Environmental Management Plan for Mangrove and Turtle Rehabilitation at *Laamu Gaadhoo*

Project Proponent

Agro National Cooperation

Consultant

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EIA P01/2019

September 2021

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ACKNOWLEDGEMENT

Consultants would like to extend sincere gratitude to everyone who have contributed to this report. Thanks are due to those who contributed to the consultation meetings are highly appreciated. Special thanks to Ahmed Shan, for the surveys.

LIST OF ABBREVIATIONS AND UNITS

CBD	Convention on Biological Diversity
DS	Decision Statement
EPA	Environmental Protection Agency
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FENAKA	Fenaka Cooperation
GHG	Greenhouse gas
GPS	Global Positioning System
IWRMC	Island Waste Resource Management Center
ME	Ministry of Environment
MEE	Ministry of Environment and Energy
MECCT	Ministry of Environment, Climate Change and Technology
MEA	Maldives Energy Authority
MNDF	Maldives National Defense Force
MNPI	Ministry of National Planning and Infrastructure
MPHRE	Ministry of Planning, Human Resource and Environment
MLSA	Maldives Land and Survey Authority
MWSC	Maldives Water and Sewerage Company
ToR	Terms of Reference
URA	Utility Regulatory Authority
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
WIG	Waste incinerator guideline
WDC	Women Development Committee

EXECUTIVE SUMMARY

Introduction

The Purpose of the Environmental Management Plan (EMP) is to identify, assess social and environmental impacts caused during rehabilitation of Mangrove and Turtle Rehabilitation ecosystems at Gaadhoo, Laamu Atoll. This project is financed by the AgroNat. The EMP was prepared in accordance to the 2012 Environmental Impact Assessment (EIA) Regulations, in particular Schedule E3. AgroNat is identified as the project proponent. The EMP was prepared in accordance with the approved Terms of Reference (ToR) by the AgroNat.

Common Survey methods for undertaking EMP were used. In addition to the collection of primary data few secondary data are also used during the impact analysis of the proposed project. The main field data that was collected includes, stakeholder consultations and vegetation assessments.

Justification

AgroNat also aims to achieve economic targets relating to food security, import substitution, creation of jobs and improving the trade balance. To expand the agricultural farming, few islands including L. Gaadhoo was leased to AgroNat.

Project Description

The proposed project includes reforestation 30 m at the turtle beach and mangrove area. Furthermore, effective management of the two conservational area through establishment of code of conduct, engagement of local communities. Furthermore, ongoing cleanup activities within the buffer zones and monitoring the efforts.

Legislative and Regulatory requirements

As the proposed project is located within the Maldivian jurisdiction, the project shall abide to all national laws. The legal chapter undertake legal analysis with respective to the proposed project.

Bio-Physical and Social Environment

Gaadhoo is located on with longest reef flat and shares the reef flat with Fonadhoo-Gan Link located Laamu Atoll or Hahdhumathi Atholhu. The ground is generally flat. The island has a turtle nesting beach and marsh mangrove ecosystem which is listed as sensitive area by Environment Protection Agency (EPA). The island enjoys similar monsoonal climate as observed in the country. Laamu Gaadhoo is located in south zone of the country hence, the island is expected to have very low impact associated with surges, cyclonic impacts. However, the island is expected to high to medium impacts due to Tsunami, the island is subjected to lower degree of impacts and island is considered to be among least impact due to a possible earthquake.

Stakeholder Consultations

An integral part of this EMP has been consultation with all relevant parties including, relevant government authorities and community members. Involvement of stakeholders is crucial for the effective implementation of the proposed project. In this regard, in addition to AgroNat, EPA, Ministry of Environment, Climate Change and Technology (MoECCT), Ministry of Fisheries, Marine Resource and Agriculture (MoFMRA), Maldives Marine Research Institute (MMRI) and Olive Ridley Project (ORP) was consulted during the process. The major outcome from the stakeholders includes, that welcome the project which is aimed to address conservation management. All stakeholders further recommended maintenance of 30 m buffer within two sensitive areas.

Impact identification

Impacts during of the projects were assessed and identified. The positive and negative impacts can be direct, indirect, cumulative, reversible, and irreversible in nature. Furthermore, the impacts differ in terms of significance (low, moderate or high) and duration. The main methods used for impact identification is through expert or professional judgements and Leopold matrix. Major impacts identified during the construction phase are noise, increase of dust, GHG emission and most significantly accumulation of waste. Health and Safety impacts is also considered as higher impact to expose of high noise, polluted site. Agricultural Leachate flow would generate some level of impacts to the Mangrove, groundwater and soil.

The impacts predicted for the proposed project have limitations due to lack of long-term data.

Mitigation Measures

The EMP provides appropriate the mitigation measures for the identified major associated impacts are suggested. These include proper supervision by closed experts. Additionally, ensuring work is completed in the shortest possible time is also identified as one the preventive mitigation measures in reducing the impacts identified. During the afforestation, mitigation measures to decrease the accumulation of waste includes adhering to the guidelines published by the EPA. Furthermore, the impacts associated with the noise would be reduced working during day time in contrast to the night times and completion of works within shortest possible time. Furthermore, AgroNat shall abide to the proper management and servicing of the leachate mechanism installed at the island.

Environmental Monitoring Plan

Environment Monitoring Plan is proposed to determine changes to the environmental parameters due to the project. The monitoring is estimated to cost USD 1200 per annum.

EIA Consultants Recommendation

Although the project involves inevitable negative environmental impacts, the impacts due to the project is small in contrast to the environmental benefit associated with the proposed project. However, mitigation measures have been proposed to adequately minimize the significant impacts. Hence, the project is justifiable in light of the environmental and anticipated ecological benefits from the project which clearly outweigh the negative environmental impacts.

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ތައާރަފު

މިރިޕޯޓަކީ ހައްދުންމަތީ ގާދޫގައި، އެކުލެވިގެންވާ ވެލާއަރާ ގޮނޑުދޮށާއި އެތެރެކޮޅުގައި އުފެދިފައިވާ ކުޅި ލުނބޯކުރުމުގައި ތިމާވެއްޓަށް ކޮށްފާނެ އަސަރުތައް ދެނެގަނެ، މިކަމުގެ ސަބަބުން ތިމާވެއްޓަށް ކުރާނެ ނޭދެވޭ އަސަރުތައް ކުޑަކުރުމަށް ކުރެވޭނެ ކަންކަން ހުށަހަޅައި އެކުލަވާލެވޭ ރިޕޯޓެކެވެ. މިރިޕޯޓު އެކުލަވާލާފައިވަނީ، ދިވެހިރާއްޖޭގެ ތިމާވެށި ރައްކާތެރިކުރުމާއި ދެމެހެއްޓުމުގެ ޤާނޫނު (ޤާނޫނު ނަންބަރު4/93) ދަށުން އެކުލަވާލެވިފައިވާ ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ބަލާ ރިޕޯޓު ހުށަހަޅާ ގަވާއިދު 2012 ގައި ބަޔާންކޮށްފައިވާ ކަންކަމާއި، ވަކިން ހާސްކޮށް އީ.އައި.އޭ ޤަވާއިދުގެ ޖަދުވަލު 'ބ' ގައި ބަޔާންކުރެވިފައިވާ އެންވަޔަރަންމަންޓަލް މެނޭޖްމަންޓް ޕްލޭން އާއި އެމްބިއަންޓް މޮނިޓަރިންގ ޕްލޭން ހިމެނެއެވެ. މި މަޝްރޫއު އިދާރާކުރަނީ އެމްޑީސީ އެވެ. އެމްޑީސީ އަށް ދަނޑުވެރިކަމުގެ މަސައްކަތް ކުރުމަށް މިރަށް ހަވާލުކޮށްފައިވަނީ 25 އަހަރުގެ މުއްދަތަކަށެވެ.

އީ.އައި.އޭ ސާރވޭ ކުރެވިފައިވަނީ ދިވެހިރާއްޖޭގައި އެކަށައަޅާ ސާރވޭކުރުމަށް ބޭނުން ކުރާ އާލާތްތަކާއި ޖީޕީއެސް ބޭނުން ކޮށްގެންނެވެ. އެގްޒިސްޓިންގް މަޕިން ޓްރާންސެކްޓް ސަރަހައްދުގެ ދިރުންތަކުގެ ތަފްސީލް ނަގާފައެވެ. އަދި އެހެންމެ ޖީ.ޕީ.އެސް ގައި ބަޔާން ކުރެވުނު ފަދައިން ރަށުގެ ކައުންސިލާއި ބައި ބައްދަލުވުންތަކެއް ބޭއްވި މަޝްވަރާކޮށް ވާހަކަ ދައްކާ ކުރެވިފައިވެއެވެ.

މަޝްރޫއު ހިންގުމުގެ ސަބަބު ނުވަތަ ބޭނުން

އެކޯސިސްޓަމްގެ އަހަމިއްޔަތު ރާއްޖޭގެ ދަނޑުވެރިކަން އިތުރު ހަރުދަނާކޮށް ކުރިއަރާ ގެންދިއުމުގެ ގޮތުން ރާއްޖޭގައި ކާބޯތަކެތީގެ ޒަރޫރީ ހިއްސާއެއް މިރާއްޖޭގައި ވަޒީފާ ބޮޑުކުރުމަށެވެ. އެ އަމާޒު ހާސިލްކުރުމަށް ދަނޑުވެރިކަން ކުރިއަރުވާ ރާއްޖޭގެ ތެރޭ ސަރަހައްދުތަކުން ދަނޑުބިމަށް އެކަށީގެންވާ ބިން ހޮވާފައިވާ ރަށްތަކުގެ ތެރޭގައި ލ. ގާދޫ ވެސް ހިމެނެއެވެ.

މަޝްރޫއުގެ ތައާރަފު

މި މަޝްރޫއުގެ ދަށުން ވެލާ އަރާ ގޮނޑުދޮށާއި ކުޅީގެ 30 މީޓަރ ގެ ގުރިން ބަފަރއެއް ޤާއިމްކުރެވޭނެއެވެ. މި ދަނޑުބިމުގެ ބާރު ކުރުމަށް ބޭނުންކުރާނީ ރަށުގެ ބިމެވެ. އަދި އެހެންމެ މި ދާ ސަރަހައްދު ހިމާޔަތް ކުރުމުގައި މި އުސޫލު ވަޒަންކުރަން އާއި އެކަމަށް އަދާހަމަ ކުރެވޭނެއެވެ. އެއްގޮތަށް ހިމާޔަތް ކުރުމުގައި ސަރަހައްދު އަމާޒު ކުރެވޭނެ، ލާރި ކަމުގެ އެހީ ފަސް ބޭނުންވާނެއެވެ. މީގެ އިތުރުން މި ސަރަހައްދުގެ ސާފުކުރެވޭނެ ބިމުގެ ދޫކުރެވޭނެއެވެ.

މަޝްރޫއުގެ ތަރުތީބު

މި މަޝްރޫއު ކުރިއަށް ގެންދާނީ ދިވެހިރާއްޖޭގެ ހުރިހާ ޤާނޫނާއި ގަވާއިދަކާއި އެއްގޮތްވާ ގޮތަށެވެ. އެގޮތުގެ މަތިން ވަކިން ހާއްސަކޮށް ތިމާވެއްޓާބެހޭ ޤާނޫނާއި، ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ބަލާ ރިޕޯޓު ހުށަހަޅާ ގަވާއިދު 2012 އާއި އެއްގޮތަށެވެ.

ތަނ ބެހެއްޓުމަށް ހ ގަނޑުތަކުގެ ތެރެއިން ކަނޑުގެ ކަނޑާ ދުރަށް ދާ ގަނޑުތަކެއް ކަނޑައެޅުމަށް ދަތި ކަމަށް ވާ ކަމަށް ބަލައިގެންނެވެ. ތަނ ހ ގަނޑުގެ ދަށުގައި ހ.ފ.ކ. ގެ ތެރެއިން ކަނޑާ ދުރަށް ދާ ގަނޑުތަކެއް ކަނޑައެޅުމަށް ގާތް ކަމަށް ވާ ކަމަށް ބަލައިގެންނެވެ.

ފުލުން، ތާވީލާ ތަނ ތަކުގެ ކާނާ ދިނުމުގެ ކަންކަން

ހަމަ ތަނ ތަކުގައި ކާ ދެ ބަލި ދެ ބަލި ދެ ބަލި

ތިމާގެއިން ގެންދާނެ ކަންތައް ފަދަ ކަންތައްތަކުގެ ތެރެއިން ކޮންކަންތައް ކުރަންވާނެ ކަންތައްތަކެއް ކަމަށް ބަލައިގަންނަ ކަންތައްތަކުގެ ލިސްޓެއް ތައްޔާރުކުރަންވާނެ ކަމަށް ބަލައިގަންނަ ކަންތައްތަކުގެ ލިސްޓެއް ތަކެވެ. ލިޔެކިޔުން ދަށްކުރުމަށް ކަންތައްތަކުގެ ތެރެއިން ކޮންކަންތައް ކުރަންވާނެ ކަމަށް ބަލައިގަންނަ ކަންތައްތަކުގެ ލިސްޓެއް ތަކެވެ. ލިޔެކިޔުން ދަށްކުރުމަށް ކަންތައްތަކުގެ ތެރެއިން ކޮންކަންތައް ކުރަންވާނެ ކަމަށް ބަލައިގަންނަ ކަންތައްތަކުގެ ލިސްޓެއް ތަކެވެ. ލިޔެކިޔުން ދަށްކުރުމަށް ކަންތައްތަކުގެ ތެރެއިން ކޮންކަންތައް ކުރަންވާނެ ކަމަށް ބަލައިގަންނަ ކަންތައްތަކުގެ ލިސްޓެއް ތަކެވެ.

ކުރިއަށް ތަންފީޒުކުރަންޖެހޭ ތަދުވެގެންދާ ކަންތައްތަކުގެ ލިސްޓް

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I. INTRODUCTION

As per article 5 (a) of the Environmental Protection and Preservation Act of the Maldives (Law No. 4/93) and the Environmental Impact Assessment (EIA) Regulation 2012 of the Maldives, any development projects/activities that may have a significant impact on the environment are required to have an Environment Management Plan (EMP) submitted to the Environmental Protection Agency (EPA) prior to implementation. Therefore, this EMP Report aims to comply with legal requirements before implementation of the project discussed below.

A. Project Title

Environmental Management Plan for Mangrove and Turtle Rehabilitation at Gaadhoo, Laamu Atoll.

B. Project Proponent

The proponent of this project is the Agro National Corporation. The contact details of the Project Proponent are specified below.

Agro National Corporation Ltd,
H. Orchid Building, 8B
Ameeru Ahmed Magu
Male', 20095, Maldives
Email : info@ agronational.mv
Phone : +960 3030 400

C. Aims, objectives and purpose of the EMP

The Purpose of the EMP is to identify, assess social and environmental impacts caused during rehabilitation of Mangrove and Turtle Rehabilitation ecosystems at Gaadhoo, Laamu Atoll. Additionally, this EMP would recommend mitigation measures and appropriate management programme that is needed to avoid/reduce those socio-environmental impacts generated. In this regard, the EMP is structured as follows

- **Chapter 1: Introduction:** provides the aim, objectives, and scope of the EMP report.
- **Chapter 2: Project Description:** describes the components of the project.
- **Chapter 3: Existing Environment:** describes the present conditions of the biophysical and socioeconomic environment of the project impact boundary.
- **Chapter 4: Legislative and Regulations**: this chapter outlines the relevant national legislative requirements pertaining to the proposed project.
- **Chapter 5: Environmental Impacts:** describes an assessment of the potential environmental impacts associated with the proposed project.
- **Chapter 6 Mitigation Measures:** the measures would be implemented to reduce any potentially adverse environmental and social impacts are also identified.

- **Chapter 7: Environmental Monitoring and Management Plan:** outlines the environmental monitoring and management plan for construction and operation of the proposed project.
- **Chapter 8: Information Disclosure and Stakeholder consultation:** include main findings of stakeholder consultation including public consultation and information disclosure strategy.
- **Chapter 9: Conclusion:** provides summary of main findings of the EMP report and recommendations for the project implementation.
- **Accompanying Appendices:** The accompanying appendices will provide EPA letter for environmental screening, Schedule E3 of the EIA Regulations, EPA guidelines, project boundary, stakeholder meeting records, commitment letter by the AgroNat, evidence of sharing with the atoll council and CVs of the consultant.

D. Scope of EMP

The scope of this EMP is appended in Appendix A. The scope of the EMP was formulated based on the Schedule E3 of the 2012 EIA Regulations (see Appendix A).

E. Project Needs and Justification

Food security remains a significant challenge in the Maldives, due to over dependency of imported food into the country. Limited arable land across the archipelago has resulted in reduction of local produce. It is estimated that approximately 90% of the food that is consumed by the country is imported (Shabau 2009). In order to address the issue of food security in the country many initiatives were launched till date. However, a significant growth in the sector is not achieved mainly due to focus on small scale farming in the country.

In order to galvanize momentum in 2020, the Government of Maldives (GoM) established a State-Owned Enterprise (SOE) on agriculture. The aim of the Agro National Cooperation (AgroNat) is to was founded as a State-Owned Enterprise with the overall mandate to assist in developing the agricultural sector. AgroNat works toward enforcing objectives such as enabling an efficient supply-chain for agriculture, providing technical expertise and training to farmers, expanding the role of women in farming, and facilitating access to quality fertilizers across islands. AgroNat also aims to achieve economic targets relating to food security, import substitution, creation of jobs and improving the trade balance. To expand the agricultural farming, few islands including L. Gaadhoo was leased to AgroNat.

F. Methodology

This methodology used for this EMP is in consistent with the EIA Regulations 2012 and also in accordance to the scope. Furthermore, the methodology adopted in the EMP is consistent with best practices of EMP methodology that is widely undertaken in the Maldives and at international level. The adopted methods for undertaking this EMP are discussed below.

1. Generic Approach

The general approach for preparation of this EMP was divided into four strategic parts. They are; literature review/desktop study, filed assessments or survey, assessment of results/findings and compilation of the report.

2. Literature review

Reviewing existing literature on the same or similar topic allows comprehending and understanding dynamics on the issue. In this regard, this EMP being related to IWRMC relevant published research journal articles and government published and drafted reports were studied and reviewed. This has allowed to broader understanding of the situation thus leading to much greater focus while identifying the information and data needed for this EMP.

3. Secondary data

Even though the secondary data has its own limitations such as lack of accountability, use of such data is advisable when first hand data or the primary data is not available. This EMP has used secondary data, as long-term climate settings can be comprehended with the use of such data available at a request from Maldives Metrological Service (MMS). Historical and secondary data are used in most of the assessments, however complete reliance on them would have implications on the impact's analysis. Thus, care was taken while using the secondary data, furthermore as the data was primary sourced from Maldives government agency mandated to measure the physical parameters it is assumed that these data are accurate and dependable. The tidal data is secondarily sourced and predicted for the project location as long-term such data is not available. The nearest tide gauge is located at Kahdhoo Airport therefore, those data are used to estimate and understand the possible tidal pattern around the resort. Rainfall, temperature, wind and humidity are also secondary sourced due to non-availability of long-term data at the project location.

4. Method for biological environment

The biological environment comprises of flora and fauna on both terrestrial and marine.

Land biological environment

The survey followed simple geo-tagging of the possible significant vegetation type to be removed directly due to implementation of the project.

Mapping and location Identification

The proposed location along with the alternative locations for the proposed locations are mapped. Mapping was undertaken using standard DGPS and mapped ArcGIS.

II. PROJECT DESCRIPTION

A. Project Location

Gaadhoo is located on southeast side of Laamu Atoll. The island shares a reef system with Fonadhooo-Gan link. The island is geographically located, at approximately 04°44′10″N latitude and 73°29′55″E longitude (see Figure 1). The island has an approximate area of 71.1 Ha. The island has an approximate length of 1.9 km (N-S direction) and width (widest place) of 1.3 km (W-E direction). The nearest inhabited island (Fonadhoo) is located 5 km East of island. The island located approximately 258 km South of the capital Malé. The nearest domestic airport (Kahdhoo Airport) is located approximately 8 km East of the island. Additionally, nearest international airport (Velana International Airport) is located 258 km North of the island. The nearest tourist island (Six Sense Laamu) is located 5.2 km West of the island. Table 1 shows the features of the L Gaadhoo.

Figure 1 project Location

Table 1 Features of the project location

Island	L. Gaadhoo
Atoll	Laamu Atoll (Hadhunmathi Atholhu)
Latitude	04°44′10″N
Longitude	73°29′55″E
Length	~ 0.525 km
Width (at the widest)	~ 0.450 km
Island Area	~ 71.1 Ha
Distance to the Atoll Capital	~ 5 km N of Gaadhoo (Fonadhoo)
Distance to National Capital	~ 258 km N of Gaadho (Malé)
Distance to nearest Domestic Airport	~ 8 km E of Gaadhoo (Kahdhoo Airport)
Distance to nearest International Airport	~ 258 km N of Gaadhoo (Velana International Airport)

Distance to nearest resort island	~ 5 km W of Gaadhoo (Six Sense Laamu)

B. Land ownership and project duration

The island is leased to AgroNat for 25 years to undertake contract and commercial farming practices.

C. Mangrove Ecosystem

Mangrove ecosystem provides its ecosystem services to the local communities. Maldivian mangrove has several open and closed mangroves in the Maldives (Chaudary 2000). It is estimated that 12% of the Maldivian islands have mangrove or marsh land either closed or open in nature (Saleem 2003). Additionally, most of the mangroves are located in northern island in contrast to the southern parts of the Maldives. Mangrove ecosystem provides many ecological services such as acting as nursery grounds for juvenile fishes, natural drainage for the island, and protect against soil erosion.

Laamu atoll has 10 mangroves. These areas are identified as the Environmental Protection Agency (EPA) as environmentally sensitive zones and some of the areas are even protected. The Island of L. Gaadhoo has a closed wetland. The wetland is located north of the island (Figure 2). It is identified as one of the ecologically important because of the presence of true mangrove species.

Figure 2 Mangrove at L. Gaadhoo

D. Green Sea Turtle Beach

The southern beach of the island is widely known for Green Sea Turtle habitat (Figure 3). According to residents this island Green Sea Turtle is highly migratory species. The beach area has a berm of 2 – 4 m. The length of the turtle nesting beach is approximately 383 m. The main type of vegetation observed at the turtle nesting beach is Beach Plum (*Magoo*).

Figure 3 Green Sea Turtle nesting beach

E. Components of the Project

The main components of the proposed project area;

- Preparatory works
- Capacity Building and Community Engagement
- Reforestation at conservation buffer boundaries
- Project Management
- Monitoring Mechanism

1. Preparatory works

The preparatory works includes, preparation of the EMP, and also development of zonation mapping of the sensitive zones.

2. Capacity Building and Community Engagement

Conservation efforts require mobilisation of community and provision of sensitization programme. Throughout the implementation of this EMP, ongoing capacity building and community mobilisation will be taken place. Community will also include future contract and commercial farming community that would be based in the island for farming practices.

3. Reforestation at conservation buffer boundaries

Maintaining conservation areas with its buffer is critical to ensure ecosystem are less harmed due to the farming impacts. In that regard, reforestation will take place at the buffer boundaries. Most of the reforestation would take place around 30 m from the turtle beach and 30 m around the mangrove area. Through this project coconut palm is intended to be used.

4. Project Management

The entire project from planning, design and construction works is managed by AgroNat. An office setup will be located on the site including erection of appropriate project information boards and installation of night vision camera at the turtle beach. A monitoring mechanism proposed in this EMP will be used by AgroNat to monitor both ecosystems.

F. Health and safety measures

Basic first aid facilities and safety gears shall be made readily available by the contractor during the construction phase of the project. In case of an emergency, the workers shall be taken to the health centers Fonadhoo and if the need be, taken to Gan Regional Hospital or Malé. Other specific safety measures during construction phases are detailed in the respective components under the project description.

During the operational phase basic first aid facilities and safety gears shall be made readily available to the working staff at the powerhouses. Occupation health and safety guideline shall be strictly followed by all personnel. In case of an emergency, the workers shall be taken to the health centers at Fonadhoo and if the need be, taken to Gan Regional Hospital taken to Malé.

G. Project boundary and surroundings

In general, the whole island comes under the boundary of study area. Figure 4, show a reduced version of the project impact boundary.

Figure 4 Project impact boundary

H. Project inputs and outputs

The materials required for construction, which is not available locally, shall be imported and shipped from Malé to the site. The equipment required for the project are an excavator and general construction tools (see Table 2 and Table 3).

Table 2. Major minimum inputs required for the proposed project.

Input resource(s)	Source/ type	Estimated Amount	Source of resource
CONSTRUCTION PHASE			
Manpower	Local	40	AgroNat will hire consultants or inhouse staff for implementation of EMP
Machinery and equipment	Small Excavator	2	AgroNat will hire
	Truck	1	
	Constructional equipment's	As required	
Water	Groundwater for nonportable purpose	150 l/day/person	From the island
	Bottle Water	Adequate number	Local purchase or import
	Green Shredder	1	

Table 3. Project outputs anticipated to be generated from the proposed project

Project outputs	Method of generation/Qty	Method of control
CONSTRUCTION PHASE		
Reforested Buffer zones	Constructed by AgroNat	Based on specification set in this EMP
Monitoring Reports	Prepared by consultants	

III. LEGISLATIVE AND REGULATORY REQUIREMENTS

This chapter presents a brief summary of laws, regulations, guidelines, and international conventions that are applicable to the proposed project and measures that will be taken to ensure that the project conforms to these requirements. The chapter will be broadly divided into seven sections; national laws, regulation, guidelines, environmental permits, national guiding policies and, international conventions.

A. Maldives Constitution

It is important to note that the Article 22 of the Constitution of Maldives provides guidance on the protection of the environment and sustainable development. According to this Article no development project will go ahead if its impacts are detrimental to the environment.

B. National Environmental Legislations

1. Environment Protection and Preservation Act 1993

Environment protection and Preservation Act (EPPA 4/93) came into effect in 1993, is the umbrella law, which provides the key environmental guidance on the protection and management of environment in the Maldives. The following articles of the law are relevant to the proposed project and all activities of this project will be carried in accordance with the guidelines provided in the law.

Article 4

Under the Article 4, the Ministry of Environment is responsible for identifying protected areas and natural reserves and formulating necessary rules and regulations for their protection and preservation. All the necessary steps will be taken to ensure the proposed project would cause no significant negative impact on protected areas.

Article 5 (a)

Under the Article 5 (a), an EIA is mandatory requirement before implementing any development project that may have a potential impact on the environment. This EIA report has been prepared and submitted to the EPA in compliance to this article.

Article 6

Under the Article 6, Ministry of Environment has the authority to terminate any project that has any undesirable impacts on the environment. In this report, all the significant negative impacts of the proposed project are identified, and all the necessary mitigation measures will be taken to reduce all negative impact from the proposed project.

Article 7

Under the Article 7(a), disposal of any type of waste, oil, poisonous gases or any substances that may have harmful effect on the environment is prohibited. And in case where disposal of such waste becomes absolutely necessary, they should be disposed only within the areas designated for that purpose and necessary steps should be taken to avoid any harm to the health of the population. A waste management plan is included in the report describing how the waste produced in the proposed project will be disposed of.

Article 8

Under the Article 8, disposal of any hazardous or toxic or nuclear wastes that is harmful to human health and environment is prohibited. Any such waste produced from the proposed project will be managed carefully and disposed of according the standards set by the regulations.

Article 9

Under the Article 9, the penalty for breaking the law and damaging the environment are specified. The project proponent is aware of this provision and all the activities of the proposed project will carried out in accordance with the guidelines set by the government agencies.

2. First Amendment to EPPA 4/93

The first amendment to the EPPA 4/93 was gazetted on 24 April 2014. The amendment empowers the Ministry designated for environmental protection and preservation to lead and formulate all environmental preservation and conservation related regulations, guidelines, policies, strategies in coordination with other stakeholders. This amendment replaces Paragraph 3 of EPPA 4/93.

Furthermore, the amends 'Ministry of Planning and Environment" mentioned throughout the EPPA 4/93 as 'Ministry". 'Ministry' in this context is defined as the Ministry mandated to carryout environmental affairs.

Applicability to the Proposed Project

The project is expected to generate waste and other environmental impacts, hence adhering to the EPPA is mandatory to ensure addressing environmental impacts caused.

3. Employment Act 2008

The Employment Act of the Maldives was ratified in 2008, with the overall aim to determine the fundamental principles relating to the employment in the country. Through this act two central institution is formed. They are Labour Relations Authority and Employment Tribunal. According to this Act Employment Agreement is legal requirement for any work undertaken unless otherwise indicated in the Act.

Applicability to the proposed project

The project involves employment of staff during the construction and operation phase. Hence, the responsibilities and rights of all parties (both the employee and the employer) has to be protected as per the provision under this legislation.

4. Immigration Act 2007

Guidelines on the entry, departure and deportation of foreign workers and nationals in Maldives are stated in Maldives Immigration Act (1/2007). The Act provides for work visa and work permit of foreign nationals who visit Maldives for the purpose of working.

If the contractor employs number of foreign nationals in the project manpower, all foreign workers must hold relevant work visa and all necessary documents.

Applicability to the proposed project

The project may involve employment of foreign staff during the construction and operation phase. Hence, foreign visa needs to be sorted in accordance to this act.

5. Law on general public services 1996

Under this law, the general public services are electricity, telephone, water and sewerage services. Relevant articles under this law pertaining to the proposed project are: -

- Article 3 states that any party can provide general public services only after getting registered in the competent authority and according to its regulations;
- Article 4 states that any public service must be provided after a contract agreement has been made between the service provider and the customer. The agreement must be made according to the regulations put forward by the competent authority;
- Article 5 states that a transfer of service between customers must be made only after a contract has been made between the customers according to the service providers regulations. If the customer fails to comply with the agreement, the service provider can discontinue service only after approval from competent authority;
- Article 7 states that the service provider can permanently discontinue its services according to regulation mentioned in article 3 of this law. However temporary discontinuation can be made after giving prior notification to the customers and according to the agreement made between the service provider and the customer;
- Article 8 states that the tariffs for the services must be approved from the competent authority prior to implementation. Further, any amendments to tariff structure also must be approved from the competent authority before implementation; and
- Article 9 states that any damage made to service provider's facilities by anyone, he can be charged with 10 prison penalty or banishment. Further, any action against this law (excluding what is mentioned in article 9 (a) of this law) can be charged between MVR 100 to MVR 5000 by the competent authority.

Applicability to the proposed project

The utility service provider shall provide its services upon registration at those authorities. Since water and electricity requirement is essential in operating the project. The center shall adhere to the conditions set by authorities as mentioned in this act.

C. Relevant Regulations

1. Environmental Impact Assessment 2012

The Environmental Impact Assessment Regulation 2007, which came to effect in 2007, has been revised and published as Regulation on the Preparation of Environmental Impact Assessment Report 2012 in 8th may 2012 (2012/R-27). Regulation is formulated under the Environment Protection and Preservation Act 9 (EPPA 4/93). The purpose of this regulation as stated in regulation is to provide a step-by-step guidance for proponents, consultants, government agencies and general public on how to obtain approval for a development proposal.

Schedule D of the Regulation on the Preparation of Environmental Impact Assessment Report 2012 has stated a list of development proposals requiring an Environmental Impact Assessment study, which includes water projects. Hence, this EIA report is subjected to the Regulation on the Preparation of Environmental Impact Assessment Report 2012 and follows the guidelines and procedures provided in the regulation. Since 2013 till date 5 Amendments were made to the 2012 EIA regulation. Table 4 summarizes the major amendments to the EIA Regulations.

Table 4 Amendments made to the 2012 EIA Regulations 2012

Regulation number	Date of Amendment	Amended Articles	Remarks
2013/R-18	09/April/2013	Article 13 and 20	Procedural amendments
2015/R-174	30/08/2015	Article 4, 7, 8, 9, 10, 11, 13, 14, 17, 18, and 20	Shift of Tourism related mandates to Ministry of Tourism Procedural amendments
2016/R-66	11/08/2016	Article 5, 6, 10, 11, 13, 14, 15, 16, 17, 18, 19 and 20	EPA tasked with all EIA regulation works Procedural amendments including EIA Consultant categories, qualifications.
2017/R-7	19/01/2017	Schedule U	Projects that are exempted from conduct of an EIA.

Applicability to the proposed project

The project is expected to generate environmental impacts; hence this EMP is prepared.

2. Waste Management Regulations 2013

Waste Management Regulation (2013/R-58) is formulated under the Environment Protection and Preservation Act (Law number 4/93) and was published in 2013. The key purposes of this regulation as stated in the regulation are to;

- Minimize the direct and indirect negative impact caused to human health and environment due to waste.

- Compile the national standards to be maintained in relation to waste management in the Maldives.
- Establishing and environmentally friendly, safe and sustainable waste management system through an integrated waste management structure.
- Implementing polluters pay principle, and
- Introducing extended producer responsibility.
- This regulation provides the standards for the following waste management activities;
- Waste collection.
- Land and sea transport of waste.
- Waste treatment.
- Waste storage.
- Management of waste disposal centers.
- Landfilling.
- Hazardous waste management.

Waste generated in the islands of Maldives should be disposed only in areas that are designated and authorized for the purpose by the implementing agency. And dumping of any waste on the following areas under any circumstance is prohibited by the regulation.

- Protected areas declared under Environment Protection and Preservation Act (Law number 4/93)
- Mangroves/ Wetlands and marshes.
- Lagoon area of islands
- Reefs.
- Lagoons.
- Sandbanks.
- Beaches of islands.
- Vegetation line of islands.
- Parks
- Roads.

Dumping of waste or littering to places other than areas authorized by the implementing agency is considered as an offence under the regulation. List of waste management activities that requires permission from the implementing agency and the procedure for obtaining the permission are specified under the Article 16 of the regulation. Penalties for breaching the guidelines specified in the regulation are stated under the Article 34 of the regulation.

This report has a comprehensive waste management plan describing the management of waste generated by the proposed project. All the waste will be handled and managed according to the guidelines prescribed in the Waste Management Regulation.

Applicability to the proposed project

The project is expected to generate waste, therefore safe disposal of water accumulated during construction and operation at the facilities need to be comply with this regulation. This report

has a comprehensive waste management plan describing the management of waste generated by the proposed project. All the waste will be handled and managed according to the guidelines prescribed in the Waste Management Regulation.

3. Regulation on Mining and Utilization of coral, sand and coral aggregate

The main purpose of this regulation is to control, monitor the mining of sand and coral, while encouraging the practice of sustainable mining of sand and coral.

According to this regulation, sand and coral mining from any place within the territory of Maldives should be carried out after obtaining written permission from designated authority. This regulation covers sand and coral mining from uninhabited islands that have been leased; sand mining from other uninhabited islands; and coral aggregate mining from uninhabited islands that have been leased. Coral mining from house reef and atoll rim has been banned since 26 September 1910 through a directive from President's office. Penalties for breaching of the regulation are specified under the Article 10 of this regulation. Coral and coral aggregate would not be mined and used in any activities of the proposed project.

Applicability to the proposed project

The project involve construction which would involve sand and mortar. Hence, careful consideration needs to be done to avoid illegal sand mining.

4. Regulation for the Chopping, Uprooting, Removing and Transfer between islands, of Palms and Trees

This regulation is formulated under the Environment Protection and Preservation Act (Law number 4/93). This regulation provides the guidelines for chopping, uprooting, removing and transfer between islands of palms and trees. The main objective of regulation is to minimize the negative impacts from the chopping, uprooting, removing of palms and trees on the natural environment of the islands by setting out the proper guidelines and discouraging the action. According to the regulation, Palms and trees should be chopped or removed or uprooted out of mere necessity and for every palm or tree chopped or removed or taken out of the island, two palms for each palm removed and two trees for each tree removed should be planted on that island.

According to the Article 3 of the regulation, it is prohibited to remove:

- All forms of palms and trees within 15 meters inward to an island, from the outermost trees closest to the beach
- All forms of palms and trees within 15 meters outward of ponds and wetlands
- All forms of palms and trees on an area declared by the government as a protected area and all forms of palms and trees protected by the government for the purpose of preservation of biodiversity.

According to the Article 5 of the regulation, an EIA report should be submitted before chopping, uprooting or removing palms and trees from a large area of land, for the purpose of transferring to another island; for agricultural purposes; for building of social centers; or clearing the vegetation for any other purposes.

Removal of any palms or trees for purpose of the proposed project will be carried out in accordance with the guidelines provided in this regulation.

Applicability to the proposed project

Even though the project does not involve removal of plants at the project location, this regulation needs to needs to be considered.

5. Regulation for the determination of penalties and obtaining compensation for damages caused to the environment 2011

This regulation (2011/R-9) is formulate under the Environment Protection and Preservation Act of the Maldives (Law number: 4/93) and came to effect in 2011. The objective of the regulation as stated in the regulation is to stop violations of Act 4/93; to prevent the repetition of such violations; to penalize and obtain damages caused to the environment.

According to the Article 7 of the regulation, if an incident occurs while conducting a project or other work, that is likely or estimated to cause damage to the environment, proponent or in charge of the project should report to the implementing agency and should take immediate action to stop the damage or cause of the damage.

Under the Article 14 of the regulation, any party, from whom the implementing agency requires information relating to an investigation or for other purposes of this regulation, should provide such information.

The schedules of the regulation describe the factors to consider when determining the fine to be charged on a party causing damage to the environment and formulas to measure the magnitude of the damages caused to the environment.

Applicability to the proposed project

The project is expected to cause environmental impacts such as waste, management of sanitation facilities. Even though mitigation measures are proposed in this EMP, environmental damage may occur due to accidents. This project will be subjected to liabilities if ineffective implementation of mitigation measures leads to detrimental effect on the environment.

6. Regulations on the Migratory Birds 2014

The aim of this regulations to ensure protection and conservation of Migratory birds in the Maldives. According to this regulation all the birds expect Dhivehi Kambili, Huvadhoo Raanbodhi, Dhivehi Raanbondhi, Medu Raajethera Raanbondhi Dhivehi koveli and Kaalhu are

considered as Migratory birds under this regulation. Under this regulation a party will be penalized between 501 – 50,000 MVR if breached any terms of the regulations.

7. Healthy and Safety Regulation in Constructional Projects 2019

The aim of this regulation is to enforce adequate health and safety environment during constructional activities in the Maldives. This regulation also mentions penalties associated with violation of any articles of it. As part of this regulation the contractor shall prepare a handbook on health and safety of the project and ensure the workers or labours informed about the handbook.

Applicability to the proposed project

Since the project involves constructions, the constructional environment should maintain the requirements of health and safety measures at the site as mentioned in this regulation.

8. Regulations on Construction Contractors

Under the regulation all contractors working in the construction industry are to be registered. The regulation includes the requirements of contractor's registration, grading, implications on participating in international tenders, insurance, project licenses, Joint venture registrations, responsibilities of the registered contractors and applicable fine for breaching the regulation.

Applicability to the proposed project

Since the project involves construction contractors, hence all the contractual works should be guided by the regulations.

D. Relevant Guidelines

1. Maldives Building Code

Maldives Building Code Handbook was published in 2008. The purpose of the document is to set performance standards for buildings to ensure that:

- People who use buildings can do so safely and without endangering their health
- Buildings have attribute appropriately to the health, physical independence, and wellbeing of the people who use them
- People who use buildings can safely evacuate from the building as and when necessary, and
- Buildings are designed, constructed, to enable it to be used in ways that promote sustainable development.

This code consists of two general clauses outlining classified building uses and interpretations and 35 technical clauses which cover aspects such as structural stability and durability, fire safety, access, moisture control, safety of users, services and facilities and energy efficiency.

E. Environmental Permits

1. Decision Statement

Under the Regulation on the Preparation of EIA Report 2012, the proponent should apply to EPA for an Environmental Decision Statement prior to undertaking a Development Proposal in the manner listed in the Article 8 of the regulation. The application procedure and the issuance of the Environmental decision statement are described in the Regulation on the Preparation of EIA Report 2012. This EMP report is prepared to obtain the Environmental Decision Statement for the proposed project.

F. Relevant Guiding Policies and Documents

1. Strategic Action Plan 2019 - 2023

The Strategic Action Plan (SAP) of the Government of Maldives is a central policy framework and planning document that guides the overall development direction of the Maldives for the next five years. The SAP consolidates the current Government's manifesto pledges with existing sectoral priorities. The SAP serves as the main implementation and monitoring tool to track the progress of the delivery of the Government's policies and development priorities. The SAP is formally rolled out into the line ministries' day to day operations from 1 October 2019. The SAP consists of 5 Sectors and 33 subsectors. The project specifically falls under 4th Sector "*Jazeera Dhiriulhun*", subsector 4.5 waste as a resource.

2. National Solid Waste Management Policy

A national policy for the proper management of waste in the Maldives was formulated and published in 2008. This policy guideline applies to all people and to all community, government agencies, industrial and commercial activities undertaking in the Maldives.

National Solid Waste Management Policy consists of the following 11 policies:

- Establish a governance structure for solid waste management which will distribute clearly delineated roles and responsibilities for solid waste management at island, regional and national levels will be established
- All waste producers have a duty to manage the wastes they generate
- Wastes will be managed and disposed as close as possible to the place of their generation
- The waste management system will accommodate the specific requirements of special wastes
- Waste management planning will be based on verifiable facts and known effective strategies
- The waste management system will be financially viable
- Consolidated legislation will be introduced to support the implementation of the policy

- Private sector participation (PSP) will be facilitated where it is financially viable for both the government and the private sector
- Financial incentives and disincentives will be pursued to support good waste management practices
- Goods that are harmful to the environment or cause public nuisances and unacceptable waste activities will be discouraged
- The community participation in and awareness about good waste management practices will be maximized

G. Relevant International Conventions, Treaties and Protocols

1. United Nations Convention on Biological Diversity

The main objectives of the Convention on Biological Diversity (CBD) are; conservation of biological diversity, sustainable use of the components of biological diversity and fair and equitable sharing of the benefits arising out of the utilizing of genetic resources. Maldives is a member of the convention since it entered into force on 29 December 1993. All the necessary guidelines will be followed and proper steps will be taken to ensure the project activities poses minimum negative impacts on the biodiversity.

2. United Nations Framework Convention on Climate Change

The main objective of this convention is to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system. Convention entered into force in 1994. This convention was complemented by the Kyoto Protocol, a legally binding treaty under which member countries have committed to reduce their emissions by an average of 5 percent by 2010 against 1990 levels. UNFCCC encourages all its member countries to act to prevent and limit further climate change by developing, gathering and sharing information on greenhouse gas emissions, national polices and best practices and to protect and adapt to the impacts of climate change by launching national strategies.

The Paris Agreement is also an agreement within the framework of the UNFCCC dealing with GHG emission mitigation, adaptation and finance proposed to start in the year 2020. Upon opening for signatories on 22 April 2016, 180 UNFCCC members have signed the treaty (including Maldives), however, only 22 of which ratified it so far which is not enough for the treaty to enter into force yet. The aim of the convention as described in Article 2 of the treaty is "enhancing the implementation" of the UNFCCC through: -

i. Holding the increase in global average temperature to well below 2° C above pre-industrial level and to pursue efforts to limit the temperature increase to 1.5° C above pre-industrial levels, recognising that this would significantly reduce the risk and impacts of climate change;

ii. Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and lower GHG emissions development in a manner that does not threaten food production; and
iii. Making finance flows consistent with a pathway towards low GHG emissions and climate resilient development.

3. Sustainable Developed Goals

In 2015 the world leaders agreed towards a new international development agenda known as 2030 Agenda for Sustainable Development: Sustainable Development Goals (SDGs). This new international agenda is a successor of the Millennium Development Goals which was agreed in year 2000. The SDGs comprises of 17 goals. Goal 6 of this Agenda focus on water and sanitation. The main objective of this goal is to ensure availability of sustainable water and sanitation to all. This goal has 7 targets which has elements related to the provision on IWRM as proposed under the project.

IV. BIO-PHYSICAL AND SOCIO-ECONOMIC BASELINE

A. The Maldivian setting

Maldives is located geographically 7°6'35"N to 0°42'24"S in Indian Ocean. (Kench, 2011). Maldives is one of the six atoll island nations around the globe and has the largest atoll globally (Kench, 2011). The Maldivian archipelago comprises of 22 atolls with 1,190 islands and is 1,000 km long and 200 km wide (MEE, 2016). The average size of Maldives atolls is 1.4 to 2,800 sq. km and atoll basin has a depth of 30-80 m (MEE, 2011). Additionally, average size of Maldives islands are 0.5 to 2 sq. km (MHAHE, 2001). The islands are low-lying islands, 80% are <1 m above mean sea level (MEEW, 2007) , with an area of 300 sq. km (MEEW, 2006).

B. Environmentally sensitive areas

The island has a mangrove ecosystem and beach, which is considered as environmentally senstive area. Figure 5 below shows the environmentally sensitive areas within 15 km radius of the project location.

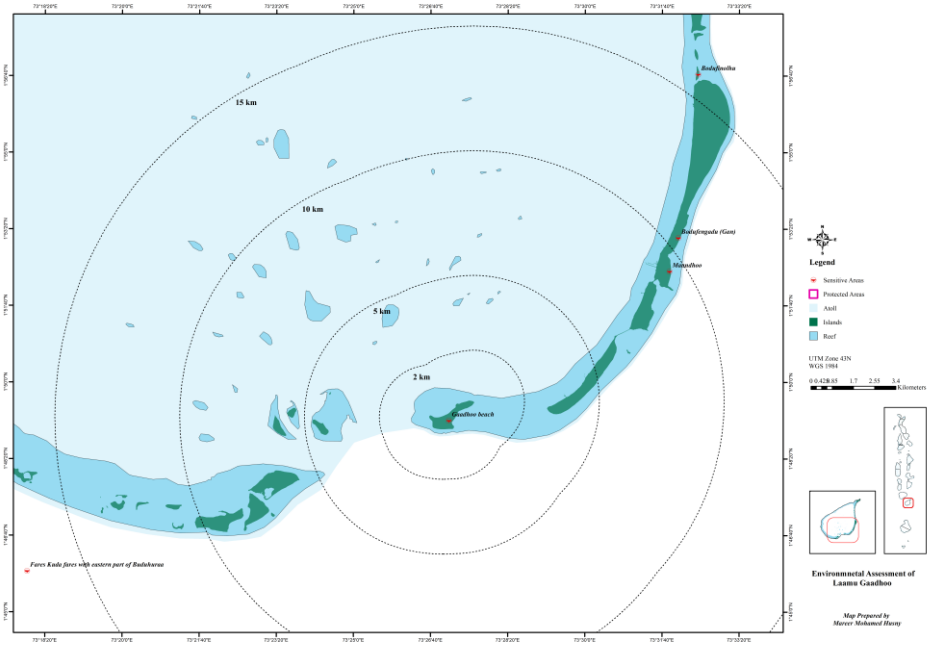

Figure 5: Environmentally sensitive sites around a 15 Km radius of L. Gaadhoo

C. Physical Environment

For this purpose of this EMP, the physical environment will include climatology, oceanography and wave dynamics, natural hazards and vulnerability, hydrogeology and geomorphological environment.

D. Climatology

Maldives island chain is situated at the equator; thus, the islands enjoy a tropical climate. Table 5 shows summary of the key meteorological climate observed in the Maldives.

Table 5 Summary of the key metrological observation in the Maldives

Climate Parameter	Data/Information	Source
Air Temperature	29^0C	(MEE 2016) (Edwards et al. 2001)
Sea Surface Temperature	28 – 29 ^{0}C	
Humidity	73 – 85%	
Rainfall	1,948 mm annually	
Wind	7 -12 knots	
Waves	2 – 3 meters wave height with period of 18 – 20 seconds	
Tides	0.3 m – 1.0 m	

Five regional locations collect meteorological data. The data collection is undertaken by the Maldives Metrological Service (MMS). Kahdhoo being at the nearest long-term climate data collection region to that of project location, the primary climate data for Kahdhoo is used during the climate analysis in this EIA. Based on the general observation, the Maldivian climate experiences monsoonal reversals.

1. Maldivian Monsoons

The Maldives being located at the Indian sub-continental terrain is subjected to monsoonal weather patterns. The Maldivian islands are subjected to reversal monsoonal patterns, indicating presence of two very distinct seasons. The Northeast (NE) Monsoon dry period or locally known as *Iruvai* occurs during December to February, on the other hand Southwest (SW) monsoon (*Hulhangu*) occurs during May to September. These two monsoon patterns occur a result of climatic influence, such as change in waves, wind direction. Table 6, below shows the salient features of the seasons observed in the Maldives.

Table 6 Summary of the salient features of Monsoonal climate observed in the Maldives

Season	Months	Characteristics
NE Monsoon	December –February	Primary wind direction is from NW towards NE Higher winds blow from Western sides Sky is clearer with low cloudiness Sea is much calmer Low rainfall, thus its dry period
Transitional Period – Hulhangu Halha	March – April	Wind flowing direction changes from NW Wind blows from all directions Dominating western side winds Occasional rain and sea roughness Changes to cloud cover
SW Monsoon		Primary wind direction is SW Higher winds blow from Western sides

		Increase cloudiness Rough sea conditions High rainfall, thus its wetter period
Transitional Period – Iruvai Halha	May - September	Wind flowing direction changes from SW and blows from all directions Dominating western side winds Occasional rain and sea roughness Changes to cloud cover

2. Temperature

Maldives experiences topical climate, in this sense Maldives observes temperature of 28^{0}C to 30 ^{0}C. The annual temperature from 1992 – 2019 curve shows, there the temperature remains approximately 29.5 ^{0}C. Monthly temperature shows an asymmetric curve, where temperature rises to a peak in April (see Figure 6) Historical data shows that April is regarded as the hottest month of the year, with an average temperature of 30.4 ^{0}C. It is also noted that most of the cooler temperature is observed during the month of December (28.8 ^{0}C).

Projected model indicates there is an increasing trend on overall temperature across the country. The projections also indicate that the overall temperature is on an increasing trend. The temperature is projected to rise with warmer days (29.05°C–30.15°C) in the 2030s and 2040s, particularly in northern Maldives where the average annual temperature will range from 29.60°C to 30.15°C under the RCP 4.5 Scenario (see Figure 7). Under the RCP 8.5 scenario also the similar trend is project as of RCP 4.5 with much higher temperatures in north ranging from 29.05°C– 29.60°C in the 2020s and 2030s to 29.60°C–30.15°C in the 2040 (see Figure 8).

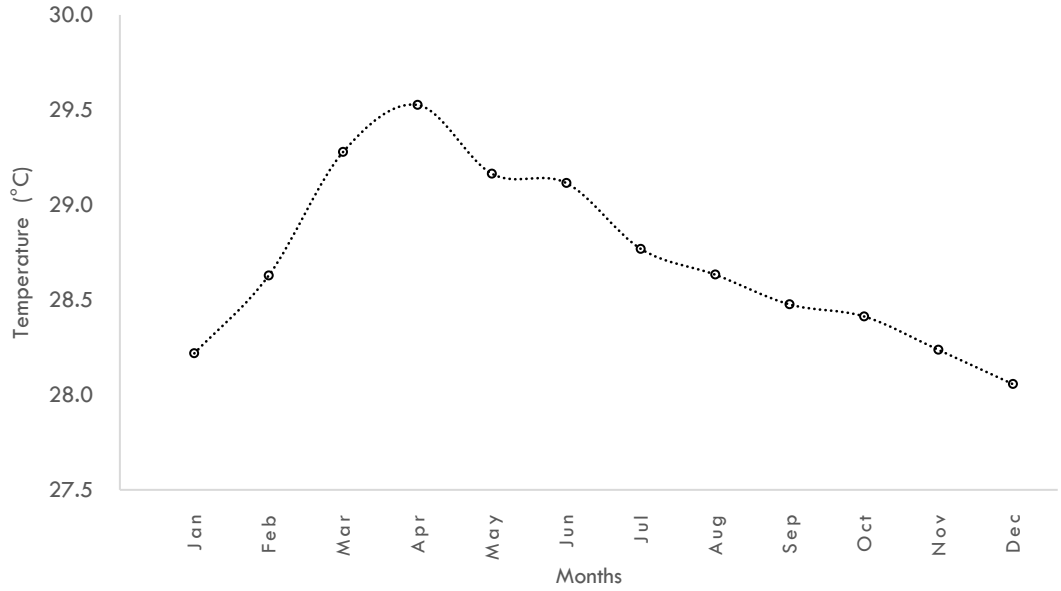

Figure 6 Monthly Temperature Distribution in Kahdhoo (Source: Data from MMS).

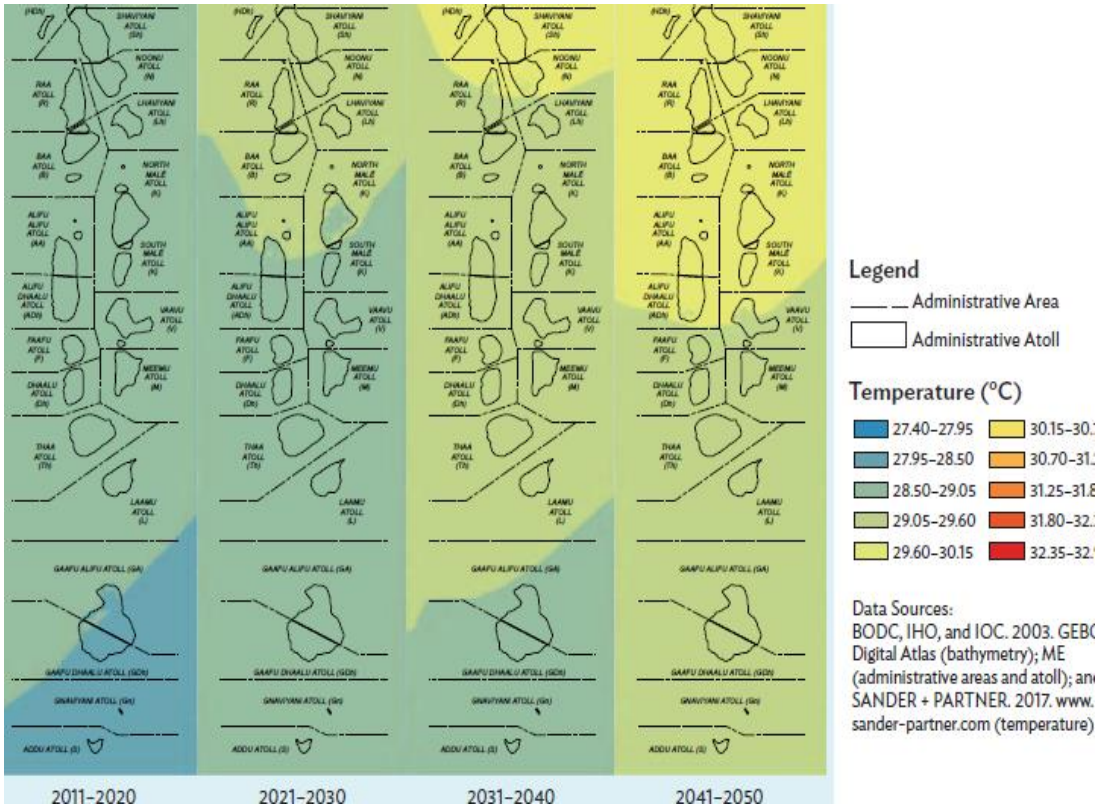

Figure 7 Average annual temperature projections from 2011 – 2050, under moderate emissions (ADB 2020).

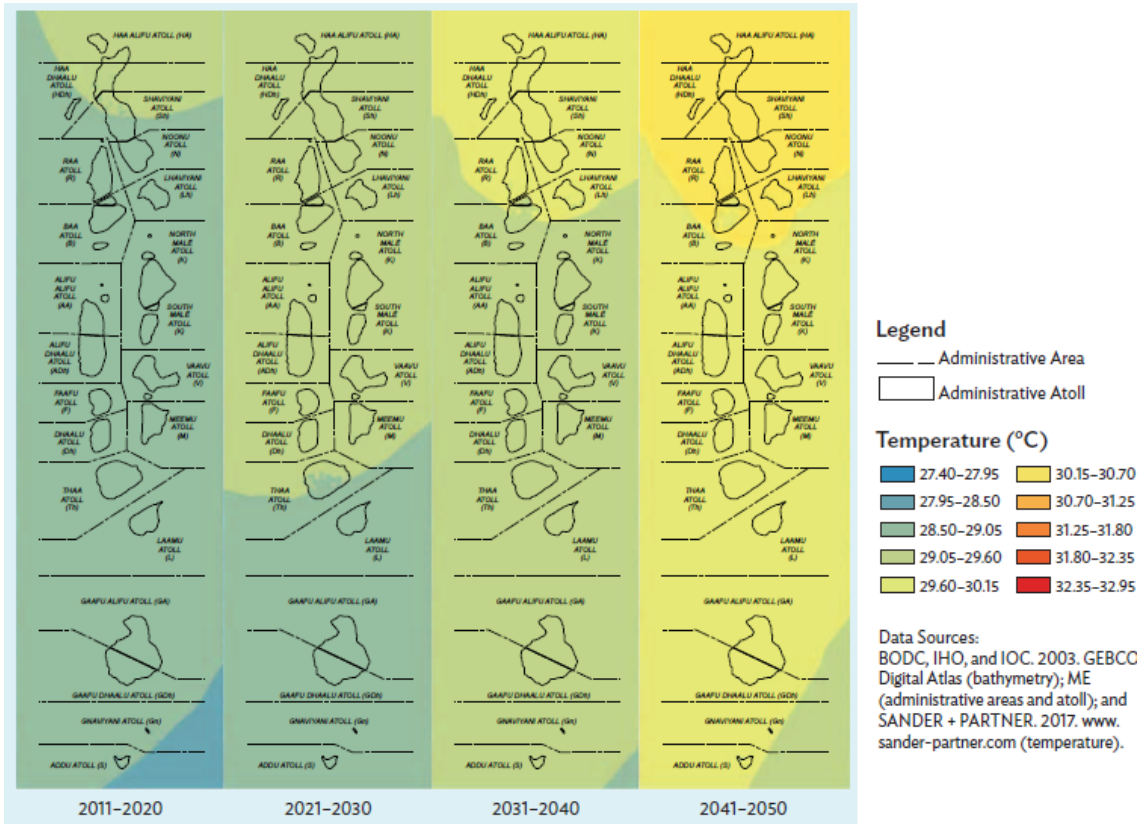

Figure 8 Average annual temperature projections from 2011 – 2050, under higher emission (ADB 2020).

3. Rainfall

Rain is common in the Maldives climate. Majority of the months in a year is dominated by SW monsoon, thus making rainfall a frequent event. The Maldives experiences an average rainfall of 2,124 mm. The Northern islands in the Maldives receive low rainfall when compared to the southern islands. As the project is located in the central to southern region, the location will receive an average amount of rain annually.

The average monthly rainfall in Kahdhoo is 188.9 mm, with the highest rainfall in May (7,841.9 mm) over the 27 years. The lowest rainfall observed is observed for the month on February with a rainfall amount of 2,308 mm (see Figure 9). Comparative analysis of total yearly rainfall from 1992 – 2019 shows that 2011 there was a significant less rainfall of 1,560 mm of rain, when compared to the highest which was observed in the year 2006 (3,126.9 mm) (see Figure 10). Thus, in general it can be concluded that average rainfall on the islands or entire chain of islands is showing a decreasing trend.

According to 2020 Asian Development Bank, assessments that have undertaken climate modeling in in line with IPCC pathways indicate a decreasing rainfall over the time. Given the Gaadhoo is located at the central part of the Maldives, in accordance with moderate greenhouse gas scenario it is expected a reduction of rainfall rate by 1.3 – 4 mm/day (See Figure 11). A similar trend is also observed with further reduction of rainfall rate is expected to occur under high emission scenario (see Figure 12).

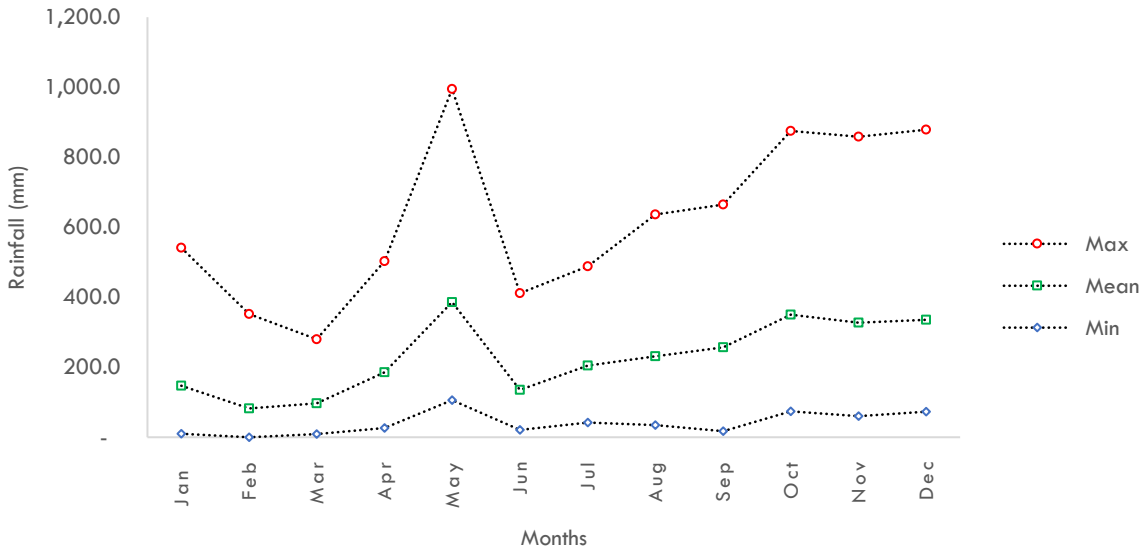

Figure 9 Monthly Rainfall Distribution in Kahdhoo (Source: Data from MMS).

Figure 10 Annual Rainfall Distribution in Kahdhoo (Source: Data from MMS).

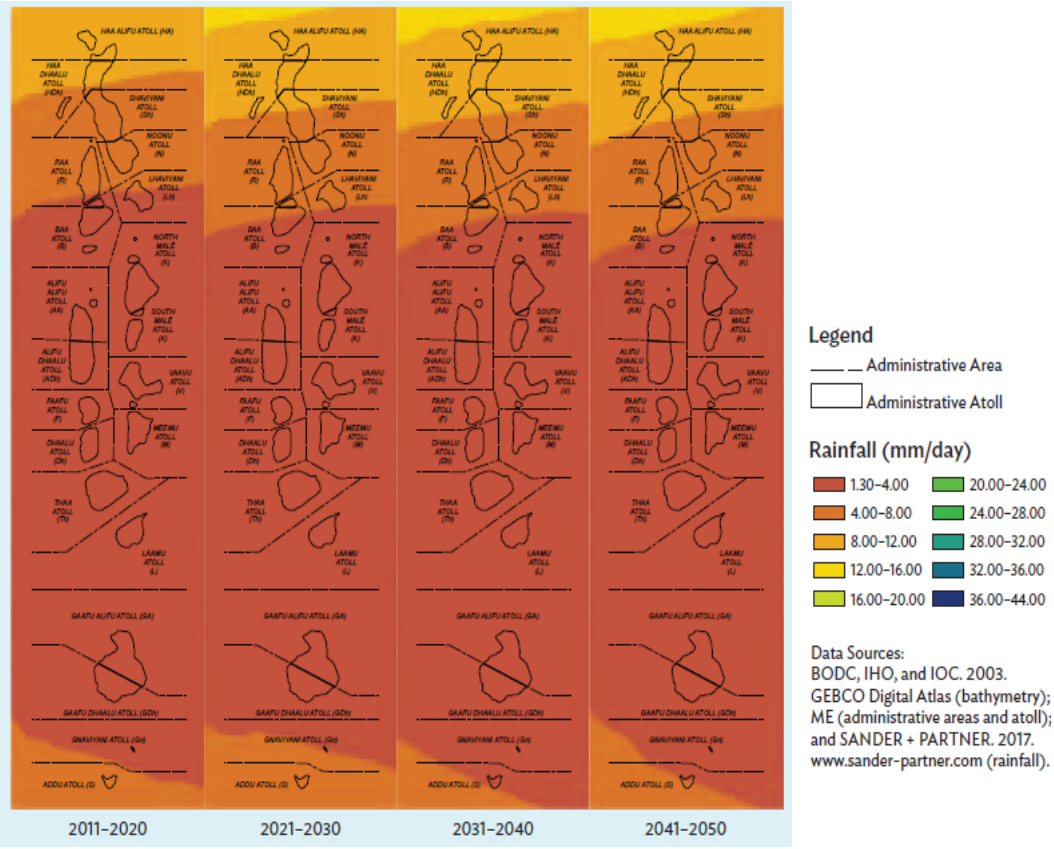

Figure 11 Average annual rainfall projections from 2011 – 2050, under moderate emission scenario (ADB 2020).

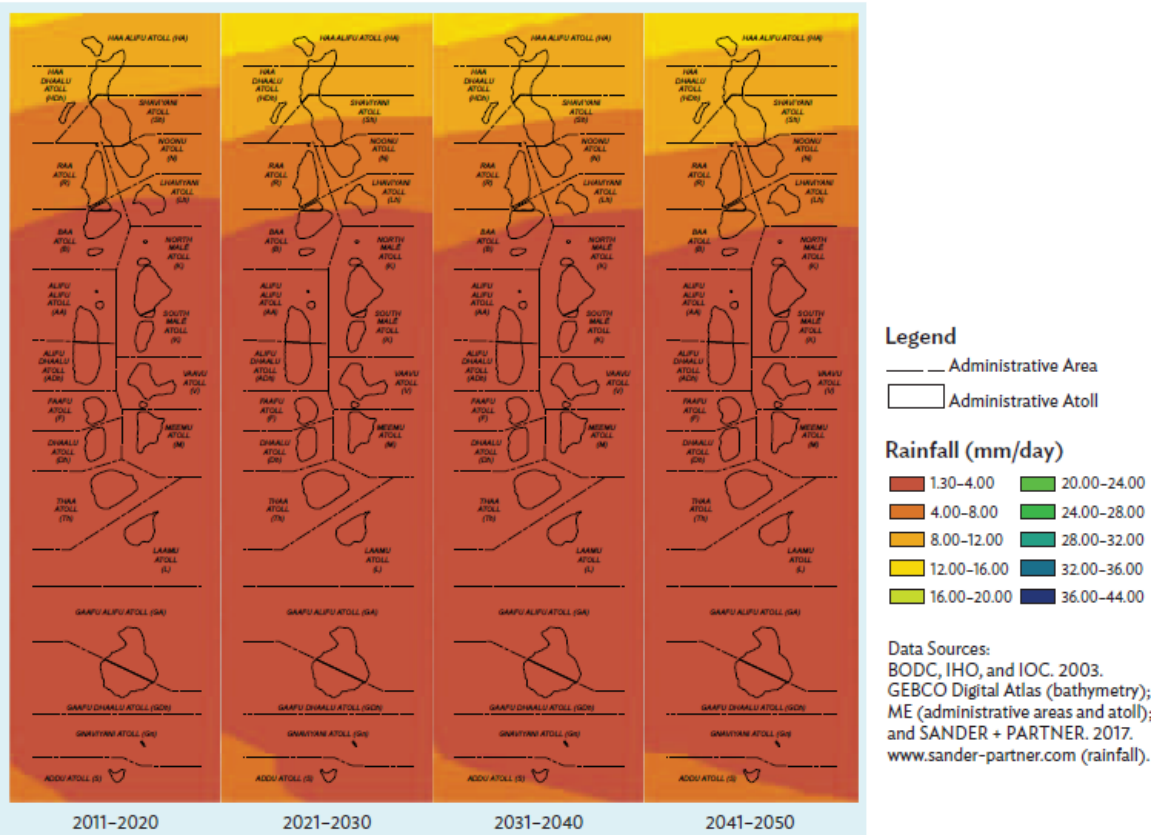

Figure 12 Average annual rainfall projections from 2011 – 2050, under high emission scenario (ADB 2020).

4. Wind

Wind is one the key climate factor in the Maldivian monsoon formation. The change or reversal of wind direction and speed results in transformation of local currents around the island. Thus, wind plays a significant role in determining climate system in the Maldives. Additionally, wind remains a geological agent that shapes the coastal dynamics in the Maldives islands.

The monsoon observed in the Maldives is mild as the country is situated on the equator. This reduced monsoonal activity resulted in few or no presence of strong winds, cyclones or gales in the Maldives. However, on the other hand there is occurrence of storms and line squalls during April and May with an intensity of 60 knots.

Westerly wind is the dominant wind direction throughout the year. Furthermore, slightly stronger winds are observed from westerly direction during the NE monsoon. According to (Naseer 2003) the speed and direction of wind has remained similar over the last two decades of monsoonal periods in the Maldives with an average wind speed of 7 -12 knots. The author noted that high-speed wind is dominated in the central region with an average speed of 18 m/s. The high wind patterns are observed during the month of May and October.

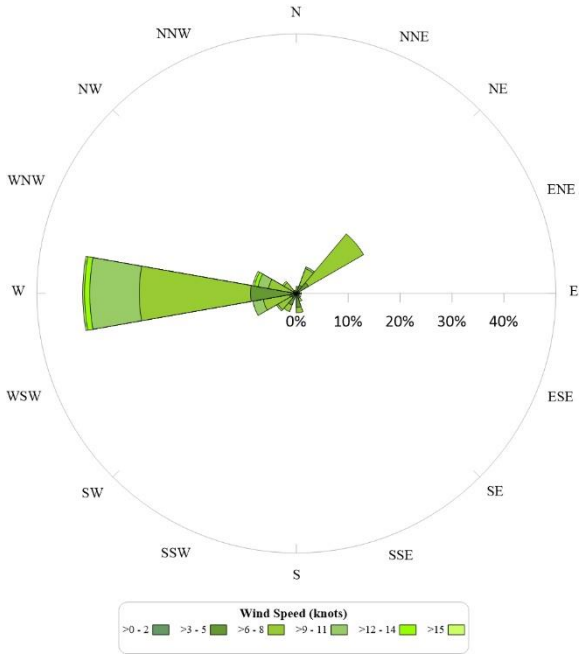

Figure 13 The average annual wind speed and direction at L. Kahdhoo from 1975 – 2019 (Data Source MMS).

The northern islands in the Maldives are exposed to cyclonic events rather than the central and southern islands. Despite Maldives being located in rare cyclonic zone, Maldives over the history has experienced few cyclonic events. In this notion, (UNDP, 2006) reports 11 such cyclonic events with the span of 128 years. On the other hand, all the cyclones observed in the Maldives are mild and have no caused much damage. Additionally, report also confirms that there was no cyclonic event since 1993.

E. Oceanography and wave dynamics

1. Tides

Locally in the Maldives a mixed semi-diurnal or diurnal type of tides is felt in the island (MHAHE, 2001). In other words, the islands experience two sets of both high and low tides around the cycle with different tidal heights. In addition to the daily variation in tides, there are variations in tides due to the lunar cycle which are caused by the varying gravitation pull of the moon due to the position of the moon. When the moon and the sun is aligned in a straight line the gravitational pull is greatest and this causes a spring tide. When the moon and the sun are aligned at 90^0 their combined gravitational pull is at the minimum and this causes a neap tide.

With reference to mean sea level (MSL) the mean higher high water is +0.34 m and mean lower low water is -0.36 m. However, it has been reported that the highest astronomical tide was at +0.64 and lowest astronomical tide at -0.56.

Table 7 Tidal Recording from Maldives. Source: (MEEW, 2002)

Tide Level	Referred to Mean Sea
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 (MLLW)	-0.36
Lowest Astronomical Tide (LAT)	-0.56

2. Waves

The wave dynamic is a crucial element in maintaining healthy active beach and coral growth. Wave formation is closely linked to the wind direction and speed. Thus, higher wave activity is noticed during the slightly strong windy days such as during the SW monsoons seasons. Maldivian waves are formed due to two main reasons. They are either associated with local monsoonal wind and swells generated by distance storms.

The local monsoonal wind resulted waves have a period of 3 -8 seconds however, the distance storm led waves have much higher period (14 – 20 seconds) (Kench and Brander, 2006; Kench et al., 2006). The local monsoonal wind resulted waves are stronger during May – July in SW monsoon, with an average wave period of 2 – 4 seconds. On the other hand, swell generated waves observed in the central region of Maldives have an average height of 2 – 3 meters with a period of 18 – 20 seconds. Thus these two types of wave formation are easily distinguished, as the distance storm type of waves would result in coastal flooding (Goda, 1998).

Despite the limited data available on deep-water waves, regional wave climate data indicates that deep-water waves approach the Maldives from southerly quarters (Kench and Brander, 2006; Young, 1999).The maximum peak wave height (H_s) reached 1.8 m in July is observed from south-southwest, while minimum wave height of 0.75 m is observed in March from southeast

Recent studies (Kench and Brander, 2006) undertaken in the Maldives on understanding waves climate shows wave energy gradient across the atoll. The findings of this study are as summarized below.

- The combined energy effect from swells and wind-wave is greater on the windward of the island.
- The energy intensity faced on the leeward side of the island is low during both the monsoons as the house reef located on the windward side of the reef system absorbs most of the energy.
- The wave height around the island remains more or less equal during the refractions of wave energy.
- High tides are associated with higher wave energy dissipated on the island shorelines.

Waves are stronger on the SW side of the island during the SW monsoon, and during NE monsoon on western side of the island. Similarly, during the NE monsoon, the north east of the island is subjected to very high energy.

More specifically as the island is located along the western atoll rim, effect of the SW monsoon would be more severe than the NE monsoon. Thus, more erosion is observed along the western side of the island. Furthermore, the island is subjected to year-round residual SE swells waves refracted through the reef passes. However, being largely shielded from the other islands these residual energies would be very smaller.

3. Currents

The current generated in the lagoon plays a significant role in aid in beach sediment movement across the island (Binnie Black and Veatch, 2000; Gourlay, 2011; Kench and Brander, 2006). Within the local setting in the Maldives, due to small tides there is not much significant current generated within the lagoon area. Thus, the seasonal variation adds extra energy to the system through changing wind patterns. For example, during the SW monsoon eastward current flow is stronger on the other hand during NE monsoon westward current will be stronger. Towards the end of SW season in April the westward current would slowly deteriorate while giving away to eastward currents to dominate or take in place. The opposite phenomenon occurs during the reversal of NE monsoon to that of SW monsoon.

Swell waves in Maldives are generally experienced by swells generated by distance swells generated due to storms. Occasional flooding has occurred in Maldives due to swells and distance storm generated swells were associated with these flooding's. Recent studies of a wave climatology using hindcast shows that large significant wave heights are accompanied by longer periods indicting they are remotely generated (see Figure 14).

In situ current measurements of the project site varied based on location and tide. Figure 15, shows the current movement at the eastern and western side of the island.

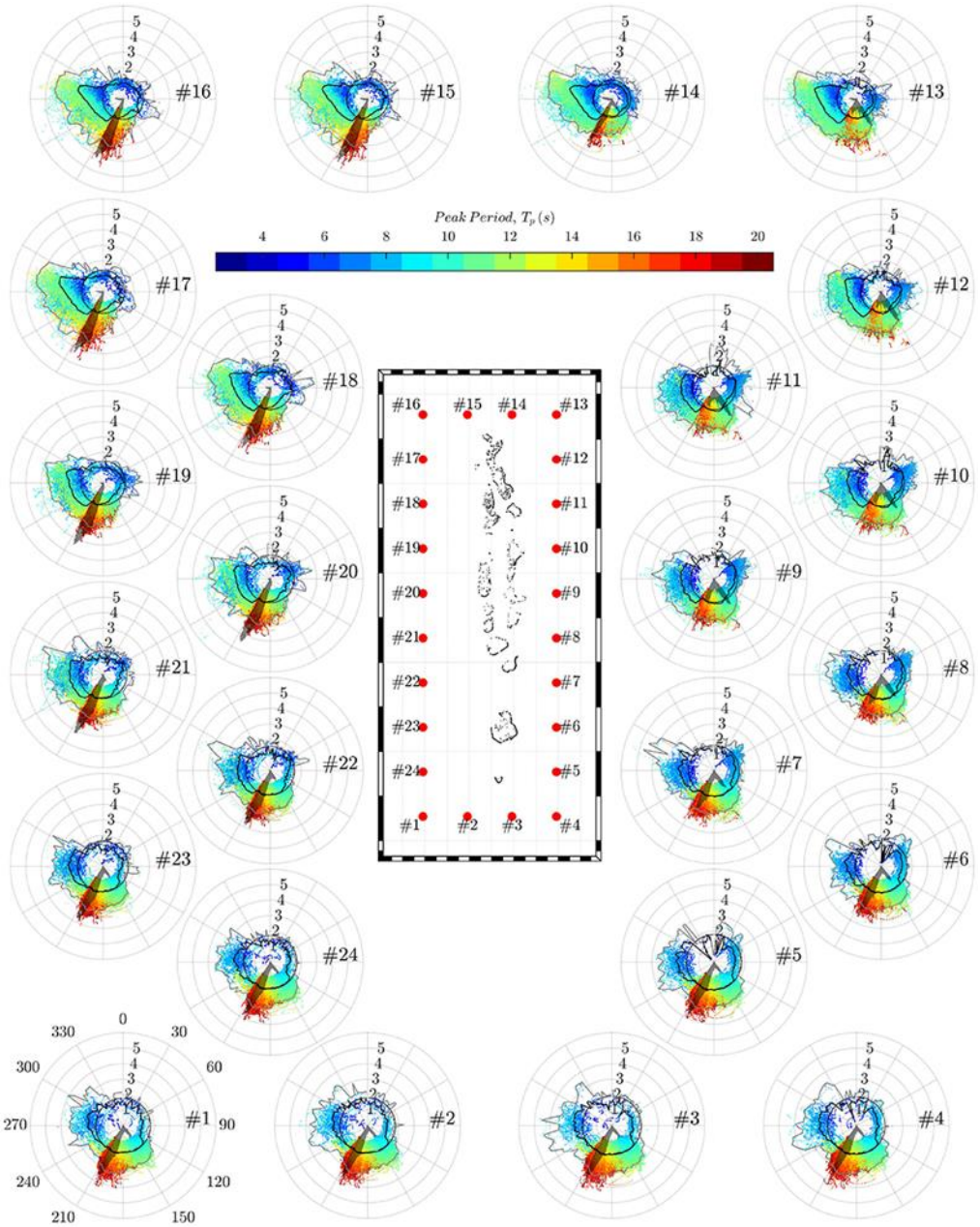

Figure 14 Wave climatology around Maldives, Amores et.al 2021.

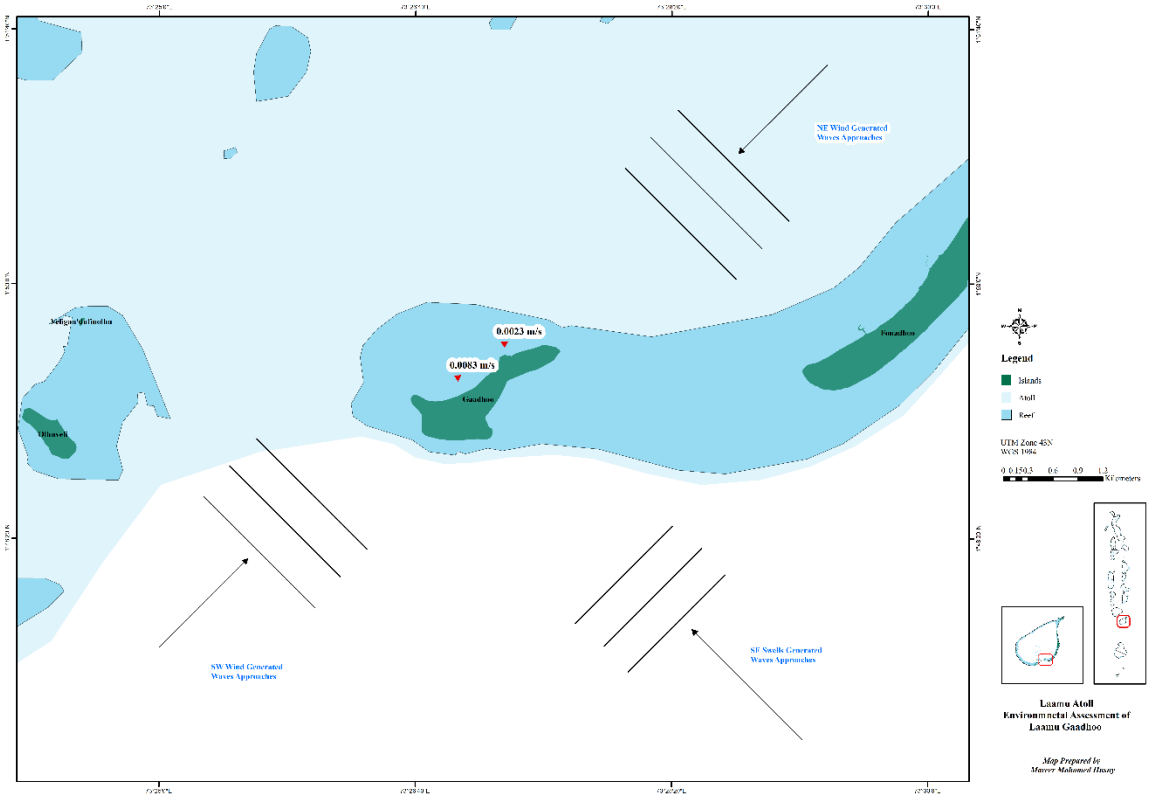

Figure 15 Local current and wave patters around L. Gaadhoo

4. Natural hazards and vulnerability

The Maldivian islands in general are geographically located in a very fragile environmental setting. Fewer islands in the Maldives are exposed to lower level of hazards when compared to others. For example, during the 2004 Indian Ocean Tsunami indicated that islands situated along the eastern rim of Maldivian atolls are more exposed to tsunami induced flooding in contrast to the islands situated along the western rims.

The island geomorphologic, geographic and positioning remains key in exposure to natural hazards or associated risks. The location of the island in the atoll, island orientation, types of sediments on the island, vegetation cover, nature of house reef all indicate vulnerability of the island with respective to any natural hazard. The Maldives islands are considered to be moderate region on its level of exposure to such level of extreme conditions.

Extreme Weather Events

Extreme weather events are referred to an event when such event has conditions of weather above or below the identified threshold conditions (Parry et al., 2007). Table 8 shows the extreme weather occurrences in the Maldives. As the Maldivian islands are generally coastal environment, the coastal hazards and associated risks are deeply studied. (UNDP, 2006) argues, that central region in the Maldives is less exposed to cyclones in contrast to the northern islands.

Table 8 Key Extreme conditions observed in the Maldives. Source: (MHAHE, 2001)

Parameter	Extreme condition	Date / Year
Highest Maximum Daily	34.1^0C	15, 28 April 1973
Highest Monthly Average Maximum Temperature	32.7^0C	April 1975
Lowest Monthly Average Minimum Temperature	21.7^0C	March 1974
Wettest year recorded	2,707 mm	1978
Direst year recorded	1,407 mm	1995
Wettest month recorded	588 mm	October 1994
Heaviest Daily Rainfall	200 mm	11 October 1998
Freak Storms	Lasted for 12 hours	2000
Strong Tidal wave		April 1987
Strong Wind	90 Knots /hour	30 May 1991
Average Air Pressure	1012 & 1010 mb in December & April	-
Indian Ocean Tsunami	12 m wave	26 December 2004

Coastal Hazards

Based on the level of impacts to the island and the community, coastal hazards can be categorized into two types; they are coastal impacts that are of greater impact and that of lower impacts. The Disaster Risk Profile of the Maldives identifies six natural disaster risks. They are earthquakes and tsunamis, cyclones/thunderstorms, flooding (due to rain), droughts (prolonged dry periods), storm surges and strong winds, tornadoes. In most of the disaster related events are short-lived events, for example 2004 Indian Ocean Tsunami or recent swells in the country. The vulnerability assessment undertaken in the Maldives shows that flooding due to rain most common in northern and central zones of the country.

The geological hazard distribution shows that northern islands of the Maldives are at more risk from storm surges, tsunami and high winds/cyclones. L. Gaadhoo is located in south zone of the country hence, the island is expected to have very high impact associated with surges, cyclonic impacts. However, the island is expected to low to medium impacts due to Tsunami, the island is subjected to lower degree of impacts and island is considered to be among least impact due to a possible earthquake (see Figure 16).

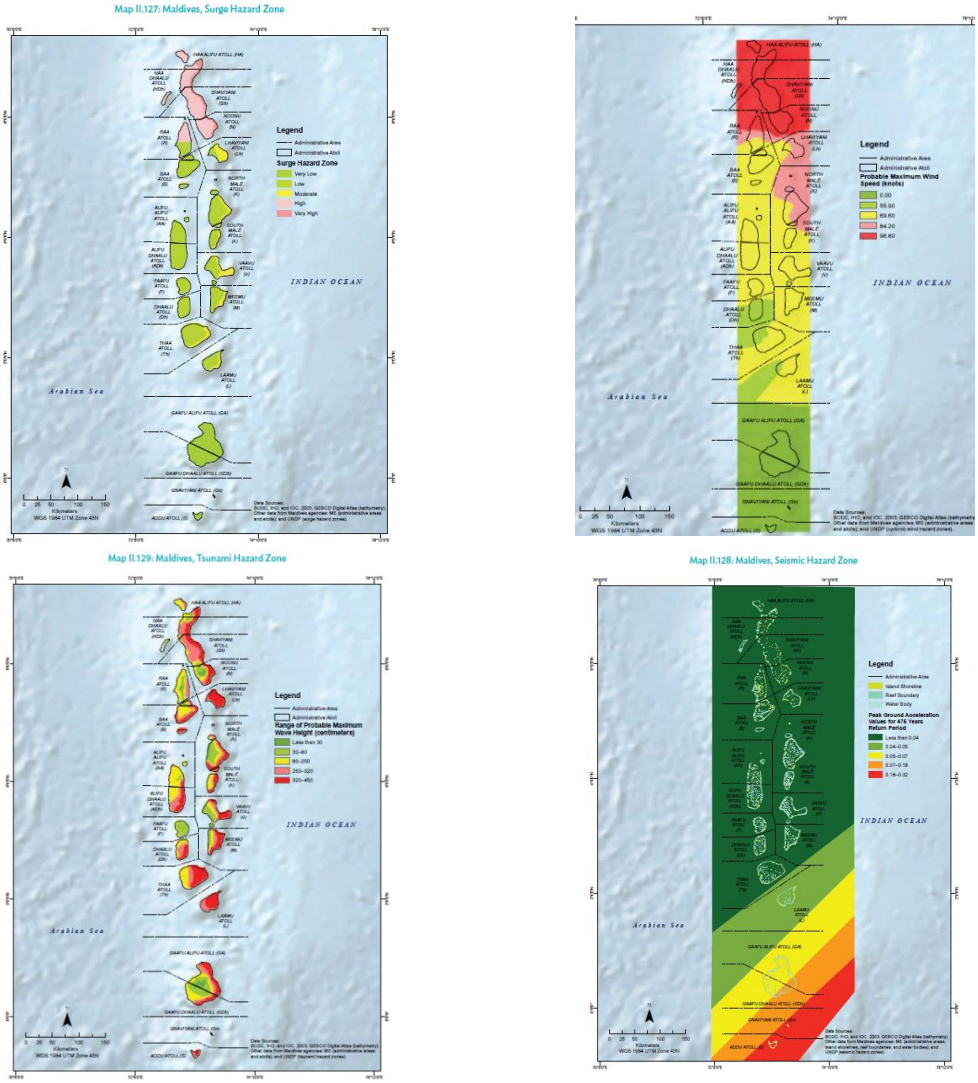

Figure 16 Hazard distributions, storm surge (top right), cyclonic events (top left), tsunami (bottom right) and seismic (bottom left).

F. Soil Condition

The soil profile of the island was done at two respective locations. Figure 17, shows soil characteristics at the current agricultural plots and previous community area.

Figure 17 Soil Characteristics at existing agricultural plots (left) and community area (right)

Soil analysis shows that at the existing agricultural area has approximately 1 feet payer of humas. This indicate the soil has rich layer of humus which is used for cultivation of the crops. However, with regard to the soil profiling at the community area does not have humus layer.

G. Proximity to residential areas

The island was inhabited by residents of Gaadhoo now moved to Foanadhoo. Hence there are buildings that were used prior to moving. The community area is at the center of the island. Recent images of the island indicate approximately 23.7 ha area is used as community area (see Figure 18).

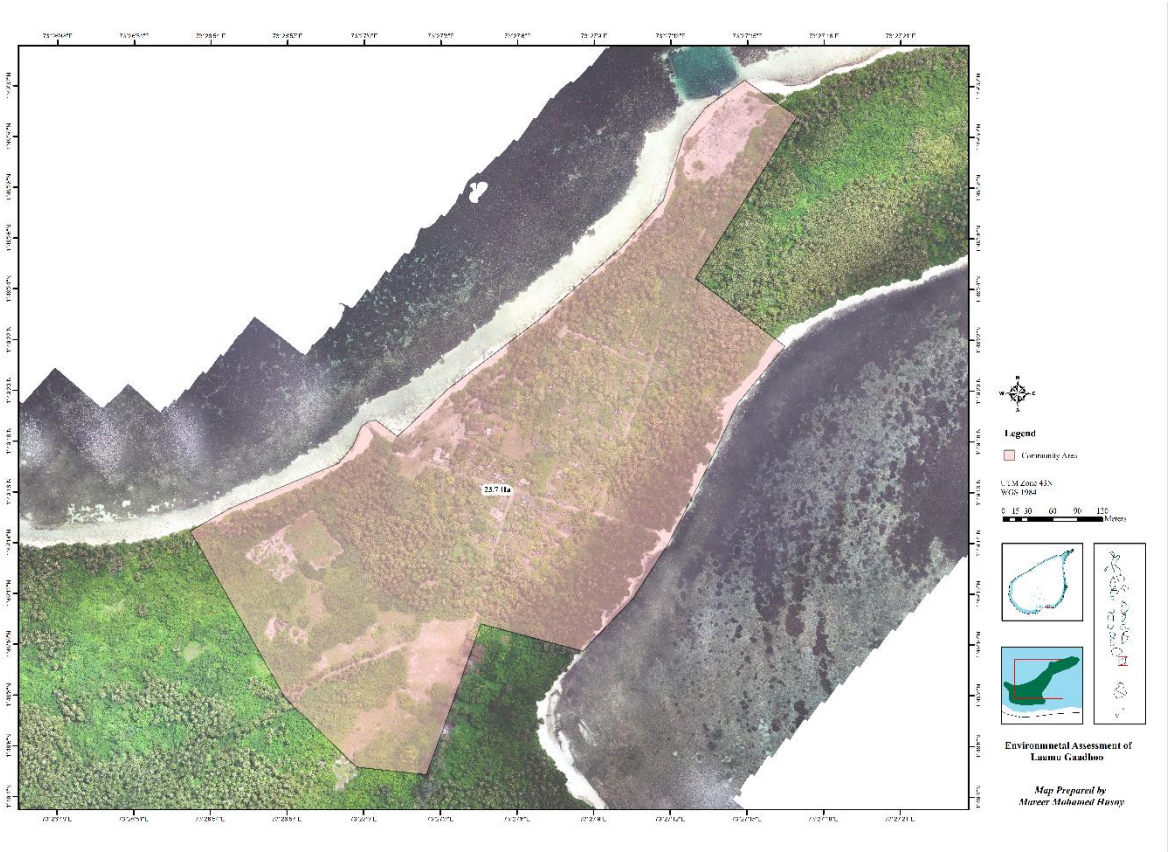

Figure 18 Development footprint of L. Gaadhoo

Buildings are significantly damaged. Once resident area is currently used by the staff during their visit. Figure 19, shows the current built area of the island.

Figure 19 Existing built-up area of the island

H. Vegetation

Since the evacuation of the residents from the island, shrubs dominate in most part of the island. This has resulted formation of thick undergrowth in the island. In order to assess the abundance of the vegetation types on the island, random vegetation transects were surveyed. Additionally, significant flora that is found in the island is also mapped. Table 9, shows abundance of dominant trees at the vegetation transects.

1. Dominant trees

The main dominant type of the trees is Coconut (Dhivehi Ruh), Thatch screw pine (Boa Kashikeyo), Indian almond tree (Midhili), Breadfruit (Bambukeyo), Indian Mulberry (Ahi), and Sea Hibiscus (Dhigaa).

- **Bayan Tree:** The island has one large Banyan tree (*Nikagas*) which is considered as the signature tree of the island (Figure 20).
- **Coconut:** This is the most common tree that is found in the island. Most of the coconut palm (*Dhivehi Ruh*) is mature with a height of approximately 40 m above the ground level. Most of the coconut is found in the southern side of the island. However, coconut cover stretches along the coastline of the entire island. In addition to the mature coconut trees, there are many juvenile coconuts that occurs mostly within the southern of the island.
- **Screw pine:** Screw pine (*Boa Kashikeyo)* is common type of trees mostly found at the vegetation belt in most of the islands of Maldives. This type of trees usually grows to approximately 20 m above the ground level. They are very abundant near the Mangrove area. Additionally, they were found at the coastal areas, since they withstand higher salt spray and strong winds.
- **Indian almond tree:** Indian almond tree (*Midhili or Gobugas)* is common type of trees mostly found mostly away from the coastal belt. This type of trees usually grows to approximately 10 m above the ground level. Most of the Indian almond trees that were found in the island are juvenile trees, however few larger trees were observed.
- **Breadfruit:** Breadfruit (*Banbu keyo*) is staple food in the country. Even though there are many breadfruit trees were observed in the island, most of the trees are dying. Most of these trees are located within the built-up area of the island. This is wide known phenomenon evident along

with an island evacuation. The average size of the trees is between 5 – 20 m. The trees do not have any fruit at the time of survey (see Figure x).

- **Indian Mulberry:** Indian Mulberry (*Ahi*) is common type of trees in the island. The fruit and leaves of the trees are used as medicinal purpose. The level of abundance of mature Indian Mulberry was few, however many juveniles such trees were encountered at the time of survey. The average size of these juvenile trees is estimated as 2 – 3m.
- **Sea Hibiscus:** Sea Hibiscus (Dhigga) is a common tree in the country that is present both within the coastal belt and within the island. Even though there are few large trees at the transects lines only juvenile trees were found.

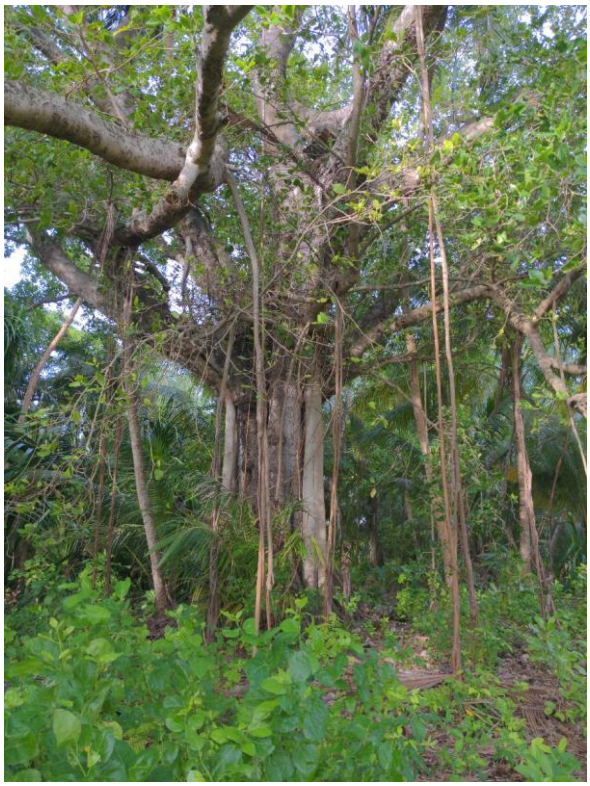

Figure 20 Banyan Tree

Table 9 Abundance of the trees at L. Gaadhoo along vegetation transects (Cumulative)

Family Name	Scientific Name	Common Name	Local Name	Abundance	Average height /m
Arecaceae	*Cocos nucifera L.*	Coconut	*Dhivehi Ruh*	Mature (47) Juvenile (159)	2 - 40
Rubiaceae	*Morinda citrifolia L.*	Indian Mulberry	*Ahi*	51	2 – 3
Moraceae	*Ficus benghalensis L.*	Bayan tree	*Nika*	1	4
Pandanaceae	*Pandanus absonus*	Thatch screw pine	*Boa* *Kashikeyo*	8	2 - 4
Combretaceae	*Terminalia catappa L.*	Indian almond tree	*Midhili*	4	2 - 3
Moraceae	*Artocarpus altilis*	Breadfruit	*Banbukeyo*	2	5 - 20
Malvaceae	*Taliparitiliaceum*	Sea Hibiscus	*Dhigaa*	3	2 - 3

2. Dominant Shrubs

The main shrubs that were present were, Beach plum (*Magoo*), Singapore Daisy (*Mirihi*), Love vine (*Velanbuli*), Scaly sword fern (*Keesfilaa*). Table 10, shows abundance of dominant shrubs at the vegetation transects.

- **Beach Plum:** Beach Plum (*Magoo*) is a common shrub that is located mostly found at the coastal belt. The average height of these shrubs is few meters. The shrub is very tolerant to high salt spray and strong winds. They also protect the island from significant erosion with stronger root system.
- **Singapore Daisy:** Locally known as *Mihiri*, is coastal and in land shrub that is found in the islands. They also have a compact and stronger root system. Even though they grow on the coastal area, they are less salt tolerant in comparison to the Beach Plum. In term of abundance, it is widely observed in the island mainly because of the abandoned buildings and ruins.
- **Love vine:** Locally referred as *Velanbuli*, is leafless parasitic twiners. They are highly invasive and mostly found in dense and untouched parts of the forest in the Maldives. Since this island was abandon few years ago, there is significant growth of Love vines in observed.
- **Scaly Sword Fern:** Scaly Sword Fern (Keesfilaa) is a very common type of shrubs observed in the Maldives. This fern was primarily observed southside of the island. These ferns usually grow within marshy to sub marshy land area.

Table 10 Abundance of the shrubs at L. Gaadhoo along vegetation transects (Cumulative)

Family Name	Scientific Name	Common Name	Local Name	Abundance	Average height /m
Goodeniaceae	*Scaevola sericea Vahl.*	Beach Plum	*Magoo*	High	Few
Asteraceae / Compositae	*Silphium trilobatum L.*	Singapore Daisy	*Mirihi*	High	Few
Lauraceae	*Calodium cochinchinensis*	Love vine	*Velanbuli*	High	Few
Nephrolepidaceae	*Polypodium hirsutulum*	Scaly Sword Fern	*Keesfilaa*	High	Few

3. Vegetation Transects

Seven random vegetation transects (30 m) were at the island to determine the average type of vegetation in the island. Table 11, shows the main features of the vegetation transect are discussed below.

Table 11 Features of the vegetation transects.

Transects	Features
VT1	Dominant trees include, Coconut Palm (Juvenile and Mature), Indian Mulberry and Banyan Tree. Main shrubs at this transect includes Singapore Daisy, Beach Plum and Love vine (2 -3m height). Total of 41 trees were observed. 90% of the transect consists of Coconut Palm (7 – 30m height). Banyan trees observed at the transects have an average height of 5 – 15m. **Error! Reference source not found.**, shows the average height and major types of trees along the transect.
VT2	The transect is along the turtle beach line. Three Tree heliotrope were observed along the transect. Most of the vegetation is Beach Plum which has an average size of 5 – 7m.

Transects	Features
VT3	The transect is along the turtle beach line. All of the vegetation is Beach Plum which has an average size of 5 – 7m.
VT4	Dominant trees include, Coconut Palm (Juvenile and Mature), Indian Mulberry and Screw Pine. Main shrubs at this transect includes Singapore Daisy, Beach Plum and Scald Sword Fern (2- 3m height). Total of 66 trees were observed. 77% of the transect consists of Indian Mulberry. Average height of Indian Mulberry is 5 – 10 m. The average height of juvenile coconut is 7 – 10m, while mature trees have a height of 30m. **Error! Reference source not found.**, shows the average height and major types of trees along the transect.
VT5	Dominant trees include, Coconut Palm (Juvenile and Mature), and Indian Mulberry. Total of 68 trees were observed. 98% of the transect consists of Mature and Juvenile Coconut Palm (5 – 30m height). Average height of Indian Mulberry is 5 – 10 m. **Error! Reference source not found.**, shows the average height and major types of trees along the transect.
VT6	Dominant trees include, Coconut Palm (Juvenile and Mature), Indian Almond and Screw Pine. Total of 79 trees were observed. 76% of the transect consists of Mature and Juvenile Coconut Palm (5 – 30m height). Average height of Screw Pine (5 – 8m height), which represents 16% of the transect. Indian Almond has a composition of 8% with an average height of 5-10m. **Error! Reference source not found.**, shows the average height and major types of trees along the transect.
VT7	Dominant trees include, Coconut Palm (Juvenile and Mature), Indian Mulberry, Indian Almond, Sea Hibiscus and Breadfruit. Main shrubs at this transect includes Singapore Daisy and Beach Plum (2 – 3m average height). Total of 41 trees were observed. 61% of the transect consists of Mature and Juvenile Coconut Palm (3 – 30m). Average height of Indian Mulberry is 5 – 7m, which represents approximately 15% of the transect. The average height of Indian Almond (7 – 25m) represents 10% of the transect. Breadfruit represents 7% of the transect with an average height of 7 – 25m. **Error! Reference source not found.**, shows the average height and major types of trees along the transect.

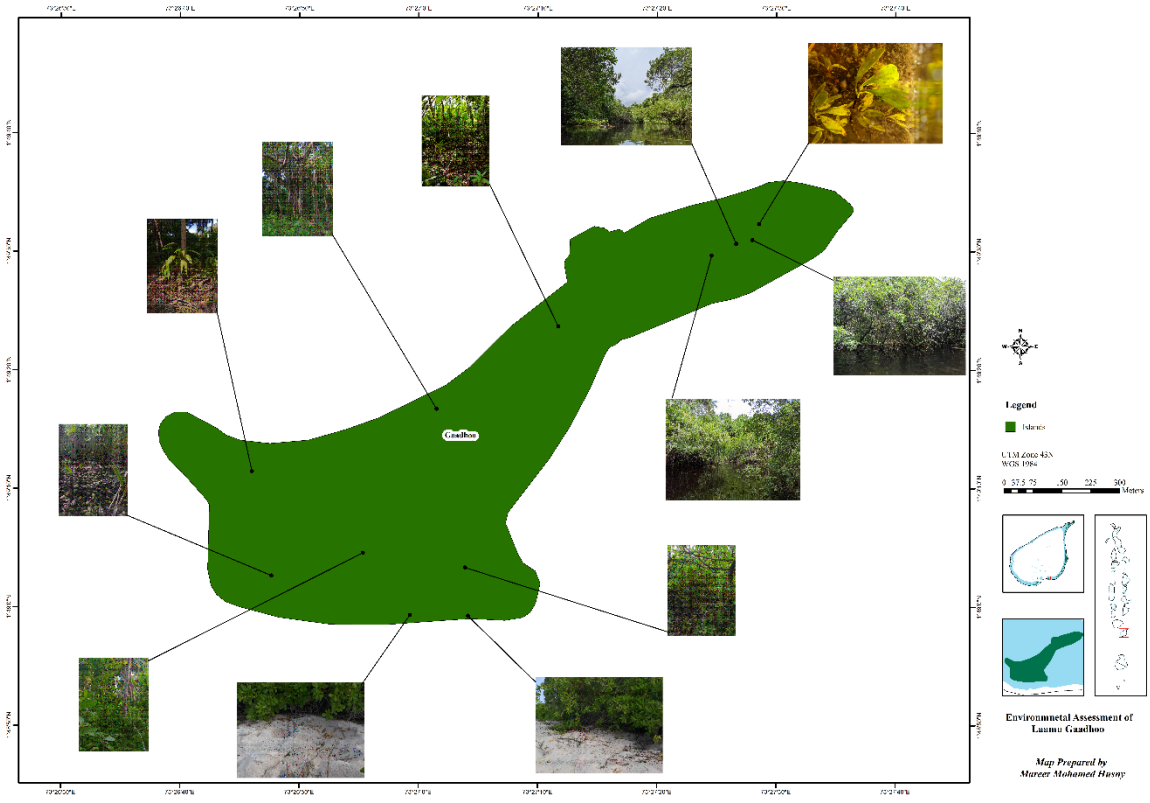

Figure 21 Vegetation at L. Gaadhoo

V. STAKEHOLDER CONSULTATION

A. Introduction

Involvement of stakeholders is crucial for the effective implementation of the proposed project. An integral part of this EMP has been consultation with all relevant parties including, relevant government authorities and community members. This chapter aims to summarize the stakeholder consultations that were conducted. Due to ongoing COVID-19 pandemic all the stakeholder consultations were undertaken through online platforms. The meeting attendance is appended in Appendix E.

- AgroNational Corporation
- Ministry of Environment, Climate Change and Technology
- Ministry of Fisheries, Marine Resources and Agriculture
- Environmental Protection Agency
- Laamu Atoll Council
- Maldives Marine Research Institute

B. AgroNational Cooperation

On 18 August 2021 (Wednesday) at 1400 hrs, the Consultant met with the AgroNational Corporation to discuss on the proposed project. Table 12 shows the summary of the discussion.

Table 12 Summary discussion with the AgroNational Corporation

Items	Description
Date of Consultations	18 August 2021 (Wednesday) | 1400 hrs
Venue	AgroNational Corporation
Name of Stakeholders	AgroNational Corporation and Consultant
Language	Dhivehi
Introduction	The objective of this meeting was to inform and undertake consultation on the proposed project.
Summary of discussion	▪ AgroNat provided a scope of work on the island. The island was leased to AgroNat for 25 years for commercial and contract farming purpose. ▪ The project will be implemented in three major phases, Phase I involves construction of all support infrastructure, Phase II will be focused on contract farming and third and final phase will be commercial farming. ▪ An oral report of the field investigation was provided by the consultant and highlighted biodiversity hotspots. They include turtle nesting beach, mangrove area and sea grass ecosystem. ▪ Consultant recommended southern beach of the island to be conserved with a 30 m buffer from the turtle nesting zone. Physical buffer can be either established through plantation such as coconut palm or by a wire mesh. Furthermore, a 30 m buffer along the wetland. ▪ Vegetation belt was also recommended for 20m around the entire island. ▪ AgroNat suggested that they intend to install night vision cameras at the beach to reduce poaching of turtle nesting. ▪ AgroNat informed they do not intend to remove large vegetation or trees from the island. However, agricultural farming would require removal of shrubs from the plots.

C. Ministry of Environment, Climate Change and Technology

On 19 August 2021 (Thursday) at 1230 hrs, the Consultant met with the Ministry of Environment, Climate Change and Technology (MoECCT) to discuss on the proposed project. Table 13 shows the discussion with MoECCT.

Table 13 Summary discussion with the MoECCT

Items	Description
Date of Consultations	19 August 2021 (Monday) | 1230 hrs
Venue	Virtual meeting
Name of Stakeholders	MoECCT and Consultant
Language	Dhivehi
Introduction	The objective of this meeting was to inform and undertake consultation on the proposed project.
Summary of discussion	▪ MoECCT, identified L. Gaadhoo as one of the environmentally sensitive islands due the presence of green turtle nesting beach, seagrass ecosystem and mangrove. ▪ MoECCT, recommended establishing buffer of 30 m at the turtle nesting beach (entire south beach of the island) and around the mangrove area. Furthermore, to maintain 20 m buffer vegetation belt. ▪ MoECCT, advised to maintain a green vegetation at the southern beach of the island to ensure there is less noise and light pollution. In this regard, MoECCT highlighted to use existing coconut palm at the site as green barrier. They also recommended to manage the coconut palm via sustainable management practices. ▪ The seagrass meadows on both sides of the island are a keystone habitat that provide juvenile fishes and diet for sea turtle. Therefore, MoECCT recommends to protect the habitat.

D. Ministry of Fisheries, Marine Resources and Agriculture

On 24 August 2021 (Tuesday) at 1030 hrs, the Consultant met with the Ministry of Fisheries, Marine Resources and Agriculture (MoFMRA) to discuss on the proposed project. Table 14 shows the discussion with the MoFMRA.

Table 14 Summary discussion with the MoFMRA

Items	Description
Date of Consultations	24 August 2021 (Tuesday) | 1030 hrs
Venue	MoFMRA
Name of Stakeholders	MoFMRA and Consultant
Language	Dhivehi
Introduction	The objective of this meeting was to inform and undertake consultation on the proposed project.
Summary of discussion	**General Waste Management Issues in the island** ▪ MoFMRA, acknowledged ecological significance of the island and emphasis on protection of mangrove area and the turtle nesting beach. This protection or preservation needs to adhere to guidelines published by MoECCT. (Ie; 30 m buffer along the southern beach and around the mangrove area, 20 m along the vegetation belt). ▪ MoFMRA, seeks to get approval of removal of large and significant trees from the island. This includes keeping the record of the trees to be removed from the island, replantation to be carried out within the island. Such removals should be done in accordance to the regulations of the Maldives and shall be approved by MoECCT or EPA. ▪ MoFMRA, recommends that animal husbandry needs to be 30 to 60 m away from regular agricultural area.

	▪ Since the island will be used for agricultural use for both contract and commercial farming, groundwater shall not be utilized, thus water requirement of the island and its activity shall be available through establishment of a desalination plant. ▪ Waste needs to be adequately managed since there would be hazardous waste generated through the agricultural activities. Adequate measures need to be installed at the island. Moreover, waste water runoff needs to be addressed and measures needs to be taken into consideration seepage to seagrass meadows or soil. ▪ Agricultural zones or plots shall have green buffer between plots. For example, each 50,000 sqft shall have a 15 ft green buffer. MoFMRA, encourages to use existing plants as buffer. However, if such plants are not available alternatives such as Neem plants could be utilized.

E. Environmental Protection Agency

On 24 August 2021 (Tuesday) at 1100 hrs, the Consultant met with the EPA to discuss on the proposed project. Table 14 shows the discussion with the EPA.

Table 15 Summary discussion with the EPA

Items	Description
Date of Consultations	24 August 2021 (Tuesday) | 1100 hrs
Venue	Virtual
Name of Stakeholders	EPA and Consultant
Language	Dhivehi
Introduction	The objective of this meeting was to inform and undertake consultation on the proposed project.
Summary of discussion	**General Waste Management Issues in the island** ▪ EPA, stressed ecological significance of the island and emphasis on protection of mangrove area and the turtle nesting beach. This protection or preservation needs to adhere to guidelines published by MoECCT. (ie; 30 m buffer along the southern beach and around the mangrove area, 20 m along the vegetation belt). ▪ EPA, emphasized buffering around the core areas is the first phases, community awareness is critical to reduce the impact to sensitive habitats. In this regard, EPA recommends erection of signboards including zonation and code of conduct. ▪ EPA will gazette Turtle Management Plan in early 2022, that would be applicable for all the turtle habitat in the country. Under this Management Plan, a proper surveillance mechanism will be established. ▪ EPA, recommends use of red lights within the island and prohibit use of white lights within the coastal areas as it would detour sea turtle. ▪ EPA suggest using technologies such as night vision cameras for surveillance and monitoring of poaching activities. ▪ EPA propose, to include provision of the turtle management within the individual contracts for both commercial and contract farmers. ▪ EPA currently works closely with Olive Ridley Project to monitor the sea turtle conservation efforts. The efforts are strongly encouraged by EPA and engage communities for conservation efforts. ▪ EPA also recommends to establish inhouse conservation efforts through staff and rangers.

F. Maldives Marine Research Institute

On 30 August 2021 (Monday) at 1100 hrs, the Consultant met with the Maldives Marine Research Institute (MMRI) to discuss on the proposed project. Table 14 shows the discussion with the MMRI.

Table 16 Summary discussion with the MMRI

Items	Description
Date of Consultations	30 August 2021 (Monday) | 1100 hrs
Venue	Virtual
Name of Stakeholders	MMRI and Consultant
Language	Dhivehi
Introduction	The objective of this meeting was to inform and undertake consultation on the proposed project.
Summary of discussion	▪ Maldives Marine Research Institute (MMRI) identify environmental significance of the island. The western side of the island is also known for presence of megafauna such as String Rays. ▪ MMRI, recommends continued monitoring of the nutrients within the marine environment to effectively managed excess leachate from farming activities that are proposed on the island. ▪ MMRI, further suggest in case of EIA triggered for construction of support infrastructure, farming activities a separate consultation to be undertaken. ▪ Leachate management is something that needs to be adequately managed to ensure no marine environment and the mangrove area is overloaded with nutrients. ▪ MMRI, support the efforts of the MoECCT to protect and conserve the natural environment as discussed.

G. Olive Ridley Project

On 31 August 2021 (Tuesday) at email exchange was made between consultant and Olive Ridley Project staff on the proposed project. Table 14 shows the discussion with the council.

Table 17 Summary discussion with the Council

Items	Description
Date of Consultations	31 August 2021 (Tuesday)
Venue	Email communication
Name of Stakeholders	ORP and Consultant
Language	English
Introduction	The objective of this meeting was to inform and undertake consultation on the proposed project.
Summary of discussion	▪ Include beach monitoring assessment regularly to check on the population of turtle. ORP, recommends an inhouse conservationist to undertake those assessment regularly. ▪ ORP suggest no constructional activity within the 30 m buffer and also no over water construction. ▪ Undertake regular cleanup activities and also establish a sustainable waste management practice on the island. ▪

VI. IMPACT PREDICTION AND ASSESSMENT

A. Introduction

Implementation of infrastructure projects would result in both positive and negative impacts to the environment and social situation within the project boundary. Enhancement of the positive impacts and addressing negative impacts associated with the project will improve overall sustainability of any project. Therefore, all development projects should be undertaken with utmost attention paid to avoid, minimize and mitigate unavoidable impacts of the particular project to the immediate and surrounding environment of the project location. The impact boundary is annexed in Appendix E.

B. Impact Assessment Methodology

These positive and negative impacts can be direct, indirect, cumulative, reversible, and irreversible in nature. Furthermore, the impacts differ in terms of significance (low, moderate or high) and duration. The associated impacts are identified through the following methods.

- Expert and professional judgments and opinions, such as project EIA consultants, proponent and contractor.
- Leopold Matrix
- Environment and Socio-Economic Baseline in Chapter IV

1. Expert and professional judgments

Expert judgment is one of the well-established methods used for impact identification and prediction in environmental assessments. In this method, expert would be predicting the impacts based on wide experience and academic knowledge on the proposed project types. This method of impact prediction is quick, easy and can be done at a low cost when compared to the use of sophisticated software's and models to predict the impacts associated with the proposed project. Therefore, expert judgments are used in this EMP for predicting and identifying the impacts.

2. Leopold Matrix

A Leopold Matrix is built to examine environmental impact effects of the project of the conducted in the United States in compliance with the US Environmental Policy Act of 1969. This matrix address the challenge of assessing the interactions between the project and environment and socio-economic settings with a provision of numerical weighting of impacts (Josipovic et al., 2014). The scale of impacts assessment used for this EMP is described in Table 18.

Based on the consultant's experience using the impact evaluation scale a number is allocated for magnitude, significance, reversibility and duration for each activity. The combined cumulative number is then estimated through assessment of the mean value. This exercise is

repeated for both positive and negative impacts during both phases of the project. This cumulative number is then used as a decision factor about the overall impact's nature of the project.

Table 18 Impact Evaluation Scale

Criteria	Scale	Characteristics
Impact Magnitude	-4	Very high effect (devastation)
	-3	High effects
	-2	Medium effects
	-1	Low effects
	0	No observable effect
	1	Positive effects
	2	Medium positive
	3	Highly positive
	4	Very high positive effect
Impact Significance	0	Insignificant
	1	Impact at site level
	2	Impact at immediate neighborhood level
	3	Impact at island level
	4	Impact at atoll level
Impact Reversibility	0	Insignificant/Easily reversible
	1	Moderate reversible
	2	Reversible with high cost
	3	Irreversible
Impact Duration	0	Immediate
	1	Short-term/construction period only
	2	Medium term (five years of operation)
	3	Long-term/continuous

The types of impacts identified in this EMP is classified in Table 19.

Table 19 Nature and Type of Impacts

Type of impact	Definition
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g., between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
In Direct	Impacts that result from other activities that are encouraged to happen as a consequence of the project (e.g., in-migration for employment placing a demand on resources).
Cumulative	Impacts that act together with other impacts (including those from concurrent or planned future third-party activities) to affect the same resources and/or receptors as the project.

Table 20 Negative impacts associated with the project in Laamu Gaadhoo

Project Activities	Physical Components					Biological Components						Social-Cultural Components				Cumulative		Average	
	Air Quality	GHG Emissions	Noise	Soil	Ground Water	Terrestrial Flora	Terrestrial Fauna	Beach Environment	Sea Turtle Habitat	Wetland Area	Marine Water	Health and Safety	COVID-19	Employment	Landscape				
Preparatory works	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Capacity Building and Community Engagement	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	(1) 1	(1) 2	- -	- -	(2)	3	(0)	0
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 1	3 1	- -	- -	4	2	0	0
Reforestation at Buffer boundaries	- -	- -	(1) -	(1) 1	(1) 1	(1) 1	(1) 1	- -	- -	- -	- -	- -	- -	- -	- -	(5)	4	(0)	0
	- -	- -	1 1	1 1	1 2	1 1	1 1	- -	- -	- -	- -	- -	- -	- -	- -	5	6	0	0
Project Management	- -	- -	(1) 1	- -	- -	- -	(1) 1	- -	- -	- -	- -	- -	- -	- -	- -	(2)	2	(0)	0
	- -	- -	1 1	- -	- -	- -	1 1	- -	- -	- -	- -	- -	- -	- -	- -	2	2	0	0
Leachate Management	- -	(1) 1	(1) -	(1) -	(2) 1	(1) -	(1) -	- -	- -	- -	- -	- -	- -	- -	- -	(7)	2	(0)	0
	- -	1 3	1 -	1 -	3 2	1 -	1 -	- -	- -	- -	- -	- -	- -	- -	- -	8	5	1	0
Accidental spillage or leakages	- -	(1) 1	(1) -	(1) -	(2) 1	(1) -	(1) -	- -	- -	- -	- -	- -	- -	- -	- -	(7)	2	(0)	0
	- -	1 3	1 -	1 -	3 2	1 -	1 -	- -	- -	- -	- -	- -	- -	- -	- -	8	5	1	0
Socio-Economic Status during implementation	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	(1) 2	- -	- -	(1)	2	(0)	0
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	3 1	- -	- -	3	1	0	0

Key M Magnitude S Significance
R Reversibility D Duration

Combined Cumulative Negative Impacts	(0)	0
	0	0

Table 21 Summary of the impact matrices

Combined Cumulative	Negative
Magnitude	0
Significance	0
Reversibility	0
Duration	0

Table 21 summary of the negative impacts of the proposed project. The results indicate the positive impacts associated with the proposed project would outweighs the negative impacts associated with the project. Thus, making the overall cumulative impact of the propose project positive, with improve ecological condition of the island.

C. Impacts during Preparatory works

The preparatory works includes, preparation of the EMP, and also development of zonation mapping of the sensitive zones. During this process, environmental survey would be undertaken. Most of this survey will be undertaken by experts hence minimum environmental impacts would be generated to the sensitive areas.

D. Capacity Building and Community Engagement

Conservation efforts require mobilisation of community and provision of sensitization programme. Throughout the implementation of this EMP, ongoing capacity building and community mobilisation will be taken place. Community will also include future contract and commercial farming community that would be based in the island for farming practices. This activity would not generate environmental impacts.

E. Reforestation at conservation buffer boundaries

During the reforestation process, careful consideration needs to be taken to ensure that existing coastal vegetation is not impacted especially within the turtle beach and also near the mangrove marsh area. The coconut palm that is removed for clarence land for farming activity may be used for reforestation at those areas, if needed. During this process, significant amount of waste, noise and vibration would be felt at those sensitive environments. These noise and vibration would be limited to brief time of reforestation only.

F. Project Management

The entire project from planning, design and construction works is managed by AgroNat. An office setup will be located on the site including erection of appropriate project information boards. A monitoring mechanism proposed in this EMP will be used by AgroNat to monitor both ecosystems.

1. Accumulation of waste

Implementation of the proposed project is associated with increase in waste production. Waste generated as the projects proceed is likely to get accumulated, which results in increase problems in managing the waste for a short-term period in the island. Thus, such waste accumulation during the construction phase can be considered as a direct impact, short-term with a significant level of impact, however easily reversible if concrete mitigation measures are adopted.

2. Health and Safety

The labour force employed for during the project may be subjected with health hazards such as during the construction and exposed to high noise. Due to lack of planning, implementation and negligence of work ethics in the area of construction, several unforeseen incidents have occurred. Additionally, during the last few years the number of such cases has increased. Therefore, the impact to health and safety needs to be taken into consideration during the planning and implementation stages, as it would significantly reduce emergence of such incident.

3. Accidental spillage or leakages

Contamination of sensitive environment due to leachate in the farming practices may be anticipated. During such a spillage might impact the terrestrial environment including mangrove body and turtle beach. These impacts are usually short to long-term and involves high cost to reverse it. In most of the case the spillage is high nutrient content leachate. Hence, a leachate control plan is recommended and mechanism to collect leachate is also addressed in the proposed project.

There are certain positive aspects of the project, which includes employment opportunities and research activities. With establishment of proper. Table 22 summarizes the significance of impacts of the proposed project.

Table 22 Summary of the significance of the impacts to the environment from the proposed project

Phase	Project Activities	Impacts	Types			Magnitude				Duration				Reversibility		
			Direct	Indirect	Cumulative	Negligible	Minor	Moderate	Major	Immediate	Short-term	Medium-term	Long-term	Insignificant	Reversible	Irreversible
Construction Phase	**Mobilization and Site Preparations**	Noise	x	x	x	x	x	x	x	x	x	x	x	x	x	
		GHG Emissions	x	x	x	x	x	x	x	x	x	x	x	x	x	
	Foundational Works	Ground Water contamination	x		x	x	x			x	x			x	x	
		Noise	x	x	x	x	x			x	x			x		
		Air Quality	x	x	x	x	x			x	x			x		
		GHG Emission	x	x	x	x	x			x	x			x		
	Construction of service or support building	Ground Water contamination	x		x	x	x			x	x			x	x	
		Noise	x	x	x	x	x			x	x			x		
		Air Quality	x	x	x	x	x			x	x			x		
		GHG Emission	x	x	x	x	x			x	x			x		
	Construction of Organic and Inorganic waste areas	Ground Water contamination	x		x	x	x			x	x			x	x	
		Noise	x	x	x	x	x			x	x			x		
		Air Quality	x	x	x	x	x			x	x			x		
		GHG Emission	x	x	x	x	x			x	x			x		
	Construction of Waste storage area (hazardous and non-hazardous)	Ground Water contamination	x		x	x	x			x	x			x	x	
		Noise	x	x	x	x	x			x	x			x		
		Air Quality	x	x	x	x	x			x	x			x		
		GHG Emission	x	x	x	x	x			x	x			x		
	Operation of facility	Air quality	x	x	x	x	x			x	x			x		
		GHG Emission	x	x	x	x	x			x	x			x		
	Leachate/Pests/Rodents/Odor/Noise/Litter/Storm water Management	GHG Emission	x	x	x	x	x			x	x			x		
		Social Well-being	x				x	x	x	x	x			x	x	
		Noise	x	x	x	x	x			x	x			x		
		Air Quality	x	x	x	x	x			x	x			x		
	Socio-Economic Status during operation	Social Well-being	x				x	x	x	x	x			x	x	

G. Limitations and uncertainties in impact prediction

The impacts identified and mitigation measures discussed in this EMP are not free from uncertainty. Prediction of any impact will have certain degree of uncertainty as project site specific long-term data of ecological, geomorphological and social condition of the island is poorly understood. Additionally, a brief field assessment was undertaken, which is a weak representation of the prevailing situation in the island. Furthermore, generally, Maldivian environmental settings are very poorly understood in the context of its origin and geological formation. Similarly, different islands in the Maldives have different and unique systems therefore, likely impacts in different islands would be varied across the archipelago, indicating that impacts predicted in this particular EMP would involve certain degree of uncertainty.

Despite, the inherent uncertainty of the proposed impact prediction care is taken to present a comprehensive impact assessment without bias. In this aspect, as discussed in the chapter 1, Methodology in addition to field assessment relevant and recent literature is analyses before predicting such impacts. In this notion, similar EMP exercise conducted and prepared by other consultants were also reviewed and analyzed.

VII. MITIGATION MEASURES

A. Introduction

Addressing any impact resulting from an implementation of proposed project requires a mitigation measure. Mitigation measures could be defined as actions that area taken to prevent, reduce or control any impact during any phase of the project. A full proof mitigation measures would ensure avoidance of negative impacts and enhancement of positive impacts generated from the project. Thus, this chapter aims to provide adequate mitigation measures for the impacts that were predicted during construction and operation phase of the proposed project.

B. Mitigation Assessment Methodology

Sustainability of the measures depend on factors such as benefit it generates, costing, required manpower, type or nature of equipment, relevant expertise, timing and availability of technologies. An adequate measure will incur zero to negligible cost with highest possible benefit to the environment with medium utilization of manpower and equipment.

This EMP have used these criteria in identifying mitigation measures for the proposed project.

C. Limitation

Even though a practical approach is undertaken to identify and recommend mitigation measures there is always likelihood of unforeseen impact. This may be due to the any of the reasons or combinations of the reasons below.

- The impact predicted might be much more significant in magnitude or likelihood, as different environmental settings effects differently.
- Monitoring plan is not followed adequately that would allow variations of the mitigations measures to reduce the level of impact.

D. Reforestation of buffer areas

Major impact that is likely to occur during reforestation are limited to noise pollution, air quality, GHG emissions. Hence, the following mitigation measures are proposed to address impacts that is occurring during mobilisation and site preparations works.

- All the loading and works shall be carried out under direct supervision as per recommendations of this EMP.
- Machineries shall be used by experienced workers
- All machineries and equipment's used would be well tuned and maintained
- All construction activities would be carried out in shortest possible time and only during day time
- Minimum machineries need to be used and most of the works shall be manual
- The construction sites would be fenced accordingly; this is expected to reduce noise pollution and dust to beach.
- Use fuel with low Sulfur content, to reduce emission of high global warming potential gases such as oxides of Sulfur.

E. Project Management

During the project implementation stages as indicated about significant amount of waste generation and accumulated is expected. In order to prevent the negative impacts of waste accumulation during the, the following mitigation measures need to be adopted.

- Waste Minimization efforts to be taken during the leachate flow to the sensitive areas
- Appropriately sort, label and handle waste in accordance with risks associated in handling different types of waste.
- Waste generated at the site would be taken to island or regional waste management facility for disposal on daily basis.
- All hazardous waste including oil should be properly handled and disposed to Regional Waste Management Facility.
- Recyclables would be traded to companies for recycling as per such demand.
- Develop protocols for research center, in line with the EPA guidelines (Annex B)
- Brief the working force on waste minimization and handling protocols prior to commencement of construction.
- Erecting of sign boards
- Formulation of code of conduct
- No noise activity within the sensitive area or buffer
- No light pollution
- Ongoing monitoring activities needs to be set to monitor the quality of beach.
- A proper maintenance needs to be attended immediately in such an incident.

Table 23 below shows a summary of the proposed mitigation measures during construction and operation phases of the proposed project.

Table 23 Summary matrix for the proposed mitigation measures of the project

Project Activity	Mitigation Measure	Expected benefits	Man power	Equipment/ tech./skills	Responsible Party	Cost (USD)
Reforestation of buffer zones	Machineries shall be used by experienced workers	Reduce noise pollution and GHG emission Reduced number of vegetation cleared	30	Strategic management of work force and machineries	AgroNat	500
	All machineries and equipment's used would be well tuned and maintained					
	All construction activities would be carried out in shortest possible time and only during day time					
	The construction sites would be fenced accordingly; this is expected to reduce noise pollution and dust to beach.					
	Use fuel with low Sulfur content.					
	Minimum machineries need to be used and most of the works shall be manual					
Project Management	Waste Minimization efforts to be taken during the constructional phase	Improved working conditions and health and safety of the working sites Avoidance of accidentals and emergencies Reduction of noise level at the turtle beach and wetland area. Reduced light pollution at the turtle beach	30	Strategic management of work force and machineries Allocation of designated area for waste collection Management of the research facility	AgroNat	2000
	Appropriately sort, label and handle waste in accordance with risks associated in handling different types of waste.					
	Waste generated at the site would be taken to island or regional waste management facility for disposal on daily basis.					
	All hazardous waste including oil should be properly handled and disposed to regional waste management facility.					
	Recyclables would be traded to companies for recycling as per such demand.					
	Brief the working force on waste minimization and handling protocols prior to commencement of construction.					
	Develop protocols for research center, in line with the EPA guidelines (Annex x)					
	Erecting of sign boards					
	Formulation of code of conduct					
	No noise activity within the sensitive area or buffer					
	No light pollution					
	Ongoing monitoring activities needs to be set to monitor the quality of beach.					
	A proper maintenance needs to be attended immediately in such an incident.					
	Installation of red lights within the coastal belt (only if required)					
Health and Safety	Close supervision and monitoring of the work by an expert		30		AgroNat	1500

Project Activity	Mitigation Measure	Expected benefits	Man power	Equipment/ tech./skills	Responsible Party	Cost (USD)
	Brief the workers on possible risks and health hazards in the engaged works	Avoidance of accidentals and emergencies. Improved groundwater quality. Improved soil conditions. No overflow of nutrient to wetland and beach.		Strategic management of work force and machineries Allocation of designated area for waste collection Management of the research facility		
	Strategic planning must be done prior to the constructional work					
	Usage of safety warning signs and tapes around the area to prevent any accidents					
	Appropriate clothing and attire should be used by the labourers					
	Works should be limited to daytime as to limit noise pollution					
	Adequate availability of health equipment during the whole constructing period.					
	Drains are well maintained, and clogs are removed regularly					
	Farmers are well brief and legally binding on leachate management.					

VIII. ENVIRONMENTAL MONITORING PLAN

A. Introduction

Environment monitoring framework is a methodological assessment of environmental stressors within the environmental settings over a long-term period within the project boundary (World Bank, 1999). In this regard, this chapter aims to provide an Environmental Monitoring Plan for the proposed IWRMC. This logical assessment is an important element to include in the overall EMP. The benefits from such a framework includes but not limited to the following.

- Helps determine whether the proposed mitigation measures are in place, and the overall effectiveness of these measures.
- Identification of corrective actions that may require during construction and operation phases of the proposed project.
- Facilitate monitoring of the effects of development prior to, during and after project implementation.
- Assess the accuracy of the impact prediction methods used.

B. Environmental Monitoring Plan

The Environmental Monitoring Plan will encompass of all the types of the monitoring to achieve a realistic and comprehensive Plan. The three widely used monitoring types are baseline, impact and compliance monitoring (Ogola, 2009). In this regard, the purpose of the monitoring plan is to analyses the extend and magnitude of the impacts and inform mitigation measures to further improve its effectiveness.

1. Baseline Monitoring

For the purpose of this EMP, a baseline environmental condition was assessed. The results were including in Chapter IV. Therefore, this information and data collected for undertaking this EMP would be used as a baseline data to carry out the monitoring work. The scope of the baseline monitoring are as follows.

- Terrestrial Vegetation Assessment
- Water quality
- Soil conditions
- Noise levels

2. Impact Monitoring

During the construction and operation phase of the proposed project the biophysical and socio-economic elements are subjected to change. The level of impact would be assessed through this type of monitoring. The scope of the impact monitoring are as follows.

- Accumulation of waste
- Leachate
- Noise levels
- Water quality

3. Compliance Monitoring

Consistence keeping of all records would fulfil the requirement of the EMP process in Maldives. Different environmental standards such as drinking water quality, sewage water quality and level of noise and air quality are developed in the country. The project needs to comply with all these requirements. Thus, the scope of the compliance monitoring are as follows.

- Accumulation of Waste
- Leachate
- Noise levels
- Accidental spillage

4. Monitoring Programme

Table 24 summarize proposed monitoring programme for the project during both construction and operation phase. Furthermore, the methodology adopted to collect information and data during the monitoring programme would be methodology adopted in this EIA (as discussed in Chapter I.F). The total cost of monitoring Programme is 1200 USD.

Table 24 Environmental Monitoring Programme for Proposed Project

Parameter	Indicator	Method	Frequency	Responsible Party	Estimated cost (USD)
Baseline Monitoring					
Flora and Fauna	Number of trees removed/replanted	Vegetation Survey	Annually	AgroNat	50
Wetland and Marine Water quality	Foul smell or colour	Visual assessment and parameters such as Nitrogen, Phosphate and Sulphate	Annually	AgroNat	50
Soil conditions	Leachate or oil spill	Visual assessment and Augur method	Annually	AgroNat	50
Noise levels	Increase noise level at sensitive areas	Noise meter	Annually	AgroNat	50
Impact Monitoring					
Leachate	Leachate or oil spills or rodents or pests	Visual assessment	Annually	AgroNat	50
Wetland and Marine Water quality	Foul smell or colour	Visual assessment and parameters such as Nitrogen, Phosphate and Sulphate	Annually	AgroNat	50
Solid waste	Quantity and type of waste	Visual	Annually	AgroNat	300
Compliance Monitoring					
Solid waste	Quantity and type of waste	Visual	Annually	AgroNat	300
Accidental Spills	Visual assessment	Waste and litter found at the beach and wetland area	Annually	AgroNat	100
Leachate	Leachate or oil spills or rodents or pests	Visual assessment	Annually	AgroNat	50

C. Environmental Management Plan

EMP will identify role of the stakeholders in assessing environmental impacts during the proposed project. It will also provide evidence that the proponent has been abiding the legislative requirements, guidelines and policies. The management plan proposed for the project would comprise of a framework with four major components. Figure 22 shows schematic of EMP.

- **Policy planning and monitoring** which outlines the planning of actions and the frequency of monitoring of actions
- **Implementation and operation** which outlines the major indicators of the actions which should be monitored for maintenance of standard and quality assurance and the measures to mitigate the impacts.
- **Remedial actions** which specify actions to address the inconsistence actions or problems identified during monitoring.
- **Auditing and reviewing** which is required to revisit the environmental management plan for better improvement of the plan as the project continues and change accordingly for quality of services.

Figure 22 Schematic flow of an EMP

1. Institutional Arrangement

Effective and meaningful engagement of stakeholders would determine the successful implementation of any project. The involvement of the stakeholders is depended on the key alignment of the objectives of the project.

Figure 23 shows the institutional arrangements for implementation of the project. Based on these parameters, at the during the design phase of the project, several stakeholders within the community, government and NGOs were identified. The main stakeholders that were identified

are as follows, along with their roles and responsibility with reference to the proposed project are outlined below.

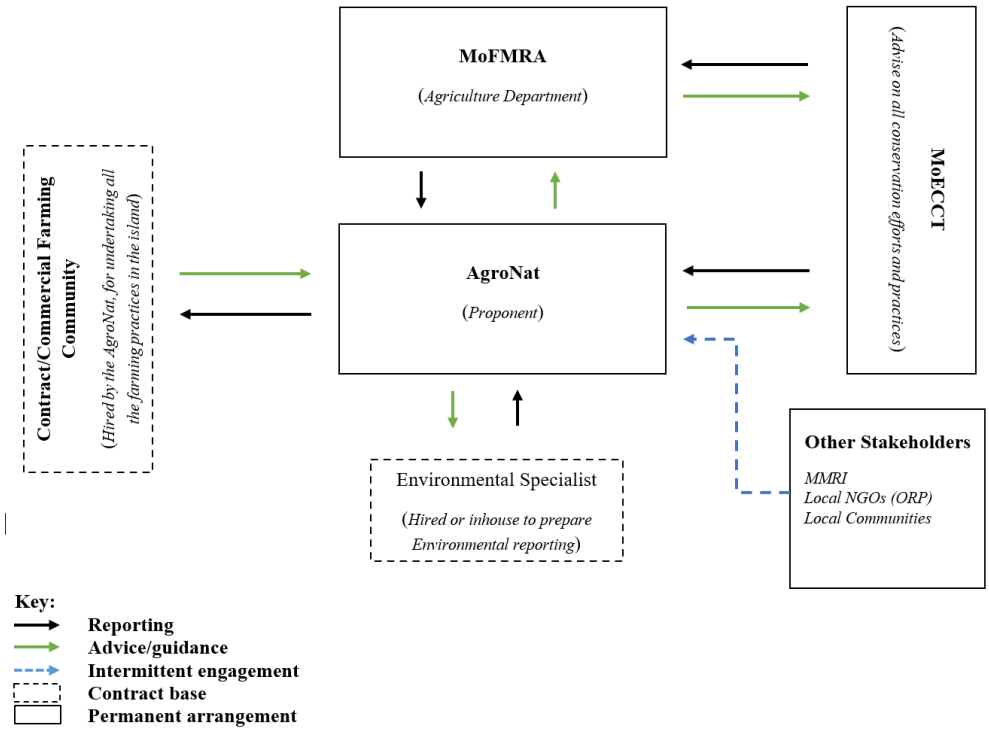

Figure 23: Institutional arrangements for the proposed project

2. Roles of Stakeholders

The main stakeholders that needed for the implementation of EMP are as follows.

AgroNat

AgroNat is the Proponent of this project. They would be responsible for oversee the project activities during the management of the project. The proponent has to be familiar with the rules and regulation relating to the project and conservation efforts. In addition, the proponent will carry out the activities in the management plans and the monitoring. The necessary expertise would have to be sought to prepare the monitoring reports, including preparation of Monitoring Report. AgroNat would be guided by MoECCT on conservation efforts.

Ministry of Environment, Climate Change and Technology

MoECCT in particular Conservations Department of the Ministry is responsible to formulate conservation and protection policies and necessary guidelines. This would be key institution that would provide technical assistance to the AgroNat during management of project activities.

Ministry of Fisheries, Marine Resources and Agriculture

MoFMRA is primarily responsible for all the policy works and implementation of marine and agricultural works within the country. The Agriculture Department within the Ministry is particularly involved in approval and management of those islands that are leased for agriculture purpose.

Maldives Marine Research Institute

MMRI, is tasked with overall work in undertaking marine research activities. In this regard, MMRI will liaise with AgroNat in conservation matters.

EPA

For environmental clearance EPA will go through their procedure of EPA to check this EMP before the construction approval would be given. Furthermore, EPA will enforce turtle Management Plan that is expected to come in next year.

Environmental Conservation Specialist (Inhouse/contract base)

The environmental expert should do the necessary field and analysis. The expert should also compare with the baseline conditions and advice the proponent on the necessary changes. The expert would carry out environmental audits necessary for the enhancement of the management and monitoring plan.

Other Stakeholders

Furthermore, local NGOs will be also important stakeholders that would enable creating awareness within the local communities to drive positive change on waste management issues.

3. Structure of the Monitoring Report

Based on the data collected, a mid-term monitoring report will be compiled and submitted to the relevant authorities for compliance. Following is a possible sample structure of the report.

1. Introduction
    a. Background about the project
    b. Status of the baseline assessment
2. Field assessment for monitoring
    a. Assessment methodology
    b. Assessment results and analysis
3. Recommendations and conclusions
    a. Results compared to baselines status
    b. Recommendations for improvements

D. Commitment by the Proponent

The proponent is fully committed to undertaking the monitoring program outlined in this section (refer Appendix G).

IX. CONCLUSIONS

The aim of this EMP has successfully assessed and evaluated the potential environmental and socio-economic impacts of the proposed rehabilitation and conservation efforts of Turtle Beach and Mangrove area at L. Gaadhoo. The EMP was prepared in accordance to the 2012 EIA Regulations, in particular to the Schedule E3. This project is financed by the AgroNat. The project proponent is AgroNat.

AgroNat also aims to achieve economic targets relating to food security, import substitution, creation of jobs and improving the trade balance. To expand the agricultural farming, few islands including L. Gaadhoo was leased to AgroNat.

The proposed island has two environmentally significant areas including a green sea turtle nesting beach and wetland. The proposed activities are to maintain a green buffer of 30 m at the turtle nesting beach (southern beach of the island) and 30 m around the wetland areas. Coconut palm buffer zone is recommended as they would absorb light and noise pollution which would alter the natural habitat.

The main impacts would be due to noise activity; hence it is recommended not undertake high noise activity within the close proximity of these established buffer zones.

The EMP provides appropriate the mitigation measures for the identified major associated impacts are suggested. These include proper supervision by closed experts. Additionally, ensuring work is completed in the shortest possible time during day time only is also identified as one the preventive mitigation measures in reducing the impacts identified. This also includes measures to address impacts due to leachate management.

Environment Monitoring Plan is proposed to determine changes to the environmental parameters due to the project. The monitoring is estimated to cost USD 1200 per annum.

Although the project involves inevitable negative environmental impacts, such impacts are not serving as to not undertake the project. Mitigation measures have been proposed to adequately minimize the significant impacts. Hence, the project is justifiable in light of the socioeconomic conditions and anticipated benefits from the project which clearly outweigh the negative environmental impacts.

DECLARATION OF CONSULTANTS

I confirm that this EMP has been prepared in accordance with the EIA regulation 2012 and other related legal instruments. I certify that the statements made in this EMP are true, complete and correct to the best of our knowledge and abilities.

Mareer Mohamed Husny | (EIA P01/2019)

DECLARATION OF PROPONENT

The proponent's commitment to the entire project during construction and operation phase of the project is annexed in Appendix G.

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APPENDIX A: SCHEDULE E3 OF 2012 EIA REGULATIONS AND TOR

Schedule E (3)

Contents of Environmental Management Plan

Copy of the Environmental Management Plan should be submitted on A4 size paper, containing fold-out maps on A3 size paper. The report shall be signed by the proponent and the consultant. The Management Plan may be submitted in Dhivehi and English.

Title page
This page should contain:

- Name of project;
- location of project;
- names of individual members (including consultants) of the team responsible producing the Environmental Management Plan;
- proponent's name and signature; and
- date completed.

Introduction
Environmental Management Plan should include background information on the project, including project plans, purpose, objectives and details of project schedules.

Project Description
This should describe the type of project with detailed implementation plans of the project. This should include the following:

- Project location
  This should include details of project location identifying the location of planned activities of the project; scaled site plan (at least A3 size) showing locations of all proposed project components; and background information on the habitat and the surrounding environment of the project location.

- Activities of the construction and implementation phase of the project
  The details of activities during construction and implementation phase of the project should be included. It should also include:
  - Schedule of activities planned for the construction and implementation phase
  - Project timeframe. Details of any additions or extensions.
  - Types and counts of staff.
  - Equipment and machinery to be used.
  - Locations of dedicated work areas and facilities

- Project Schedule
  Planned project start and end dates should be provided. If the project is distributed to phases, start and end dates for each phase should be provided.

Relation of Environmental Management Plan to Project

This should include the relationship between the Environmental Management Plan and the Project. As such, the details of studies conducted and decisions reached should be included. Summaries of communication and recommendations received from respective government authorities and related parties shall be included. Details of how the outcomes from any such discussions are incorporated into the Environmental Management Plan shall also be included.

Objectives of the Environmental Management Plan

The target objectives of the Environmental Management Plan may be presented in point form in this section. As such, regular management activities to maintain the project implementation location and associated features of the location, may be included.

Scope of Environmental Management Plan

(a) Impact assessment and determining mitigation procedures: Possible impacts from the project should be determined and included in the Plan, including details of most appropriate conditions for mitigation procedures. The structural and non-structural mitigation procedures of the plan should be presented separately. And the stage at which the project would roll into an active phase should be detailed in the Environmental Management Plan.

(b) Development plans: During checklist preparation, and environment assessment stages, the details of the expected profits and exposed opportunities from the project should be identified and included. Some of these opportunities may be further developed so as to benefit the surrounding environment and general living conditions. And plans for sustainable development of such opportunities shall be included in the Environmental Management Plan.

(c) Environmental impact monitoring programmes: In order to ensure that the proposed mitigation procedures are carried at the national standards and that they do achieve their objectives, Environmental Impact monitoring programmes should be included in the Environmental Management Plan. Such programmes shall include the following:

1. Measures and standards to determine the positive or negative environmental effects from each mitigation function
2. Method of determining affects
3. Frequency
4. Measures
5. Areas of survey to determine the affects

(d) Responsible parties: responsible parties for carrying out mitigation functions and conducting monitoring programmes should be identified in the Environmental Management Plan. The interrelations and co-ordination systems between the different parties involved in the mitigation functions and monitoring programmes should be detailed in the Plan.

(e) Schedule of activities of the Environmental Management Plan: The details of the timeframes and frequency of the different activities of the Environmental Management Plan should be included.

(f) Reporting: The policies for reporting outcomes from mitigation functions and monitoring programme, to the relevant authorities should be detailed in the Environmental Management Plan. As such these plans should include how contractors and sub-contractors report to the proponent and how the proponent reports to the ministry, including the responsible parties for the different stages of reporting.

(g) Expenses: The details of the costs on mitigation functions and monitoring programmes should be included.

Declaration of the Consultant

I certify that the statements made in this Environmental Management Plan are true, complete and correct.

Name: _____

Signature: _____

Date: _____

Appendices

These should include:

- additional technical information and baseline data;
- full list of references;
- names and Registration Certificate numbers of the Environmental Management Plan consultants; and
- CV s of any unregistered individuals who participated in the preparation of the Environmental Management Plan.

بسم الله الرحمان الرحيم

Request for Quotations

(Development of an Environmental Management Plan for Turtle and Mangrove rehabilitation Programme in L. Gaadhoo)

ANNEX 1: TERMS OF REFERENCE

Objective and Scope of Preparation of Mangrove and Turtle Conservation Plan

L. Gaadhoo is identified as one of the islands in the Maldives that has unique mangrove habitat. Additionally, the island is also known as turtle breeding ground. Hence, this project aims to prepare a Mangrove and Turtle Protection and Conservation Plan for the island. In order to ensure short and long-term environmental impacts that would arise due to improvement and rehabilitation work (to be described in the first section based on the sub-project/activity), a Protection and Conservation Plan will be developed as per the EMP (Schedule E 3) scope presented below and in accordance to the Environmental Impact Assessment Regulations (2012).

1. **Introduction:** Briefly describe the major components of the proposed project. Provide background information on the project, including project plans, purpose, objectives, and details of project schedules.

   The introductory chapter should also cover the legal aspects related to the project, which is detailed below.

   Legislative and Regulatory Considerations: Outline the project's consistency with the existing national, state, regional and local planning that apply to the project include reference to relevant statutory and non-statutory plans, planning policies, guidelines, strategies, and agreements as appropriate. Outline the pertinent policies, regulations and standards governing project location, land use, environmental quality, and public health and safety. This section does not have to be exhaustive but should cover information on legal requirements specific to the project, such as permits to be taken under the Environmental Impact Regulations (2012) and the land allocation process followed with MLSA and other relevant institutions.

2. **Study Area:** Specify the boundaries of the study area for the protection and conservation area highlighting the location and size of the proposed location. The study area should include nearby

environmentally sensitive areas. Justification for site selection shall be provided (A3 size Scaled). Relevant developments in the area must also be addressed including residential areas and all economic ventures and cultural sites.

3. **Existing Environment:** The existing environment study will not require detailed data collection and survey, analysis techniques since this is a Conservation Plan and not a full EIA study. However, the following information must be provided based on field observations and consultations with the island council and the community. Photographic evidence should be provided where appropriate.

a) Coastal Modification / Erosion: Provide information related to any coastal modifications undertaken in the island in recent history and the side of the island subjected to coastal erosion. Indicate whether any coastal erosion is noticed from the shoreline closest to the proposed development.
b) Vegetation present at the site: Describe the number and type of vegetation present at the project site including scientific and local names.
c) Protected Areas and Environmentally Sensitive Sites: Provide information on the environmentally protected and sensitive areas that exists close to the proposed development.

4. **Project Description:** Provide a full description and justification of relevant parts of the project, using maps at appropriate scale where necessary. The following should be provided including all inputs and outputs related to the proposed activities shall be justified.

a) Provide a clearly labelled concept design and scaled site plan of the project boundary.
b) Submit a detailed description of the components of the project and how the project activities will be undertaken.
c) Describe the activities of the proposed components.
d) Describe the operational phase components of the project including operationalization of the EMP Action Plan
e) Include a project schedule.
f) A matrix of inputs and outputs related to the project activities shall be included and described separately for construction and operational phase.

5. **Impact Identification:** The EMP report should identify all the impacts, direct and indirect, during rehabilitation programme, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

a) Physical / Chemical: describe impacts on groundwater, soil, noise, and waste.
b) Biological: describe impacts on vegetation and fauna.

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 outline all positive and negative/short and long-term impacts. Identify impacts that are cumulative and unavoidable.

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. Mitigation measures to avoid or compensate the rehabilitation process. 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.

7. **Development of monitoring and Conservation plan:** Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for vegetation clearance, spillage assessment and grievance redress mechanism. 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. The plan shall also identify positive actions and strategies that would be required to sustain the ecosystem including an action plan for conservation of core habitat identified.

8. **Stakeholder consultation:** Identify appropriate mechanisms for providing information on the development project to relevant stakeholders. Consultations must be undertaken with the island council and local NGOs. The report should include a list of people/groups consulted, their contact details and summary of the major outcomes.

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

APPENDIX B: EPA GUIDELINES ON TURTLE RESEARCH CENTER

Guideline for Sea Turtles Rehabilitation and Care

The following conditions must be met for all species of sea turtles held in captivity for research and rescue purpose in the Maldives under permit issued by Environmental Protection Agency in accordance with the Environment Protection and Preservation Act 4/93. Conditions are also included for the transport, rehabilitation, and disposition of sea turtles.

Educational Display of Captive Turtles:

1. Interpretive signage in both Dhivehi and English must be accompanied with Turtles on display. These displays must include the following: species identification, protection status under the IUCN Red list of threatened species, general life history, and current conservation issues (e.g., incidental capture in fisheries, boat strikes, ingestion of debris, ocean dumping, loss of nesting beaches, loss of developmental habitats and adult foraging grounds, beachfront lighting, etc.)

2. For any rehabilitating turtle proposed for public display, the veterinarian responsible for the care of the animal must deem that the turtle is stable and the additional stress associated with public display will not affect the turtle's health. The release of the turtle must not be delayed or expedited to facilitate the public display.

3. It is the responsibility of the individual/institution to which a permit is issued to ensure that their facility has the necessary tank space to accommodate the sea turtles until it is ready for release. Turtles obtained as hatchlings with injuries/abnormalities does not need to be moved to another facility because of inadequate tank space. However, turtle hatchlings free of abnormalities or defect should not be held in the facility for display.

4. Visitors must be given clear instructions to minimize disturbance and stress to turtles. Touching of turtles or their tanks, excessive noise, and flash photography should be prohibited.

5. Tanks must be half covered or have a hiding spot for turtles to decrease stress. Tanks must have access to sunlight to exhibit natural basking behavior.

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Rehabilitation

Transport

1. Sea turtles must be transported in a climate-controlled environment (temperatures between 21°C and 27°C (70°F and 80°F)), protected from extremes of heat and cold, and kept moist.
If a turtle is transported at temperatures greater than or equal to 23.9°C (75°F), it must be cooled by keeping a wet towel on the carapace and by periodically applying water. Water and wet towels must not be used when transporting turtles at temperatures less than 23.9°C (75°F) or at any time they are exposed to an air-conditioned environment (exception: open wounds must be kept moist with clean freshwater regardless of temperature). At temperatures less than 23.9°C (75°F), juvenile turtles (less than 30 cm straight carapace length) may be kept from drying out during transport by applying a thin layer of a water-based, water soluble, nonpetroleum lubricant (e.g., K-Y Jelly) to the carapace and all the soft tissues (except the eyes and any open wounds). Larger turtles (≥30 cm straight carapace length) do not need a lubricant because they are less likely to dry out due to their low surface to volume ratio: use of a lubricant should be avoided to minimize handling injuries. If transport is longer than 45 minutes, ophthalmic gel may be used to maintain moisture in the turtle's eyes to avoid eye damage.

2. Turtles must be placed in closed containers with sufficient holes for adequate ventilation during transport. Turtles must not be transported in water. The containers housing turtles during transport must be padded and must not contain any material that could be accidentally ingested.

3. Hatchlings (sea turtles with a straight carapace length ≤ 4 cm) must be transported in a container with moist sand. Post-hatchlings (sea turtles with a straight carapace length > 4 cm and ≤ 6 cm for all species except leatherbacks) must be transported in a container with a damp towel or cloth at the bottom of the container.

4. The containers must be secured during transport so they do not slide around or tip over. A research permit/no objection letter from EPA must accompany turtles during transport.

5. It is encouraged to apply a wet cloth across turtle's eyes as it reduces stress during handling for transportation.

Sea turtle holding facility requirements

Tank Size requirements

1. Hatchlings and post-hatchlings (up to 6 centimeters straight carapace length) – for one hatchling, a tank or sub-section of a tank with a surface area of at least five times the shell length by two times the shell straight carapace width of the turtle plus a minimum water depth of 1 foot. The minimum tank width must be no less than two times the shell width. Hatchlings must be housed separately.

2. Turtles greater than 6 centimeters and up to 50 centimeters straight carapace length – for one turtle, a tank with a surface area of at least seven times the shell length by two times the shell straight carapace width of the turtle plus a minimum water depth of 3 feet. For each additional turtle, increase the original surface area by 50%. The minimum tank width must be no less than two times the shell(s) width (i.e., for multiple turtles, the sum of the shell straight carapace widths must be multiplied by two to determine the minimum tank width).

3. Turtles greater than 50 centimeters and up to 65 centimeters straight carapace length – for one turtle, a tank with a surface area of at least seven times the shell length by two times the shell width of the turtle plus a minimum water depth of 3 feet. For each additional turtle, increase the original surface area by 50%. The minimum tank width must be no less than two times the shell(s) straight carapace width (i.e., for multiple turtles, the sum of the shell straight carapace widths must be multiplied by two to determine the minimum tank width).

4. Turtles with a straight carapace length greater than 65 centimeters – for one turtle, a tank with a surface area of at least nine times the shell length by two times the shell straight carapace width of the turtle plus a minimum water depth of 4 feet. For each additional turtle, increase the original surface area by 100%. The minimum tank width must be no less than two times the shell(s) width (i.e., for multiple turtles, the sum of the shell straight carapace widths must be multiplied by two to determine the minimum tank width).

Exceptions:

a. Sick or injured turtles may be held in a smaller isolation tank if determined by a veterinarian to facilitate treatments. Any turtles held for this purpose must be protected from desiccation and moved to an appropriate tank as soon as health allows.

b. If necessary, hatchlings or post-hatchlings being held short term (to allow time to arrange

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safe release to the wild) may be held in a tank with dimensions less than those required above. They must be separated if aggression is observed between the hatchlings.

Tank Condition Requirements

1. The inside surfaces of any holding tank must be non-abrasive, free of burrs or projections that could cause harm to turtles, and free of toxic heavy metals and organics, such as lead or copper paints. Any tank with painted surfaces must be free of biological hazardous material and must not be actively chipping or flaking.

2. A holding tank must not contain any non-food items that may be ingested by a turtle or any items that would obstruct a turtle's ability to surface either to breathe or to float.

3. A holding tank must not contain entangling materials. Rock ledges or other habitat mimicking items in the tank are encouraged to allow turtles to rest. However, these items must be constructed or placed in a manner that ensures a turtle cannot become tightly wedged or trapped underwater.

4. A tank must be designed to ensure the turtle stays within the tank at all times unless removed by facility personnel.

5. The drains or intakes of a holding tank must be constructed or securely shielded to prevent accidental entrapment. Inflows and drains must be placed to ensure appropriate water turnover and flow rates throughout all areas of the tank.

6. To help prevent the water temperature from becoming too warm (> 30°C/86°F), any outdoor holding tank must be at least 30% shaded. If water is recirculated, shading must be increased to at least 50% shaded.

7. All the tanks in which sea turtles are housed must have enough lighting (sunlight and/or artificial lighting) to allow for easy viewing of the animals in all areas of the tank. Outdoor tanks with shading are encouraged as it mimics the natural environment

8. UV requirements must be met for all sea turtles held in center, either provided by natural sunlight during daylight hours or if artificial lighting is used, good quality full spectrum bulbs (UVA/UVB) (wavelength of UVB -280 nm to 320 nm) must be used to promote general health and avoid potential metabolic problems. These bulbs must be changed every 6 months and placed at suitable distance as

to allow sufficient UVB absorption (24 inches is the usual maximum distance and <12 inches often suggested by manufacturers) If “diffusers” are used, care must be taken to ensure appropriate full spectrum exposure. If UV requirements are not met, then hatchling and juvenile turtles should not be kept at the facility and adults should only be kept on a short-term emergency basis.

9. The photoperiod of captive sea turtles must be similar to a natural photoperiod and mimic the daylight hours. Tanks must not be artificially illuminated to provide a photoperiod of more than 14 hours per 24-hour period to represent the natural seasonal photoperiods.

10. When tending to the animals at night it is advisable to use red lights by the facility to avoid unnecessary stress.

Water Quality

1. The salinity must be maintained between 20 ppt and 35 ppt. If necessary, sea turtles may be maintained in more or less saline water for up to 24 hours per week. Sick or injured sea turtles may be kept at salinities below 20 ppt or above 35 ppt as prescribed by a veterinarian. It is advisable to pump seawater directly from the sea which is filtered for small debris and circulated.

2. Water pH must be maintained between 7.2 and 8.5.

3. Water temperature must be maintained between 20°C and 30°C (68°F and 86°F). High and low extremes may induce disease (particularly fungal), injury, or even death and must be avoided.

4. Chlorine can be used to treat the water to reduce bacterial and algae growth, but levels must be kept below 1.0 part per million (ppm). Chlorine levels greater than 1.0 ppm may cause irritation to turtle eyes.

5. No other chemical may be used to treat water in a tank housing sea turtles if the chemical is not safely ingestible by turtles at the dilution that would be needed for effective treatment.

6. Coliform bacteria must not exceed 1,000 MPN (most probable number) per 100 ml of water. Steps must be taken to prevent the conditions in which coliform bacteria proliferate (removing suspended material and larger pieces of feces and leftover food). EPA reserves the right to request total coliform counts every 3 months or more frequently if conditions warrant it.

7. The water must be clear enough to allow easy viewing of sea turtles in any part of the tank to assess health and activity.

8. Facilities holding turtles for rehabilitation must have tanks that maintain water quality by filtration or flow through. Tanks that require complete or near complete water changes as the sole means of maintaining water quality, such that the water level is dropped to the point where the turtle is sitting on the tank floor ("dump and fill"), may only be used for rehabilitation on a "temporary" (defined as an event where the turtle is expected to be medically cleared and ready for release within a 45-day period) or on an "emergency" (defined as an acute mass stranding event or an equipment-related failure at the facility such as power outages) basis as these conditions are not acceptable for long-term rehabilitation due to the additional stress caused by frequent maintenance.

9. Any flow-through seawater system must be maintained to facilitate sufficient turnover of seawater. At a minimum, any flow-through system must have a filtration system on intake. For closed or semi-open systems, filtration must be incorporated into the system to ensure appropriate water quality of recirculated water. Filtration and flow through systems must be able to maintain the minimum water quality parameters.

10.The facility must have the ability to (1) monitor and operate within the parameters described in this document, (2) correct any situation in which the parameters are not met, and (3) properly care for the sea turtles while corrective measures are being taken.

11. Treatment or pre-filtration of fresh seawater is recommended to remove infectious cercariae (parasitic larva of a trematode worm).

12. If sea turtle tanks are regularly drained and cleaned, adequate holding tanks must be available to house the turtles safely during this time.

Handling of sea turtle eggs/ hatchlings

1. Sea turtle hatchlings are only permitted to be held in care if they have been recently confiscated as pets and are sick/injured or suffering from abnormalities. They should not be held longer than necessary and as soon as they are deemed healthy by the veterinarian they should be released without delay. If any sea turtle hatchlings are being rehabilitated in the facility, EPA should be notified through email (erc@epa.gov.mv) within 24 hours.

2. Under no circumstances should hatchlings be retained as pets, for display or for profiteering. Hatchlings benefit from residual yolk that is internalized at hatching and is sufficient, under natural conditions, to nourish them during their offshore swim. If held captive during their earliest days, hatchlings may fall short of their swimming goal and meet an untimely death.

3. The natural process of turtles emerging from nests on their own and making their way to the sea should be practiced. Under no circumstances, they should be collected from nests and released altogether. If hatchlings are making their way safely to sea, no one should interfere with the process and allow the hatchlings to proceed naturally. However, if hatchlings travel inland due to disorientation, they should be collected and released on the beach oriented to the sea immediately without any delay.

4. Nest relocation will be allowed on cases of beach erosion, salt inundation, predation or development projects in those areas. Ideally nests should be moved within 4-6 hours of nesting and no later than 12 hours after deposition to ensure the survival of the eggs. EPA should be notified through email (erc@epa.gov.mv) and approval must be obtained to relocate a nest.

5. Permit will be suspended for facilities housing healthy sea turtle hatchlings without informing EPA.

Food and Feeding

1. The food fed to the turtles must be of good quality and comparable quality of food that is reflective of their diet in wild. Food must either be fresh, flash frozen and glazed, or frozen in some other manner that ensures the quality of it. Any frozen food must be completely thawed in cool air, preferably, or cool water, prior to feeding and used entirely or discarded. Under no circumstances may food be refrozen.

2. Proper diets for sea turtles should be established by the holding facility to ensure that turtles do not become obese. It is the responsibility of the holding facility to ensure and justify the adequacy of its feeding regimen for each species and size class.

3. Unless absolutely necessary for rehabilitation, hand feeding of turtles that is soon to be released should not be practiced. The turtle must be allowed to feed on its own as soon as possible. The use of bottom feeders or other tools mimicking the natural feeding environment is encouraged.

4. Prior to release, turtles of species that routinely feed on live prey in the wild must be

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provided with and observed capturing live food prior to release to ensure sufficient foraging capabilities.

Access to veterinary medical care

1. Injured sea turtles kept at any center should either have direct access to veterinary care or be able to be transported to a veterinary facility within an acceptable time frame (24 hours).

2. Non-veterinary personnel at a center may be directed to administer certain treatments and non-controlled drugs under the guidance and supervision of a veterinary surgeon.

3. Only registered veterinary surgeons may perform acts of veterinary surgery. Only veterinary surgeons may diagnose, prescribe, advise on the basis of a diagnosis and perform surgery on animals.
    - Acts of surgery are not permitted to be performed by non-veterinary personnel, including human medical doctors, based on the unique anatomy and physiology of reptiles. Only a qualified veterinary surgeon has the knowledge to perform such surgery safely and effectively.
    - Surgery can only be performed with anesthetic and analgesia provision, administered by the veterinary surgeon.

4. Injured or diseased animals should be physically separated with their own clean seawater source, and all reasonable efforts made to avoid cross-contamination to unaffected animals.

5. When a facility's veterinarian has determined that the turtle has recovered sufficiently from its illness or injury and is ready for release, the permit holder, must contact EPA within 24 hours to notify the time and site for the release. The site for release must be determined based on the latest scientific information on turtle movements or regional knowledge.

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Inspection

In order to ensure that facilities holding live sea turtles for rehabilitation, education, and/or research is maintaining the requirements for care and rehabilitation, and are in compliance with Environment Protection and Preservation Act 4/93 and guidelines, all facilities are subject to inspection by EPA at least twice a year. The permit holder must agree to facilitate and accommodate these visits.

EPA should be notified through email (erc@epa.gov.mv) within 24 hours of all the turtles rehabilitated and released back to the wild.

Facilities may be asked to provide a current coliform bacteria count and water quality data upon inspection. If the facility does not meet the requirements of their permit, which include the above *Guideline for sea turtle rehabilitation and care*, it will be considered a violation of the protected species research permit and could result in the permit being suspended.

ENVIRONMENTAL PROTECTION AGENCY
Male', Rep of Maldives

APPENDIX C: PROJECT IMPACT BOUNDARY


73°26'40"E
73°26'50"E
73°27'0"E
73°27'10"E
73°27'20"E
73°27'30"E
1°49'40"N
1°49'30"N
1°49'20"N
1°49'10"N
1°49'0"N
N
W
E
S
Legend
Ecological / Cultural Sensitive Area
Primary Impact
Secondary Impact Area
UTM Zone 43N
WGS 1984
0 25 50 100 150 200
Meters
Environmnetal Assessment of
Laamu Gaadhoo
Map Prepared by
Mareer Mohamed Husny

APPENDIX D: STAKEHOLDER MEETING RECORDS

Name	Designation	Office	Email/Contact no
Haroon Rasheed	Managing Director	AgroNat	haroon.rasheed@agronational.mv
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Mohamed Shimal	Marine Biologist	MMRI	mohamed.shimal@mmri.gov.mv
Ismail Ali	President of the Laamu Atoll Council	Laamu Atoll Council	info@laamu.gov.mv
Isha Afeef	Sea Turtle Biologist and Guest Educator	ORP	laamu@oliveridleyproject.org

APPENDIX E: COMMITMENT LETTER BY PROJECT PROPONENT

APPENDIX F: EVIDENCE OF EMP REPORT SUBMISSION TO ATOLL COUNCILS