line. As the proposed site falls within these restricted areas, discussions must be carried out between the proponent and the ministry before commencement of this project in order to come to an agreement on how this issue can be resolved. The regulations provides provisions for discussion with EPA if the project isof economic or social importance.

3.4 Waste Management Regulation 2013

Waste Management Regulation (WMR) was published on August 2013 and came into effect in February 2014. It is implemented by EPA. The aim of WMR is to implement the national waste policy, which contains specific provisions to:

- Implement measures to minimize impacts on human health
- Formulate and implement waste management standards
- Implement an integrated framework for sustainable waste management
- Encourage waste minimisation, reuse and recycling
- Implement Polluter-Pays Principle
- Introduce Extended Producer Responsibility

WMR contains four main sections:

- Waste management standards: Defines standards for waste collection, transfer, treatment, storage, waste site management, landfills and managing hazardous waste.
- Waste management Permits: Defines approval procedures for waste sites
- Waster transfer: Standards and permits required for waste transport on land and sea, including trans-boundary movements.
- Reporting requirements: Defines reporting and monitoring requirements and procedures.
- Enforcement: Defines procedures to implement WRM and penalties for non-compliance.

The proponent shall use registered vessels under this regulation for transporting waste to Thilafush.

The proponent should also ensure compliance from the subcontractors in handling and transport of waste from the island to the designated waste site.

3.5 The Environmental Liability Regulation (Regulation 2011/R-9)

This law is pursuant to Article 22 of national constitution that states that protection, preservation and maintenance of the Maldivian natural environment, the richness of the living species, the natural resources and the beauty of the Maldives for the present generations as well as for the future generations is a basic obligation of the Maldivian government. The government shall enforce that the activities conducted in order to gain economic and social development should be

of sustainable nature that protect the environment and such activities shall not deteriorate the environment, endanger any species, damage the environment, and shall not waste any natural resources.

This regulation is also pursuant to Environment Protection and Preservation Act of Maldives (4/93). The regulation is aimed at maintaining equal standards for reprimanding and enforcing environmental liabilities, fines for those who violate the rules and regulations and give guidance to those who are involved in the implementation process of the regulations pursuant to Preservation Act of Maldives (4/93).

One of the key objectives of the environmental liability regulation is also to practice polluter-pay-principles in the Maldives.

All project developer and contractors shall be aware of this provision and contractors shall take all practical measures to ensure that all relevant laws and regulations, and the EMP proposed in this EIA is followed.

3.5.1 Compliance

In general, the proposed developments are in compliance with the laws and regulations described above. Where there is a special requirement to comply, the EMP identifies measures and mechanisms required to comply.

3.6 Environmental Permits Required for the Project

3.6.1 Environmental Impact Assessment (EIA) Decision Note

The most important environmental permit to initiate project work would be a decision regarding this EIA. The EIA Decision Note, as it is referred to, shall govern the manner in which the project activities must be undertaken. This EIA report assists decision makers in understanding the existing environment and potential impacts of the project. Therefore, the Decision Note may only be given to the Proponent after a review of this document following which the Ministry may request for further information or provide a decision if further information is not required. In some cases, where there are no major environmental impacts associated with the project, the Ministry may provide the Decision Note while at the same time requesting for further information.

3.6.2 Dredging and Reclamation Permit

Prior to any costal work that requires dredging or reclamation, a special permit has to be taken from the EPA. A specific form published by EPA has to be completed and submitted for the

approval. EIA application form will only be accepted when the form is submitted with the costal modification approval given by EPA in writing.

Dredging and Reclamation approval for this project will be issued by EPA at the time of issuing the Decision Note.

3.7 Responsible Institutions

The main government institutions that have roles and responsibilities relevant to this project are summarised below.

3.7.1 Ministry of Environment and Energy

The Ministry of Environment is mandated for the effective implementation of the Environmental Protection Act of the country and has the statutory power over issues related to the environment. It has the central control over the environment protection, management, conservation and environmental emergencies. The Ministry operates mainly at a policy level and the more regulatory and technical assessment activities are mandated to EPA. All aspects related to EIA process are now transferred to Ministry of Tourism. However, implementations of all other relevant environment regulations are within the mandate of Ministry of Environment.

3.7.2 Atoll Council

Under the Decentralization Act, Noonu Atoll has an elected an Atoll Council located on Manadhoo island. The Atoll Council Office is the main focal point of Government Ministries in Male' City and they co-ordinate and liaises with Government Ministries and elected island councils on all issues relating to the Atoll.

A copy of this EIA will have to be submitted to the Noonu Atoll Council prior to submission to the Environment Protection Agency. The letter of receipt is attached to Appendix J.

3.8 Guiding Policies and Documents

3.8.1 National Environmental Action Plan II (NEAP II)

The aim of NEAP II is to protect and preserve the environment of the Maldives and to sustainably manage the country's natural resources for the collective benefit and enjoyment of present and future generations.

Accordingly, the key strategies of the NEAP II are:

- Continuous assessment of the state of the environment in the Maldives, including impacts of human activities on land, atmosphere, freshwater, lagoons, reefs and the ocean; and the effects of these activities on human well-being
- Development and implementation of management methods suitable for the natural and social environment of the Maldives and maintain or enhance environmental quality and protect human health, while at the same time using resources on a sustainable basis
- Ensure stakeholder participation in the decision making process by consultation and collaboration with all relevant sectors of society
- Preparation and implementation of comprehensive national environmental legislation in order to provide for responsible and effective management of the environment
- Adhering to international and regional environmental conventions and agreements and implementation of commitments embodied in such conventions.

Furthermore, NEAP II specifies priority actions in the following areas:

- Climate change and sea level rise; coastal zone management;
- Biological diversity conservation; integrated reef resources management;
- Integrated water resources management;
- Management of solid waste and sewerage;
- Pollution control and management of hazardous waste;
- Sustainable tourism development;
- Land resources management and sustainable agriculture
- Human settlement and urbanization.

3.8.2 Waste Management Policy

The aim of the waste management policy is to formulate and implement guidelines and means for solid waste management in order to maintain a healthy environment. Accordingly, the key elements of the policy include:

- Ensure safe disposal of solid waste and encourage recycling and reduction of waste generated;

- Develop guidelines on waste management and disposal and advocate to enforce such guidelines through inter-sectorial collaboration;
- Ensure safe disposal of chemical, hazardous and industrial waste.

The proponents of this project must be aware of the policy and all solid and hazardous waste produced in this project should be disposed according to the Environmental Management Plan for the project, which reflects the principles of the Waste Management Policy.

3.9 International Conventions

3.9.1 Convention on Biological Diversity

The Maldives is a party to the United Nations Convention on Biological Diversity. The objective of the convention is "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding". The proposed development activities outlined in this project does not fall on any area recognised for its ecological value. Therefore it is unlikely there will be a major loss of biodiversity. The loss is not going to be significant at atoll or national level. Yet, it is recommended that the developer ensure that silt screens are used during dredging works, construction of the jetty and breakwaters to minimise any impact on the marine biodiversity.

3.9.2 International Plant Protection Convention

The Maldives has become a party to the International Plant Protection Convention (IPPC) as a step to protecting native plant species in the Maldives from the risk of diseases introduced by imported plant varieties. The Maldives adhered to the IPPC on 3 October 2006 and the Convention requires that certificates of phytosanitary condition and origin of consignments of plants and plant products be used for import and export of plants and plant materials. Contracting parties have the full authority to regulate entry of plants and plant products and may prescribe restrictions on imports or prohibit importation of particular plants or plant products. Thus it is advisable that the proponent be aware of the requirements of IPPC and obtains the necessary phytosanitary certificates if any plants are to be imported to stabilise the beach or for landscaping.

3.9.3 UNFCCC and Kyoto Protocol

The Maldives is a party to the United Nations Framework Convention on Climate Change and the Kyoto Protocol to the UNFCCC. The objective of the Convention is to achieve, in

accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The IPCC defines mitigation "as an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases." The greenhouse gas inventory of the Maldives forms an integral part of the First National Communication of the Maldives to the UNFCCC. In March 2009, the President of the Maldives has announced the target to make Maldives carbon neutral by 2020. Hence, in the implementation of the project, careful attention needs to be given to ensure energy efficiency and reduce transport related fuel consumption. Furthermore, planting of beach vegetation would help in mitigation of greenhouse gas emissions from the project.

The IPCC defines adaptation "as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects." Various type of adaptation include anticipatory and reactive adaptation; private and public adaptation; and autonomous and planned adaptation. The adaptation policies and strategies of the Maldives are given in the Maldives National Adaptation Programme of Action (NAPA). The replenishment of the beach can be considered as a long-term adaptation measure against beach erosion caused by rising sea levels.

4 EXISTING ENVIRONMENT

4.1 Physical Environment

4.1.1 Meteorology

4.1.1.1 Climate

The climate in Maldives is warm and humid, typical of the tropics. The average temperature ranges between 25°C to 30°C and relative humidity varies from 73% to 85%. The annual average rainfall is approximately 1,948 mm. As Maldives lies on the equator, Maldives receives plenty of sunshine throughout the year. Significant variation is observed in the climate between the northern and the southern atolls. The annual average rainfall in the southern atolls is higher than the northern atolls. In addition, greater extremes of temperature are also recorded in the southern atolls. On average southern atolls receive 2704 hours of sunshine each year. Table 4-1 provides a summary of key meteorological findings for Maldives.

Table 4-1: Key Meteorological Information of the Maldives

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

4.1.1.2 Monsoons

The climate of Maldives is characterised by the monsoons of the Indian Ocean. Monsoon wind reversal significantly affects weather patterns. Two monsoon seasons are observed in Maldives: the Northeast (Iruvai) and the Southwest (Hulhangu) monsoon. The parameters that best distinguish the two monsoons are wind and rainfall patterns. The southwest monsoon is the rainy season while the northeast monsoon is the dry season. The southwest monsoon occurs from May to September and the northeast monsoon is from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November. . The nearest meteorological station is Haa Dhaalu Hanimaadhoo Meteorological Office. This study uses National Metrological Centre at Hulhule' Island (Velana International Airport) due to availability of more a comprehensive dataset.

4.1.1.3 Winds

The winds that occur across Maldives are mostly determined by the monsoon seasons. The two monsoons are considered mild given that Maldives is located close to the equator. As a result, strong winds and gales are infrequent although storms and line squalls can occur, usually in the period May to July. During stormy conditions gusts of up to 60 knots have been recorded at Male'.

Wind has been uniform in speed and direction over the past twenty-plus monsoon seasons in the Maldives (Naseer, 2003). Wind speed is usually higher in central region of Maldives during both monsoons, with a maximum wind speed recorded at 18 ms^{-1} for the period 1975 to 2001. Mean wind speed as highest during the months May and October in the central region. Wind analysis indicates that the monsoon is considerably stronger in central and northern region of Maldives compared to the south (Naseer, 2003).

Besides the annual monsoonal wind variations there are occasional tropical climatic disturbances (tropical storms or low intensity tropical cyclones) in the central region which increases wind speeds up to 110 km/h, precipitation to 30 to 40 cm over a 24 hour period and storm surges up to 3 m in open ocean (UNDP, 2006).

Table 4-2 summarises the wind conditions in central Maldives throughout a year. Medium term meteorological data from Hulhule meteorological centre (see Figure 4-1, Figure 4-2, and Figure 4-3) and findings from long-term Comprehensive Ocean-Atmosphere Data Set (COADS) are used in this analysis. National Meteorological Centre data is used here as it contains the most comprehensive set of data compared to Hanimaadhoo, which became operational only in the 1990s.

Table 4-2: Summary of General Wind Conditions from National Meteorological Centre

Season	Month	Wind
NE - Monsoon	December	Predominantly from NW-NE.
	January	High Speeds from W
	February	
Transition Period 1	March	From all directions. Mainly W.
		High Speeds from W.
	April	
SW - Monsoon	May	Mainly from W.
	June	
	July	High Speeds from W.
	August	
	September	
Transition Period 2	October	Mainly from W.
	November	High Speeds from W

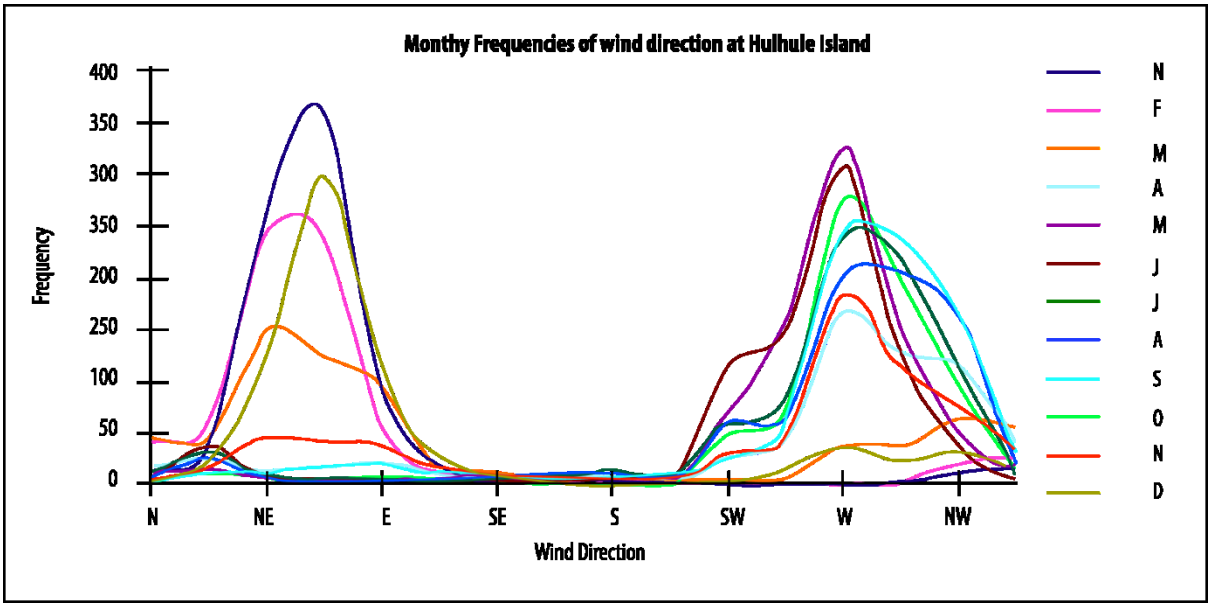

Figure 4-1: Monthly Frequencies of Wind Direction in Central Maldives based on National Meteorological Center 10 year Data (adapted from Naseer, 2003).

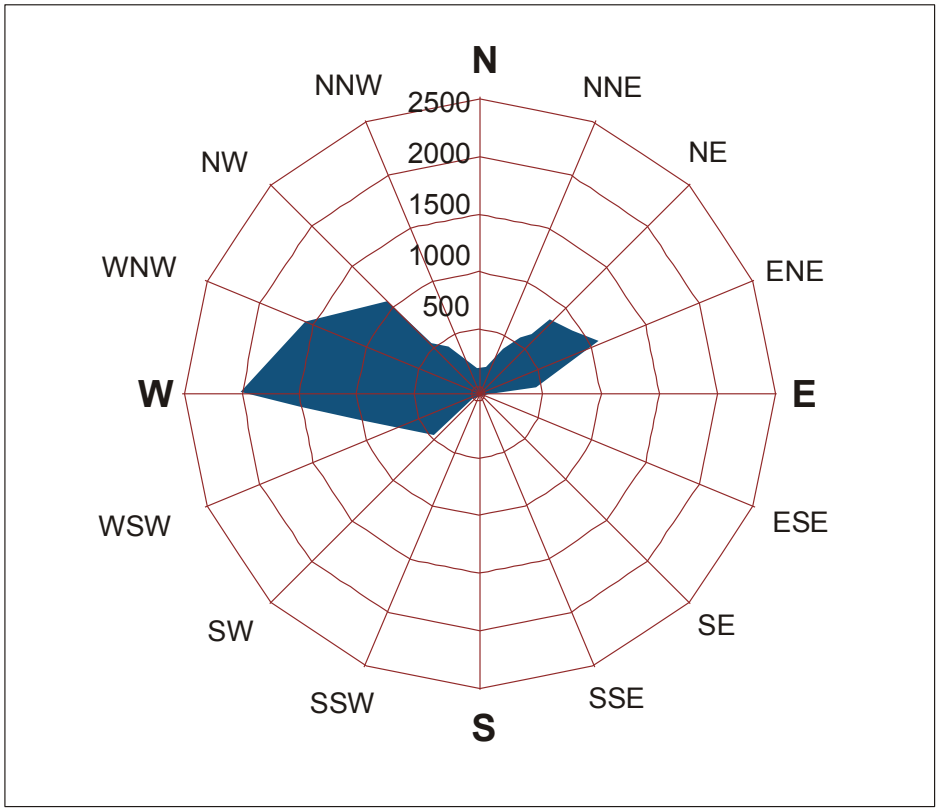

Figure 4-2: 24 Year Wind Frequency Recorded at the National Meteorological Centre.

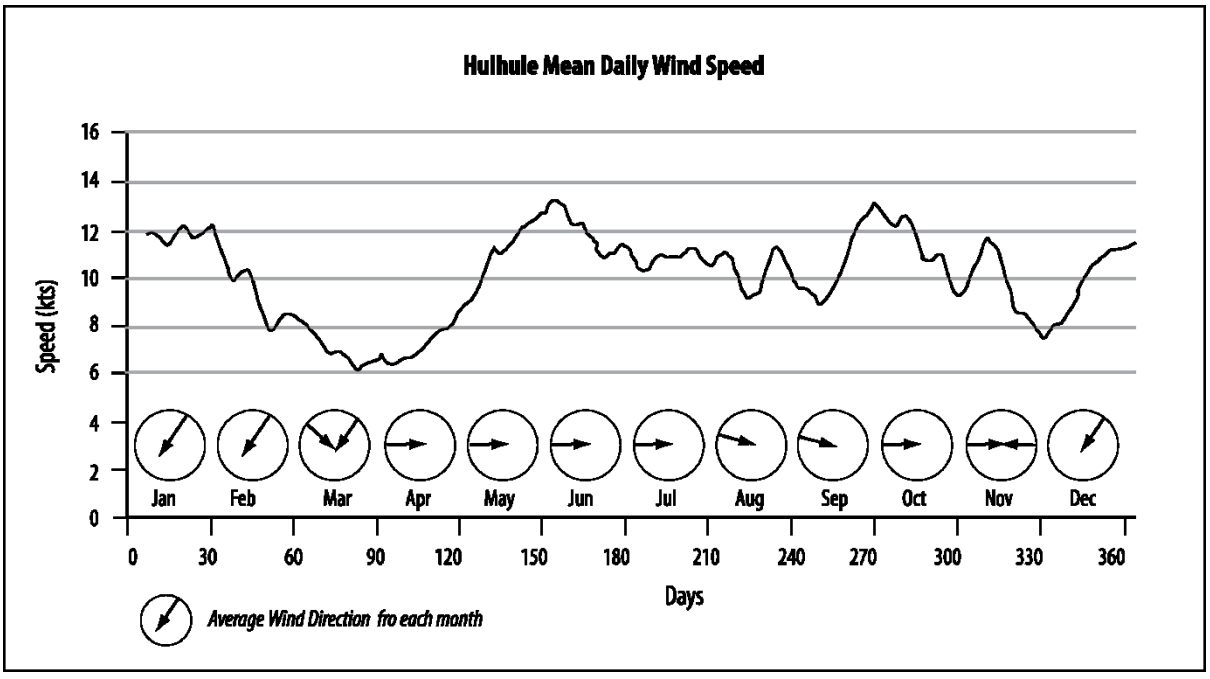

Figure 4-3: Mean Daily Wind Speed and Direction Recorded at National Meteorological Centre (1978 – 2004)

The Disaster Risk Profile of Maldives (UNDP, 2006) reports 11 cyclonic events over the Maldives in the last 128 years and only one event over the central Maldives. All of these events were of category 1 cyclones. There have been no cyclonic events since 1993.

4.1.1.1 Rainfall

The average annual rainfall for the archipelago is 2,124 mm. There are regional variations in average annual rainfall: southern atolls receive approximately 2,280 mm and northern atolls receive approximately 1,790 mm annually (MEC, 2004). Mean monthly rainfall also varies substantially throughout the year with the dry season getting considerably less rainfall. This pattern is less prominent in the southern half, however. The proportions of flood and drought years are relatively small throughout the archipelago, and the southern half is less prone to drought (UNDP, 2006).

The mean annual rainfall in Hulhule' is 1991.5 mm with a standard deviation of 316.4 mm and the mean monthly rainfall is 191.6 mm. Rainfall varies throughout the year with mean highest rainfall during October, December and May and lowest between February and April (See Figure 4-4).

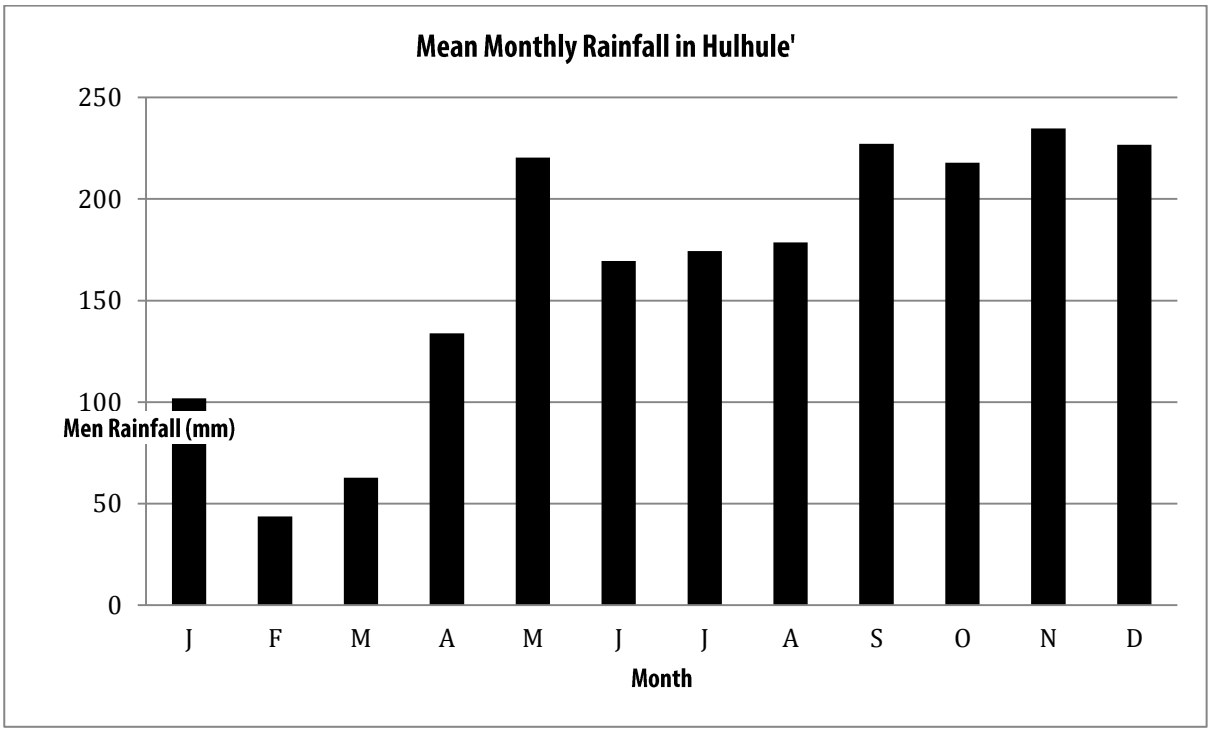

Figure 4-4: Mean Monthly Rainfall in Hulhule' (1975-2004)

Analysis of daily maximum annual rainfall data shows high variability, including extremes (see Figure 4-5 below). However, no significant long term trends are evident in the Hulhule data.

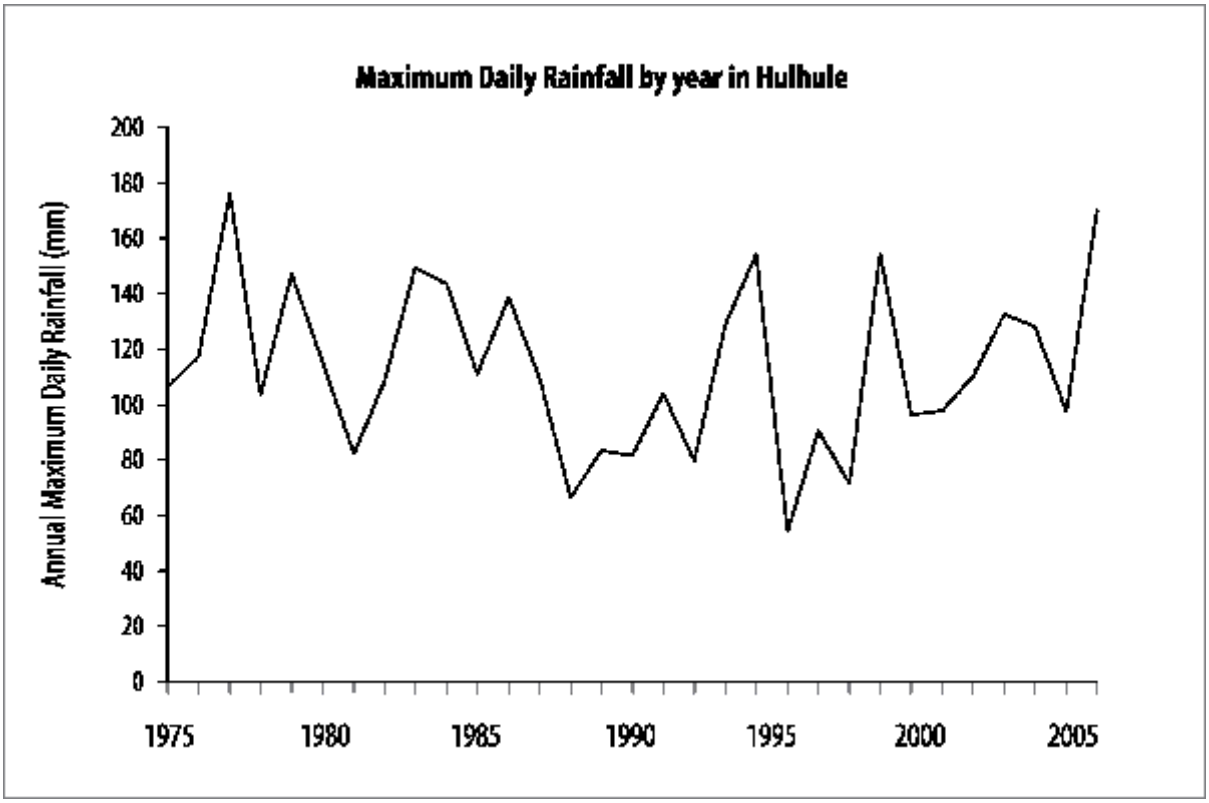

Figure 4-5: Maximum daily rainfall by year in Hulhule' (1975-2005) - (Source: Hay, 2006)

The probable maximum precipitations predicted for Hulhule' by UNDP (2006) are shown in Table 4-3.

Table 4-3: Probable Maximum Precipitation for various Return periods in Hulhule' (UNDP, 2006)

Station	Return Period			
	50 year	100 year	200 year	500 year
Hulhule'	187.4	203.6	219.8	241.1

4.1.1.2 Temperature

Daily temperatures of Maldives vary little throughout the year with a mean annual temperature of 28°C. The annual mean maximum temperature recorded for Male' during the period 1967-1995 was 30.4°C and the annual mean minimum temperature for the same period was 25.7°C. The highest recorded temperature for Male' was 34.1°C on 16th and 28th of April 1973. The hottest month recorded was April 1975 with a maximum monthly average temperature of 32.7°C, the next highest being 32.6°C in April 1998. The lowest minimum average temperature of 23.7°C was recorded in July 1992.

There is considerable inter annual variability in extreme temperatures for Hulhule as shown in Figure 4-6. A maximum temperature of at least 33.5°C is rare at Hulhule and has a return period of 20 years (Hay, 2006).

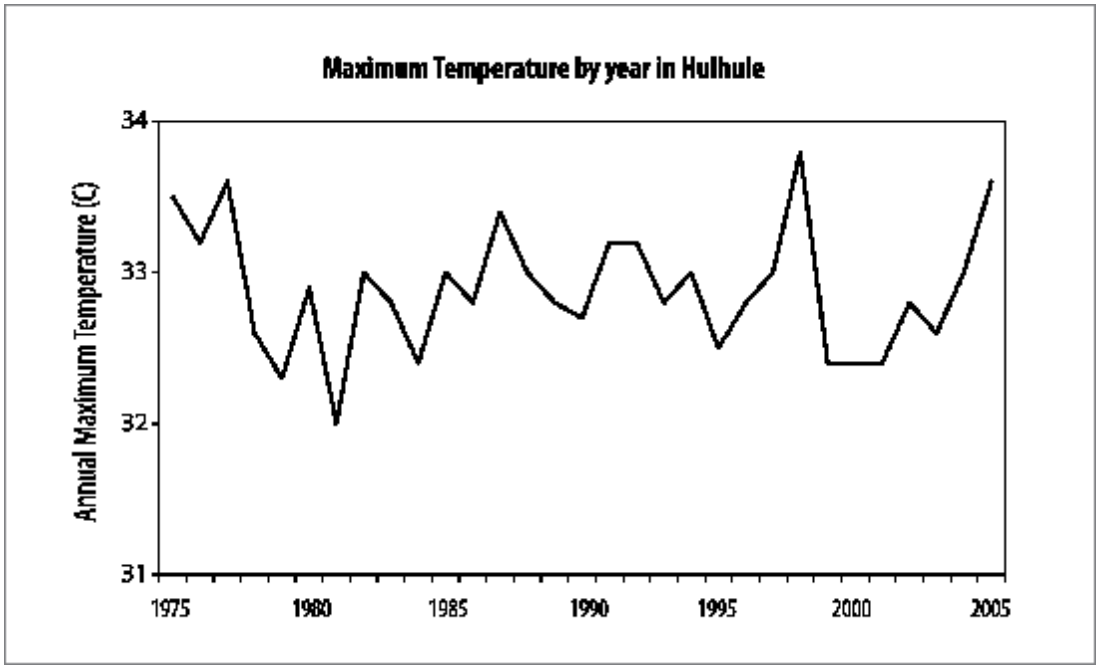

Figure 4-6: Maximum Temperature by year in Hulhule'- 1975-2005 (Source: Hay, 2006)

4.1.2 Hydrology

4.1.2.1 Tidal Pattern

Tides in the Maldives are mixed and semi-diurnal/diurnal. Water levels at the site vary mainly in response to tides, storm surge or tsunamis. Tidal variations are referred to the standard station at Hulhulé Island. Typical spring and neap tidal ranges are approximately 1.0 m and 0.3 m, respectively (MEC, 2004). Maximum spring tidal range in Hulhulé is approximately 1.1 m. There is also a 0.2 m seasonal fluctuation in regional mean sea level, with an increase of about 0.1 m during February to April and a decrease of 0.1 m during September to November. Table 4-4 summarizes the tidal elevations reported at Hulhulé, which is representative of tidal conditions at the project site.

Table 4-4: Tidal Variations at Hulhule International Airport

Tide Level	Referred to Mean Sea level
Highest Astronomical Tide (HAT)	+0.64
Mean Higher High Water (MHHW)	+0.34
Mean Lower High Water (MLHW)	+0.14
Mean Sea Level (MSL)	0.00
Mean Higher Low Water (MHLW)	-0.16
Mean Lower Low Water (MHLW)	-0.36
Lowest Astronomical Tide (LAT)	-0.56

The predicted tide curve for the period for the month of April 2017 at Hulhule is presented in Figure 4-7 below.

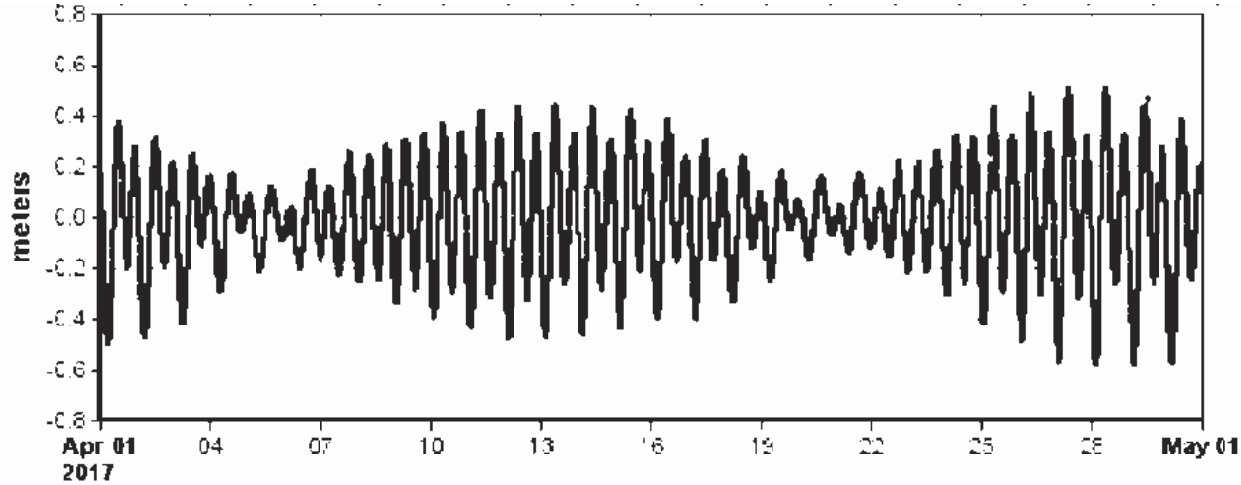

Figure 4-7: Predicted tides for April 2017, based on data supplied from Department of Meteorology, Maldives

4.1.2.2 Waves

There are two major types of waves observed along the islands of Maldives. The first type is wave generated by local monsoon wind with a period of 3-8 seconds and the second type is swells generated by distance storms with a period of 14-20 seconds [Kench et. al (2006), DHI (1999), Binnie Black & Veatch (2000), Lanka Hydraulics (1988a & 1998b)]. The local monsoon predominantly generates wind waves, which are typically strongest during April-July in the southwest monsoon period. Wave data for Male and Hulhulé' between June 1988 and January 1990 (Lanka Hydraulics 1988a & 1998b) shows that the maximum significant wave height (H_s) recorded for June was 1.23 m with a mean period (T_m) of 7.53s. The maximum recorded H_s for July was 1.51 m with a T_m of 7.74s. The mean wave periods were 5.0 – 9.0s and the peak wave periods were within 8.0 – 13.0s.

Maldives experiences occasional flooding caused by long distance swell waves that are generated by South Indian Ocean storms (Goda 1988). The swell waves of height 3 m that

flooded Male' and Hulhulé' in 1987 are said to have originated from a low-pressure system off west coast of Australia (refer the next section for more detail). In addition, Maldives has recently been subject to an earthquake-generated tsunami reaching heights of 4.0 m on land (UNDP, 2006). Historical wave data from Indian Ocean countries show that tsunamis have occurred in more than 1 occasion, most notable has been the 1883 tsunami resulting from the volcanic explosion of Karakatoa (Choi et al., 2003).

The estimated wave regime around Maafaru Island is presented in Figure 4-8. The island is generally expected to receive strong waves on the eastern rim throughout the year, particularly during the NE monsoon. The northern and southern rim will also be affected from swells for most part of the year. The proposed project site on the North Eastern side of the island will receive year round residual swell waves from the Indian Ocean but will mostly be protected from wind waves during the SW monsoon.

The western side will receive monsoonal wind waves during SW monsoon but will be generally calm during the NE monsoon.

4.1.2.3 Swell Waves and Storm Surges

Waves studies around Maldives have identified the presence of swell waves approaching predominantly from a southwest to a southerly direction [Kench et. al (2006), Young (1999), DHI(1999), Binnie Black & Veatch (2000) and Naseer (2003)].

The location of the island on the eastern rim of Miladhunmadulu Dhekunuburi Atoll exposes the island to direct impacts of SE swell waves approaching from the Southern Indian Ocean. The timing of the long distance swell waves is associated with the South Indian Ocean storm activity (Young 1999). Waves generated from abnormal events could also travel against the predominant swell propagation patterns (Goda, 1998), causing flooding on the eastern and southern islands of Maldives (UNDP, 2009).

The island is exposed to periodic swell waves approaching from the SE, which is likely to have a significant impact on the proposed project site throughout the year. The island is also partially exposed to refracted swell waves approaching from the SW. Impacts of these waves are expected to be moderate to minimal most times of the year.

In addition to swell waves, islands of the Maldives are also exposed to storm surges associated with localised storms and cyclonic events (UNDP 2009). The Disaster Risk Assessment report (UNDP, 2006), reported that Maafaru is located in the very high storm surge hazard zone. The most likely direction of approach for these waves is from E and NE.

4.1.2.4 Currents

In general, currents which affect the sea areas around the islands reef system can be the result of one or more of tidal currents, wind-induced currents and wave-induced currents. It is presumed that dominating two monsoon season winds have a greater effect on both oceanic currents lagoon currents around Maldives. Westward flowing currents are dominated from January to March and eastwardly from May to November.

For the project site wave-induced currents also appear to play an important role on the ocean side reef flat, and the north and south ends of the island as there is a year round presence of swell waves.

In situ current measurements of the project site varied based on location and tide. Data on current flow for Maafaru Island are provided in Figure 4-9. Data showed a moderate westerly flow during the SW monsoon.

These measurements should be treated with caution as it represents data for a single day and was observed only in a one hour window. Prolonged measurements over two seasons are required to provide exact values of current speed.

4.1.2.1 Bathymetry

A detailed bathymetric survey of the proposed project site was undertaken during May 2017. Survey results have been summarised in bathy charts Appendix F. The depth figures presented are in meters below MSL. The data shows that the depths at the proposed project are less than -1 m MSL.

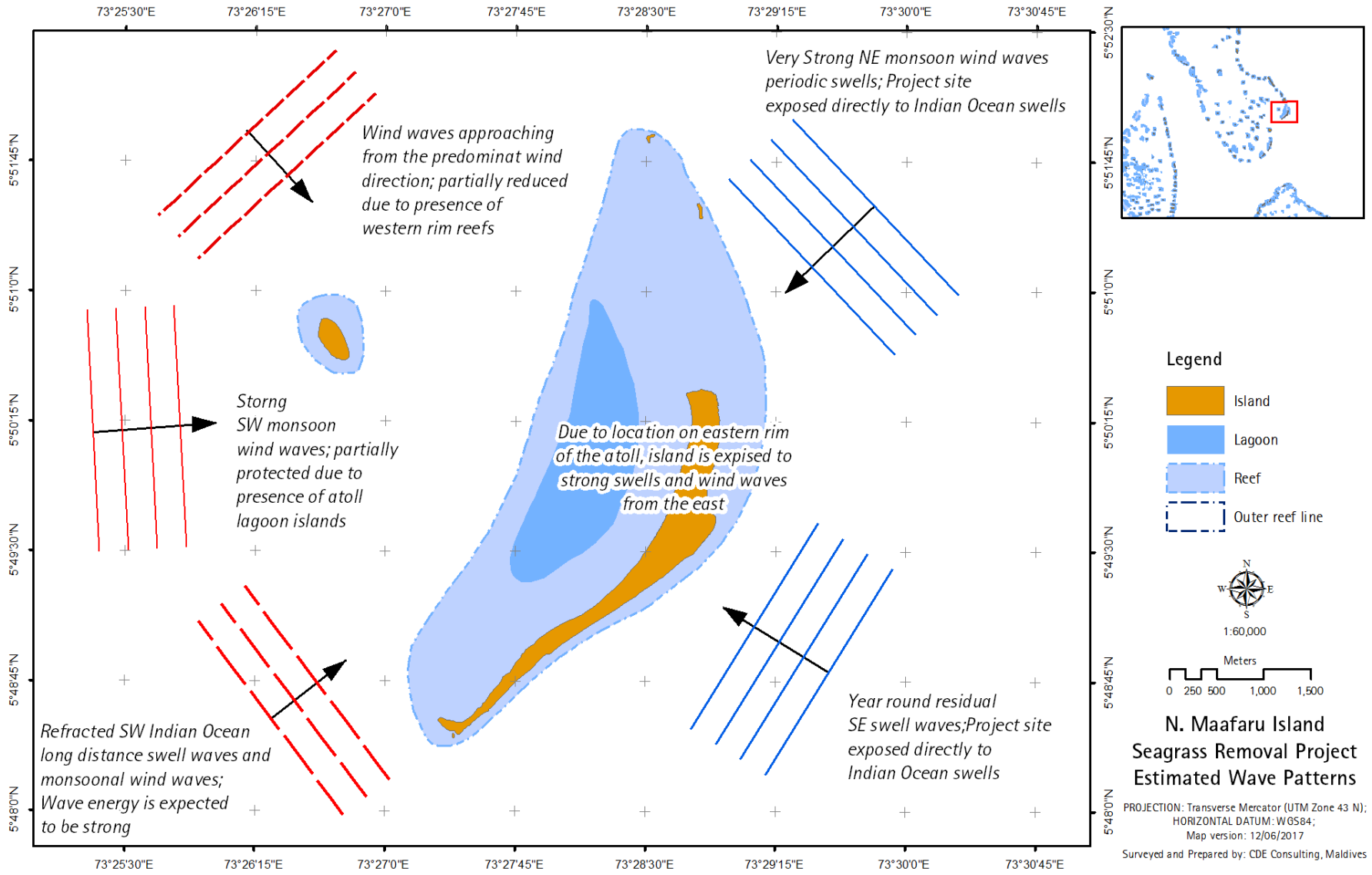

Figure 4-8: Estimated wave regime around Maafaru island

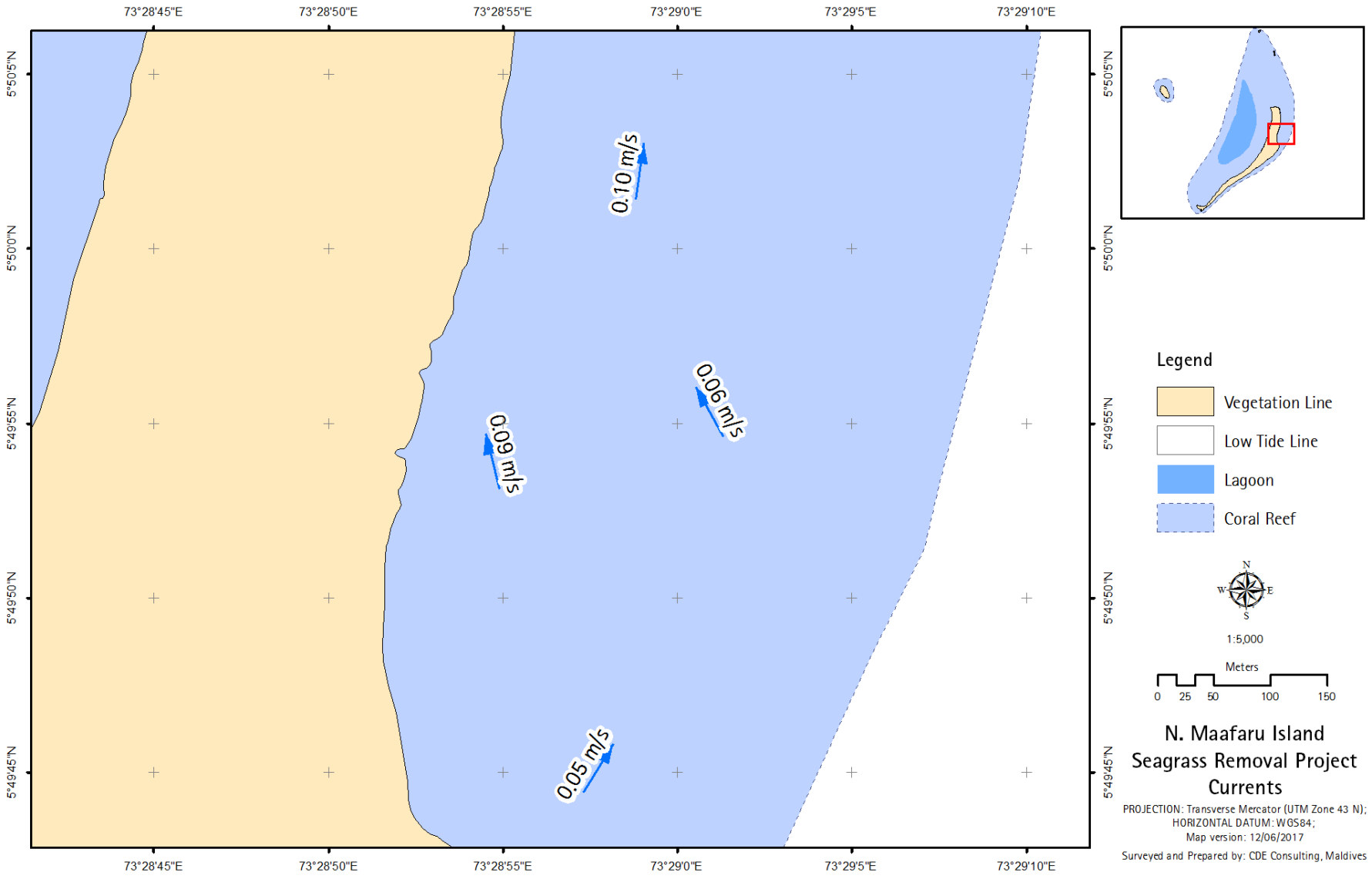

Figure 4-9: Observed current flow patterns on the reef

4.1.3 Beach

4.1.3.1 Beach erosion and coastal changes

Historical changes and long-term erosion

Analysis of historical changes to beach was undertaken using remote sensing technology by comparing aerial photographs from 1969 (see Figure 4-10) against shoreline data from GPS surveys from 2008 and 2014.

The results show that the island has undergone shoreline changes in some sections of the island over the last 45 years. Comparison of data between 1969 and 2014 shows that, shoreline had shifted significantly on the northern end and the eastern side. Overall approximately 2.1 ha has eroded on the northern side and about 7.0 Ha has accreted on the NW and western side (excluding the reclaimed 0.9 Ha land around the jetty). Beach had retreated 150 m on the northern tip over the last 45 years. This material has been relocated to the NW side where the beach advanced a 144 m. The changes on the northern tip are typical of north-south oriented islands located on the eastern rim of the atoll. Similarly the shift of 150 m is in line with similar shifts observed in other islands of Noonu Atoll. However, the growth of 7 ha of new land is remarkable on an eastern rim island. Much of this material would have come from the western side lagoon and through erosion on the eastern shoreline. The presence of a deep opening on the NE corner of the reef may also have assisted in the significantly high sediment production rate of the reef, as observed in the growing reef flat width.

Beach retreat on the western side, immediately SE of the settlement is about 126 m over the last 45 years. A total of 3.4 ha have been eroded and evidence of recent severe erosion is present in the dead vegetation in the lagoon. About half of the eroded material is found immediately north of the site where a 1.4 Ha land has accreted. The remaining material could have moved northward and on to the western side. The significant retreat on the eastern side is also remarkable and only a few islands on the eastern rim of northern Maldives have undergone such erosion on its eastern shoreline.

The rest of the island beach on the eastern side has remained fairly stable although a slow retreat of 6-7 m over the 45 years could be observed.

The western side shoreline in general has advanced at a very slow rate. However there have also been patches of erosion, the most notable of which is the area where shoreline was naturally breached for the lagoon to connect with the marshland.

This assessment shows the long-term trend based on two points in temporal scale, but it discounts the periodic shifts that may have occurred in between.

Comparison of data from the last 15 years shows the same trends as observed in the medium-term. Erosion on the eastern side, as discussed above, has accelerated over the last 12 years.

Predicted short-term beach changes

The volatility of the northern end of the island is likely to continue but at a slower rate for the next few years. The severe erosion on the eastern side is likely to continue the same speed until the shoreline forms a smooth line.

The proposed site is exposed to erosion on the eastern side, albeit at a slow pace. Coastal protection may be required at some stage.

Beach composition and sediment characteristics

The beach material on the western side generally comprise of fine sand. The reclaimed area contains mixed rubble due to dredged material.

The south western side of the island generally comprise of coarse to very coarse material.

Seasonal Sediment Movement Pattern

Much of the seasonal movement is restricted to the northern and southern end of the island, which is the general movement pattern in elongated, north-south oriented islands.

During the NE monsoon the sand pit on the northern end shifts westward. The process starts during the NE transition period and reaches the maximum extent by the end of February. The process reverses in the SW monsoon with sand shifting east ward.

The western shoreline maintains a fairly constant beach width throughout the year, although the high tide line reaches higher level during the SW monsoon.

Similarly, the eastern shoreline only has minimal movement throughout the year, owing to the year round wave driven currents.

4.1.3.2 Pictorial description of Coastal Conditions

A pictorial summary of the coastal conditions on the eastern and western side of the island is provided in Figure 4-12 and Figure 4-13.

Western side

The northern tip of the island contains a comparatively small sand pit which shifts seasonally (Figure 4-12, D).

The northern half of the western side is fairly stable for most parts of the year but lacks a beach (See Figure 4-12, C). The existing jetty area has been reclaimed from dredged sand but has no solid shore perpendicular structures to obstruct sediment flow (Figure 4-12, B)

Beach on the southern half is narrow with the high tide line reaching into the vegetation (Figure 4-12, F).

There is a naturally breached area on the beach which connects the lagoon and the marsh land (Figure 4-12, E)

The southern half of the western side is characterised by a seasonal beach with some pioneer vegetation (Figure 4-12, G).

Eastern side

The northern half of the western side does not have beach and the high tide line reaches the vegetation line. There is also persistent but slow erosion in the NE corner (Figure 4-13, A, B). The area immediately SE of the settlement is undergoing severe erosion (Figure 4-13, D). Eroded material are being deposited immediately north of the site (Figure 4-13, C).

The southern half of the eastern side contains a narrow and a comparatively steeper slope with coarse sand (Figure 4-13, F).

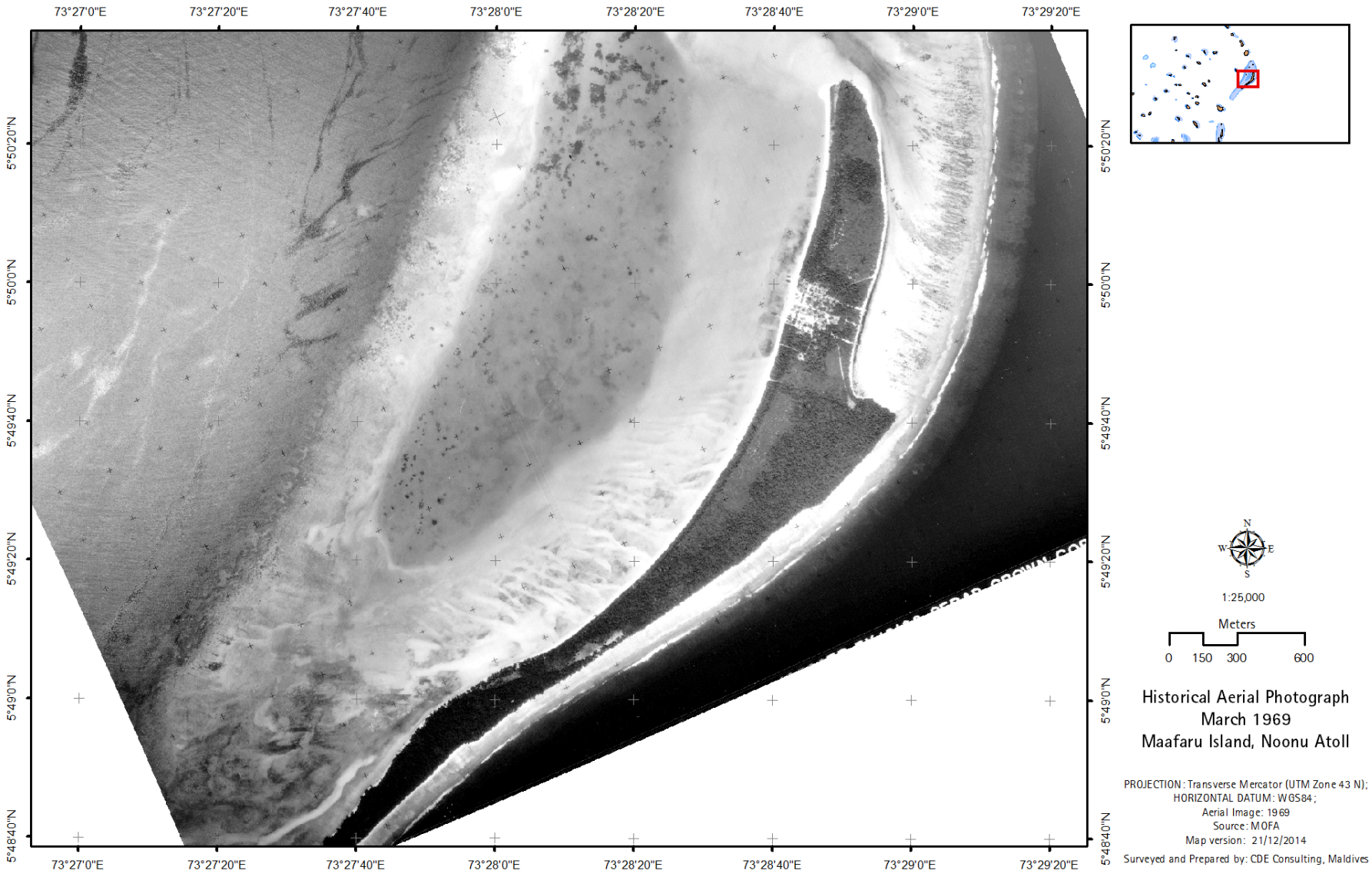

Figure 4-10: Historical photograph of Maafaru - 1969

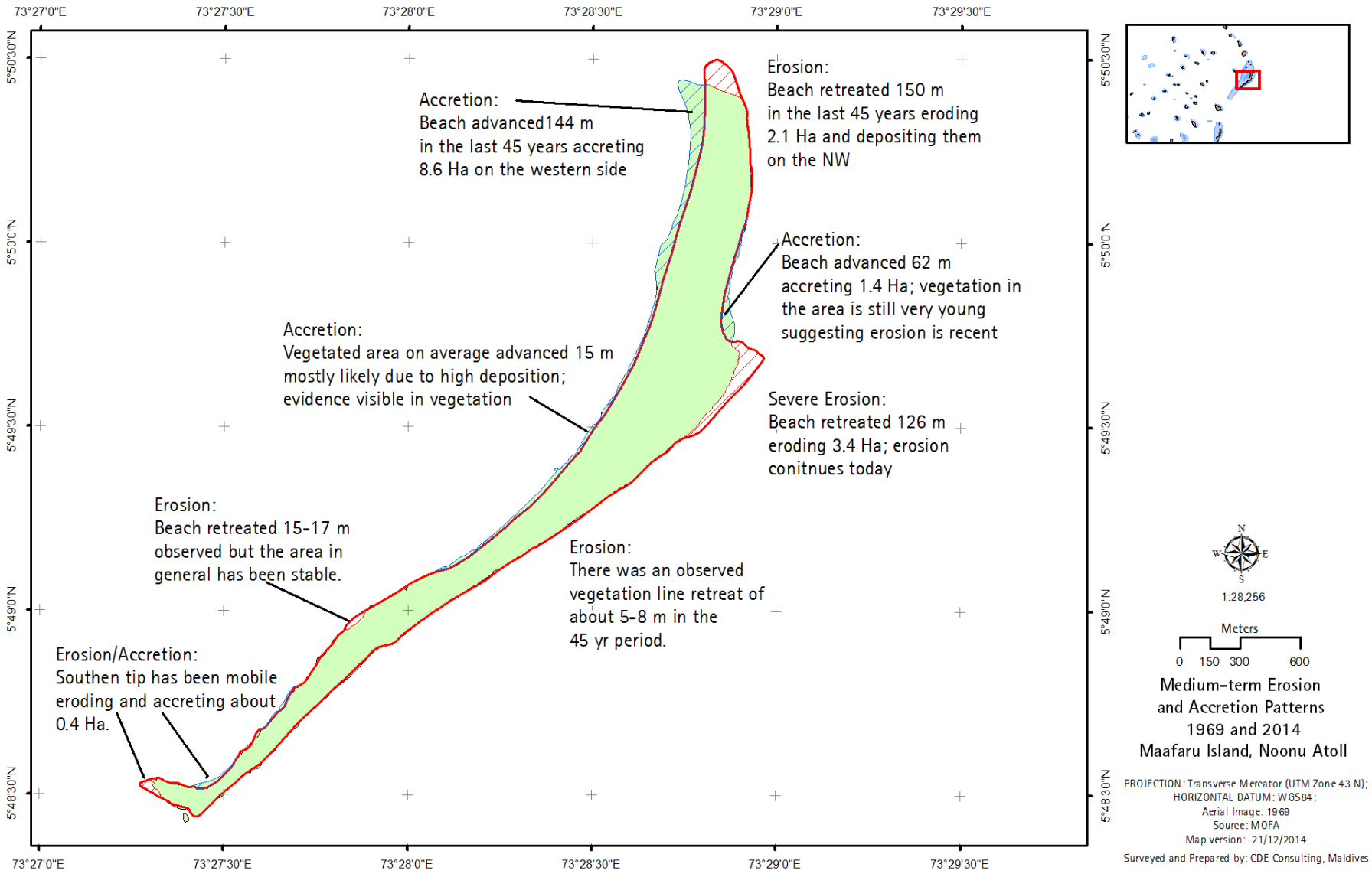

Figure 4-11: Historical changes to shoreline – 1969 and 2014

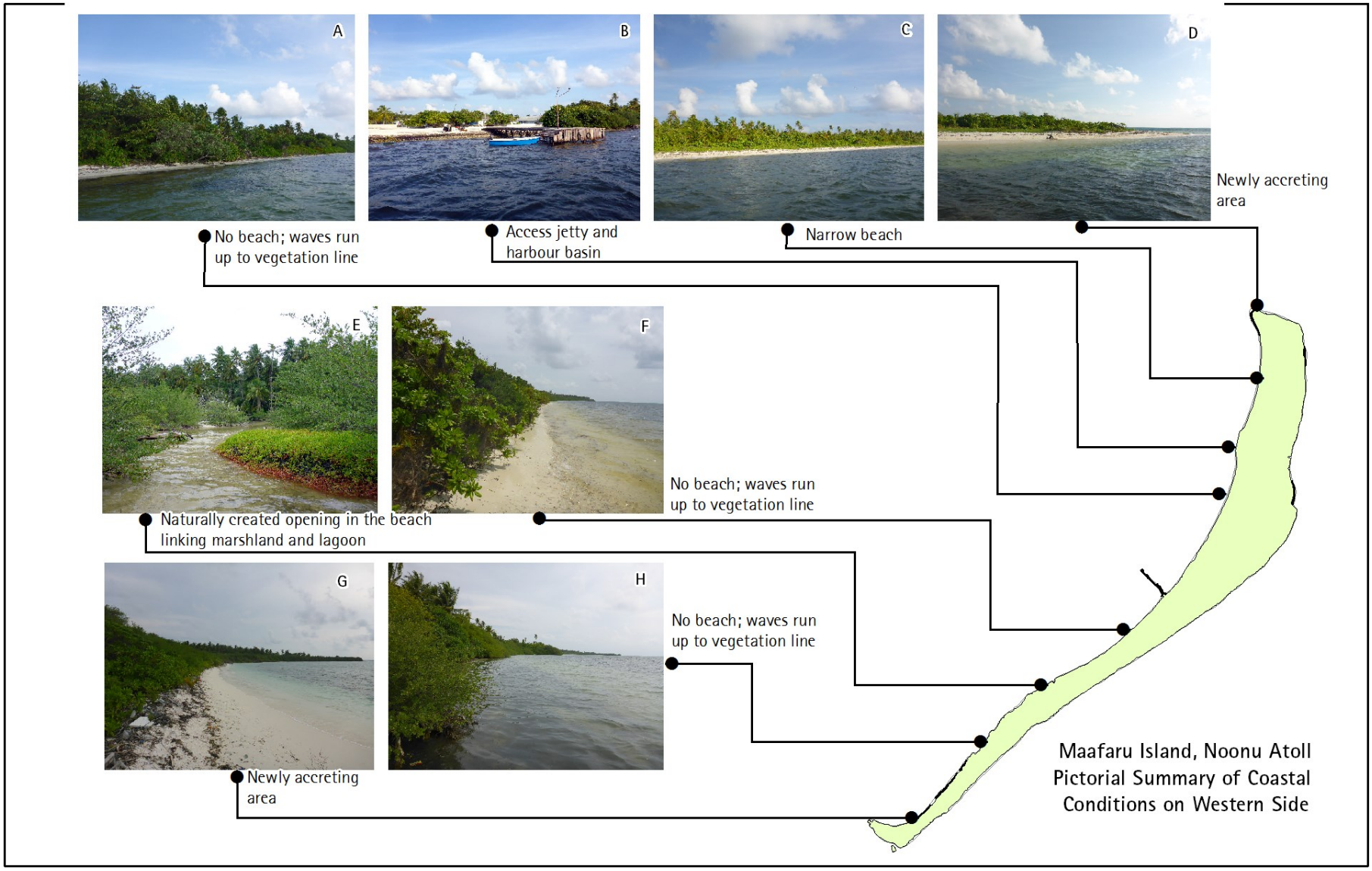

Figure 4-12: Pictorial summary of coastal conditions on the western side of Maafaru

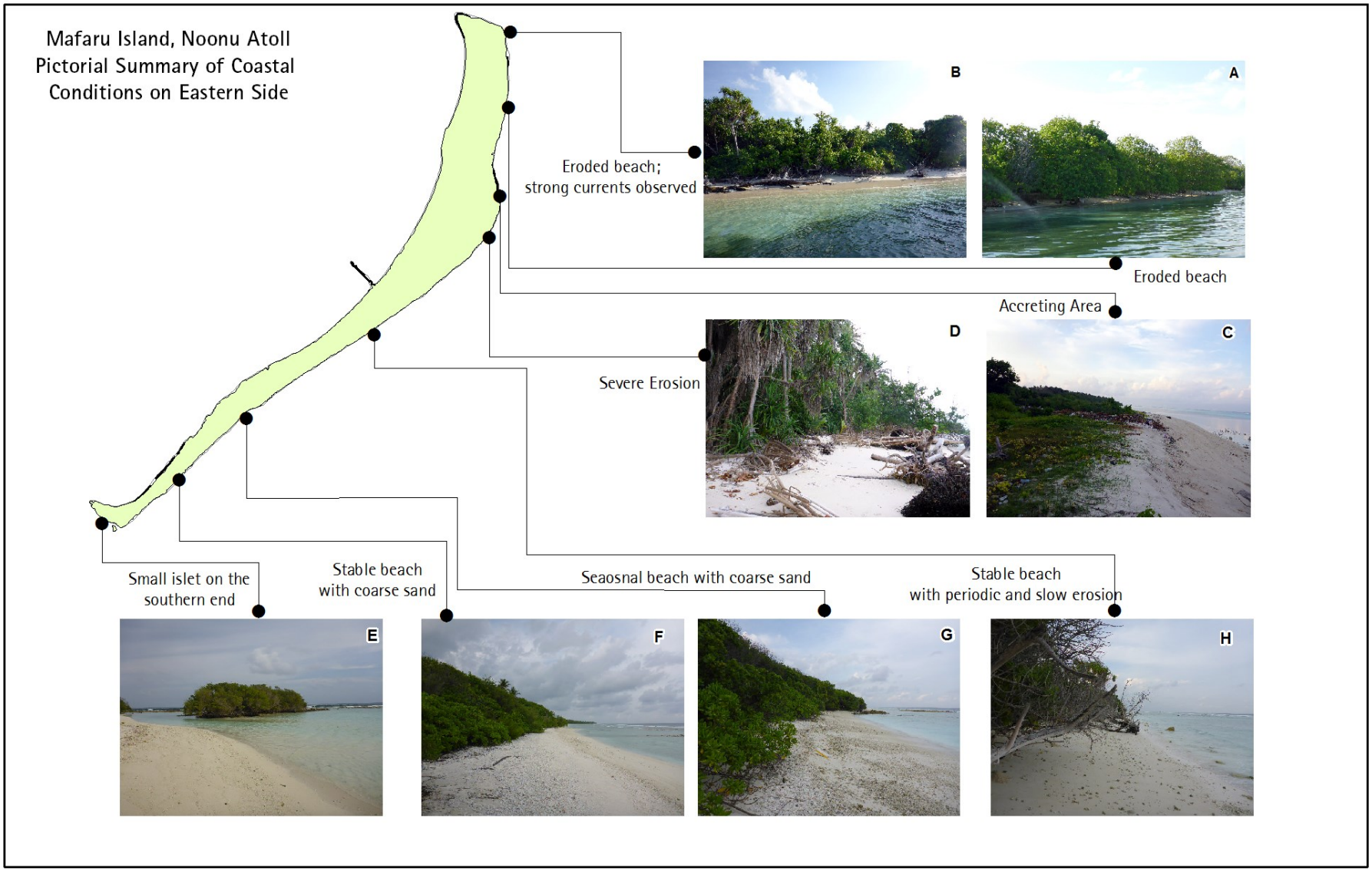

Figure 4-13: Pictorial summary of coastal conditions on the eastern side of Maafaru

4.1.3.3 Beach profiles

Beach profiles were surveyed in open beach areas around the island. Beach profiles provide invaluable information about the sediment volume, beach slope and changes to volume and slope over time. The surveyed beach profiles for Maafaru are attached in Appendix E.

4.1.4 Marine Water Quality Assessment

The primary objective of the lagoon and groundwater water quality sampling was to determine the present conditions of the marine water and groundwater in and around Maafaru Island. Water samples were collected from 3 locations on the 29th of April 2017. Marine water samples were collected from mid depth following the protocols mentioned in Annex of the Terms of Reference approved for the project. Groundwater was collected from wells located within the island.

All parameters except pH, Salinity, Conductivity and TSS was analysed at the Malé Water and Sewerage Company (MWSC) Water Quality Assurance Laboratory. PH, Salinity, Conductivity and TDS were analysed at QLab by using ProDSS Multiparameter Water Quality Meter.

Table 4-5 shows the test results of the marine water quality assessment. The MWSC test results are provided in Appendix C.

Table 4-5: Water quality assessments for study area

Parameter	Optimal Range (EPA)	Results		
		SW1	SW2	GW1
Physical appearance	Clear	Clear with particles	Clear with particles	Pale yellow with particles
pH	8.0-8.3	8.19	8.24	**7.65**
Salinity (ppt)		34.93	34.92	0.28
Nitrate (mg/L)	<5	3.0	3.7	1.1
Conductivity (µS/cm)		39194	40757	34480
Phosphate (mg/L)	0.005 – 0.020	**0.07**	**0.06**	**0.22**
Total Suspended Solids (mg/L)		<5 (LoQ 5 mg/L)	<5 (LoQ 5 mg/L)	Not Tested
Turbidity (NTU)	3-5 NTU >5 causes severe stress	0.486	0.509	Not Tested

The temperature of all water samples were within the range of 29-30°C. Marine water quality for majority of the parameters tested, appear to be within acceptable ranges at all locations. Phosphate level and nitrate levels are slightly higher than the optimum level for some of the

samples collected. Phosphate levels are however higher than the optimal level in all the samples, with a significant increase in phosphate levels in the groundwater sample. The pH of the groundwater is noted to be below the EPA recommended optimal range.

4.2 Biological Environment

4.2.1 Marine Environment

The aim of this assessment is to establish the baseline condition at the proposed project location. Assessments were carried out on 27th April 2017. The weather during the survey was sunny with calm sea conditions. The main objectives of the assessments were:

To determine the general status of the area associated with the island.

- To assess the condition of the marine environment which will be directed impacted by the project
- To determine the fish species abundance and composition of the reef system

The following sub-sections provide details site, the methodology adapted for this assessment and the results.

4.2.1.1 Snorkelling Visual Survey

Snorkelling visual surveys were carried out at selected locations of the lagoon, to qualitatively determine the main benthic composition and the general status at these areas. This method allows for a quick assessment of the sites. General status of these sites were recorded, special attention was given to types of corals and fishes present at these sites and the environmental conditions that could affect growth such as suspended solids, depth, and other threats to coral life.

The beach at this site is covered in a thick layer of sea grass debris. The lagoon is generally shallow, 0.5 - 1.5 m depth, and the sea grass bed extends to approximately 130 m from the shore. The dominant sea grass species at this area observed was *Thalassia hemprichii* and no live coral cover was recorded. Further out from the sea grass zone onwards, the reef flat is dominated by sand and coral gravel with isolated patches of dead coral patches. Clumps of *Halimedia sp* were observed among the dead coral patches.

Live coral cover in this area was very low (<5) and only a few juvenile massive corals were recorded. However further away from the lagoon near the reefs edge, large *Porites* colonies (massive form) were observed. Live coral was higher closer to the reef edge and larger fishes were observed at this area.

The main fishes observed at this site were juvenile Wrasses (*Labridae*) and Emperors (*Lethrinidae*). In addition, few species of sea cucumber (Black sea cucumber - *Actinopyga miliaris* spotted sea cucumber – *Synapta maculata*) was observed in the lagoon during the survey.

Figure 4-14: Upper panels shows the dense Thalassia hemprichii beds at the site, bottom panels shows clumps of Halimeda spp. and turf algae grown on patches of dead corals.

5 IMPACTS IDENTIFICATION

5.1 Introduction

The seagrass removal on Maafaru Island will lead to modification and changes of the existing environment outlined in the previous chapter. Hence the above-discussed baseline environmental conditions are used as benchmarking conditions for assessing the future environmental impacts from this project. In this regard, the aim of this chapter is to highlight and identify the environmental impacts of the proposed beach replenishment in the island.

Thus, potential adverse and beneficial impacts of beach replenishment activities on the island are identified and evaluated in this section. The following sections provide details of the evaluation of impacts. The affected area and footprint of the proposed project is presented in Figure 2-5

5.2 Nature of potential impacts on key components

Nature of potential impacts is defined here as *no impact, adverse impact or beneficial impact*. Table 5-1 below provides the nature of potential impacts from the proposed project on environmental by the project. Where impacts are not applicable to different components, this is indicated as 'X'. Some components may be affected both adversely (indicated as [-]) and beneficially (indicated as [+]) from the project.

5.3 Identification of significant impacts

Environmental and socio-economic components that may be impacted by the project as identified in Table 5-1 are further evaluated to identify significant impacts. Assessments of the impacts are conducted using the four criteria of magnitude, reversibility, duration and distribution as described below. Evaluation of key impacts is provided in Table 5-2.

1. **Magnitude**: Refers to the quantum of change that will be experienced as a consequence of the impact.
2. **Reversibility:** Refers to the degree of reversibility of an impact (i.e. ease of reversing the conditions).
3. **Duration:** Refers to the temporal scale (i.e. duration, frequency) of the impact. It does not take into account the duration of the impact's effects.
4. **Distribution:** Refers to the spatial scale of the area impacted (e.g. a small portion of a reef or an entire lagoon)

Estimates for negative impacts represent a 'worst case scenario' based on the assumption that the project will undergo full scale development with no consideration for its environmental and social consequences, i.e. significance is assessed prior to implementation of mitigation measures. Values are attributed by the EIA team on the basis of direct observation of surveyed sites, professional judgment and pre-existing experience in development projects of similar nature.

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Table 5-1: Impact Identification Matrix for the project

Activity	Noise Level	Air Quality	GHG emissions	Coastal processes	Groundwater	Terrestrial Flora and Fauna	Soil condition	Marine flora and fauna	Marine water	Marine environment	Protected species	Natural hazard risk & safety	Health and safety	Employment
Construction Stage														
Seagrass Removal														
Site setup and mobilization	-	x	x	x	x	x	x	x	-	-	x	x	-	+
Workforce	-	x	x	x	x	x	x	x	x	x	x	x	x	+
Seagrass removal	-	-	-	-	x	x	x	-	-	-	x	+	-	+
Dredge disposal	-	-	-	-	-	x	-	-	-	-	x	x	-	+
Demobilization	-	x	-	x	x	x	x	x	x	x	x	x	x	-
Operation Stage														
Operation of the recreational area	x	x	x	-	x	x	x	x	x	x	x	+	+	x

X (no impact), - (negative impact) + (positive impact)

Table 5-2: Evaluation of key impacts on the natural environment during construction and operation stage

Impact area	Potential impacts	Nature/Distribution/Duration/Magnitude	Reversibility	Significance
		Construction stage		
Ambient noise level	**Noise pollution:** Operation of machinery during site preparation, removal of seagrass, and dredge disposal. However these will not be operated continuously for a long period of time.	Direct/negative; 200 m radius of Project site; Short term; Minor negative change	Easily reversible	Insignificant - Limited hours of operation.
Ambient air quality	**Air quality degradation:** negligible level of air emissions during transport of labour force and equipment to the project site. Small amounts of emission are anticipated during operation of machinery.	Direct/negative; 200 m radius of Project site; Short term; No change;	Easily reversible, negligible effects	Insignificant - Negligible level of emissions over a short time period.
GHG emissions	**Increase in GHG gas in atmosphere**; operation of machinery and vessels that emit GHGs will results in negligible increase in GHG in the atmosphere.	Direct/negative; Island level; Short term; No change;	Easily reversible	Insignificant - negligible amount of GHGs is anticipated to be released.
Coastal Processes	**Destabilised shorelines:** Removal of seagrass will reduce sediment trapping consequently effecting sediment transport rates. Furthermore, the newly	Direct/negative/cumulative	Reversible with maintenance activities	Significant – less sediment held by seagrass so sediment

Impact area	Potential impacts	Nature/Distribution/Duration/Magnitude	Reversibility	Significance
	reclaimed dredge disposal site will undergo significant changes to the volume of sediment transported and subsequently affect erosion and accretion patterns. The new shape of the island will also significantly affect coastal hydrodynamics which may in turn result in significant changes to the shoreline.	North Eastern and North Western shorelines Shore-term; Minor negative to positive	and erosion mitigation	transport likely to increase. The eastern shoreline has undergone significant change over the last 40 years so likely to cause significant changes. As harbour construction is being carried out at the dredge disposal site, this will have a cumulative effect on the coastal processes will likely cause significant changes.
Groundwater	**No impact:** Immediately after the dredge disposal there is no impact, however there will be changes to the fresh water lens.	Indirect/negative Site level; Short term; No change	Reversible	No impacts ; the area is too small to have any significant impacts
Marine Flora and Fauna	**Loss of marine flora and fauna:** Marine habitats in the direct foot print of the seagrass removal area and dredge disposal area will likely be affected.	Direct/negative; Project site; Long term; Moderate negative change	Reversible	Moderately Insignificant – No coral reef habitats along project foot print. Marine fauna will likely

Impact area	Potential impacts	Nature/Distribution/Duration/Magnitude	Reversibility	Significance
	Increased turbidity and sedimentation: During the dredge disposal process, it is likely that turbidity and sedimentation will increase significantly at the dredge disposal site. This is will harm the bottom dwelling Holothuroids, other fish species and corals			migrate to other locations.
Marine Water and Environment	**Loss of seagrass habitats-** Project is aimed at removing seagrass habitats including sea grass beds, bottom dwelling organisms. **Contamination of marine environment:** During site setup, sand bed construction, dredging, and dredge disposal, sediment plumes will likely be generated and contribute to increased turbidity. This will degrade the overall quality of the marine water. In addition, there is a possibility of accidental spillage of fuel and other materials into the water.	Direct/negative; Project site; Short term; Negative change	Reversible	Moderately Insignificant as most marine organisms will adapt and will relocate due to turbidity. The sediment plumes will dissipate over a short period of time once construction activities end.
Health and safety	**Risks to health and safety**; During the construction risks to workers health and safety is increased, as chances of accidents are high.	Direct/negative; Project site; Short term; Moderate negative change.	Reversible	Significant - Risks to health and safety especially during construction stage is high

Impact area	Potential impacts	Nature/Distribution/Duration/Magnitude	Reversibility	Significance
Employment	Income earning opportunities for sand miners, temporary workers, restaurants, guesthouses and transport sector.	Direct/positive; Island level; Short term; Moderate positive change	N/A	Insignificant - Short term employment opportunity,

6 SIGNIFICANT IMPACTS AND MITIGATION MEASURES

6.1 Introduction

The preceding chapter has identified significant impacts to the environment upon and during the implementation of the above-mentioned project. This chapter aims to investigate details of those significant impacts. The major environmental impacts identified during the seagrass removal are contamination of water, noise, vibration and air pollution, loss of benthic organisms, changes in coastal hydrodynamics, and health and safety risks. This chapter illustrates significant impact during the seagrass removal phase. Moreover, the chapter proposes appropriate mitigation measures in reducing the impact level. Furthermore, these mitigation measures will be appropriately justified. Finally, the chapter illustrates the significant environmental impacts upon completion of constructional phase of the project.

6.2 Potential Adverse Impacts during Construction Phase and Suggested Mitigation Measures

6.2.1 Marine Water Quality Degradation

During the seagrass removal phase any accidental spill of oil and toxic substances will contaminate the marine environment. Therefore, special care should be taken when handling oil, solid waste and hazardous waste to entirely avoid any accidental spills and leakage. Furthermore, mitigation measures must be undertaken in order to ensure that sediment plumes are controlled and the increase in turbidity is localised.

Mitigation measures to prevent from water contamination (marine and/or ground water):

- All machinery will be properly tuned and maintained.
- All paints, lubricants, and other chemicals used on site will be stored in secure and bunded location.
- Oil, solid waste and hazardous waste will be handled carefully and transported in sealed containers in properly bunded vehicles/vessels.
- Construction activities will be carried out under the supervision of a suitably experienced person.
- All costs are included in the contract price.
- Ensure all project activities are restricted to necessary areas only.

- Carry out construction activities during calm conditions.
- Construct bunds around seagrass removal area as well as dredge disposal area to limit spread of sediments.
- Continuous monitoring should be carried out to identify abnormal water quality parameters.

6.2.2 Noise, Vibrations and Air Pollution

During the mobilisation of equipment and operation of heavy machinery, it is anticipated that significant noise will be generated. Such vibrations may alter species behaviour in the short term. In addition, dust and emissions from vehicle and machinery exhausts will degrade the air quality. However, these adverse impacts will be short term and can be mitigated to avoid nuisance.

Mitigation measures for noise, vibrations and air pollution

- All construction works will be carried out during day time to minimise nuisance to the locals and disturbances caused to nocturnal fauna such as birds and fruit bats that uses auditory communication.
- All vehicles and machinery will be tuned and well maintained to minimise air pollution.
- All costs are included in the contract price

6.2.3 Loss of lagoon bottom organisms and habitats

Lagoon bottom is a habitat for certain organisms such as worms, molluscs, amphipod etc., which are important food sources for bottom feeders such as certain species of fishes. Lagoon bottom of project activity zones will be affected during the bed-rolling process through direct removal of benthic communities and habitats and disturbing habitats of lagoon bottom organisms. However, it has been found elsewhere that lagoon bottom dwelling organisms re-establish within few months after such disturbances.

Mitigation measures to minimize loss of marine organisms and habitats

- Carry out the activities in as short a time period as possible to allow normal conditions to re-establish in the area as soon as possible.
- Ensure all project activities are restricted to necessary areas only.

- Do not close of off the bund wall in a single day. Give at least two tide cycles before it is closed to allow migration of fauna.
- Ensure bunds are properly constructed and closed off.

6.2.4 Loss of Seagrass habitats and changes to coastal hydrodynamics

There will be a complete removal of seagrass habitats at the proposed site on the eastern section of the island. This will include the sea grass beds, bottom dwelling organisms such as molluscs, sea urchins, sea cucumbers and marine worms, seagrass algae and some juvenile fishes. However, most fish species are highly adaptive and may avoid the dredged area due to turbidity. Slow moving organism may be lost. The construction of the bund wall also may trap some fish species.

For the rest of the marine organisms, the loss of habitats may force them to move to alternate locations, either to the North or South of the project site. Sea grass is often a feeding ground for a number of species, particularly turtles. Loss of habitat may force such animals and organisms to seek alternative habitats.

Sea grass also has its benefits to the coastal environment processes by trapping sediments and stabilising lagoon bottom. This is known to be a natural method of shoreline stabilisations. Removal of seagrass will affect the sediment transportation and stabilization rates.

The dredge disposal area will change the shape of the island significantly and thus affect nearshore hydrodynamics.

Mitigation measures reduce impacts on marine organisms

- Leave the out-lying smaller sea grass patches as it is to facilitate migration of surviving organisms.
- Do not close of off the bund wall in a single day. Give at least two tide cycles before it is closed.
- Continuous monitoring should be carried out to identify abnormal changes to the shoreline and nearshore currents.

6.2.5 Risks to health and safety of construction workers

Health and safety risks arising from construction work is high. Thus, it is important to take measures to reduce these risks as some of these accidents can be devastating impacts on lives of individual workers.

Mitigation measures to reduce risks to health and safety of construction workers

- Health checks prior to start of work
- On-site first aid kit
- Qualified person to properly instruct and supervise the work
- Evacuation facility in place all the time during construction
- The construction site should be properly closed so access is not possible for unauthorized personnel.
- Main cost will be initial investment in first aid kits, and health checks (cost estimate range for these (MRF 7500 - MRF 10,000).

6.3 Potential Adverse Impacts during Operational Phase and Suggested Mitigation Measures

6.3.1 Changes in Hydrodynamics and Erosion

The removal of seagrass from the project site will result in changes to the coastal hydrodynamics including wave propagation and sediment transport rates. This may result in significant erosion at the site. Furthermore, the newly reclaimed area will cause significant changes to the shoreline as the system tries to achieve equilibrium with the new island shape.

Mitigation measures to manage hydrodynamic changes

- Continuous monitoring of the East and West sections of the island close to the seagrass removal site and dredge disposal site in order to identify abnormal activity and implement mitigation measures when needed.

7 ALTERNATIVES

7.1 "No-project" Alternative

The option of a no project alternative has been considered for the beach replenishment. The advantages and disadvantages of the No Project option are presented in Table 7-1.

Table 7-1: Summary of "No Project" Alternative

Options	Advantages	Disadvantages
Leave sea grass beds as they are	– Marine habitats are not disturbed – Alteration of sea bed and potential future erosion avoided	– Dissatisfaction of locals as no recreational areas for swimming are available close to the community. – Aesthetically unpleasant lagoon – Aesthetically unpleasant beach due to beaching of seagrass.

Given the disadvantages of existing beach condition on the island, the preferred option is to go ahead with the project.

7.2 Alternative dredge disposal sites

The sites shown in Figure 7-1 were evaluated as alternative dredge disposal areas. Table 7-2 provides an evaluation of these alternative sites compared to the currently proposed dredge disposal site in Appendix B.

Table 7-2: Summary of alternatie dredge disposal sites

Options	Advantages	Disadvantages
Proposed dredge disposal site (Preferred site)	– The area is to be reclaimed for the proposed regional airport. Using this site for dredge disposal will reduce the amount of material required later. – The area is currently being filed for the harbour development project that is currently under way. Using this same area and extending the backfilling will reduce the size of the area	– The impacts will be magnified as the area will experience cumulative impacts of both projects.

Options	Advantages	Disadvantages
	affected by cumulative impacts. – The site is directly accessible from the seaweed removal area making transport and logistics simple.	
Alternative dredge disposal site 1	– The area is to be reclaimed for the proposed regional airport. Using this site for dredge disposal will reduce the amount of material required later.	– More significant impacts on marine flora and fauna since the incidence of marine life is higher at this site as it is further away from the community. – Located further away from the harbour which is currently being developed so the cumulative impacts of both projects will likely cover a greater area.
Alternative dredge disposal site 2	– The wetland will have to be filled for the construction of the proposed regional airport. Using this site for dredge disposal will reduce the amount of material required later.	– Site is located very far from the proposed seagrass removal site. Transport of the material will therefore be very difficult. – The wetland has a very rich biodiversity of both marine and terrestrial flora and fauna. Using this site will irreparably damage the ecosystem. – Higher possibility of groundwater contamination during the dredge disposal process. – Located further away from the harbour which is currently being developed so the cumulative impacts of both projects will likely cover a greater area.

Based on the above assessment it is evident that the proposed site has significant advantages over both the alternative sites It is therefore recommended that the proposed site be used as the dredge disposal site.

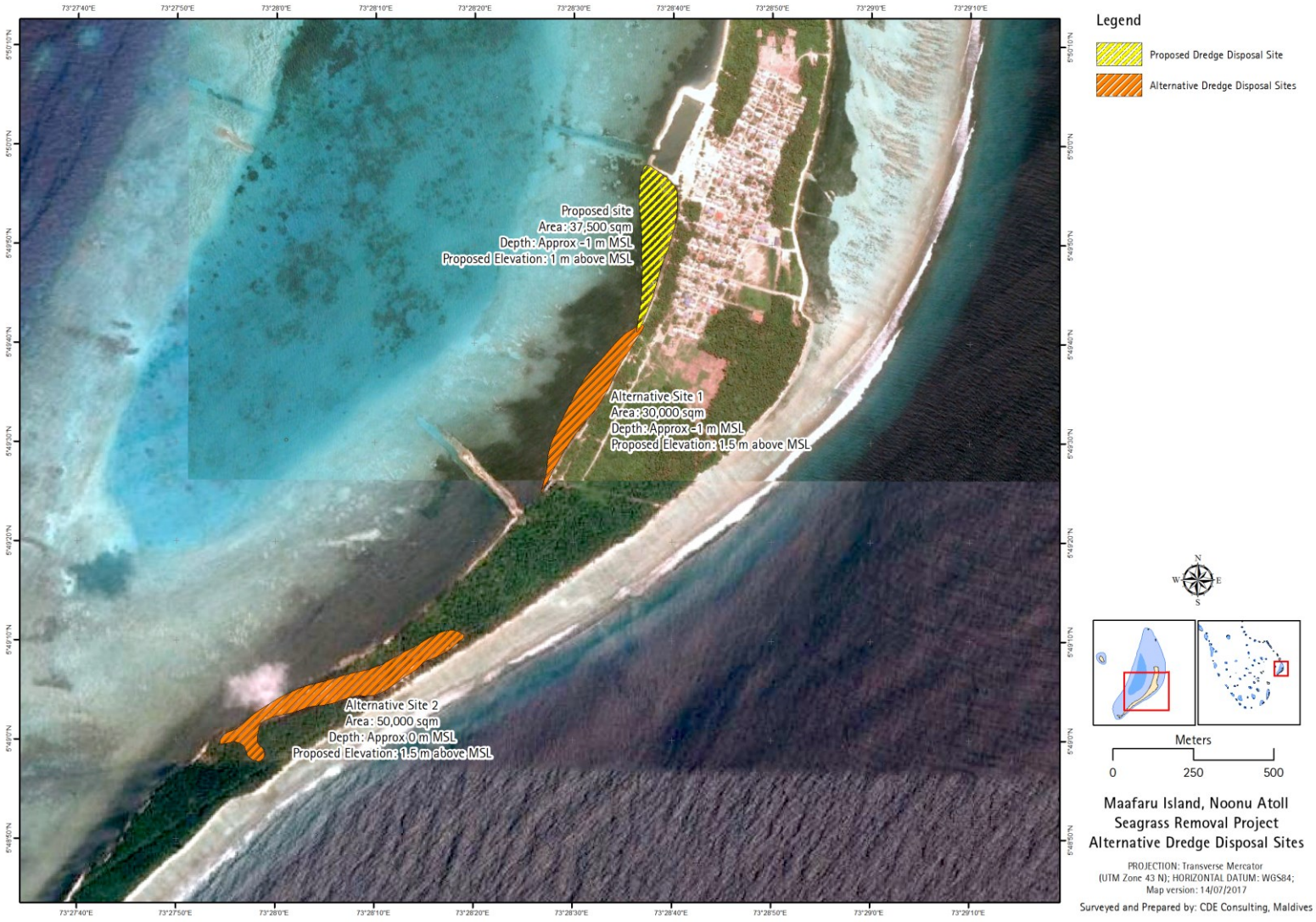

Figure 7-1: Alternative dredge disposal sites

7.3 Alternative sedimentation control measures

Table 7-3 indicates the alternative technologies for the sediment containment.

Table 7-3: Summary of sediment containment measures

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

For this project, bund walls are preferred due to the small area covered and the small size of the project.

7.4 Alternative seagrass removal methods

Table 7-4 indicates the alternative technologies for the sediment containment.

Table 7-4: Summary of seagrass removal methods

Type of Measure	Advantages	Disadvantages
Excavating the seagrass (Preferred method)	– Ensures seagrass is completely removed with little possibility of re-growth. – More financially feasible as seagrass removal and deepening of lagoon carried out in one project.	– High impact on marine environment due to dredge disposal.
Bed rolling	– Less impact on the environment	– More costly as another project will

	as does not require dredge disposal.	have to be carried out to increase the water depth and create the swimming area. – Possibility of seagrass re-growth
Driving over area with excavator	– Less impact on the environment as does not require dredge disposal. – Faster as does not require construction of sandbeds	– More costly as another project will have to be carried out to increase the water depth and create the swimming area. – Possibility of seagrass re-growth

Though the excavating the seagrass results in a higher environmental impact due to dredge disposal, the financially feasible and permanent solution provided by this method significantly outweigh the advantages of using the other methods. With the implementation of mitigation measures to reduce the environmental impacts, the excavation of seagrass is the preferred method of seagrass removal for this project.

8 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) is an important component of the EIA process, needed to determine the accuracy of impact prediction, the adequacy of mitigation measures, and level of compliance with commitments regarding implementation of mitigation measures and monitoring of relevant environmental aspects.

The main objectives of the environmental management plan are to:

- Produce a framework for managing anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions.
- Provide evidence of compliance to legislation, policies, guidelines and requirements of relevant authorities.

8.1 Environmental management system

The environmental management framework for the proposed project is based on the standards and policies set out by the Environmental Protection Agency of the Maldives.

- **Environmental Management Planning and establishment of key performance indicators:** The EMP specifies environmental management measures and required performance standards
- **Monitoring and corrective action**: The implementation of EMP measures will be monitored. Any inconsistencies between the EMP and its on-site implementation will be identified and addressed through corrective actions
- **Auditing, reviews and improvement**: The EMP will be reviewed. Improvements to the EMP will be made as necessary to achieve desired environmental outcomes.

The environmental management strategy is demonstrated in Figure 8-1.

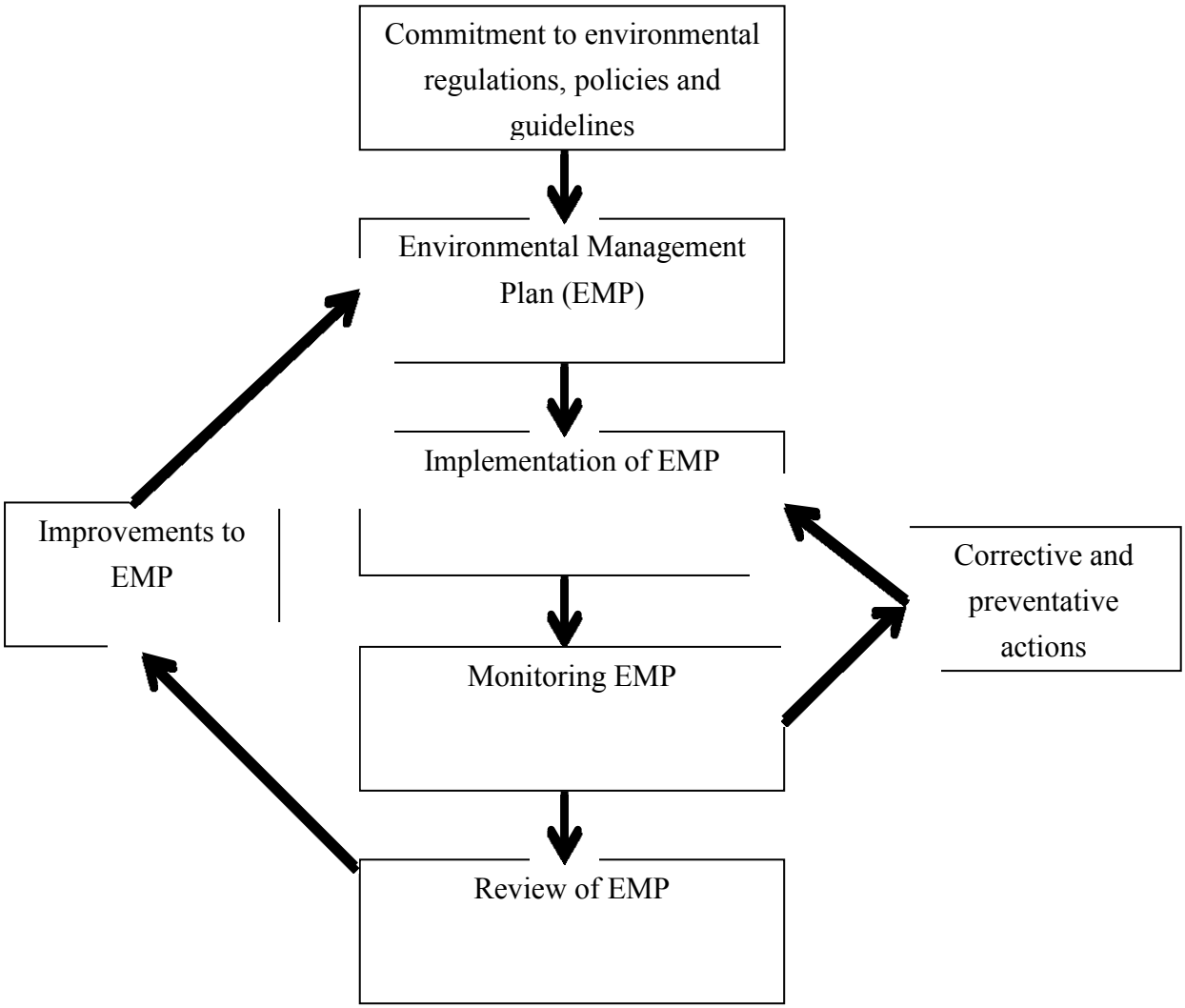

Figure 8-1: Environmental Management Strategy flow diagram

8.2 Management structure and responsibilities

The following parties are involved in the EMP of this project:

- Project proponent
- Environmental consultant
- Environmental Protection Agency (EPA)

The roles and responsibilities of the parties involved are as follows.

8.2.1 Project Proponent

- Execution of all project activities
- Preparation of EMP
- Detailed designs of the project

- Monitoring of the project activities
- Submission of annual environmental monitoring reports as required by the EPA

8.2.2 Environmental Consultant

- Preparation of EMP
- Monitoring of performance of project activities according to the EMP
- Auditing the EMP to ensure desired outcomes are achieved
- Making amendments to the EMP according to the results of the audits
- Preparation of environmental monitoring report as required by the EPA (detailed in Chapter 9 of this report)

8.2.3 Environmental Protection Agency

- Review environmental monitoring report
- Intervention in the event of a breach in environmental permit conditions

8.3 Reporting requirements

Reporting shall be undertaken to provide evidence of the ongoing implementation of the EMP and will cover any training activities, site conditions and operations, monitoring data, details of non-conformances, incidents, complaints and follow up action, results of audits and reviews. Reporting shall be undertaken by the project proponent and the Environmental Consultant.

The environmental reporting process is summarized in the Figure 8-2. All non-compliances and complaints during the execution of the project are to be reported to the EPA. The environmental management plan for execution of the project is provided in Table 8-1.

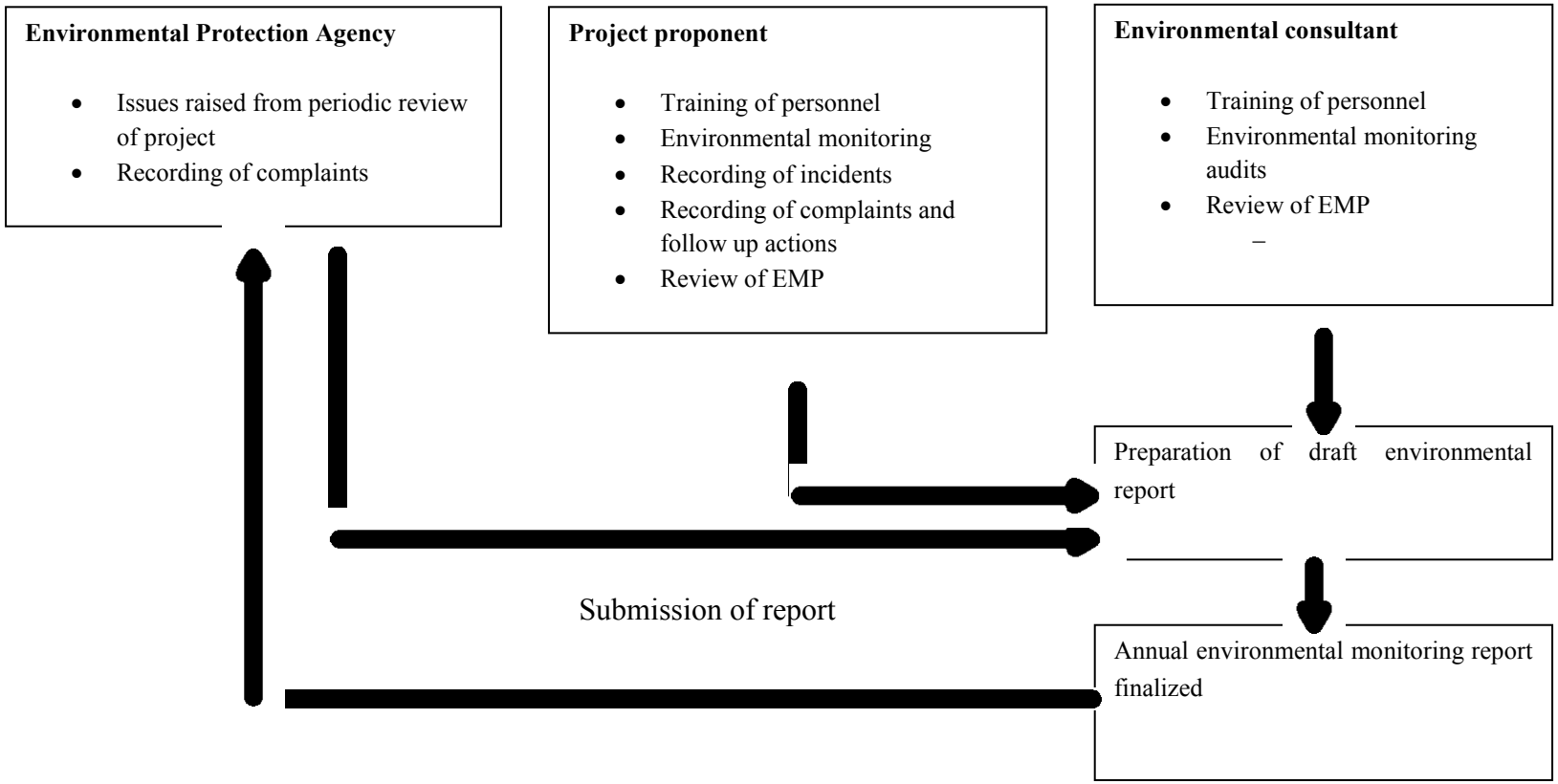

Figure 8-2: Environmental Reporting Process

Table 8-1: Environmental Management Plan for construction and operation phase

Activity	Management measures	Responsible party	Timing
Training of staff and contractors	All construction workers and project management staff will be provided information on general environmental issues, compliance with environmental permits and EMP. All staff involved with environmental monitoring will be provided training in environmental monitoring procedures.	Project proponent & Environmental Consultant	Before commencement of construction activities
Documenting non-conformances and corrective actions	All non-conformances to the environmental permit conditions, observed during monitoring will be documented. Necessary corrective actions and preventative actions will be identified Corrective actions will be implemented, with systematic follow ups to ensure effectiveness of these measures	Project proponent & Environmental consultant	Continuous during construction phase
Control of water contamination	Oil, solid waste and hazardous waste handled carefully and transported in sealed containers. All paints, lubricants, and other chemicals used on site stored in a secure and bounded location. Littering and accidental disposal of construction wastes avoided by preplanning. All raw materials stored away from the vicinity of the coastal areas. General refuse stockpiled in one central area.	Project proponent	Continuous during construction phase

Activity	Management measures	Responsible party	Timing
	Construction activities carried out under the supervision of an experienced person. Regular visual inspection of surrounding marine environment for waste		
Waste management (Waste generated from construction activities, the construction workforce will generate domestic and sewage waste)	All waste segregated, stored temporarily and transferred to the existing waste management site and domestic sewage generated will be dealt through the existing sewerage treatment system or septic tanks.	Project proponent	Continuous, during construction phase
Supervision of project activities	Assign suitably experienced and qualified personnel to supervise the entire project and ensure that all activities are carried out with minimal adverse impact on the environment	Project proponent	Before commencement of the project

9 ENVIRONMENTAL MONITORING PLAN

9.1 Introduction

While the negative environmental impacts of the project can be significantly minimised if proper mitigation measures are taken, as identified in Chapter 6, the potential for unforeseen impacts still exists. Furthermore, some of the predicted impacts may turn out to have greater significance than predicted, making the suggested mitigation measures ineffective. Therefore, frequent and regular monitoring of the relevant environmental aspects is a vital component of environment management. This chapter outlines the environmental monitoring plan for the proposed project.

9.2 Objectives of the Monitoring Plan

The main objectives of the monitoring plan are:

- To identify whether the predicted impacts are accurate and mitigation measures taken are effective
- To identify any unforeseen impacts so that appropriate mitigation measures can be taken at the earliest
- To identify and resolve any issues of social unrest at the earliest
- To eliminate or reduce environmental costs

9.1 Aspects of the Monitoring Plan

Table 9-1 below summarizes the key aspects of the monitoring plan. The Table indicates the methodology, frequency and estimated cost for each monitoring attribute that will be required for the proposed project.

Table 9-1: Aspects of the Monitoring Plan

Monitoring Attribute	**Indicator**	**Methodology**	**Frequency**	**Estimated Cost***
Water Contamination (Marine)	Water quality	Laboratory analysis	On completion of project and thereafter annually for two years	US$700 per survey
Sedimentation	Sedimentation rate	Use of sediment traps	One week before start of construction activities till one week after construction activities end	US$600 per week
Waste monitoring	Waste generation levels	Waste census	Once during the construction	US$450 per survey
Marine Water Contamination	Oil spills	Visual observation	Daily for the duration of the project	N/A
	Oil leakage from machinery or vessels	Maintenance and tuning of all machinery & vessels	Weekly during the construction phase	US$42 per week
Erosion and Coastal Changes on Maafaru Island	Beach profiles	Surveying using level, staff, compass & D-GPS	Two months after completion of the project and thereafter annually for two years.	US$650 per survey
	beach line (at high tide & low tide)	D-GPS tracks along the beach		
	Long shore currents	Drogue method		
Water Depth	Water Depth	Sonar mite or handheld echo sounder	Two months after completion of the project and thereafter annually for two years.	US$450 per survey

* does not include logistical costs

9.2 Monitoring Report

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

The report will be based on the suggested monitoring attributes in this monitoring plan and that of the decision statement issued by the EPA.

9.3 Commitment for Monitoring

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

10 STAKEHOLDER CONSULTATION

Meeting with MHI was held on 12th July 2017 at MHI at 12:00 hrs. Environment Analyst at the infrastructure department of MHI Ms.Nafha Aujaz represented the ministry during this meeting. Project components were briefed to the representative and she was asked about the ongoing projects of MHI at Maafaru and for MHI views, concerns and recommendations about the proposed project. Contact details of Ms.Nafha and summary of discussions of the meeting is provided below.

Contact details:

Ms.Nafha Aujaz
Environment Monitoring Units
Infrastructure Department
Ministry of Housing and Infrastructure
Email: emu@housing.gov.mv
Phone: +960 3004110

Summary of Discussions:

- MHI has an ongoing harbour expansion and upgrading project at N.Maafaru. This project site is on the western side of the island. The proposed dredge disposal site of the sea grass removal project may fall in the footprint of harbour expansion project and the project may require finding an alternative disposal site. The exact footprint of the harbour project could not be clarified during the meeting. It was informed that the details of the project would be shared with the consultant via email at a later time.
- In disposing the dredge waste, MHI advises to identify and use the dredge material for works in the island that may require sand presently or in the near future such as levelling of flood prone areas or beach replenishment of eroding coastal areas so that additional sand dredging from lagoon can be avoided.
- Main concern of MHI with regards to the proposed project is the potential impacts of dredging on the island coastline and its effects on coastal infrastructure and future land use. It was advised to consider the hydrodynamics and coastal processes of the project area and to carry out the project in a way that has minimal negative impacts on the nearby coastal areas.
- MHI offered to share the EIA report of the harbour expansion project and recommended utilizing the findings of the surveys done for this project in the sea grass removal project to get a more comprehensive understanding of the study area.

11 POTENTIAL DATA GAPS AND ASSESSMENT LIMITATIONS

11.1 Gaps In Information

The environment of Maldives is generally poorly understood. This may be due to the lack of detailed studies in the Maldives. Much of the literatures on coral islands are derived from studies done in the Pacific which unfortunately has very different climatic and geologic settings.

Detailed environmental analysis for an EIA is often required to be undertaken in a relatively short period of time. Give the seasonal climatic variations in Maldives and the differences in local geomorphologic and climate settings in individual islands such a short time frame is often too little to assess selected aspects of the environment. This problem is compounded by the absence of long-term studies in other parts of Maldives. Hence, most EIA's end up being based on an environmental snapshot of specific point in time. However, experienced EIA specialists can deliver a close match to reality based on a number of similar assessments. In this regard, the following gaps could be identified in information.

- Absence of long-term site specific or even regional data (at least 2 years). Most critical data include current, wave and terrestrial modification history.
- Absence of historical and long-term records on reef and lagoon environment.
- Lack of detailed data on geology and soil due to time limitation in EIA submission.
- The resolution and quality of the aerial images are poor hence accurate estimates of past aerial images such as 1969 and 2004 images were difficult. Moreover, these images (1969 and 2004) were taken in black and white spectrum thus allowing fuzziness in identifying beach toes.

These gaps are seriously considered in the assessment and care has been taken to address the issue in designing mitigation measures and the monitoring programme.

11.2 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, geomorphological or social conditions in a particular place. As note earlier, there is also no long term data and information regarding the particular site under consideration, which makes it difficult to predict impacts. It is important to consider that there will be uncertainties and

voluntary monitoring of natural processes as described in the monitoring programme is absolutely essential.

12 CONLUSIONS

This project is proposed by Noonu Maafaru Council in order to create a recreational swimming area on the island that is easily accessible to the local community. The proponent proposes to carry this out by removing a section of seagrass located on the Eastern side of the island, directly adjacent to where the community is located within the island. This submission seeks to get environmental approvals for the project.

The council has received a number of complaints regarding the aesthetic quality of the beach, and unpleasant odours when the material is beached. Therefore, in order to improve the aesthetic quality of the beach and provide locals with a safe recreational swimming, the removal of seagrass colonies is required.

The proposed developments are in conformance to the laws and regulations of the Maldives, other than the dredging and reclamation regulation. All the required permits prior to initiation of the work have already been attained from the respective regulatory bodies, namely concept approval from the Housing Ministry. The project parameters cannot adhere to the dredging reclamation regulation as is states that no dredging can be undertaken within 500 m form the ocean side reef edge and 50 m from vegetation line. The island's eastern shoreline is located within 500 m of the ocean side reef edge and proposed swimming area covers areas within 50 m of the shoreline. Therefore, discussions must be held between the proponent and the Ministry before the commencement of the project in order to solve this issue.

The assessment shows that the proposed developments involve significant impacts on the marine environment and potential changes to the coastal hydrodynamics. The main impacts from the project are on marine environment, particularly marine pollution, and temporary loss of benthic organisms.

Key mitigation measures for the construction stage include undertaking construction works during calm weather conditions as much as possible particularly when wave activity is calm, carrying out the activities in as short a time period as possible to allow normal conditions to re-establish in the area as soon as possible, and ensuring that all machinery are in good working condition.

Operational stage impacts are mainly limited to potential changes in hydrodynamics which could lead to erosion. As it is not possible to identify with certainty whether erosion occur, no specific erosion prevention measures are proposed but appropriate action will be decided after monitoring the changes.

The alternatives were evaluated for the project but the current designs and methods have been preferred due to the significant advantages that the proposed design has over alternatives. An alternative location which was considered on the South East section of the island was rejected due to the practical, financial, and environmental limitations. Other locations could not be considered as significant developments have been proposed for locations both to the North and South of the existing community. The only feasible location is the proposed location on the North West of the island. Silt screens were considered as an alternative sedimentation control measure. However given the small size of the project area, the use of the proposed bund walls is preferred as it is more financially feasible.

Monitoring of the project is crucial particularly the changes to hydrodynamics, shoreline, water quality, and lagoon benthos recovery.

Overall the project is beneficial socio-economic impacts to Maafaru island.

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APPENDIX A – Terms of Reference

بسم الله الرحمن الرحيم

No: 203-EIARES/290/2017/3

Terms of Reference for Environmental Impact Assessment for the Proposed Sea grass Removal at Maafaru Island, Noonu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on 12th June 2017 for undertaking the EIA of the proposed seagrass removal at Maafaru Island, Noonu Atoll. The proponent for the project is Noonu Maafaru Island Council.

While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the EIA report.

1. **Introduction and rationale** – Describe the purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is 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 minimum A3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds site, sensitive species nursery and feeding grounds). Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites

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

   Task 1. Description of the proposed project – Provide a full description and justification for the sea grass removal using maps at appropriate scales where necessary. The following should be provided (all inputs and outputs related to the proposed activities shall be justified):

The main activities of the project are:

- Sea grass removal from the proposed area,
- Finishing sea grass removal to the required levels,
- Environmental monitoring during removal activities,
- Measures to protect environmental values during the implementation phase,

- Project management (include scheduling and duration of the project and life span of facilities; communication of implementation details, progress, target dates, access to site, safety, equipment and material storage, fuel management and emergency plan in case of spills)

Sea Grass removal;

- Location and size of sea grass removal area(s) on a map;
- Justification for the selection of this location;
- Method and equipment used for sea grass removal
- Justification for selecting the methods and equipment;
- Duration of the activity;
- Labour requirements and (local) labour availability;
- Housing of temporary labour, and
- Emergency plan in case of spills (diesel, grease, oil)

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 and from at least two benchmarks. 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 shown below:

Climate

- Rainfall, wind and waves
- Risk of hurricanes and storm surges;

Geology and geomorphology

- Offshore/coastal geology and geomorphology (use maps);
- Bathymetry (bottom morphology) of the proposed sea grass removal areas (use maps);
- (Seasonal and Historical) patterns of coastal erosion and accretion at Maafaru Island, and
- Characteristics of seabed sediments to assess direct habitat destruction and turbidity impacts during implementation;
- Shoreline and vegetation line at the project impact area
- Condition of dredge spoil disposal area including shoreline

Hydrography/hydrodynamics (use maps)

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents;

- Detail coastal and marine environmental conditions of the impacted area. Marine environment shall include baseline reef status (the benthic flora and fauna) at selected sites

- Seawater quality measuring: temperature, pH, salinity, turbidity and sedimentation rate

Ecology

- Identify marine protected areas (MPAs) and sensitive sites such as breeding or nursery grounds for protected or endangered species (e.g. coral reefs, spawning fish sites, nurseries for crustaceans or specific sites for marine mammals, sharks and turtles). Include description of commercial species, species with potential to become nuisances or vector.
- Benthic and fish community monitoring (see appendix for monitoring guidelines);
- Landscape integrity, and
- Include marine water monitoring at the sea grass removal site

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

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Legal requirements:

- Approval from Island Council
- Decision Note by Environmental Protection Agency

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

Impacts on the natural environment

- Changes in flow velocities/directions, resulting in changes in erosion/sedimentation patterns, which may impact shore zone configuration/coastal morphology;
- Loss of marine bottom habitat due to the sea grass removal resulting in (temporary) loss of bottom life, which may impact fish stocks and species diversity and density of crabs, shellfish etc.;
- Sediment dispersal in water column (turbidity at the sea grass removal site) possibly resulting in changes in visibility, smothering of coral reefs and benthic communities and affecting fish and shellfish etc.;
- Impacts of noise, vibration and disturbance;
- Impacts on ground water table and quality as a result of disposal of sea grass on land (leaching of salts in the sea grass and change in ground water quantity);
- Impacts on unique or threatened habitats or species (coral reefs, sea turtles etc.), and
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment

- Impacts of the works in fishing activities (disturbance);
- Monitoring of socioeconomic and demographic development.

Construction related hazards and risks

- Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);
- Risk of accidents and pollution on workers and local population, and

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

Task 5. Alternatives to proposed project – Describe aalternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This includes but should not be limited to alternative equipment/machinery for sea grass removal, alternative disposal sites and alternative containment measures. The report should highlight how the sea grass removal location was determined. All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options should be specified for each component of the proposed project.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures with particular attention paid to sedimentation control and future changes in coastal processes. Mitigation measures to avoid or compensate habitat destruction caused by sea grass removal will have to be considered, e.g. temporary sediment control structures, coastal protection structures to reduce erosion, coral reconstruction and MPA replacement areas. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. An Environmental management plan for the proposed project, identifying responsible persons, their duties and commitments shall also be given. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan (see appendix)– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for coastal modification, beach morphology, sediment movement around the island. Ecological monitoring will be submitted to the EPA to evaluate the damages during

implementation, after project completion and every three months thereafter, up to one year and then on a yearly basis for five years after. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided. Information should be provided monitoring the following conditions:

- Water quality, especially turbidity;
- Sedimentation rates on nearby coral reefs, benthic system and sea grass beds;
- Condition of the sensitive ecosystems and marine resources;
- Re-colonization of the benthic organisms in the sea grass removal areas;
- Erosion and accretion;
- Environmentally sound site clearance;
- Environmentally sound removal of equipment.

Task 7. Stakeholder consultation, Inter-Agency coordination and public/NGO participation) – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders, government authorities that is required. .The report should include a list of people consulted, their contact numbers and what were the major outcomes. Consultations need to be done with the following parties;

- Ministry of Housing and Infrastructure

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

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 3 months from the date of this Term of Reference.

13th June 2017

APPENDIX B – Site Plan

73°28'30"E 73°28'35"E 73°28'40"E 73°28'45"E 73°28'50"E 73°28'55"E 73°29'0"E 73°29'5"E

5°50'5"N 5°50'0"N 5°49'55"N 5°49'50"N 5°49'45"N 5°49'40"N 5°49'35"N

Proposed DredgeDisposal Site
Area: 26,000 sqm
Depth: Approx -1 m MSL
Proposed Elevation: +1 m MSL

Proposed Seagrass Removal Site
Area: 52,000 sqm
Dredge depth: -1.5 m MSL
Dredge volume: Approx 52,000 cbm

Legend

- Proposed Seagrass removal site
- Proposed Dredge Disposal Site
- Proposed Transport Route

N
W E
S

Meters
0 25 50 100 150 200

Maafaru Island, Noonu Atoll Seagrass Removal Project Site Plan

PROJECTION: Transverse Mercator
(UTM Zone 43 N); HORIZONTAL DATUM: WGS84;
Map version: 07/08/2017

Surveyed and Prepared by: CDE Consulting, Maldives

APPENDIX C – Water Quality Results

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

WATER QUALITY TEST REPORT

Report No: 500173640

Customer Information:
AURINKO PVT LTD
ORCHIDMAAGE, 4TH FLOOR
Ameeru Ahumadhu Magu
Male'. Maldives 20095

Report date: **03/05/2017**
Test Requisition Form No: **900175515**
Sample(s) Recieved Date: **02/05/2017**
Date of Analysis: **02/05/2017 - 03/05/2017**

Sample Description	Maafaru - SW1	Maafaru - SW2	**TEST METHOD**	**UNIT**
Sample Type	Sea Water	Sea Water		
Sample No	83186304	83186307		
Sampled Date	29/04/2017	29/04/2017		
PARAMETER	**ANALYSIS RESULT**			
Physical Appearance	Clear with particles	Clear with particles		
Total Suspended Solids	<5 (LoQ 5 mg/L)	<5 (LoQ 5 mg/L)	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Turbidity	0.486	0.509	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU
Nitrate	3.0	3.7	Method 8171 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Phosphate	0.07	0.06	Method 8048 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L

Keys: mg/L : Milligram Per Liter, **NTU** : Nephelometric Turbidity Unit

Checked by

Afnan Farooq
Laboratory Executive Gr.1

Approved by

Mohamed Eyman
Assistant Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory
This report shall not be reproduced except in full, without written approval of MWSC
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer

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

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
FEN Building 6th Floor, Machangoalhi, Ameenee Magu, Male', Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

WATER QUALITY TEST REPORT

Report No: 500173641

Customer Information:
AURINKO PVT LTD
ORCHIDMAAGE, 4TH FLOOR
Ameeru Ahumadhu Magu
Male'. Maldives 20095

Report date: **03/05/2017**
Test Requisition Form No: **900175515**
Sample(s) Recieved Date: **02/05/2017**
Date of Analysis: **02/05/2017 - 02/05/2017**

Sample Description	Maafaru - GW1	TEST METHOD	UNIT
Sample Type	Ground Water		
Sample No	83186311		
Sampled Date	29/04/2017		
PARAMETER	**ANALYSIS RESULT**		
Physical Appearance	Pale yellow with particles		
Nitrate	1.1	Method 8171 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Phosphate	0.22	Method 8048 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L

Keys: mg/L : Milligram Per Liter

Checked by
Afnan Farooq
Laboratory Executive Gr.1

Approved by
Mohamed Eyman
Assistant Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory
This report shall not be reproduced except in full, without written approval of MWSC
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer

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

APPENDIX D – Survey Locations Map

Beach Profiles

Site ID	X	Y
P1	73.48145	5.829167
P2	73.48134	5.830124
P3	73.48115	5.831248
P4	73.48142	5.832583
P5	73.48173	5.833686

Currents

Site ID	X	Y
C1	73.48304	5.833905
C2	73.48366	5.831981
C3	73.48189	5.831561
C4	73.48267	5.829148

Marine Water Samples

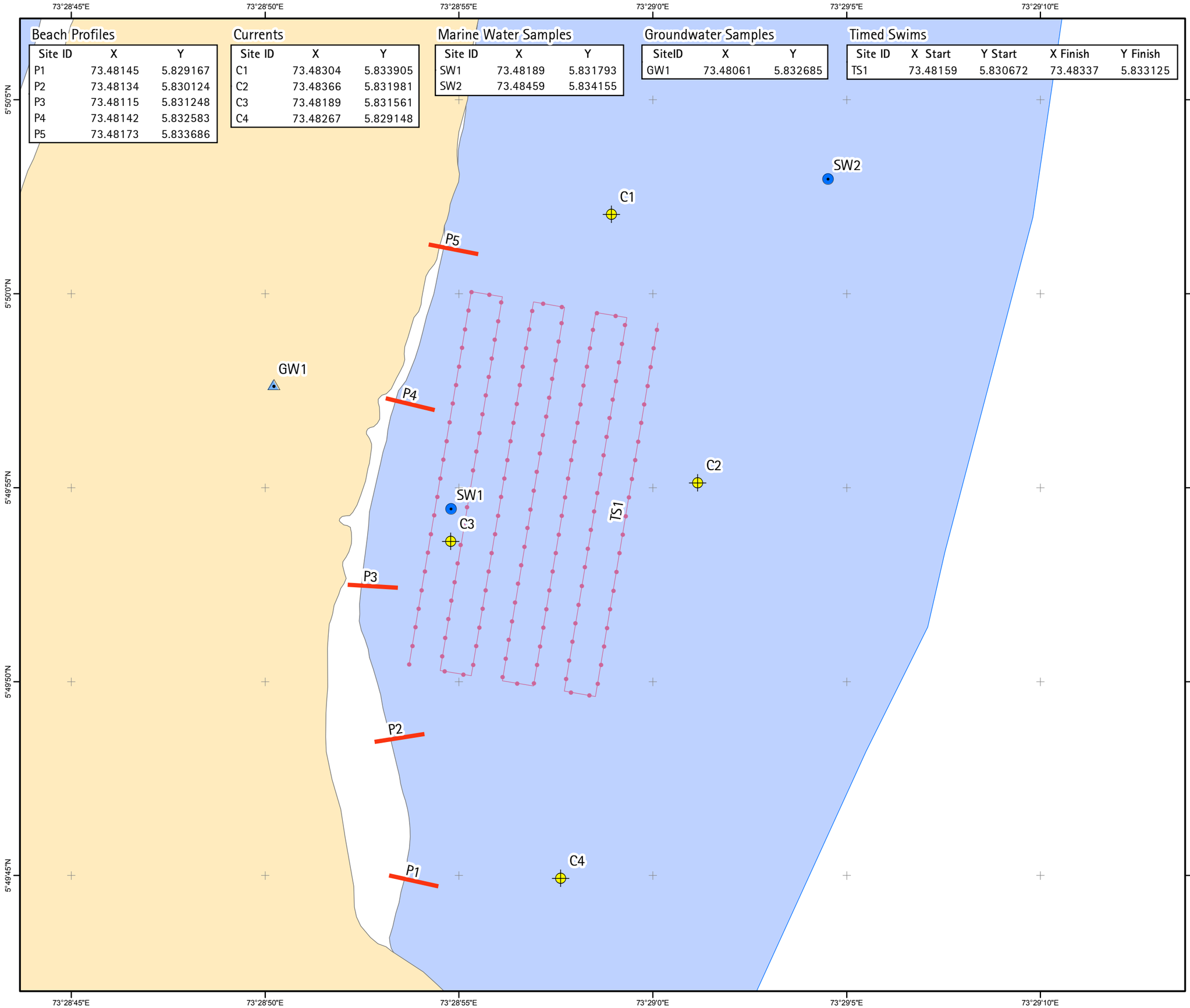
Site ID	X	Y
SW1	73.48189	5.831793
SW2	73.48459	5.834155

Groundwater Samples

SiteID	X	Y
GW1	73.48061	5.832685

Timed Swims

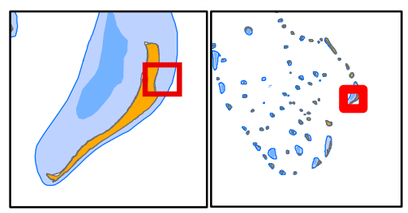
Site ID	X Start	Y Start	X Finish	Y Finish
TS1	73.48159	5.830672	73.48337	5.833125



Legend

- Currents
- Ground Water Samples
- Marine Water Samples
- Beach Profiles
- Timed Swims
- Vegetation line
- LowTide Line
- Lagoon
- Reef

N
W E
S

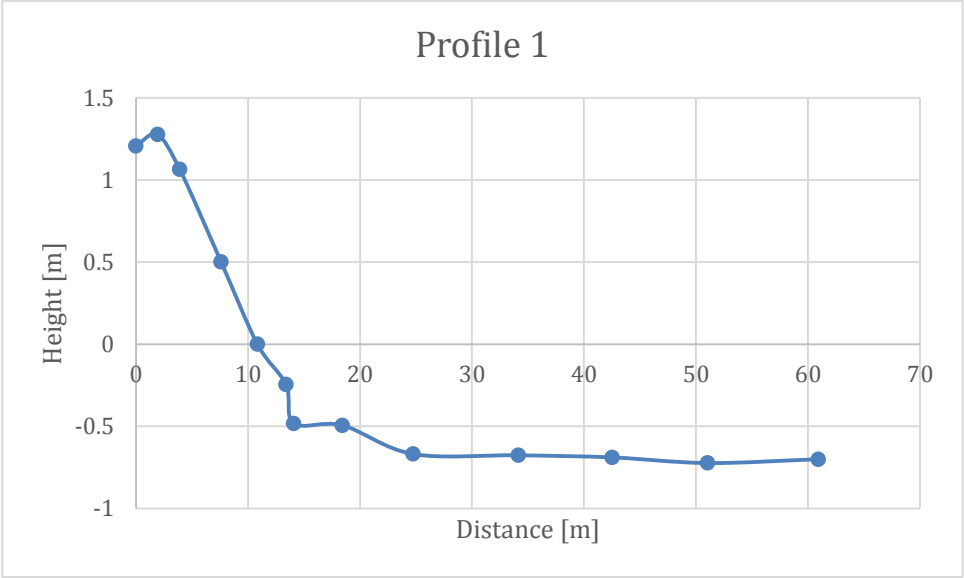


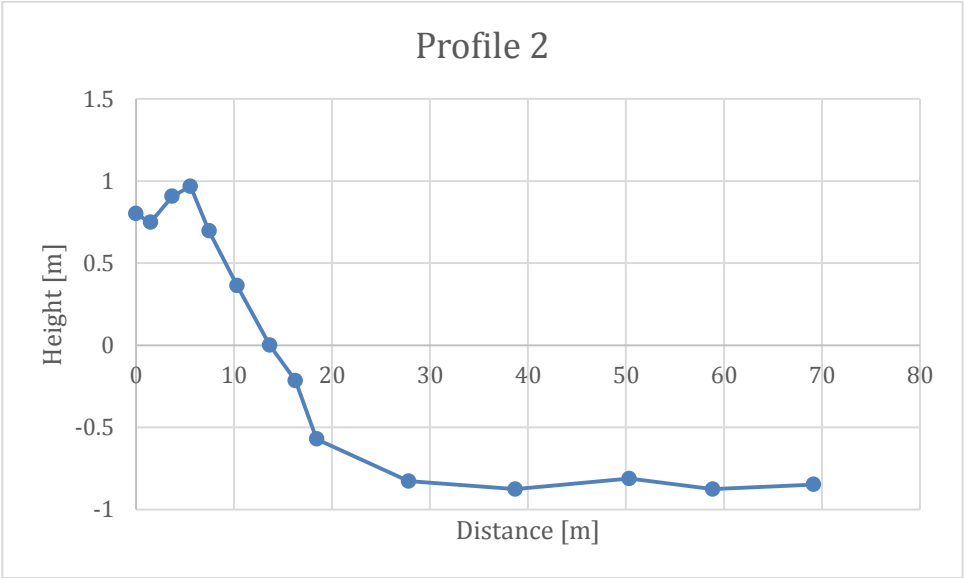
Maafaru Island, Noonu Atoll
Seagrass Removal Project
Survey Locations

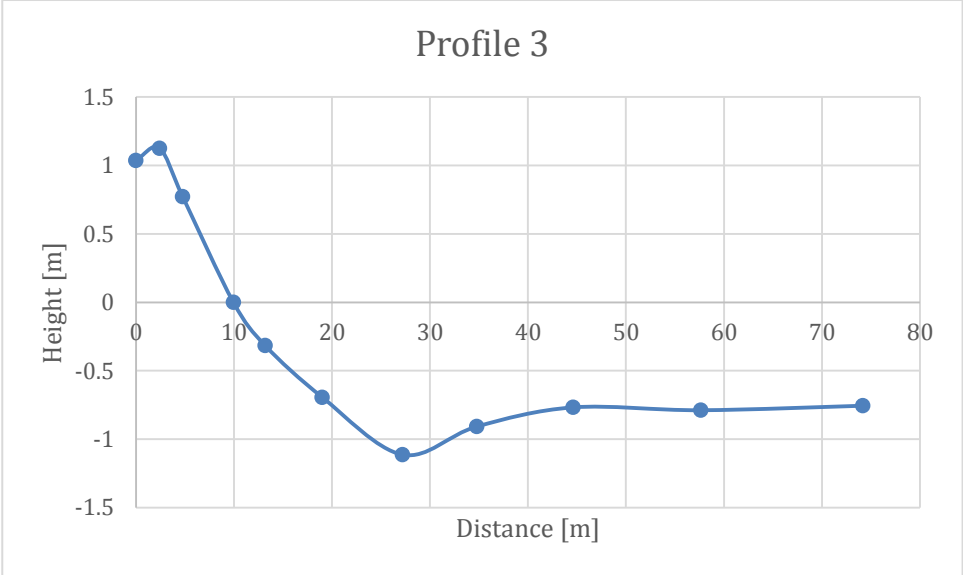
PROJECTION: Transverse Mercator
(UTM Zone 43 N); HORIZONTAL DATUM: WGS84;
VERTICAL DATUM: Hulhule Tide Gauge
Map version: 10/07/2017

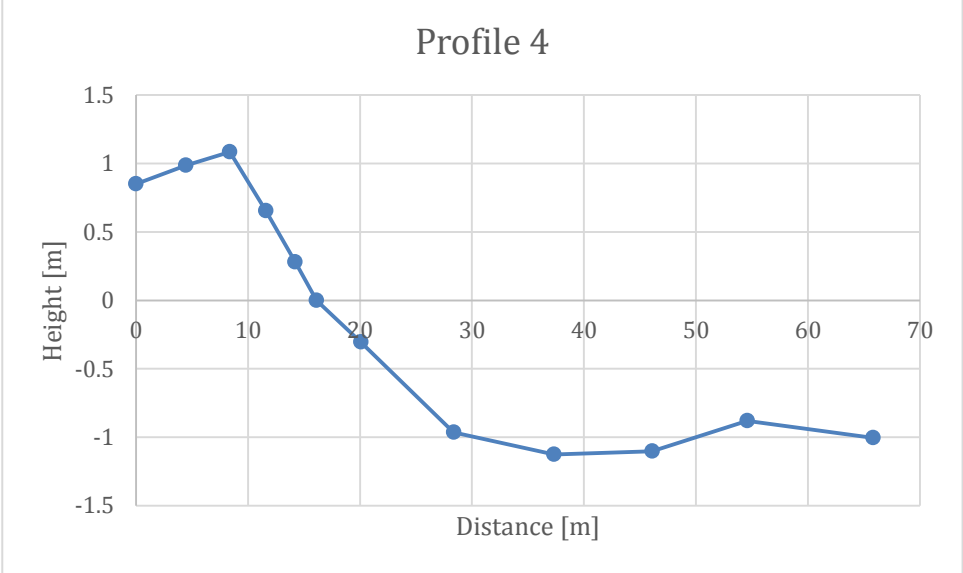
Surveyed and Prepared by: CDE Consulting, Maldives

APPENDIX E – Beach Profiles






Profile 3
Height [m]
1.5
1
0.5
0
-0.5
-1
-1.5
0
10
20
30
40
50
60
70
80
Distance [m]


Profile 4
Height [m]
1.5
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20
30
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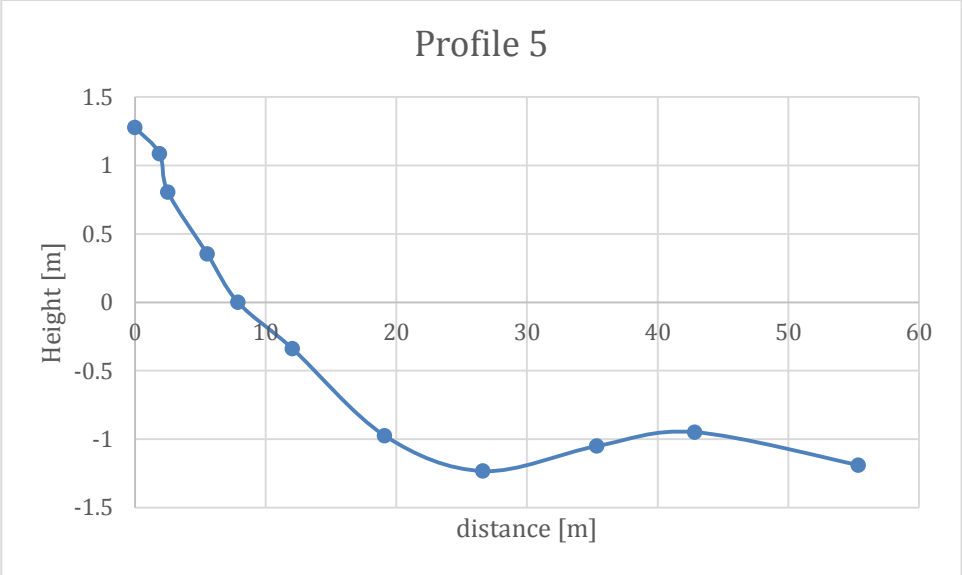
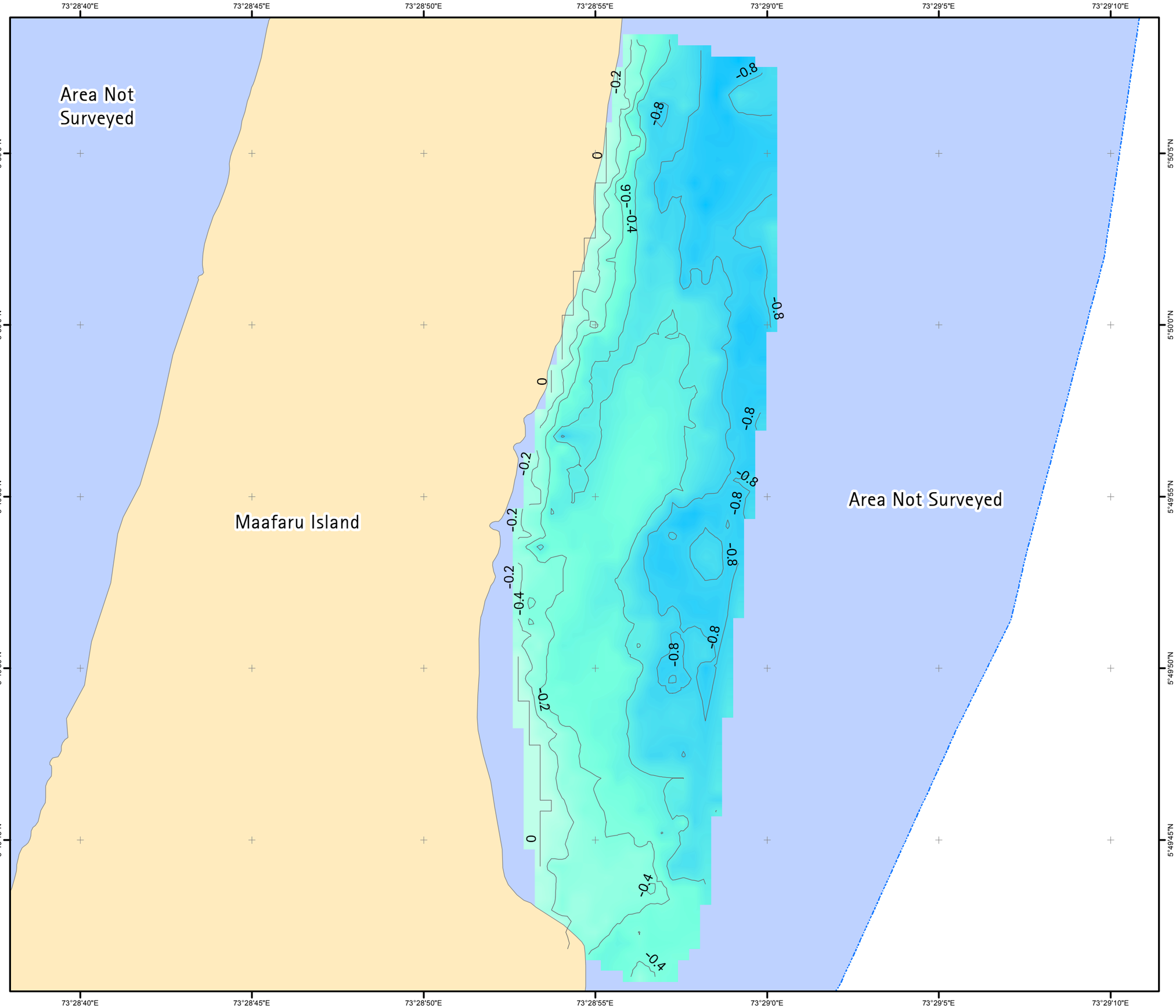
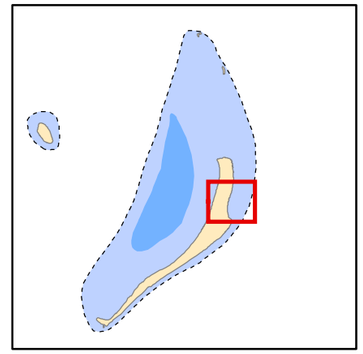
50
60
70
Distance [m]


Profile 5
1.5
1
0.5
0
-0.5
-1
-1.5
Height [m]
0
10
20
30
40
50
60
distance [m]

APPENDIX F – Bathymetry Chart





Legend

0.2 m contours

Vegetation Line

Depth in m

0

-0.96

Reef

N
W
E
S

Meters

0 25 50 100 150 200

Maafaru Island
Noonu Atoll
Bathy Chart

PROJECTION: Transverse Mercator (UTM Zone 43 N); HORIZONTAL DATUM: WGS84;
VERTICAL DATUM: Mean Sea Level (2017) - Hulhule' Airport Tide Gauge
All bathy features based on GPS surveys (April 2017)
Map version 14-06-2017

Surveyed and Prepared by: CDE Consulting, Maldives

APPENDIX G – CV's of Consultants

Ahmed Shaig

Phone: (+960) 77 88 758 shaig@cde.com.mv

Personal Details

Date of Birth: 19/02/1976 **Nationality:** Maldivian **Gender:** Male **Marital Status:** Married

Permanent Address: Maldives **Present Address:** M. Muleege, Orchid Magu, Male', Maldives.

Education

PhD, Environmental Science, 2009
James Cook University, Townsville, Australia

Research degree on 'Settlement Planning for Natural Hazard Resilience in Small Island States: The Population and Development Consolidation Approach'

BSc Land and Spatial Information Studies/Information Science. (double major), 1999-2001
University of Otago, Dunedin, New Zealand

Diploma in project planning, implementation, monitoring and evaluation, 1995
ILO training Centre, Turin, Italy

Employment History

Director, Environmental Services 2008 to present
CDE Consulting Supervisor: Dr. Simad Saeed
Republic of Maldives Phone: +(960) 7777445
Head of environmental wing

Assistant Under-secretary, Spatial Planning 2002-2004
Ministry of Planning and National Development Supervisor: Hon. Hamdun Hameed
Republic of Maldives Phone: +(960) 332-3919
Head of Spatial Planning Unit. Relevant Tasks include:

- Oversee environment related projects and application of environmental guidelines for planned projects.
- Plan, implement and oversee the development of a National GIS;
- Aid/facilitate/oversee urban planning, housing, land use planning, natural resource planning and environment related projects; Provide assistance in project planning (includes urban and regional planning, natural resources planning)

Project Manager, National Digital Mapping Project 2005 (8 months)
Ministry of Planning and National Development Supervisor: Hon. Hamdun Hameed
Republic of Maldives Phone: +(960) 332-3919

- Project involved aerial photography and satellite imagery of entire Maldives, ground surveying of key settlements, digital conversion of data and setting up a Mapping Unit.

Assistant Planning Officer/Planning Officer 1994-1999
Ministry of Planning and National Development Supervisor: Mr. Mohamed Hunaif
Republic of Maldives Phone +(960) 331-3040
Relevant tasks involved:

- Assisting in the National GIS Development Programme (Junior GIS developer)
- Facilitate urban planning, housing, land use planning, natural resource planning and environment related projects.

Experience in Consultancy

- *September 2002:* Member of the team appointed for environmental surveying and carrying capacity assessment of islands for tourism development in the southern atolls of Maldives for Ministry of Tourism Maldives.
- *October 2002:* Developed the Census GIS for United National Population Fund
- *December 2002:* Developed the Maldives Protected Areas Systems GIS for Maldives Home Affairs Housing and Environment.
- *February 2003*: Participated in the preparation of Royal Island and Spa Resort Annual Environmental Monitoring Report for Royal Island and Spa.
- *April 2003:* Member of the team selected for developing town plans for urban centres in Northern and Southern Regional Development Zones, looking specifically into environmental control measures, for Ministry of Planning and National Development.
- *April 2003:* Participated in the preparation of Environmental Impact Statement for Coastal Modifications on Rihiveli, South Malé Atoll, Maldives.
- *April 2003:* Participated in the surveying and preparation of Environmental Impact Statement for the proposed coastal improvements to address coastal erosion concerns on Royal Island Spa Resort, Baa Atoll, Maldives.
- *May 2003:* Participated in the bathymetry survey and preparation of Initial Environmental Examination for Deepening of Existing Entrance Channel to Service Jetty, Soneva Gili Resort and Spa, North Malé Atoll, Maldives
- *May 2003:* Participated in the preparation of Initial Environmental Examination for development of an access channel into the natural inner lagoon (*Vilu*) of Mayafushi resort, North Ari Atoll.
- *May 2003:* Participated in the preparation of Environmental Impact Assessment for Landaa Giraavaru Pvt. Ltd. for the development of a Four Season's Tourist Resort on the island of Landaa Giraavaru in Baa Atoll, Maldives.
- *June 2003:* Participated in survey and preparation of Initial Environmental Examination for the Development of a Mooring Area and Associated Beach Replenishment in, Boduhithi Club, North Malé Atoll, Maldives.
- *July 2003:* Participated in the surveying and preparation of Initial Environmental Examination for Short-term and Long-term Shore Protection Measures at Alimatha Tourist Resort, Vaavu Atoll, Maldives.
- *July 2003:* Conducted shoreline and vegetation line of Alimatha Tourist Resort, Vaavu Atoll, Maldives.
- *July 2003:* Participated in the surveying for Initial Environmental Examination for Short-term and Long-term Shore Protection Measures at Dhiggiri Tourist Resort, Vaavu Atoll, Maldives.
- *July 2003:* Participated in conducting and preparation of Fun Island Resort Annual Environmental Monitoring Report.
- *July 2003:* Participated in conducting and preparation of Sun Island Resort Annual Environmental Monitoring Report.
- *July 2003:* Participated in conducting and preparation of Holiday Island Resort Annual Environmental Monitoring Report.
- *August 2003:* Developed the Initial Environmental Examination for the construction of Sun Decks along the southern beach of Kudarah Island Resort.
- *September 2003:* Participated in surveying and preparation of Fonaddoo Environmental Impact Assessment Report for the development of fisheries complex, Fonaddoo, Maldives.
- *October 2003*: Participated in surveying and preparation of Kuda Rah Erosion Study and recommendations for shore protection and erosion prevention
- *November 2003:* Conducted vegetation and shoreline survey of Dhonveli Beach and Spa and Four Seasons Report for the Boundary Delineation between the two islands.
- *December 2003:* Contributed to the Landuse Planning Guidelines of Maldives (environmental aspects) for Ministry of Housing and Urban Development.
- *December 2003*: Contributed to the Development of a Building Code of Maldives for Ministry of Housing and Urban Development.
- *January 2004:* Co-author to the Environmental Guidelines for the Development of Resort Islands in Maldives, Ministry of Tourism.
- *February 2004:* Developed the Baa Atoll Spatial Development Plan for Ministry of Planning and National Development.

- *April-July 2004:* Participated in the preparation of the Environmental aspects of the 8 bid proposals for resort Development for various proponents.
- *November 2005:* Participated in the preparation of EIA for L.Gan Resettlement Project for Ministry of Housing.
- *December 2005:* Participated in the surveying and preparation of EIA for Gn Fuvahmulaku Tourist Hotel Development
- *November 2005:* Developed a GIS for strategic planning to select islands for tourism development for Ministry of Tourism.
- *January 2006:* Local consultant for the Strategic Environmental Assessment (SEA) of Maldives Regional Development Plan, for AGRIFOR Consult Consortium, Belgium.
- *June 2006:* Developed the Baa Atoll Resource Management GIS for Ministry of Environment and Energy.
- *August 2006:* Consultant to the Integrated Climate Change System (ICCS) project – Assessment of vulnerability of Maldives Islands and Beaches to climate change
- *September 2006:* Consultant to the ICCS project – Assessment of vulnerability of Maldives Infrastructure to climate change
- *November 2006:* Consultant to the preparation of National Adaptation Programme of Action in Maldives for Ministry of Environment.
- *December 2006*: Environmental Consultant to the United Nations Development Programme (UNDP) Project: Disaster Risk Assessment of Selected nine Safe Islands in Maldives.
- *April 2007:* Prepared the Coastal Erosion Assessment and Management Report for Ga.Meradhoo Island.
- *May 2007:* Participated in the preparation of EIA for N. Randheli Resort Development Project, I&T Management group.
- *June 2007:* Participated in the preparation of Millennium Development Goals, Maldives Country Report.
- *October 2007*: Natural Hazard Assessment consultant to the UNDP Project: Disaster Risk Assessment of Selected Safe Islands in Maldives.
- *November 2007*: Prepared the EIA for proposed coastal protection, beach replenishment and access improvement of Elaa, Thaa Atoll, for Mr Abbas Mohamed, H. Merry Rose.
- *May 2009*: Participated in the preparation of EIA for sand sourcing and beach replenishment project of Viligilli Island, Addu Atoll, for Shangri-La at Viligilli..
- *April 2009:* Participated in the preparation of EIA for N. Maafaru Airport Development Project for Noonu Hotels Pvt Ltd.
- *May 2009:* Participated in the preparation of EIA for resort development in Huvandhumaavattaru, Noonu Atoll
- *June 2009:* Prepared a status of the environment report Randheli Island, Noonu Atoll.
- *July 2009:* Prepared the Environmental EIA for harbour development in Fiyoari, Gaafu Dhaalu Atoll.
- *July 2009:* Participated in the preparation of EIA for Jetty and arrival lounge development project in Gan, Addu Atoll, for Island Aviation Services Private Limited.
- *July 2009:* Team Leader for the socio-economic risk assessment of Selected Safe Islands in Maldives.
- *August 2009:* Coastal erosion data synthesis for selected islands of Maldives, for World Bank Maldives Environmental Management Project.
- *September 2009:* Prepared the beach management plan and development control measures for Reethibeach Island Resort, Baa Atoll.
- *September 2009:* Participated in the preparation of EIA for agricultural island development in Felivaru, Noonu Atoll, for Fantasy Private Limited.
- *September 2009:* Consultant to review the safer islands programme and cost benefit study of mitigation measures in three islands in the Maldives for UNDP.
- *October 2009:* Consultant to the Maldives Environmental Management Project for waste management technical assistance for World Bank.
- *December 2009:* Environmental consultant for advising on resort development and development control measures in Randheli Island, Noonu Atoll.
- *January 2010:* Prepared the beach management plan and development control measures for Shangri-La Island Resort, Addu Atoll.
- *January 2010:* Consultant to the Atoll Ecosystem Conservation project conservation component defining conservation areas and development controls.
- *February 2010:* Prepared the environmental audit of Thunbafushi Island, Kaafu Atoll, for Champa Brothers Private Limited.

- *March 2010:* Prepared the beach management plan and development control for Herathera Island Resort, Addu Atoll.
- *March 2010:* Lead author in the preparation of EIA for power plant upgrading project in Palm Beach Island in Lhaviyani Atoll.
- *April 2010:* Lead author in the preparation of EIA for Seagrass removal and beach replenishment project in Olhuveli Island Resort and Spa, Kaafu Atoll.
- *April 2010:* Prepared an EIA addendum for resort development in Gaakoshibee Island, Shaviyani Atoll.
- *May 2010:* Consultant to undertake island environmental scoping studies in 30 islands in North Maldives to determine islands with resort development potential for GMR Group of India.
- *May 2010:* Lead author in the preparation of EIA for harbour development project in Madidhoo Island, Shaviyani Atoll.
- *June 2010:* Lead author in the preparation of EIA for deep piling project in Olhuveli Island Resort and Spa, Kaafu Atoll.
- *July 2010:* Lead author in the preparation of EIA for the development of an aquaculture site in Kanduoigiri, Kaafu Atoll.
- *July 2010:* Environmental planning consultant for Shangri-La at Viligilli Maldives, Addu Atoll.
- *July 2010:* Environmental planning consultant to the Addu Land Use Planning project (including defining development controls) in Addu Atoll Maldives for South Province Office.
- *August 2010:* Environmental Consultant for the Atoll Ecosystem Conservation Project to declare Baa Atoll as a UNESCO Biosphere reserve.
- *September 2010:* Lead author in the EIA for Seagrass removal and beach replenishment project in Herathera Island, Addu Atoll.
- *September 2010:* Lead author in the EIA for resort redevelopment in Vilamendhoo Island Resort, Ari Atoll.
- *September 2010:* Lead author in the preparation of EIA for Gulhifalhu land reclamation project in Gulhifalhu, Male' Atoll, for Capital Investment and Finance Limited, UK.
- *September 2010:* Participated in the preparation of EIA for sewerage system development project in Miladhoo, Noonu Atoll.
- *October 2010:* Consultant to undertake the coastal adaptation survey of 40 islands in Maldives for Ministry of Housing and Environment.
- *November 2010:* Environmental consultant for advising on resort development and development control measures in Maamigili Island, Raa Atoll
- *January 2011:* Lead author in the preparation of EIA for sewerage and water system development project in Hithadhoo Island, Addu City for Bi-water International Private Limited.
- *February 2011:* Lead author in the preparation of EIA for sewerage and water system development project in Maradhoo Island, Addu City for Bi-water International Private Limited.
- *March 2011:* Lead author in the preparation of EIA for sewerage and water system development project in Feydhoo Island, Addu City for Bi-water International Private Limited.
- *April 2011:* Lead author in the preparation of EIA for sewerage and water system development project in Maradhoo-Feydhoo Island, Addu City for Bi-water International Private Limited.
- *May 2012:* Coastal erosion mitigation assessment and planning for Six Senses Laamu, Laamu Atoll
- *January 2012:* Lead author in the preparation of EIA for sewerage and water system development project in Fuvahmulah Island, Addu City for Bi-water International Private Limited.
- *February 2012:* Coastal erosion mitigation assessment and planning for Fushivelavaru Island
- *March 2012:* EIA for the proposed resort redevelopment project in Conrad Rangali Island for Champa and Crown Resorts
- *March 2012:* EIA for the proposed resort redevelopment project in Gasfinolhu Island Resort, Champa and Crown Resorts
- *May 2012:* Environmental consultant for advising on resort development and development control measures in Gasfinolhu Island, Male' Atoll
- *June 2012:* Environmental consultant for advising on resort development and development control measures in Nakachchaa Huraa Island, Male' Atoll
- *April 2012:* Member of the consultant team that prepared the Tourism Opinion and Profile Survey 2011, Ministry of Tourism.
- *October 2012:* Environmental consultant to the preparation of 4th Tourism Master plan for Ministry of Tourism, Maldives.
- *November 2013:* Environmental consultant for advising on land reclamation, resort development and development control measures in Dhiffushi Island Reef, Male' Atoll.

- *January 2013:* Environmental consultant for advising on resort development and development control measures in Hankede Island, Addu Atoll
- *January 2013:* Environmental consultant for advising on resort development and development control measures in Hankede Island, Addu Atoll
  June 2013: Local Environment consultant to the WCCM project, HIDRIA and Aquatica, Spain.
- *June 2015:* Environmental consultant for Nasandhura Palace Hotel Redevelopment EIA, 15-storey building, Male'City
- *June 2015:* Environmental consultant for Male-Hulhule Bridge, Borehole Drilling EIA, Male' City
- *July 2015:* Environmental consultant for Male-Hulhule Bridge EIA, Male' City
- *September 2015:* Environmental consultant for Development of Tertiary Hospital in Hulhumale
- *July 2015:* Environmental consultant for Development of 9-Storey Building for ADK, Male'City

Membership of Professional Bodies

- Member of Building Code Committee, Maldives
- Member of Commission on Sustainable development
- Member of the Technical Committee for Developing Spatial Plans for conducting tourism related activities in Ari Atoll.
- Member of Climate Advisory Council to the President of Maldives 2009- to present.
- Registered EIA Consultant in Maldives Environment Protection Agency roster.

Major Publications

SHAIG, A. (2001) "An Overview of Web Based Geographic Information Systems". In Proceedings: Thirteenth Annual Colloquium of the Spatial Information Research Centre. P.A. Whigham (ed). 2 - 5 Dec, Dunedin, New Zealand. University of Otago, pp.255-264.

SHAIG, A. (2006). Climate Change Vulnerability and Adaptation Assessment of the Coastal Infrastructure of Maldives. Technical Paper submitted to Maldives National Adaptation Plan of Action for Climate Change. Ministry of Environment, Energy and Water, Male', Maldives.

SHAIG, A. (2006). Climate Change Vulnerability and Adaptation Assessment of the Land and Beaches of Maldives. Technical Paper submitted to Maldives National Adaptation Plan of Action for Climate Change. Ministry of Environment, Energy and Water, Male', Maldives.

SHAIG, A. (2007) Land Study of Maldives, 2006. Ministry of Planning and National Development, Male' Maldives.

SHAIG, A. and Aslam, M (2007) Detailed Island Risk Assessment Maldives Volume I to Volume IV – Natural Hazard Assessment (Final Draft). UNDP, Male' Maldives

SHAIG, A. (2007) Detailed Island Risk Assessment Maldives Volume I to Volume IV – Environmental Vulnerability Assessment (Final Draft). UNDP, Male' Maldives.

Academic Achievements

2001 Critchlow Associates Prize in Surveying, New Zealand.
Prize awarded annually by University council for the highest standard of Achievement in Spatial Information Studies in University of Otago.
1994 Certificate for best results in General Certificate of Examinations, Advanced Level.
Science Education Centre, Male', Maldives

References

Hamdun Hameed
Member of Parliament
Male', Maldives
Tel: (+960) 3323414
minister@planning.gov.mv

Simad Saeed, Dr
Managing Director,
CDE Consulting
Male', Maldives
Tel: +960 777 7445
Email: simad@cde.com.mv

David King, Dr.
Associate Proffessor
James Cook University
Townsville, QLD,Australia, 4811
Tel: (+61) 747 81 4441 ,Fax: (+61) 747 81 5581
Email: david.king@jcu.edu.au

Peter Valentine
Head of School, TESAG Department
James Cook University
Townsville, QLD,Australia, 4811
Tel: (+61) 747 81 4441 ,Fax: (+61) 747 81 5581
Email: peter.valentine@jcu.edu.au

Clarification

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications and my experience. I understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Signature Date: 15 July 2013

Mohamed Faizan

Contact Details

Address: H. Pent Land,
Lansimoo Goalhi,
20041 Male',
Maldives

Tel: +960-7501205

E-mail: Faizan@cde.com.mv

Education

August 2012 – October 2014 University of Malaya, (Malaysia)
- Master of Technology (Environmental management)
- Dissertation title "Study on the impact of anthropogenic pressure on coral reefs around Cape Rachado, Malacca and recommendations to improve its management"

July 2006- June 2010 International Islamic University Malaysia, (Malaysia)
- Bachelor of Biotechnology (Honours).
- Final year thesis title "Spatio-temporal study on coastline changes along Tanjung Lumpur – Cherok Paloh Coast".

June 2002 – June 2004 Centre for Higher Secondary School, (Maldives)
- GCE Advanced level.

January 1997 – February 2002 Majeediyaa School, (Maldives)
- GCE Ordinary level.

Employment History

July 2014 – Present CDE Consulting
- **Environmental Consultant** at CDE Consulting. Roles and responsibilities include preparation of Environmental Impact Assessment reports, undertaking environmental baseline surveys, and conduct environmental monitoring.

June 2010 – July 2012 CDE Consulting
- **Environmental Consultant** at CDE Consulting. Responsibilities included undertaking environmental baseline studies for Environmental Impact Assessments, and environmental monitoring. In addition, co-ordination of field surveys.

February 2005 – April 2006 Integrated Climate Change Strategy
- **Project Assistant** for the Integrated Climate Change Strategy implemented by Ministry of Environment, Energy and Water (Maldives).
- Responsibilities included assisting the project manager, in preparation of financial reports, organizing workshops.
- Helped launch monthly newsletter on climate change "Nakaiy".

EIA experience

Environmental Impact Assessment (EIA)	Proponent	Date
EIA for the proposed Malé-Hulhulé bridge - Undertook the marine baseline assessment surveys, and prepared marine assessment report	Ministry of Housing and Infrastructure	July 2015
EIA for the proposed redevelopment of of Nasandhuraa Palace Hotel - Undertook the marine baseline assessment surveys	Nasandhura Palace Hotel Investments Private Limited	June 2015
EIA for the proposed resort development in Madivaru,Kaafu Atoll - Undertook the marine baseline assessment surveys	Shuaz Investment Private Limited	May 2015
EIA for the proposed Coral Reef rejuvenation project at Velaa Private Island - Undertook the baseline assessment surveys, including stakeholder consultations. Complied the EIA report.	Velaa Private Island	March 2015
EIA for the proposed Coral Gardening at Shangri-La's Villingili Resort & Spa - Undertook the baseline assessment surveys, including stakeholder consultations. Complied the EIA report.	Shangri-La's Villingili Resort & Spa	February 2015
EIA for the proposed sewerage system project at Kanditheem, Shaviyani - Marine environment assessment and report for the EIA	Male' Water and Sewerage Company Pvt Ltd	April 2014
EIA for the proposed beach replenishment project in Holiday Inn Resort Kandooma, Maldives, South Male' Atoll - Marine environment assessment and report for the EIA	Holiday Inn Resort Kandooma Maldives	April 2014
EIA report for the proposed sewerage system at Maduvvari, Raa Atoll - Undertook the baseline assessment surveys, including stakeholder consultations. Complied the EIA report.	Mr. Ibrahim Shazyl, Venture Maldives Pvt Ltd	February 2012
EIA report for the proposed installation and operation of desalination plant at Hithaadhoo, Baa Atoll - EIA report compilation.	Mr. Ismail Shafeeu, Static Company Pvt Ltd	January 2012

EIA report for the proposed Solid Waste Management facility at Thilafushi - Baseline marine assessments and EIA report compilation.	Tatva Global Renewable Energy (Maldives) Private Limited	December 2011
EIA for the development of a domestic airport on Koodoo, GA. Atoll - Undertook baseline assessments for the EIA, and prepared the existing environment chapter for the EIA.	Bonavvista (Maldives) Private Limited Singapore	October 2011
EIA prepared for the proposed harbor entrance channel dredging project in Bodufolhudhoo Island, North Ari Atoll - Undertook the baseline assessments for the EIA, and prepared the existing environment chapter of the EIA and compiled the overall EIA report.	Ministry of Housing and Environment	August 2011
EIA prepared for the proposed re-development – phase I of Gasfinolhu Island Resort, Kaafu Atoll, Maldives - Baseline marine assessments and report preparation for the EIA.	Mr. Hussain Afeef	July 2011
EIA prepared for the proposed re-construction of Shaviyani Foakaidhoo Harbour - Undertook the marine baseline assessments and, prepared the marine assessment report for the EIA.	Ministry of Housing and Environment	March 2011
EIA for the sewerage system development in N. Miladhoo - Marine environment assessments	Works Corporation Limited	September 2010

CURRICULUM VITAE

SHAHDHA

Address: Ma.Mahal- 3F, Nikagasmagu Magu, Male', Maldives

NID: A 234112

Telephone: + 960 9700169

Email: shahushiyam@gmail.com

Profile

Bachelor of Environments graduate with a major in environmental geography, politics and cultures. Excellent understanding of human-environment relationship, factors contributing to human vulnerabilities and strategies to build human capacity and resilience. Thorough knowledge of sustainable development principles and goals. Skilled in analyzing and assessing complex environmental and development issues and preparation of reports and relevant communication materials. Experienced in working with stakeholders at government, private sector, NGOs and local communities. Passionate about human development and working with community groups to achieve sustainable development goals.

Education

Bachelor of Environments (Major in Environmental Geographies, Politics and Cultures)
University of Melbourne, Melbourne, Australia
January 2012-December 2014

Advanced Level Edexcel Examination and Higher Secondary Certificate (HSC) Examinations,
Center for Higher Secondary Education, Male', Republic of Maldives.
2007-2009

Cambridge GCE O-level, IGCSE Examinations and Secondary School Certificate (SSC) Examination,
H Dh. Atoll School, HDh.Vaikaradhoo, Republic of Maldives.
2004-2006

Employment Record

From March 2015 **To** : Present

Client: CDE Consulting Pvt Ltd

Positions held: Sustainable Development Consultant

From: February 2010 **To**: December 2011

Client: Indhira Gandhi Memorial Hospital

Positions held: Clinical Assistant

From: July 2009 To: November 2009

Client: HDh. Atoll School

Positions held: Relief Teacher

Professional Development and Memberships:

- Member of University of Melbourne Alumni Association
- Member of Maldives Australia Alumni
- Member of the University of Melbourne Australian Awards Club from September 2013 to December 2014
- Volunteer with Maldivian Red Crescent
- Volunteer with Volunteers for Environment and Social Harmony and Integration (VESHI)

Other Training

- Completed Emergency Response Training conducted by Maldivian Red Crescent from 21-25 August 2016.
- Participated as an observer in the Sixth Regional 3R Forum for Asia and the Pacific from 16th August to 19th August 2015.
- Workshop on knowledge and information sharing on issues and challenges in implementing Water supply and Sewerage projects in Maldives on 13th August 2015
- Endorsement workshop of Maldives Intended Nationally Determined Contributions (INDC)- 10th September 2015
- First National Dialogue on Intended Nationally Determined Contributions (INDCs) of the Maldives- 21st May 2015
- Standard course in First Aid at Faculty of Health Sciences, Maldives College of Higher Education 2010

Achievements

- Awarded Dean's Honours Award Bachelor of Environments Year Level 3 by University of Melbourne in 2014
- Awarded Australian Development Scholarship in 2011
- Achieved fourth place among the National Top 10 Achievers in the Higher Secondary School Completion Examinations 2009.
- Achieved second place among the National Top 10 Achievers in the Secondary School Completion Examinations 2006.
- Awarded the Best All Round Student of H Dh. Atoll School in 2006.

Language Skills

Language	Reading	Writing	Speaking
English	Excellent	Excellent	Excellent
Dhivehi	Excellent	Excellent	Excellent

Computer Skills

Experience with Microsoft office word, excel, power point and project

Professional Work Experience

Name of assignment or project: Development of Island Level Waste Management Plans for Islands of Laamu Atoll
Year: 2015
Location: Laamu Atoll, Maldives
Client: UNOPS- LECReD & CDE Consulting Private Limited
Main project features: Preparation of island level waste management plans for the inhabited islands of Laamu Atoll
Positions held: Associate Consultant
Activities performed: Assisted in preparing methodology, designed questionnaires for household, government institutions, businesses, health care facilities and schools, visited the islands and undertook assessment of existing waste situation, undertook stakeholder consultations, surveyed households, visited Island Waste Management Centers and prepared Waste Management Centers report, prepared existing situation reports, prepared solid waste management plans, researched and contacted waste equipment suppliers, contributed to investment plan preparation.

Name of assignment or project: EIA for the Proposed 25-storey Building of IGMH
Year: 2016
Location: Male', Maldives

Client: Indhira Gandhi Memorial Hospital
Main project features: EIA for the proposed 25-storey Building of IGMH
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, socioeconomic impact assessment, assessed waste impacts and prepared waste management plan, and contributed to EIA report writing.

Name of assignment or project: EIA for the development of Plots N3-56 and N3-57 under the Proposed 3000 housing units at Hulhumale'
Year: 2016
Location: Huhumale', Kaafu Atoll
Client: Sea Life Global Inc Private Limited
Main project features: EIA for the development of Plots N3-56 and N3-57 under the Proposed 3000 housing units at Hulhumale'
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, prepared waste management plan, and contributed to EIA report writing.

Name of assignment or project: EIA for the development of Plot N3-55 under the Proposed 3000 housing units at Hulhumale'
Year: 2016
Location: Huhumale', Kaafu Atoll
Client: Sea Life Global Inc Private Limited
Main project features: EIA for the development of Plot N3-55 under the Proposed 3000 housing units at Hulhumale'
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, prepared waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the Proposed Nationwide Submarine Cable by Ooredoo Maldives
Year: 2016
Location: Maldives
Client: Ooredoo Maldives
Main project features: EIA for the Proposed Nationwide Submarine Cable by Ooredoo Maldives
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment and contributed to EIA report writing.

Name of assignment or project: EIA for the Proposed Raffalhuhuraa Resort Development Project at Maifalhu, Kaafu Atoll
Year: 2016
Location: Kaafu Atoll
Client: Mesa RF Private Limited
Main project features: EIA for the Proposed Raffalhuhuraa Resort Development Project at Maifalhu, Kaafu

Atoll
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, assessed waste impacts and prepared waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the Proposed Resort Development Project at Huruvalhi Island, Raa Atoll
Year: 2016
Location: Male', Maldives
Client: Mr.Amir Mansoor
Main project features: EIA for the Proposed Resort Development Project at Huruvalhi Island, Raa Atoll
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, assessed waste impacts and prepared waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the Proposed Land Reclamation and Resort Development Project in Maagaa, North Ari Atoll
Year: 2016
Location: North Ari Atoll
Client: Big Stone Private Limited
Main project features: EIA for the Proposed Land Reclamation and Resort Development Project in Maagaa, North Ari Atoll
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, assessed waste impacts and prepared waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the Proposed Resort Development Project in Miriyandhoo, Baa Atoll
Year: 2016
Location: Baa Atoll
Client: Miriyandhoo Maldives Resorts Private Limited
Main project features: EIA for the Proposed Resort Development Project in Miriyandhoo, Baa Atoll
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, assessed waste impacts and prepared waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the Proposed Resort Development Project in Aluvifushi Island, Dhaalu Atoll

Year: 2016
Location: Dhaalu Atoll
Client: Ocean Islands Private Limited
Main project features: EIA for the Proposed Resort Development Project in Aluvifushi Island, Dhaalu Atoll
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, assessed waste impacts and prepared waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the Proposed Land Reclamation and Resort Development Project in Rasdhoo Madivaru, North Male' Atoll
Year: 2016
Location: North Male' Atoll
Client: Veli Madivaru Private Limited
Main project features: EIA for the Proposed Land Reclamation and Resort Development Project in Rasdhoo Madivaru, North Male' Atoll
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, and contributed to EIA report writing.

Name of assignment or project: EIA for the proposed Hulhule'-Male' Bridge Project
Year: 2015
Location: Male' & Hulhule', Maldives
Client: Ministry of Housing and Environment, Maldives
Main project features: EIA for the proposed Hulhule'-Male' Bridge Project
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline transport and traffic surveys, contributed to designing methodology and survey questionnaires for public consultation, conducted stakeholder consultations, contributed to assessment of waste impacts and preparation of waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the proposed test drilling For Hulhule'-Male' Bridge construction project
Year: 2015
Location: Male' & Hulhule', Maldives
Client: Ministry of Housing and Environment, Maldives
Main project features: EIA for the proposed test drilling For Hulhule'-Male' Bridge construction project
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment and contributed to EIA report writing.

Name of assignment or project: EIA for the proposed redevelopment of Nasandhura Palace Hotel, Male'
Year: 2015
Location: Male', Maldives
Client: Nasandhura Palace Hotel Investments Private Limited
Main project features: EIA for the proposed redevelopment of Nasandhura Palace Hotel, Male'
Positions held: Sustainable Development Consultant

Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, Contributed to assessment of waste impacts and preparation of waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the proposed construction of a 9-storey building at the compound of ADK Hospital, Sosun Magu, Male', Maldives
Year: 2015
Location: Male', Maldives
Client: ADK Hospital Private Limited
Main project features: EIA for the proposed construction of a 9-storey building at the compound of ADK Hospital, Sosun Magu, Male', Maldives
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, stakeholder consultations, and socioeconomic impact assessment, assessed waste impacts and prepared waste management plan and contributed to EIA report writing.

Name of assignment or project: EIA for the proposed tourist development project at Madivaru Island, Kaafu Atoll
Year: 2015
Location: K. Madivaru, Maldives
Client: Shuaz Investment Private Limited
Main project features: EIA for the proposed tourist development project at Madivaru Island, Kaafu Atoll
Positions held: Sustainable Development Consultant
Activities performed: Contributed to writing the EIA Report

Name of assignment or project: EIA for the proposed land reclamation and resort development project in Ithaafushi Reef, South Male' Atoll
Year: 2015
Location: Kaafu Atoll, Maldives
Client: Sumaiyya Holdings Private Limited
Main project features: EIA for the proposed land reclamation and resort development project in Ithaafushi Reef, South Male' Atoll
Positions held: Sustainable Development Consultant
Activities performed: Contributed to writing the EIA Report

Name of assignment or project: EIA for the proposed resort development in Bodukaashihuraa, Alifu Dhaalu Atoll, Maldives
Year: 2015
Location: Alifu Dhaalu Atoll, Maldives
Client: Millenium Capital Management Private Limited
Main project features: EIA for the proposed resort development in Bodukaashihuraa, Alifu Dhaalu Atoll, Maldives
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, undertook socioeconomic impact assessment and contributed to EIA report writing.

Name of assignment or project: EIA for the Development of a Tertiary Hospital at Hulhumale'

Year: 2015
Location: Hulhumale', Maldives
Client: Tree Top Investment Private Limited
Main project features: EIA for the Development of a tertiary hospital at Hulhumale'
Positions held: Sustainable Development Consultant
Activities performed: Undertook baseline surveys, undertook socioeconomic impact assessment and contributed to EIA report writing.

Name of assignment or project: EIA of the Shore protection project at HDh.Kulhudhuffushi
Year: 2015
Location: Haa Dhaalu Atoll, Maldives
Client: Capital Investment and Finance & Ministry of Environment
Main project features: EIA of the Shore protection project at HDh.Kulhudhuffushi
Positions held: Sustainable Development Consultant
Activities performed: Designed consultation methodology and questions, undertook socioeconomic impact assessment and contributed to EIA report writing.

Name of assignment or project: EIA of the Shore protection project at B.Thulhaadhoo
Year: 2015
Location: Baa Atoll, Maldives
Client: Capital Investment and Finance & Ministry of Environment
Main project features: EIA of the Shore protection project at B.Thulhaadhoo
Positions held: Sustainable Development Consultant
Activities performed: Designed consultation methodology and questions, undertook stakeholder consultations and socioeconomic impact assessment and contributed to EIA report writing.

Name of assignment or project: EIA of the channel dredging and beach replenishment activities at Canareef Resort Maldives, Addu City, Maldives
Year: 2015
Location: Addu City, Maldives
Client: Canaries Resort Private Limited
Main project features: EIA of the channel dredging and beach replenishment activities at Canareef Resort Maldives, Addu City, Maldives
Positions held: Sustainable Development Consultant
Activities performed: Designed consultation methodology and questions, undertook stakeholder consultations and socioeconomic impact assessment and contributed to EIA report writing.

Name of assignment or project: EIA for Resort Development at Kudadhoo Island, Lhaviyani Atoll
Year: 2015
Location: Lhaviyani Atoll Maldives
Client: Chamapalars Private Limited
Main project features: EIA for Resort Development at Kudadhoo Island, Lhaviyani Atoll
Activities performed: Designed consultation methodology and questions, undertook stakeholder consultations and socioeconomic impact assessment and contributed to EIA report writing

Name of assignment or project: Disaster Management Plan for Maldives Explorer Yatch
Year: 2015
Location: Maldives
Client: Capital Travel and Tours Private Limited
Main project features: Development of a disaster management plan for Maldives Explorer Yatch
Positions held: Sustainable Development Consultant
Activities performed: Undertook disaster risk assessment and prepared disaster management plan

Name of assignment or project: Maldives Visitor Survey February 2015
Year: 2015
Location: Maldives
Client: Ministry of Tourism
Main project features: Understanding tourist composition, reasons for visiting and tourist perception of Maldives.
Positions held: Enumerator
Activities performed: Supervised survey enumerators and undertook enumeration.

Name of assignment or project: Maldives Democracy Survey 2015
Year: 2015
Location: Maldives
Client: International Foundation for Electoral Systems (IFES)
Main project features: Assessment of the state of democracy in Maldives
Positions held: Enumerator
Activities performed: Supervised survey enumerators and undertook enumeration.

Name of assignment or project: Coastal Vulnerability and adaptation assessment of North Ari Atoll
Year: 2015
Location: North Ari Atoll Maldives
Client: International Union for Conservation on Nature (IUCN)
Main project features: assessment of coastal vulnerability and adaptability of North Ari Atoll
Positions held: Sustainable Development Consultant
Activities performed: Designed survey questionnaires for government agencies and institutions

Name of assignment or project: Environmental Monitoring of Hulhule'-Male' Bridge Project
Year: 2016- present
Location: Male', Maldives
Client: CCCC Second Harbour Engineering Company Limited
Main project features: Environmental monitoring data collection as per the monitoring plan in the EIA report and preparation of monitoring reports
Positions held: Consultant – In charge of monitoring and reporting solid waste
Activities performed: site visits, consultations with client and stakeholders about management of bridge construction waste, advising client on construction and domestic waste management at work sites and accommodation areas, preparation of waste audit methodology and preparation for quarterly waste audit

Name of assignment or project: Environmental and Social Performance Annual Monitoring of Shangri-La's Vilingili Resort & Spas 2014
Year: 2015
Location: Addu Atoll, Maldives
Client: Shangri-La's Vilingili Resort & Spa
Main project features: Annual monitoring of environmental and social parameters at Shangri-La's Vilingili Resort & Spa
Positions held: Consultant – In charge of monitoring and reporting solid waste, noise and air pollution
Activities performed: Site visits, data collection, data analysis, report writing and advising the client

Name of assignment or project: Environmental Monitoring of Vilamendhoo Island Resort & Spa
Year: 2015
Location: Alifu Dhaalu, Maldives
Client: Vilamendhoo Island Resort & Spa
Main project features: Annual monitoring of environmental parameters at Vilamendhoo Island Resort & Spas
Positions held: Sustainable Development Consultant
Activities performed: Undertook solid waste monitoring, advice and reporting and beach and coastal area surveying

Name of assignment or project: Environmental Monitoring of Holiday Inn Resort Kandooma Maldives
Year: 2015
Location: Maldives
Client: Holiday Inn Resort Kandooma Maldives
Main project features: Environmental Monitoring of Holiday Inn Resort Kandooma Maldives
Positions held: Sustainable Development Consultant
Activities performed: Undertook beach and coastal surveying and reportin

Volunteer Work

Name of assignment or project: Introducing Green Healing Hospital Concept at ADh. Atoll Hospital
Year: 2016
Location: Alifu Dhaalu Atoll, Maldives
Client: ADh.Atoll Hospital & Volunteers for Environment and Social Harmony and Integration
Main project features: Waste audit of ADh.Atoll Hospital
Positions held: Consultant (volunteer)
Activities performed: Prepared methodology, visited the hospital and undertook assessment of existing waste situation at the hospital, undertook stakeholder consultations, conducted hospital waste audit, prepared waste audit report and presentation

Name of assignment or project: Environment Day 2015 Beach Cleanup at Lh.Kurendhoo
Year: 2015
Location: Lhaviyani Atoll, Maldives
Main project features: Beach cleanup and waste awareness for public of Lh.Kurendhoo

Positions held: Consultant (volunteer)
Activities performed: Took the initiative of a beach cleanup activity at Kurendhoo on the occasion of environment day, coordinated with island council to arrange the activity and mobilize the public, lead a team effort with other volunteers to get sponsors, lead the activity and conducted an awareness session on solid waste management

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and my experience.

_____ Date: 20 October 2016

AHMED NASHWAN ABDUL MATHEEN

ahmed.nashwan.am@gmail.com

CAREER PROFILE

University Medal winning, high distinction average Bachelor of Environmental Engineering graduate who has;

- Worked for a consulting company on coastal development projects and assisted in their surveys
- Carried out research on the capabilities of coastal surveying and monitoring techniques
- Has experience in coastal field surveying equipment and techniques
- Familiar with software such as MapInfo, ArcMap, and Matlab

EDUCATION

Jan 2013 to Present — **Bachelor of Environmental Engineering**
UNSW Australia

- Recipient of the University Medal
- High Distinction Average
- Recipient of the Faculty of Engineering Deans Award during 2014, 2015, and 2016
- Member of the School of Civil and Environmental Engineering Elite Student Program during 2014, 2015 and 2016
- Awarded the School of Civil and Environmental Engineering Elite Student Summer Scholarship 2014/2015
- Carried out higher honours research in coastal engineering; estimation of bathymetry using cBathy remote sensing technique

June 2009 to June 2011 — **EdExcel Advanced Level Certificate**
Villa International High School (VIHS)

- Achieved "A star" grade qualifications in all subjects
- Awarded 4th place in National Top Ten Awards

Jan 2006 to Dec 2008 — **Cambridge International Examinations Ordinary Level Certificate**
Majeedhiyya School

- Achieved "A" grade qualifications in all subjects
- Awarded 2nd place in National Top Ten Awards

- Achieved the highest mark in the world in Computer Studies during the November 2008 Cambridge International Ordinary Level examinations
- Achieved the highest national mark in Biology during the November 2008 Cambridge International Ordinary Level examinations

EMPLOYMENT

Feb 2017 to present

Coastal Engineering Consultant
CDE Consulting Pvt Ltd

- Carried out field surveys for coastal protection development and design
- Reviewed and cross-checked coastal protection designs
- Involved in the design and development of coastal protection "breakwater islands" at Sheraton Full Moon Resort & Spa Maldives, and shore protection infrastructure N. Orivaru resort.
- Managed surveying department of the consultancy

Dec 2014 to Feb 2015

Research on Coastal Monitoring Techniques
UNSW Australia Water Research Lab

- Carried out research on the effectiveness and capabilities of modern coastal monitoring techniques, based on data from Narrabeen-Colloroy beach, NSW, Australia
- Involved in RTK GPS surveys of Byron Bay beach, NSW and Kingscliff beach, NSW for a coastal research project initiated by Dr Belinda Cooke from Macquarie University
- Prepared and presented a video at the AdaptNSW conference held in December 2015, which showcased the capabilities of coastal surveying using Unmanned Aerial Vehicles

Sept 2011 to Sept 2012, and Dec 2015 to Jan 2016

Research/Field Assistant
CDE Consulting Pvt Ltd

- Assisted survey teams during monitoring and survey trips to field and project sites
- Used MapInfo and ArcMap to prepare graphical representations of data gathered during survey trip

PUBLICATIONS

Peer-Reviewed Conference Papers

CHRISTOPHER D DRUMMOND, MITCHELL D HARLEY, IAN L TURNER, A NASHWAN A MATHEEN & WILLIAM C GLAMORE 2015. UAV Applications to Coastal Engineering. Coasts and Ports. Auckland, New Zealand.

AHMED HAIMAN RASHEEDH

PERSONAL DETAILS

Full Name:	**Haiman Rasheedh, Ahmed**	NIRC:	**A297924**
Gender:	**Male**	Date of birth:	**September 24, 1993**
Place of birth:	**S.Feydhoo, Republic of Maldives**	Nationality:	**Maldivian**
Marital Status:	**Single**		

Permanent Address:	**Goal Corner** **S.Feydhoo 19040** **Republic of Maldives**	Current Address:	**G. Velagala** **Faashanakileygefaanu Magu** **Male, Republic of Maldives**

Contact Details**:** **(Mobile): +960 7684393**

Email for correspondence: **haiman@cde.com.mv**

EDUCATION

Year	Name of Education Institute	Title of Qualification	Status
2007 – 2009	**DHARUMAVANTHA SCHOOL**	**GCE / IGCSE O' Level under the curriculum of University of Cambridge**	**Graduated**

EMPLOYMENT HISTORY

Time Period	Position Held, Employee	Task assigned
February 2014 – present	Associate Consultant, CDE Consulting	▪ Marine surveying (Conducting inspections, reef transects, manta tows, designing coral reef restoration projects, & examinations of reefs) ▪ Coral Point Count with Excel extensions (Software to determine of coral cover using transect photographs) ▪ Beach surveying ▪ Compiling Marine reports (Prepare reports on types of surveys conducted
August 2013 – February 2014	Assistant technician, Ministry of Fisheries and Agriculture	▪ Designing the structure of FAD (Fish Aggregating Device) ▪ Research on the status of pelagic fishes found near FADs
January 2011 – January 2012	Research officer, CDE Consulting	▪ Marine surveying (Conducting inspections, surveys & examinations of reefs) ▪ Beach surveying ▪ Compiling Marine reports (Prepare reports on types of surveys conducted
December 2009 – June 2010	Research officer, CDE Consulting	▪ Marine surveying (Conducting inspections, surveys & examinations of reefs) ▪ Beach surveying ▪ Compiling Marine reports (Prepare reports on types of surveys conducted)

Field Experience

- Traveled to all 20 atolls of the Maldives
- Over 100+ islands in the Maldives; including 20+ Resorts, 50+ Inhabited islands and 30+ Uninhabited islands and their associated reef systems

Some of the EIA's that I have worked on as a member of the team, or contributed to field work;

- Tourism Development Projects:
  - Adh. Bodukaashihuraa Resort Development EIA
  - B. Dhigufaruvinagandu Resort Development EIA
  - K. Madivaru Resort Development EIA
  - Lh. Fushifaru Resort Development EIA
  - N. Thanburudhuffushi Picnic Island Development EIA
  - K. Gasfinolhu Addendum EIA (Palm transplanting)
  - K. Taj Vivanta Resort Shore Protection EIA
  - Lh. Maabinhuraa Resort Development EIA
  - Aa. Maagaa Resort Development EIA
  - Aa. Madivaru Finolhu Resort Development EIA
  - Olhuveli Lagoon Reclamation EIA
  - Dh. Aluvifushi Resort Development EIA
  - Lh. Huruvalhi Resort Development EIA
- Agricultural Development Projects:
  - Sh. Madidhoo Agricultural Development EIA
  - Lh. Maduvarri Agricultural Development EIA
  - N. Minaavaru Agricultural Development EIA
- Airport Development Projects:
  - R. Ifuru Airport Development EIA
  - N. Maafaru Airport Development EIA
- Major public/ private sector Projects:
  - Tree Top Hospital Development EIA
  - Nasandhura Palace Hotel Redevelopment EIA
  - Thilafushi Harbor Development EIA
  - Male-Hulhule Bridge, Borehole Drilling EIA
  - Male-Hulhule Bridge EIA
  - Addu and Fuvahmulah ESIA for Wetland Project

Dive Qualifications

Date	Qualification	School	Status
May 2014	**Open Water Diver, PADI**	**Maldivers Diving Center, Maldives**	**Certified**
Mar 2016	**Advanced Diver, PADI**	**Dive Desk, Maldives**	**Completed, Card pending**
Mar 2016	**Emergency First Response, PADI**	**Dive Desk, Maldives**	**Completed, Card pending**

REFERENCES

Name	**Address, Telephone & Fax**	**Email, Occupation & Business Title**
Ahmed Shaig, PhD	CDE Pvt Ltd 4th Floor, Orchidmaage Ameer Ahmed Magu, Henveiru Male', Maldives (Telephone): +960 3312514 (Fax): +960 3315926	Director CDE Pvt Ltd info@cde.com.mv
Mohamed Ali	CDE Pvt Ltd 4th Floor, Orchidmaage Ameer Ahmed Magu, Henveiru Male', Maldives (Telephone): +960 3312514 (Fax): +960 3315926	Marine Specialist/ DiveMaster CDE Pvt Ltd mohamed.ali@cde.com.mv

ALI MOOSA DIDI

4th floor, MA. Rose Villa • Dhevina Magu • Male' • Maldives • 00 960 791-2001• ali@cde.com.mv

A highly motivated individual with a hardworking attitude and over ten years of experience in the surveying industry of the Maldives.

Personal

Name:	Ali Moosa Didi
Date of Birth:	18th June 1985
Gender:	Male
Marital Status:	Single
NID No:	A-154179

Education

UNIVERSITY OF CAMBRIDGE, GCE ORDINARY LEVEL
(JAN 1997)
Madharasthul Islamiya School
Male', Rep of Maldives

Employment

SURVEYOR (FULL TIME)
(January 2010 – PRESENT)
CDE Pvt Ltd
Male', Rep of Maldives

Conducting field based surveying activities; including shoreline mapping exercises, vegetation assessments, topographic surveys and hydrographic surveys. Work duties also include the consequent data processing and mapping activities of all the surveys conducted at the office.

HUMAN RESOURCES OFFICER (FULL TIME)
(January 2010 – PRESENT)
Ryco Investment Pvt Ltd
Male', Rep of Maldives

Assisted the Office Manager in handling all the human resources related duties of the Office, including Payroll processing.

ASSISTANT SURVEYOR (FULL TIME)
(January 2010 – PRESENT)
CDE Pvt Ltd
Male', Rep of Maldives

Assiting field based surveying activities; including shoreline mapping exercises, vegetation assessments, topographic surveys and hydrographic surveys. Work duties also included the consequent data processing and mapping activities of all the surveys conducted at the office.

Skills

- ✓ Competent in using Surveying Equipment and Accessories
- ✓ Intermediate in Microsoft Applications
- ✓ Intermediate in ArcGIS application

Work Experience

- Travelled to all 20 atolls of the Maldives
- Over 100+ islands in the Maldives; including 20+ Resorts, 50+ Inhabited islands and 30+ Uninhabited islands and their associated reef systems

Some of the EIA's that I have worked on as a member of the team, or contributed to the field surveying work (Past 5 years only);

- Tourism Development Projects:
  - Adh. Bodukaashihuraa Resort Development EIA
  - B. Dhigufaruvinagandu Resort Development EIA
  - K. Madivaru Resort Development EIA
  - Lh. Fushifaru Resort Development EIA
  - N. Thanburudhuffushi Picnic Island Development EIA
  - K. Gasfinolhu Addendum EIA (Palm transplanting)
  - K. Taj Vivanta Resort Shore Protection EIA
  - Lh. Maabinhuraa Resort Development EIA
  - Aa. Maagaa Resort Development EIA
  - Aa. Madivaru Finolhu Resort Development EIA
  - Olhuveli Lagoon Reclamation EIA
  - Dh. Aluvifushi Resort Development EIA
  - Lh. Huruvalhi Resort Development EIA
- Agricultural Development Projects:
  - Sh. Madidhoo Agricultural Development EIA
  - Lh. Maduvarri Agricultural Development EIA
  - N. Minaavaru Agricultural Development EIA
- Airport Development Projects:
  - R. Ifuru Airport Development EIA
  - N. Maafaru Airport Development EIA
- Major public/ private sector Projects:
  - Tree Top Hospital Development EIA
  - Nasandhura Palace Hotel Redevelopment EIA
  - Thilafushi Harbor Development EIA
  - Male-Hulhule Bridge, Borehole Drilling EIA
  - Male-Hulhule Bridge EIA
  - Addu and Fuvahmulah ESIA for Wetland Project

References

Simad Saeed, PhD
Managing Director
CDE Pvt Ltd
4th Floor, Orchidmaage, Ameeruahmed Magu,
Male'Maldives
info@cde.com.mv
Tel: +960 331 2514
Fax: +960 331 5926

Ahmed Shaig, PhD
Director
CDE Pvt Ltd
4th Floor, Orchidmaage, Ameeruahmed Magu,
Male'Maldives
info@cde.com.mv
Tel: +960 331 2514
Fax: +960 331 5926

Mohamed Ali

ID #:	A 094918
Nationality:	Maldivian
Languages:	English, Sinhalese, Dhivehi
Date of Birth:	13/09/1983
Telephone:	960-790-6007
Email:	mohamed.ali@cde.com.mv

Experience

Marine Environmental Specialist — June 2011- Present
CDE Consulting

Marine Environment Officer — July 2008 – May 2011
Banyan Tree Vabbinfaru

Freelance Lobster Hunter, Shark Fisherman — Jan 2007 - July 2008
Laamu Atoll

Dock Assistant — Sep 2006 - Jan 2007
Tourist Submarine Maldives

Education and Certifications

PADI Rescue Diver	June 2011
PADI Enriched Air Diver	June 2011
Emergency First Responder	May 2011

Basic Computer Science — 2001 - 2006
Singapore Informatics, Colombo Sri Lanka

Profile

I am very passionate about protecting the marine environment. After having worked as both a fisherman and a marine environment officer I am aware of the impact that human activity has on our fragile marine environment. My favorite activities are reef monitoring and planting coral gardens. With my undying passion for the underwater world and also with my vast experience diving all over the Maldives, educating people on the marine environment is my greatest mission, to ensure the preservation and protection of our most valuable treasure. Furthermore, I have got the opportunity to work besides the greatest marine experts in the world namely Prof. J.E.N. Veron,Dr. Norman Queen and Dr. Daphne G. Fautin.

References

N.D. Abdul Azeez Abdul Hakeem
Former Director of Conservation
Mobile: + 960 7784263
Banyan Tree Maldives

Dr. Steve Newman
Former Marine Lab Manager at Banyan Tree
steve.newman@ncl.ac.uk

Robert James
Former Marine Lab Manager at Banyan Tree

APPENDIX H – Proponent Declaration and Commitment Letter

بسم الله الرحمن الرحيم

ދިވެހިރާއްޖެ ދެކުނުމެދުގެ ތަކުރުފާރު ކައުންސިލްގެ ރަސްމީ ލިޔުން

Secretariat of Maafaru Council, South Miladhunmadulu

11th July 2017

Mr. Ibrahim Naeem
Director General
Environmental Protection Agency
3rd Floor, Green Building
Ameenee Magu
Male' 20392
Maldives

Dear Mr. Naeem,

Sub: Commitment to undertake the mitigation and environmental monitoring proposed in the EIA for Seagrass Removal at Maafaru Island, Noonu Atoll.

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.

Sincerely,

Abdul Majid Ali
Maafaru Council President

APPENDIX I – Acknowledgement from Atoll Council

بسم الله الرحمن الرحيم

2353/2017

3/8/2017

04/08/2017

cde CONSULTING

www.cde.com.mv

ނަންބަރު: CDE-L/0817/267

ނ. އަތޮޅު ކައުންސިލްގެ ރައީސަށް،

ވެދުން ސަލާމަށްފަހު ދަންނަވަމެވެ.

ނ.މާފަރުގެ މޫދުވިނަ ނެގުމުގެ މަޝްރޫޢުގެ ސަބަބުން ތިމާވެއްޓަށް ކޮށްފާނެ އަސަރު ވަޒަންކުރުމުގެ ގޮތުން ތައްޔާރުކުރެވިފައިވާ އީ.އައި.އޭ ރިޕޯޓް، ލާމަރުކަޒީ ޤާނޫނުގެ 69 ވަނަ މާއްދާ ގައިވާ ގޮތުގެ މަތިން ތިޔަ ކައުންސިލާއެކު ހިއްސާ ކުރުމުގެ ގޮތުން މިސިޓާއެކު ފޮނުވީމެވެ. ވީމާ، މިސިޓުގެ ތިރީގައި އެވާ މި ރިޕޯޓް ކައުންސިލަށް ލިބުނުކަމުގެ ސްލިޕް ފުރިހަމަ ކޮށްދެއްވުމަށްފަހު ވީއެންމެ އަވަސް ފުރުޞަތެއްގައި މިސްލިޕް ފޮނުއްވާ ފަރާތަށް ނުވަތަ މިއޮފީހުގެ ފެކްސް ނަންބަރު 3315926 އަށް ފޮނުއްވައި ދެއްވުން އެދެމެވެ.

އިޙްތިރާމް ޤަބޫލުކުރައްވުން އެދެމެވެ.

02 އޮގަސްޓް 2017

ޚާދިމުކުމް

ސިމާދު ސައީދު

މެނޭޖިންގ ޑިރެކްޓަރ

ނ.އަތޮޅު ކައުންސިލް، ނ.މަނަދޫ

އީ.އައި.އޭ ރިޕޯޓް ލިބުނު ކަމުގެ ލިޔުން

ރިޕޯޓުގެ ނަން: ނ.މާފަރުގެ މޫދުވިނަ ނެގުމުގެ މަޝްރޫޢުގެ ސަބަބުން ތިމާވެއްޓަށް ކޮށްފާނެ އަސަރު ވަޒަންކުރުމުގެ ރިޕޯޓް

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މަޤާމު: އ. ރިސެޕްޝަން އޮފިސަރ

އިދާރާގެ ނަން: މިލަދުންމަޑުލު ދެކުނުބުރީ އަތޮޅު ކައުންސިލްގެ އިދާރާ

ބަލައިގަތް ތާރީޚް: 03 އޮގަސްޓް 2017 **ބަލައިގަތް ގަޑި:** 08:57

ސޮއި:

ތައްގަނޑު: