

ENVIRONMENTAL IMPACT ASSESSMENT

For the Proposed Deep Sea Dredging

**to Reclaim and Develop 3 Resort Islands in North Male' Atoll Lagoon
(4°40'28.8"N 73°32'02.2"E - 4°40'18.4"N 73°32'24.6"E),**

Proponent:

Bodufaru Beach Resort Pvt. Ltd.

Consultant:

Amir Musthafa (EIA01/13)

August 2016

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Consultants Declaration

This EIA has been prepared according to the EIA Regulations. I certify that the statements in this Environmental Impact Assessment study are true, complete and correct to the best of my knowledge and abilities

A handwritten signature in blue ink, appearing to read 'Amir Musthafa', is written over a light blue grid background.

Amir Musthafa (EIA 01/13)

17th August 2016

Proponents Declaration

(attached in the following page)

BODUFARU BEACH RESORT PRIVATE LIMITED

No. 2-C Faamudheyriige Building, Orchid Magu, Male'
COMPANY REGISTRATION NO: C-0890/2014

Mr. Ibrahim Naeem
Director General
Environment Protection Agency
Ministry of Environment and Energy
Male', Maldives

17th August 2016

Dear Mr. Ibrahim Naeem,

Project: Proposed Deep sea Dredging to Reclaim and Develop 3 Resort Islands on the Lagoon (4°40'28.8"N 73°32'02.2"E AND 4°40'18.4"N 73°32'24.6"E) in Kaafu Atoll.

Subject: Proponents Declaration and Commitment for Monitoring and Mitigation

As the proponent of the project, we guarantee that we have read the report and to the best of our knowledge, all non-technical information provided here are accurate and complete. We are aware that this EIA report has been prepared in accordance with the EIA regulations.

We confirm our commitment to undertake all mitigation measures and carry out the monitoring program as specified in the report.

Thanking you

Yours Sincerely



Mohamed Niham
Director

Non Technical Summary

This report is the EIA undertaken for the Proposed deep sea dredging to reclaim and develop 3 resort islands in North Male' Atoll lagoon (4°40'28.8"N 73°32'02.2"E - 4°40'18.4"N 73°32'24.6"E). The EIA for the 3 Resort island reclamation and development have been approved by the Ministry of Tourism on 26th May 2016. This EIA only studies the proposed borrow area for the deep sea dredging and the conditions and impacts of dredging from this area.

An Environmental Impact Assessment was necessary for the works outlined in this report as they fall under the 'Jadhuvalu R' of the Environmental Impact Assessment Regulations 2012 of the Maldives. This report would further conform to the Dredging and Reclamation regulation. In addition to meeting the regulatory requirements, the report would further assist the proponent and important stakeholders to make decisions in an environmentally sound manner. Although this is for a tourism development, since the borrow area is not within an area dedicated for tourism activities, an approval from the EPA was necessary.

Potential borrow areas in the northern areas of North Male' Atoll close to the project area was investigated. The dredging location chosen is about 5 km west of the Project site. The overall environmental impacts of the project have been assessed using frameworks found on literature and the results indicate that the proposed project has minimum negative impact and have an overall net positive outcome. The approved EIA discusses both lagoon dredging using a Cutter Suction Dredger (CSD), and deep sea lagoon dredging using a Trailer Suction Hopper Dredger (TSHD) The main environmental positive impacts due to opting for TSHD is that there will be virtually no impact on the house reef of the project site due to the dredging activities. Furthermore, the proposed borrow area is not even remotely close to any site designated as a sensitive area or protected area by the EPA. There are some locations that are used by Divers close to the borrow area. However, the dredging location is still over 500m away from these locations. Dredging activities will no doubt increase sedimentation impacts in the area, and diving at these 3-4 locations during the dredging activities will not be pleasant. However, lasting impacts are not envisaged based on other similar projects undertaken recently. There are no known popular bait fishing grounds near the borrow area. There are no additional impacts due to reclamation as there is no change in scope with regards to this component from the approved EIA.

Important stakeholders for the project include Helengeli Island Resort, Gaafaru council, Ministry of Tourism, and Ministry of Fisheries and Agriculture. The main reservations by the stakeholders is the fact that sand is borrowed from area perceived to be close the respective stakeholders property. Moreover, they expressed their concerns on the impact of dredging works on the fisheries and tourism of the North Atoll. Gaafaru council did note

that they did not have much concerns with regards to the project due to the proximity of Gaafaru with respect to the borrow area, and due the presence of deep sea in-between. The stakeholders were informed of the previous islands reclaimed under the same project and how the impacts were minimal.

Alternative borrow area options are not viable as the sand search campaign concluded that there are no other significant sand depots within close proximity to the project area. However, another sand deposit 11.5km from the project site was investigated. It is envisaged that this area can barely the supply of sand required. Importing sand from abroad will be very costly and will have further negative impacts at the reclaim site and is not regarded as a realistic alternative.

It is recommended to continue to monitor the impacts of the proposed project by regular monitoring of marine water quality and marine environment. The monitoring plan proposed in the approved EIA is slightly modified to include more monitoring locations, near borrow area. A two stage monitoring plan is given, which recommends monitoring during dredging activities, and a monitoring trip straight after completion of dredging.. Undertaking the monitoring, along with the mitigation measures is necessary to ensure the sustainable development of the project with minimum harm to the environment.

It is thus recommended that since the project has major socio-economic benefits and environmental benefits as detailed in the initial EIA and summarised in this report, to allow the project to proceed as proposed. Moreover, since the proposed borrow area is at a considerable distance from any sensitive area, and since the initial EIA has been approved, and also considering the fact that the sand search campaign resulted in only 1 location within reasonable distance from the project to obtain sufficient volumes of sand, there is no viable reason to postpone or cancel the project due to this change. However, mitigation measures should be in place and continuous monitoring should be undertaken.

1. Introduction

1.1 Background

This Environmental Impact Assessment (EIA) report has been prepared in order to meet the requirements of Clause 5 of the Environmental Protection and Preservation Act of the Maldives to assess the impacts of the proposed deep sea borrow area to reclaim and develop 3 island resort island in north Male' Lagoon (4°40'28.8"N 73°32'02.2"E - 4°40'18.4"N 73°32'24.6"E) It is also an objective of the report to conform to the Regulation set by the Environmental Protection Agency.

The report will look at the justifications for the proposed borrow area and it will identify and determine the significance of the potential impacts of the proposed works, in addition to determining the existing environment of the area. It would also give more information on how the sand will be placed during reclamation. Alternatives to proposed components or activities in terms of location, design and environmental considerations would be suggested along with measures to mitigate any negative impact on the environment. Environmental monitoring programme is vital in order to demonstrate the long-term sustainability of the proposed project as well as to undertake mitigation measures before any impact leads to long-term significant effects. Long term monitoring helps to understand uncertainties in impact analysis improving future impact predictions and project implementation.

The major findings of this report are based assessments undertaken on 2nd to 17th August 2016. Available long-term data were collected from available sources, such as long-term data on meteorology and climate from local and global databases.

1.2 Literature Review

A literature review was undertaken to acquire background information on the site and the surroundings in addition to similar deep sea dredging works that have been carried out recently. The same contractor, Van Oord had undertaken dredging works in Feydhoo, Thinadhoo, Himmafushi, and 'Ithaafushi Lagoon' prior to this project and studies carried out for these works have been referred to.

For this EIA, the following EIAs and EIA Addendums were reviewed.

- EIA addendum for S. Feydhoo reclamation EIA (Musthafa 2016)
- EIA addendum for GDh. Thinadhoo reclamation EIA (Musthafa 2016)

- EIA for the proposed dredging activities of Ithaafushi Resort Development Project, Kaafu Atoll (CDE 2016)

1.3 Aims and Objectives of the EIA

This report addresses the environmental concerns of the dredging works. The report attempts to achieve the following objectives.

- Clarify the change in project scope
- Allow better project planning and decision-making based on sustainable development.
- Identify environmental impacts that will occur and gauge their significance due to this change
- Mitigating impacts caused due to the change in scope
- Promote informed and environmentally sound decision making
- To demonstrate the commitment by the proponent on the importance of environmental protection and preservation.

1.4 Methodologies

This EIA has been prepared by Amir Musthafa, a registered permanent EIA consultant with years of experience in Environmental Impact Assessment in the Maldives and has been involved in numerous coastal projects, and water engineering projects undertaken in the country.

Hydrographic data from the borrow area was obtained from the contractor, Van Oord, which were collected as part of the design works. Marine environment surveys and other field surveys were undertaken by the EIA survey team.

Internationally recognized and accepted methods have been used in this environmental evaluation and assessment. This EIA is based mainly on data collected during a field investigation mission for the initial EIA and one 7th and 13th August 2016. The data collection methods are described in detail under the following Section.

1.5 Methods of data collection

Conditions of the existing environment of the study area were analysed by using various surveying techniques and scientific methods. Field surveys were carried out to get a further understanding of the existing conditions at the project location. Most of the data required had already been presented under the original approved EIA for the report.

The following new investigations were carried out on site.

- Bathymetry of the borrow area
- Water Quality measurement
- Socio-economic environment assessment

1.5.1 Bathymetry

Bathymetry of the project location was undertaken by the EIA survey team using single beam echo sounders. Bathymetry of the borrow area was undertaken using a multi beam mounted on the Push buster ‘Black bird’, which was the same vessel used for the sand search campaign.

1.5.2 Water Quality Measurement

Water samples were collected using 1.5L PET water bottles at a depth of 1m from MSL from the survey points as illustrated in the Figure 1. The samples were then submitted to MWSC laboratory to test for the parameters as stated in the TOR.

1.5.3 Marine environment

Marine environment surveys were undertaken at 4 locations illustrated in the Figure 1.

The composition of the substrate was assessed by taking 15 - 20 high-resolution images every 5m along the same transect line used for the fish surveys. These were later analyzed using Coral Point Count with excel extension, developed by the National Coral Reef Institute. 20 random points per picture were analyzed to characterize the substrate composition (sample size: 200 points per transect).

1.5.4 Socio-economic environment assessment

Socio economic assessment was carried out by surveying the relevant stakeholders on site. The surveys were carried out by the EIA team as part of this study. The stakeholders were

initially contacted via email with all the relevant information. Subsequent consultations were undertaken with a checklist of clarifications and issues in place for each stakeholder.

1.6 The Project Location and Impact Area

The reclamation and development project site, proposed borrow area, and neighboring sites are shown in the Figure below. The area encircled in Red is the study area for this EIA.



Figure 1 Study area and Impact Area (encircled in Red) in addition to survey sites and sites nearby

1.7 Need and Justification

The main need for the project as a whole is an economic one. Majority of the tourist resorts are located around Ibrahim Nasir International Airport in Hulhulé. The region is preferable to developers since it ensures a continuous flow of guests as accessibility to these islands are easier compared to the rest of the Maldives. Moreover, management during the construction and operation phases of the project will be difficult for remote islands. Logistically, there are daily challenges that would need to be met. Therefore, as available islands in the region for new developments is very scarce, developers have preferred to reclaim available lagoons in Male' Atoll for their resort developments. This has also been entertained by the government authorities, as more and more lagoons have been leased within Male' atoll in recent times.

The industry in the Maldives have been rapidly improving since its inception and the no. of tourist arrivals continue to rise. Therefore, to cater for the increasing demand, more tourist facilities are required, and this project will contribute to that. The proposed development of 3 resort islands will add to the state revenue generated from tourism (through bed and land rent and recently introduced goods and services tax) and subsequently help to improve public services and living standards of the entire country as a whole. Therefore, these socio-economic needs are great for the development to proceed.

Justification for this particular location for the development is mainly an economical one for the developer and based on availability for leasing by the Ministry of Tourism. The location had been identified by the developer as preferable as it is located in the Male' atoll, but a good distance away from the central busy areas. The lagoon has also not been identified as a protected or environmentally sensitive area and locals have been visiting the area on a rare basis. Considering these factors, the development location had been justified.

With respect to the justification for carrying out the project at this time, the reclamation component of the project has been intended to coincide with another major government funded reclamation project, namely the 3 Island Reclamation project (K. Himmafushi, GDh. Thinadhoo, S. Feydhoo). Mobilization of trailer suction hopper dredgers is very costly, and therefore it is a common practice for smaller reclamation projects to align together with larger projects to reduce the mobilization costs. As such, this is the opportune time for this project, as the 3 island reclamation project has recently finished.

The justification for the proposed borrow area is due to the results of the sand search campaign undertaken by the contractor for the project, Van Oord. The campaign showed

that sufficient volume of sand is only to be borrowed in the new location given. The proposed area is justified based on its close proximity to the project site, absence of any environmentally sensitive area close by and the absence of any protected area close by. Therefore the area is ideal to undertake the works.

2. Project Description

2.1 Introduction

The purpose of this section is to describe the project, location and boundaries of the project, project schedule, main inputs, project mobilization as well as project construction activities. In addition, this section presents materials and resources that will be used as well as the main output of the project.

The scope of works for this EIA is the dredging activities in the proposed borrow area. Dredging is undertaken to carry out reclamation in the proposed site. The reclamation and development component of the project has already been approved by the Ministry of Tourism on 26th May 2016. However, these details are also provided under this Section for ease of reference.

2.2 The Proponent

The project to develop the resort is proposed by Bodufaru Beach Resorts Pvt. Ltd., which is a subsidiary company formed for the sole purpose of developing Bodufaru Beach Resorts and the 3 islands in this project. It is a company based in the Maldives and its main shareholders are the LOLC Group companies from Sri Lanka.

The group is among the largest conglomerates in Sri Lanka, with their core business being financial services. They are the largest non-banking financial institution in the country offering the entire array for financial services and have diversified into leisure, hospitals, insurance, agriculture, machinery, renewable energy, construction, information technology, and

2.3 Project Location

The proposed lagoon, in which the reclamation and development will take place is located in between coordinates 4°40'28.8"N 73°32'02.2"E and 4°40'18.4"N 73°32'24.6"E. It is generally a shallow lagoon over 3.35km long and 1.78km wide. The total area of the lagoon is roughly estimated to be about 600 Ha. The project area can be divided into a norther half and a southern half of the reef system. A vast deep lagoon exist towards the south west of the reef system in the southern half. There is a natural sand bank about 500m long on the northern half of the lagoon.

The closest inhabited island is K. Gaafaru which is 9.10km north of the lagoon in a completely different reef system. Helengeli Island Resort is the closest island 4.10km south of the lagoon. The lagoon is approximately 52.50km away from Male' International Airport.

Satellite image showing the lagoon and relevant sites nearby is given in the Figure 2



Figure 2 Location of Project Site in Kaafu Atoll

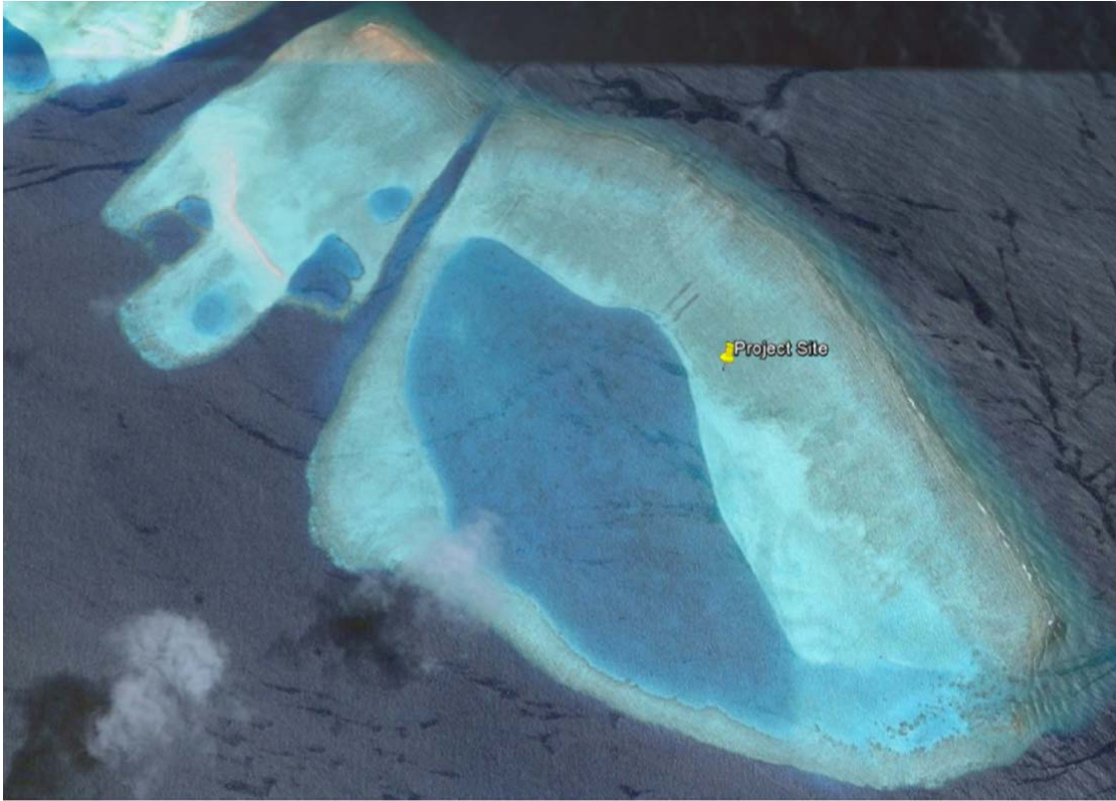


Figure 3 Proposed Reclamation Lagoon

Regarding the borrow area for the deep sea dredging, the sand search campaign around the North Male' Atoll proposed the following borrow area as shown in the Figure below.

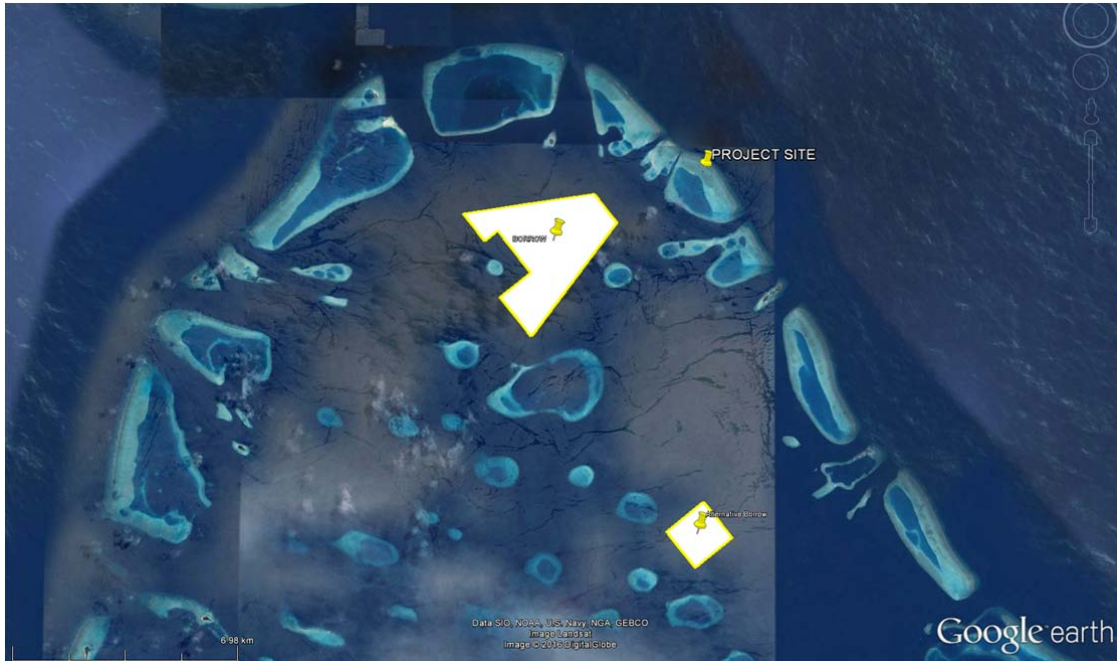


Figure 4 Proposed borrow area (north) and alternative borrow area (south)

The GPS coordinate of the borrow centre of the borrow area as given in the above figure is 4°38'56.34"N - 73°30'6.23"E. Surface area of the entire area is 9,841,060 sqm. It is estimated approximately 5,000,000.00 cbm sand is available from the borrow site. Minimum bottom depth of the area is about 40m from MSL, while maximum bottom depth is about 50m from MSL. Average sand particle sizes found on site is 0.5mm. It is envisaged that this quality sand will be available from 50% of the total area. From this area, the sailing distance to the reclamation area is about 5 km.

2.4 The Development Project

The main development works include 3 major components which includes:

- Dredging and Reclamation of 3 islands
- Development of resort facilities in the 3 reclaimed islands
- Shore protection for the 3 islands.

At this stage of the project, some details have not been finalized yet. This include the landscaping plan, which will in turn include the locations from which trees will be transplanted to the resort island. These will therefore be covered under a further EIA addendum to this report.

The main component of the project is the initial dredging and reclamation required. The following Table 3 highlights the scope of the works.

	Island A	Island B	Island C
Location	north of the lagoon	n centre of the lagoon	south of the lagoon
Area	6 Ha	10.7 Ha	13.2 Ha
Average current depth	-1m from MSL	-1m from MSL	-1m from MSL
Reclamation design height	+1.4m from MSL	+1.4m from MSL	+1.4m from MSL
Volume of sand required	180,000 cbm	360,000 cbm	435,000 cbm

The overall reclamation plans are given in the Figure 2 below:

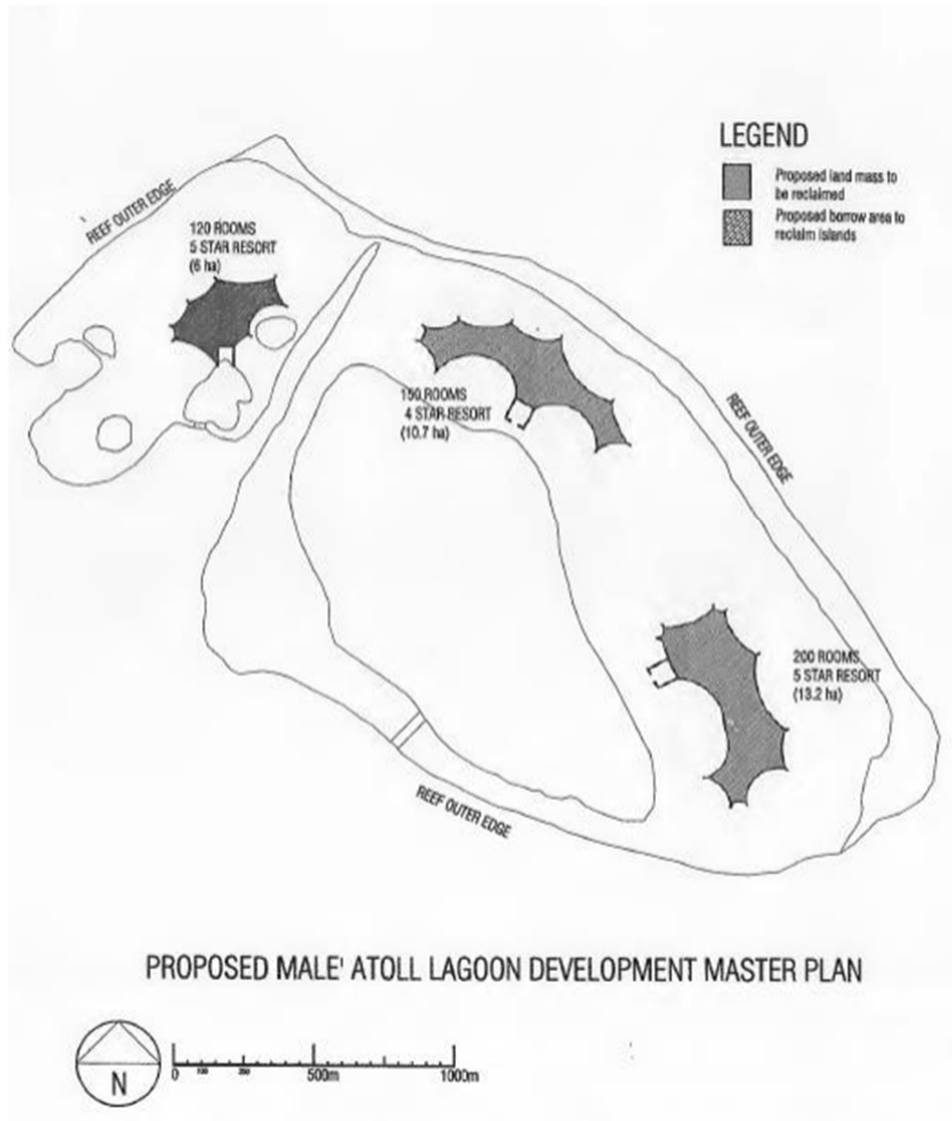


Figure 5 General Reclamation Plan

Therefore, a total of approximately 1,000,000.00 cbm of sand is required for the total works. Two methods have been proposed to obtain sand from 2 very different sources. This is summarized in the following table.

Dredger Type	Trailer Suction Hopper Dredger
Borrow Area	Male' Atoll deep sea

Average depth of borrow area	40 – 60m deep
Depth of dredging	-1m to -2m from sea bed
Distance of borrow area from project site	3 to 5km from project site
Commencement of dredging	Upon EIA approval
Localised environmental impact to the reef	Low

2.5 Dredging Equipment

Trailer suction hopper dredgers (TSHD) are hydraulic dredgers which transports, by self propelling, dredged materials by raising material out of the water and horizontally transporting them to another site while storing them in its hopper. TSHD is commonly used for large dredging projects.

In the Maldives such dredgers have been used to reclaim large amounts of land, and is usually undertaken at a national level. Mobilisation of TSHD is very costly and therefore this option can be feasible at this level if it coincides with another government project. As such, the developers have negotiated with the contractor for the 3 islands reclamation project (K. Himmafushi, S. Feydhoo, GDh. Thinadhoo) to align the proposed reclamation with the project.

Coarse sand is preferable for the project as it would create the optimal land conditions and would result in minimum sedimentation.

The material would be discharged using a floating pipeline. Discharge through bottom doors is not an option as the TSHD cannot enter the lagoon area under any circumstances. Rain bowing is also another option. While rainbowing is usually not recommended due to the impact on neighbouring communities, there are no such communities in this project area. Rainbowing is usually the most economical method for discharging huge quantities of sand in shallow locations close to the shore, as it would not require any floating or submerged pipelines and would save a lot of time. The slurry would be typically projected at a 30o angle. Research has shown that this is the most efficient angle to project slurry with the least backflow to the dredger and the craters that form in the fill area are small (IADC 2014)

The TSHD will likely have to reach the project site from the ocean ward side to dispose the material for the reclamation as its important to have as small distance as possible from the hopper to the reclamation site. The ship will be positioned using high precision GPS system and positioning systems.

2.6 Dredging Entrance Channels

Two entrance channels will need to be made to access the area. One on the south side, which is 85m long and 40m wide, and a smaller channel up north, which is roughly 40m long and 20m wide.

Dredging will be carried out by using a dredging set which includes an excavator deployed on top of a barge. The excavator bucket is approximately 1.5m³. The excavated material will be put on top of the barge until disposed of and deposited on the material piling area on the islands. A temporary sand bed may be constructed on the excavation area. Sand required for construction of the bed will be obtained by excavation from the adjacent shallow areas. These temporary sand beds if constructed will be dismantled once the excavation/ ground leveling work is finished. Sand obtained from the entrance will be used for the land for site setup in Island 1 or Island 2 area. Live corals in the direct footprint of the excavation is proposed to be relocated.

2.7 Sand Bund Construction

Construction of sand bunds is needed to control the sedimentation during reclamation. It is currently widely practiced in the Maldives, and such reclamation projects are not granted environmental clearance unless bunds are part of the reclamation project.

Sand bunds will be made by using existing materials available from the lagoon. A boundary survey has taken place to undertake pegging of the boundary line for each island. Excavators are now in place to trench the boundary area to obtain sand to make the sand bunds in sections. Preference will be made to use as much coarse sand as possible. Sand bunds will be constructed to a height of approximately 1.2m. Crest width would be about 4m, enough for easy access by a typical excavator. The sand bund layout is provided in Figure 7. Sand bunds will not be made around the deep lagoon if this is chosen as a borrow area, as this would not be efficient in mitigating sedimentation from the dredging activities.

Even if bunds are not fully completed, the dredger can pump sand at low velocities close to the bunded area, which heavy earth moving equipment can subsequently be used to move the sand to extend the bund. This bund line can be made ready for the next load. This would be a more cost effective method of constructing the bund walls rather than using the sand from lagoon to make the full bund line.

2.8 Initial mobilisation and site preparation

Site mobilization of construction equipment, materials and workforce to the islands can be brought in after the completion of the entrance clearance work, sand bunding works and completion of the temporary jetty construction.

Dredging and reclamation and subsequent Resort construction work requires use of heavy machinery and equipment. Some of these include the following

- Trailer Suction Hopper Dredger (TSHD)
- Barge
- Excavators
- Lorries
- Dump Trucks
- Loaders
- Cranes
- Cement Mixers, etc.

A practical solution would be to bring this equipment after clearing the access channel and creating a small landing area likely near Island A where the sand bank exists. A sand bed can be made which extends to the lagoon, where a flat top barges, or a landing craft with the machinery can reach close to the beach, from which a sand bund would be created. The deep lagoon near island A can be used as a temporary harbor area. The heavy machinery can then simply drive over the bed on to land.

Similar procedure would need to be followed for the remaining 2 islands once island A is completed.

2.9 Equipment, Machinery and Tools

In the construction phase key activities based on the proposed concept include site preparation, mobilization of materials and equipment, temporary accommodation and services for labour force, development of water supply, sewerage and power generation facilities, and construction of arrival and service jetties, landscaping and demobilization. Machinery and tools used for these activities would be in good condition and used under strict supervision. Heavy vehicles such as excavators, bulldozers and trucks would be kept in designated areas and existing or project specific paths would be used. Temporary sheds will be built in each island to house equipment and tools.

2.10 Temporary facilities

Temporary facilities will be developed on areas where permanent structures are to be developed. Therefore, utilities such as powerhouse, fuel tanks, desalination plant and waste management center will be developed at the early stages of the construction of the resort

Staff Accomodation

Initially, staff will be accommodated offsite on vessels, which are equipped with their own utilities. Once temporary bunds are completed and a small portion of land is reclaimed, site setup works will commence. Overwater structures will also be built to house the laborers. Each island will have capacity to house approximately 70 workers. Containers will be retrofitted and used as site offices for each island. Temporary sheds will be built to house equipment and materials.

Waste Management site

A temporary waste management area will be set up using a steel structure. The area will be open and shaded. During the construction phase, the main waste stream including kitchen waste, waste from temporary accommodation blocks, hazardous waste and waste from office blocks will be collected in designated bins for different groups of wastes. All constructional waste will be taken to this area, and segregated into 5 types; green waste, biodegradables, steel, plastics & paper, hazardous. Waste will be collected and sent to Thilafushi once a month on a dedicated vessel. Transferring of waste may be outsourced. At the conclusion of the construction stage, a full cleanup of the entire island will occur, and the site will be entirely cleaned and waste transferred to Thilafushi. The waste management site in each island will be developed into the permanent structure for resort operations.

Hazardous wastes such as grease, waste oil from generator and machinery, empty paint and varnish cans, batteries, water proofing and other finishing chemicals will be generated during the construction phase. They will be collected in separate areas and send for appropriate disposal at Thilafushi or other designated landfill in separate and appropriate packaging. In addition to these daily wastes, spillages during unloading of material would be of concern. Therefore, unloading processes will be properly supervised.

Water

Water will be provided using a 50 m³ /day reverse osmosis desalination plant in each island. Rainwater will be also be collected and used on site. Ground water will not be extracted for consumption. Only extraction of groundwater will occur for dewatering for construction. Water intake will initially be via sea water from the lagoon, which will be later changed to boreholes once the reclamation is complete and construction commences after sand has settled. Brine outfall is proposed towards the ocean ward side, about 35m from the shore.

Power

Power for the construction stage will be provided using three sets of two 900 kVA diesel generator, one set for each island, installed during mobilization. Each set will be housed in a temporary powerhouse approximately in the center of each island near the desalination plant. Power will be shifted to the main generators towards the end of the construction period. The gen-sets for the construction period will be used at the permanent facility as well.

Sewage

Sewage will be managed using temporary septic tanks in each island. Use of direct discharge was also initially discussed but later shelved. Upon completion of construction, the contents of the tanks will be allowed for decay for 3-4 months. The content will be then removed and used in the drying bed of the sewage treatment facility to be established on site. It can then be used as a fertilizer. The tanks itself will be disinfected and filled with sand.

2.11 Resort Development

The Project involves the development of 3 modern resort on the lagoon with the following general facilities;

Guest facilities

Staff facilities

Service facilities

General details of the 3 resort islands are as given in the Table 5 below:

Table 1 General Details of the Islands

	Resort A	Resort B	Resort C
Location	North	Center	South
Size	6 Ha	10.7 Ha	13.2 Ha
No. of rooms	120 rooms	150 rooms	200 rooms
Standard/Quality	5 star	4 star	5 star

The resorts are proposed to be developed based on the concepts given below.

Resort 1

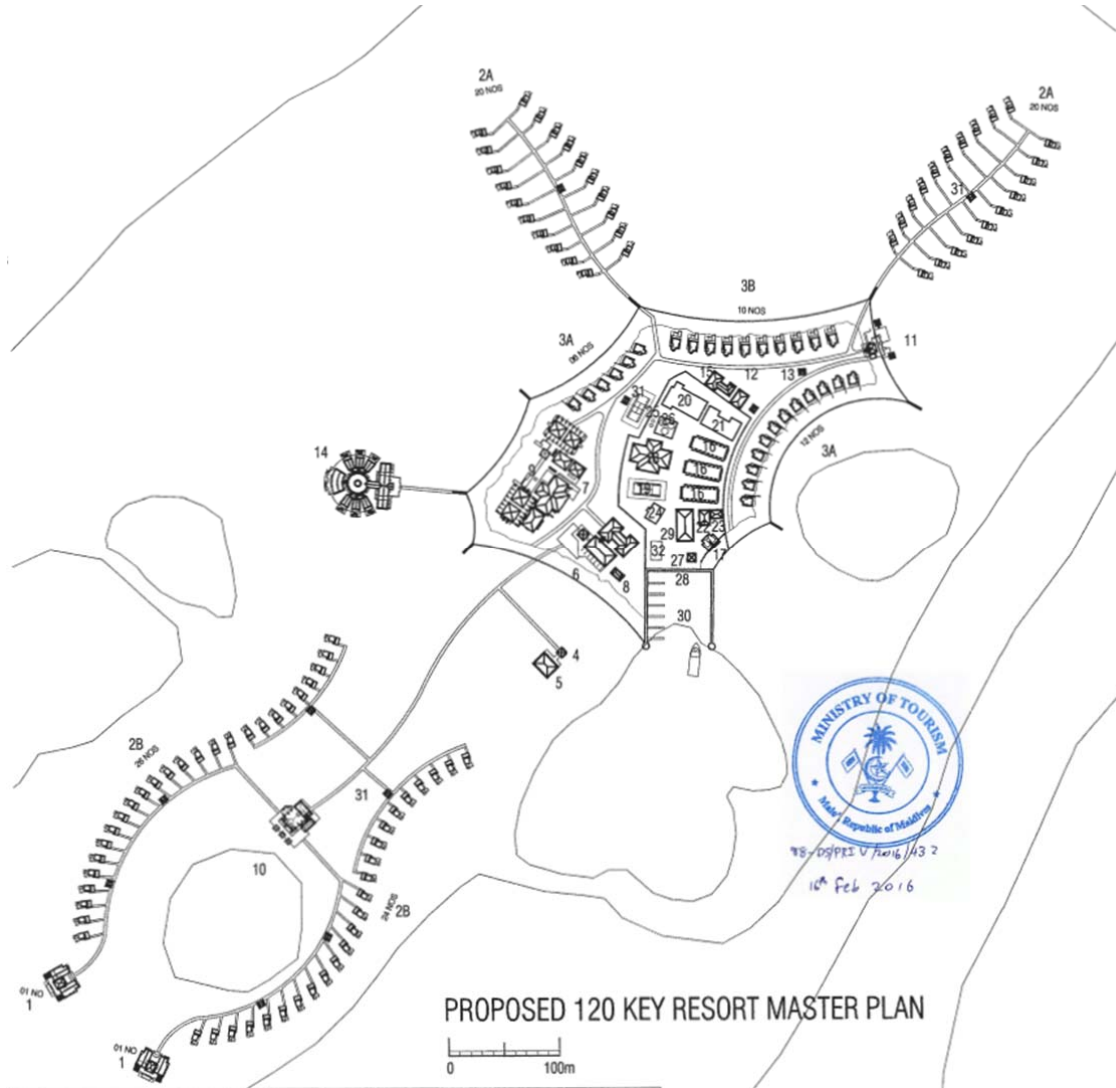


Figure 6 Resort A layout

The details of the developments for Resort 1 are given in the table below

Table 2 Resort A details

Legend	BUILDING / FACILITY	UNITS	Total Rooms	BUILT UP AREA PER ROOM (SQM)	TOTAL AREA (SQM)	NO STOREYS
GUEST ROOMS						
1	WATER SUITES	2	2	400	800	2
2A	WATER VILLAS	40	40	50	2,000	1
2B	POOL WATER VILLAS	50	50	50	2,500	1
3A	BEACH VILLAS	18	18	45	810	1
3B	POOL BEACH VILLAS	10	10	45	450	1
Total guest rooms			120		6,560	
PUBLIC AREA						
4	Arrival pavilion	1		40	40	1
5	Diving School	1		200	200	1
6	Reception / Back Office	1		976	976	1
7	Main Restaurant, Kitchen, Bar, Boutique	1		2390	2,390	1
8	Water Sports Center	1		54	54	1
9	Public Pool	1			-	1
10	Speciality Restaurant & Wine Cellar	1		476	476	1
11	Grill Bar & Bistro	1		113	113	1
12	Clinic & Wellness Center & Gym	1		200	200	1
13	Child Care Centre	1		120	120	1
14	Health and Beauty Spa	1		1300	1,300	1
15	Tennis Court	1			-	
Total Public Area					5,869	
SUPPORT FACILITY						
16	Staff Accomodation Building	3	96	784	2,352	2
17	Executive Staff Villas	1	4	57	228	2
18	Staff Restaurant & Complex	1		680	680	1
19	Staff Multi-Court	1			-	1
20	Power House & Desalination Plant	1		700	700	1
21	Laundry & Housekeeping	1		540	540	1
22	recycle House	1		100	100	1
23	carpentry & workshop	1		50	50	1
24	Mosque	1		180	180	1
25	Water Tanks	2			-	1
26	Fuel Farm	1			-	
27	Security Post	1		36	36	1
28	Service Jetty	1			-	1
29	Main Stores	1		364.5	365	1
30	Harbour	1			-	1
31	Houskeeping Stores	11		16	176	1
32	STP	1			-	1
Total Support Facility Area			100		5,407	
TOTAL BUILT UP AREA					17,836	
LAND AREA (HIGH TIDE LINE)					60,363	
TOTAL BUILT UP PERCENTAGE					30	

Resort 2



Figure 7 Resort B Layout

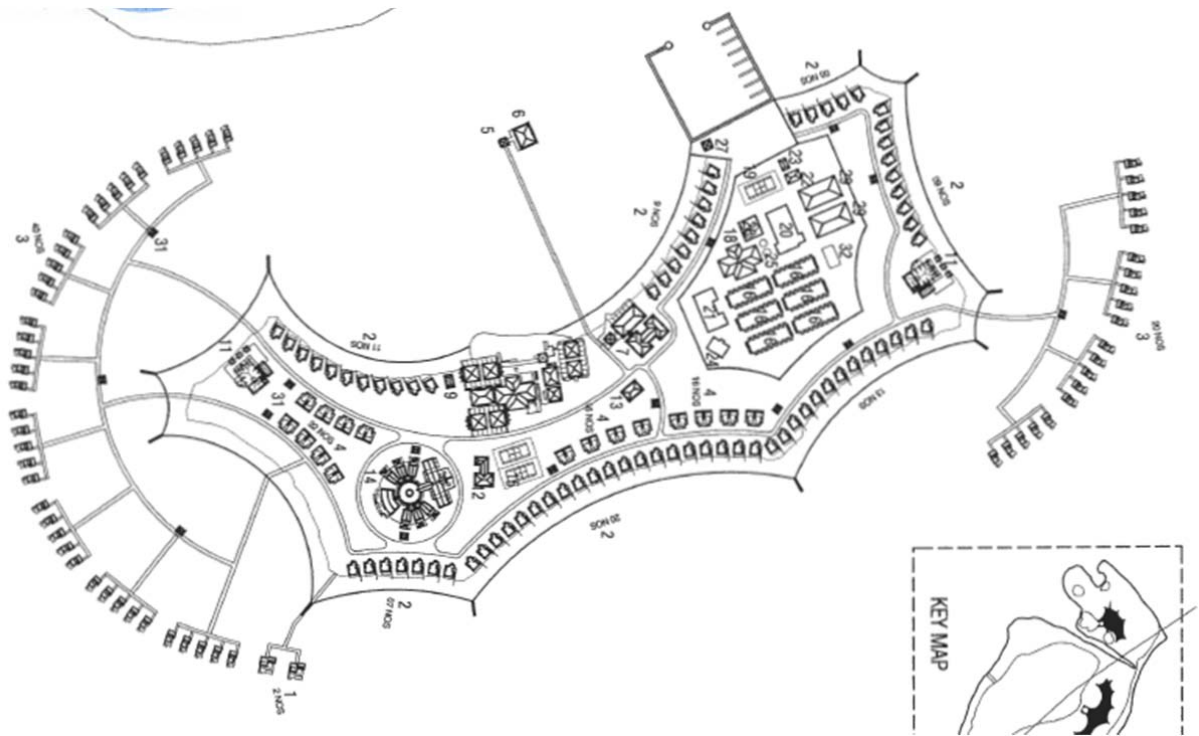
The details of the developments for Resort 2 are given in the table below

Table 3 Resort B details

150 ROOMS RESORT / AREA PROGRAM						
Legend	BUILDING / FACILITY	UNITS	BUILT UP		TOTAL AREA (SQM)	NO STOREYS
			Total Rooms	AREA PER ROOM (SQM)		
GUEST ROOMS						
1	WATER SUITES	3	3	57	171	2
2	WATER VILLAS	43	43	50	2150	1
3	BEACH VILLAS	80	80	45	3600	1
4	GARDEN CLUSTER	6	24	57	1368	2
Total guest rooms			150		7289	
PUBLIC AREA						
5	Arrival pavilion	1		40	40	1
6	Diving School	1		200	200	1
7	Reception / Back Office	1		976	976	1
8	Main Restaurant, Kitchen, Bar, Boutique	1		2390	2390	1
9	Water Sports Center	1		54	54	1
10	Public Pool	1				1
11	Speciality Restaurant & Wine Cellar	1		476	476	1
12	Grill Bar & Bistro	1		113	113	1
13	Clinic & Wellness Center & Gym	1		200	200	1
14	Child Care Centre	1		120	120	1
15	Health and Beauty Spa	1		1300	1300	1
16	Tennis Court	2				1
Total Public Area					5869	
SUPPORT FACILITY						
17	Staff Accomodation Building	4	128	928	3712	2
18	Executive Staff Villas	1	4	57	228	2
19	Staff Restaurant & Complex	1		680	680	1
20	Staff Multi-Court	1				1
21	Power House & Desalination Plant	1		700	700	1
22	Laundry & Housekeeping	1		540	540	1
23	recycle House	1		100	100	1
24	carpentry & workshop	1		50	50	1
25	Mosque	1		180	180	1
26	Water Tanks	2				1
27	Fuel Farm	1				
28	Security Post	1		36	36	1
29	Service Jetty	1				1
30	Main Stores	1		600	600	1
31	Harbour	1				1
32	Houskeeping Stores	11		16	176	1
33	STP	1				1
Total Support Facility Area			132		7002	
TOTAL BUILT UP AREA					20,160	
LAND AREA (HIGH TIDE LINE)					106,898	
TOTAL BUILT UP PERCENTAGE					18.86	

Resort 3

Table 4 Resort C layout



The details of the developments for Resort 3 are given in the table below

Table 5 Resort C details

200 ROOMS RESORT / AREA PROGRAM						
Legend	BUILDING / FACILITY	UNITS	Total Rooms	BUILT UP AREA PER ROOM (SQM)	TOTAL AREA (SQM)	NO STOREYS
GUEST ROOMS						
1	WATER SUITES	2	2	57	114	2
2	BEACH VILLAS	74	74	45	3330	1
3	WATER VILLAS	60	60	50	3000	1
4	GARDEN CLUSTER	16	64	57	3648	2
Total guest rooms		200			10092	
PUBLIC AREA						
5	Arrival pavilion	1		40	40	1
6	Diving School	1		200	200	1
7	Reception / Back Office	1		976	976	1
8	Main Restaurant, Kitchen, Bar, Boutique	1		3000	3000	1
9	Water Sports Center	1		54	54	1
10	Public Pool	1				1
11	Speciality Restaurant & Wine Cellar	1		476	476	1
12	Clinic & Wellness Center & Gym	1		200	200	1
13	Child Care Centre	1		120	120	1
14	Health and Beauty Spa	1		1300	1300	1
15	Tennis Court	2			0	1
Total Public Area					6366	
SUPPORT FACILITY						
16	Staff Accomodation Building	6	192	928	5568	2
17	Executive Staff Villas	6	24	57	1368	2
18	Staff Restaurant & Complex	1		680	680	1
19	Staff Multi-Court	1			0	1
20	Power House & Desalination Plant	1		700	700	1
21	Laundry & Housekeeping	1		540	540	1
22	recycle House	1		100	100	1
23	carpentry & workshop	1		50	50	1
24	Mosque	1		180	180	1
25	Water Tanks	2				1
26	Fuel Farm	1				1
27	Security Post	1		36	36	1
28	Service Jetty	1				1
29	Main Stores	2		600	1200	1
30	Harbour	1				1
31	Houskeeping Stores	15		16	240	1
32	STP	1				1
Total Support Facility Area		216			10662	
TOTAL BUILT UP AREA					27,120	
LAND AREA (HIGH TIDE LINE)					132,565	
TOTAL BUILT UP PERCENTAGE					20.46	

Among these proposed structures, the most environmentally sensitive facilities are those given in the following Table 6.

2.12 Jetties and Harbours

Each island will be accessible via a jetty and a small harbor; the jetty for guest arrival and the harbor for services to bring in goods and material in addition to providing a safe anchorage to vessels. Both structures will be towards the atoll side, facing the deep lagoon. The deep lagoon or vilu has depths in the range of 6.0m – 10.0m. The shallow lagoon depth is fairly uniform around the islands and the depth ranges between 1.0-2.0m at MSL

The harbor will be dredged to a depth of -3m from MSL. Concrete L-section blocks, which are commonly used in the Maldives, are proposed to be used. The blocks will be dependent upon the backfill for structural stability. They will be anchored to the sand as well. Rock boulders or geo bags have not been proposed. There is no breakwater structure, which could lead to instability inside the harbor.

Under the current design, structure perpendicular to the shoreline will be fully enclosed, in that they will not allow for water circulation. They will be either sheet piled, or built using concrete blocks or caissons. The exact structural details have not been finalised at this stage of the project. The perpendicular structure will act as a groyne and would compartmentalize the sediment transport updrift and downdrift from the harbor area.

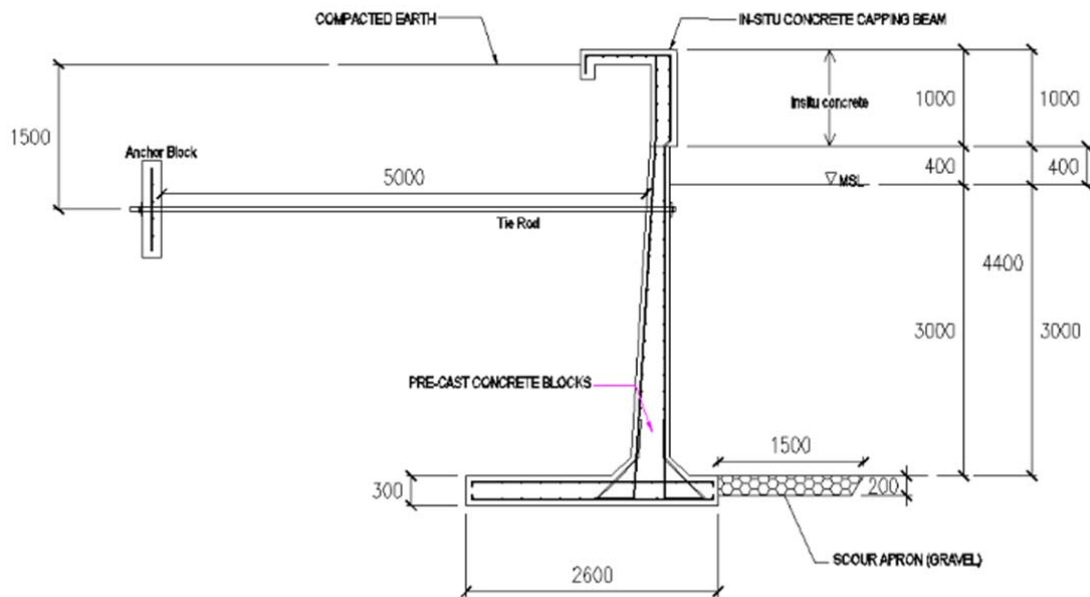


Figure 8 Quaywall section of proposed harbours

Guest arrival jetty will be constructed on ICP piles. The footings of the piles will be precast on land and transported to the site. Footing area will be cleared using excavators. The Jetties will allow for water circulation underneath.

2.13 Water Villas

Water Villas are now a customary feature of Maldivian resorts and as such each island in this development will have a number of such structures.

Island A will have 2 water large water suites of built up area 400 sqm each on the SW side, in addition to 40 suites each of which is 50 sqm facing NE and NW. There will also be additional 50 water villas with built in pools on the SW side.

Island B will have 3 water suites of built up area 57 sqm each on the NW side, in addition to 40 villas each of which is 50 sqm facing N, S and NW.

Island C will have 2 water suites of built up area 57 sqm each on the SE side, in addition to 74 villas each of which is 45 sqm facing N, and S.

From a structural point of view, all the villas will be constructed with similar ICP piles, which will all be precast on land. Excavators are the main heavy machinery used for the construction.

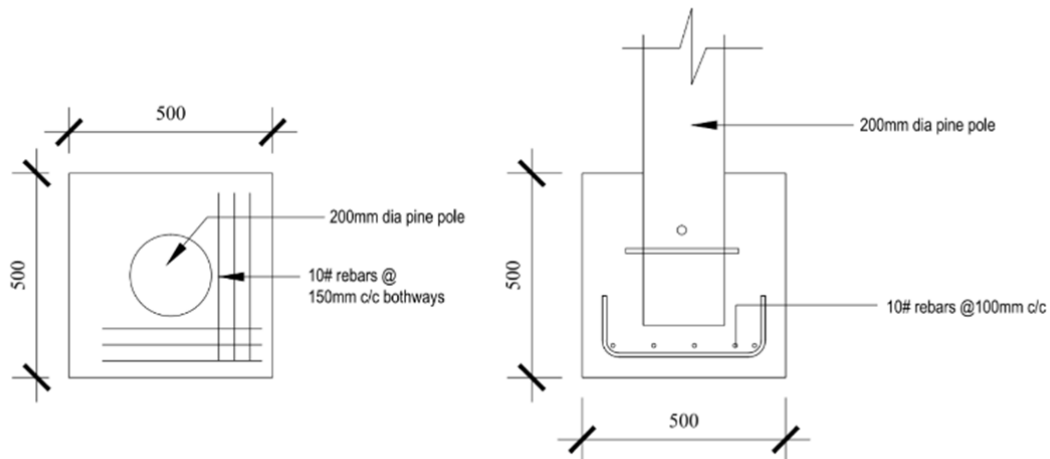


Figure 9 Typical pile section for over water structure

2.14 Beach Villas

Regular beach villas will also be constructed on each island. As these are new land, the villa construction will occur once the sand has settled enough. Island A will have 18 regular beach villas of built up area 45 sqm each on the island, in addition to 10 beach villas with built in swimming pools, each of which is also 45 sqm. Island B will have 80 such structures while Island C will have 74 beach villas without pools. The initial major works regarding all land based structures are the excavation, dewatering, and construction of foundations as discussed in the following section.

2.15 General excavation, dewatering and foundation

Excavation dewatering and foundation construction works would occur for all significant land based structures. Shallow raft or beam foundation will generally be in use. Beam foundations are most common and probably most cost effective foundation type being adopted in the Maldives, since low rise buildings do not require withstanding heavy loads. There will not be any high rise buildings as part of the project. All buildings would consist of masonry work, reinforced concrete and structural steel work using manual labours and minor excavation works. All materials will be imported and local rocks and/or sand will not

be used for construction. For single storey buildings, the general practice had been to excavate about 0.3 – 1.2 meter for foundation, which will not require any significant dewatering. Power cables, sewer, drainage and water pipe grids will be connected through underground trenches. Small excavators will be used for trenching work.

2.16 Desalination Plant

Water supply demand of the proposed resort will be met through seawater desalination using Reverse Osmosis desalination plants. Water plant capacity has been determined based on the average volume of water that will be used per person in a resort island. Plant capacity is proposed to be as follows:

Table 6 Desalination Plant details

	Island A	Island B	Island C
Primary RO plant capacity	120 ton/day	150 ton/day	200 ton/day
Backup RO plant capacity	120 ton/day	150 ton/day	200 ton/day
Total Capacity	240 ton/day	300 ton/day	400 ton/day

Water intake will be via boreholes drilled in close proximity to the desalination plant in each island. Groundwater would not be used as per the requirements of the Tourism Regulations. Also, water storage sufficient for 2 days would be installed. Feed water will be drawn from a borehole at the location of the desalination plant and brine will be discharged as shown in Annex 4. The location for the discharge had been chosen based on water depths and the estimated general water current measurements to ensure dilution and minimum impact.

It is considered to provide guests with bottled water for drinking while desalinated water produced on the islands will be supplied for other basic needs such as bathing, laundry, washing, gardening etc. Desalinated water would also be provided for staff consumption after double pass. Therefore, the quality of the water will be maintained within drinking water standards acceptable to the EPA and the Ministry of Tourism. Water quality will be tested by sending samples to EPA on a regular basis as required by the desalination plant registration monitoring plan.

Desalination plants will be installed according to the requirements of the Maldives Desalination Regulation and all plants will be registered with the EPA once the EIA Decision Statement is received. Personnel working inside the RO plant premise will only be subjected to noise levels exceeding 80dB(A) at intermittent periods. This is acceptable by

all international standards. Ear muffs would be provided on site for personnel to use. Fire extinguishers will be kept on site and other such safety procedures will be followed as per the requirement.

Groundwater will be conserved according to the requirements of the Tourism Regulation. It will not be used for purposes such as laundry, gardening, toilet flushing, etc. Groundwater will not be used during construction purposes as well. Groundwater monitoring will be undertaken to ensure that the water quality is controlled.

2.17 Boreholes

Borehole construction is generally an environmentally sensitive work, and therefore some specific details of the borehole construction methodology is given. Location of the bore hole shall be worked out from the approved drawing and marked on the top of the existing ground profile. Currently, the locations are tentative and subject to change. Drilling shall be carried out at these marked locations. 3 boreholes will be drilled in each island.

5m X 5m area surrounding the drilling location shall be cleaned before set up of drilling machine. Two mud pits shall be made by using shovel and spade in front of drilling location and connected each other by a drain and canvas lining shall be done to prevent fluid loss.

Drilling mud shall be prepared by mixing of bentonite with water with a proportion of 1:2 before 12 hours of starting of borehole. Thickness of the mud shall be controlled as per the strata encountered during drilling. If there is severe caving encountered during drilling through a particular stratum then 150 gm poly-anionic cellulosic polymer shall be used by mixing with 50 Kg bentonite and 100 liter water.

Drilling rig is placed on the drilling spot with proper platform and verticality alignment of the machine is done by using spirit level. During the whole drilling process this is checked frequently to maintain the verticality and alignment of borehole.

After attaching the mud pump and drilling machine with 50 mm hoses drilling shall be started with 250 mm reamer bit upto the loose formation or overburden and 200mm dia PVC casing will be placed inside hole. The depth of outer casing shall be decided as per geological strata encountered at site. After placing of outer casing up to required depth drilling shall be continued with mud circulation, with the help of 200 mm drag & rock roller bit.

Soil samples shall be collected from return water from borehole at every 2 m interval or change of strata. Soil samples will be preserved in polythene bags marked with borehole number and depth and date of collection. Bore Log shall be prepared as per the sample received during drilling from different depth. Soil samples shall be sent to soil testing lab for grain size analysis.

Daily Progress Report (DPR) shall be submitted regular basis. After completion of borehole drilling log along with stratification, ROP, casing details and water analysis at site shall be

submitted. Laboratory Water & Soil Testing reports shall be provided after completion of the relevant tests.

Development of bore well is essential in order to obtain an efficient and long lasting well. After the development, several tests will be undertaken. On completion of constant discharge rate, 12 hours recovery test shall be carried out & water level would be measured for every one minute for first 1 hour and then every 5 minutes for the remaining hours. All test reports shall be submitted in a tabular format after completion of all tests. After completion of yield test, submersible pump is removed from the bore well and well shall be capped with threaded PVC cap to protect it from any unwanted material from falling inside.

2.18 Powerhouse and fuel storage

Diesel generator sets will be installed in each islands powerhouse for electricity generation with backup facility. Powerhouse capacity is proposed to be as follows:

Table 7 Powerhouse details

	Island A	Island B	Island C
Primary genset capacity	2 x 650 kVA	2 x 650 kVA	2 x 1000 kVA
Backup genset capacity	2 x 450 kVA	2 x 450 kVA	2 x 650 kVA
Total capacity	2200 kVA	2200 kVA	3300 kVA

Energy efficient synchronized diesel power plants will be setup in each island, which automatically changes the load based on usage requirements. The electrical supply will be of 3 phase and high voltage cable. Powerhouse and all related facilities will be installed according to the requirements of Maldives Energy Authority.

The noise level outside the powerhouse building at the facade shall not exceed 55dB(A). Nnoise insulation will be done inside the powerhouse to ensure this standard is met. As such thick walls insulated walls, and attenuators will be in place. Generator sets will be placed on anti-vibration mounts and noise insulation baffle walls will be used. Ear muffs will be provided to staff working in the powerhouse and for visitors. Control room would be entirely sound proofed.

In each island diesel fuel will be stored in 2 - 3 tanks outside the powerhouse. The fuel tank would have a bund wall outside the tank with 110% capacity of the storage tanks to contain accidental spills and leakages. Day tanks will be utilized to provide fuel to the generator sets. Below the day tanks, a concrete bund will be made to retain any spills. Exhaust stacks will be connected to each generator set. Each exhaust stack will be above 6m from the ground level. All building will have an offset of 7m from the oil storage bund as per the Fire

and Safety Regulation. Electricity will be distributed through low voltage underground cables. Underground distribution system also consists of distribution substations, distribution feeder boxes, and service cables. Fuel storage tanks will be built using steel plates. A bund wall will be constructed around the fuel storage tanks. The tanks will be built on reinforced concrete foundations.

Fuel will be transported to site by registered local fuel suppliers. A fuelling system will be installed at the jetty head in each island, which will deliver fuel to fuel tanks in the island. At least a week’s supply of fuel would be stored. Cooling water system will be from the same setup as the desalination plant. Power supplies to the beach villas and guest facilities will follow the main footpaths and supply to the water villas will follow the water villa access jetty. Fuel transportation from the service jetty to the fuel tanks will be using appropriately sealed piping. Pipes will be placed approximately 600 mm below ground level and will have safety valves at designated locations around the island

A solar based power source has been considered for the resort and the prospect is still in discussion. A feasibility study would need to be made before determining the economics of implementing renewable energy sources in the islands. However, recently Gasfinolhu was opened with claims of being powered mainly by Solar and this gives impetus for a project such as this. If solar is to be used, it will be discussed further in an Addendum. Solar water heaters will be used to produce hot water. All guest rooms, and staff accommodation, will be supplied with hot water. Groups of 5-6 units each will be connected to approximately 600-ton capacity units.

In addition to discussions of renewable energy, and implementation of fuel-efficient engines, energy conservation will be a high priority. High energy rating appliances will used in all the islands, while LED lights and inverters will be in place. Outdoor lights will be solar. Awareness program will be carried for both tourists and guests on the importance of conservation of energy.

2.19 Sewerage Systems

During the operational phase, wastewater will be treated using sewage treatment plants (STP), as is required by the Tourism Regulation. The capacity of the treatment plant and pumping stations will be based on a minimum of 150 litres per person per day of wastewater. The capacity of the plant is proposed to be as given in the following table

Table 8 Sewage Treatment Plant details

	Island A	Island B	Island C
Sewage Treatment Plant Capacity	150 m3/day	150 m3/day	200 m3/day

A Sequential Batch Reactor (SBR) system will be used on all 3 islands. A plant house will be constructed and trenching works will be undertaken throughout each island. The network design has not been completed at this stage. The sequencing batch reactor (SBR) is a fill-and draw activated sludge system for wastewater treatment. In this system, wastewater is added to a single batch reactor, treated to remove undesirable components, and then discharged. The system works by oxidization and mixing active biomass, thereby creating a condition for bacteria to flourish and breakdown organic matter

Treated effluent will be discharged into the sea 100m away from shoreline at a depth of about 15m below MSL. The Sewage outfall location is shown in Figure 4. Treated effluent will not be used for gardening and toilet flushing and excess effluent will be discharged into the ocean beyond the house reef as proposed. A sludge drying bed is not currently proposed for the sewerage system, but can be incorporated at a future stage.

Currently there is no requirement for the approval of sewerage system designs from the EPA. There are no sewerage system design approvals or registration requirements for sewerage systems. Design Criteria for Sewerage Systems issued in January 2007 by EPA will be used to ensure that the system meets the standards required in the Maldives in addition to the manufacturers standards.

Since wastewater is treated and the outfall is at quite a considerable distance from the islands in all appropriate locations, it may be disposed in any location. The recommended location based on currents and depth to ensure maximum dilution, is the ocean ward side for each island. An emergency overflow will be considered in the design in times of disruption to the STP.

The outfall pipe will be placed and anchored to the seabed using anchor blocks carefully placed on the seabed by experienced divers. Corals will be protected during the installation.

The treated water quality is expected to be as given in the following table

Table 9 STP treated water quality guidelines

Parameter	Quality
pH	6.0 – 8.0
COD	<50 ppm

BOD	<20 ppm
Total suspended solids	<30 ppm

The outfall will be installed by placing the pipe carefully on the seabed and placing anchor blocks on the pipe at appropriate intervals. The pipe will be laid to the natural profile of the seabed. Any live corals in the way of the pipe would be transplanted prior to or during the installation process. Anchor blocks will be approximately 1 ton of reinforced concrete. The construction contractor is to undertake a detailed inspection of the outfall site to assess the profile and condition of the reef below sea level and prepare their methodology for installation and fixing. The pipe will be laid on position by experienced divers. Care will be taken to minimize damage to the reef.

2.20 Waste Management

All solid waste infrastructure required for resorts as per the Tourism Regulations will be installed on the islands. These include the following:

- Incinerator
- Recycling bins
- General waste bins
- Bottle crusher
- Compactor

Waste management sites will be developed at the waste centers used during the construction phase. A 100 sqm structure will be built in each island to manage waste. This area will house all the facilities required for the waste management as stated above.

The project site has an advantage in the close proximity to the main waste management island in the Maldives, Thilafushi. Thilafushi is 54km away from the project site and regular scheduled Dhonis can be in place to take Solid waste generated at the site to the island.

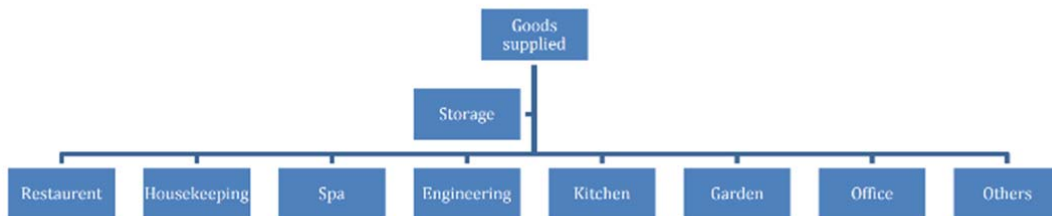


Figure 10 Supply Categories

Supply of goods into the islands are categorized in the main categories as given in Figure 17. All these sites would subsequently generate waste that would need to be dealt with. Based on available data, it is expected each island will generate the following amounts of waste (MOT 2015):

- 80% biodegradables including food, garden/yard wastes, and paper products
- 5% recyclables including metals and plastics
- 15% residuals including construction and demolition debris, organics such as wood and paper and inorganics such as concrete, glass, and discards such as textile, leather, rubber, and hazardous wastes such as batteries

The solid waste generated by an average resort island is estimated to be 1.3 MT/day, and thus for 3 islands it amounts to 3.9 MT/day. Based on these figures, it is anticipated the 3 islands developed as part of this project will generate the following amounts of wastes:

- 3120 tonnes of biodegradables
- 195 tonnes of recyclables
- 585 residuals

Understandably, these are large quantities of wastes. However, the amount of waste generated at each island will be dealt with the individual operators of each island, and therefore the task of waste management will not be as daunting.

Waste management at each island will be based on the typical practices as followed by the resort islands in the Maldives. However, it is not proposed to dump any waste at the sea as is typically practiced. The following Figure 18 shows the waste management flow chart that would be adapted at the islands.

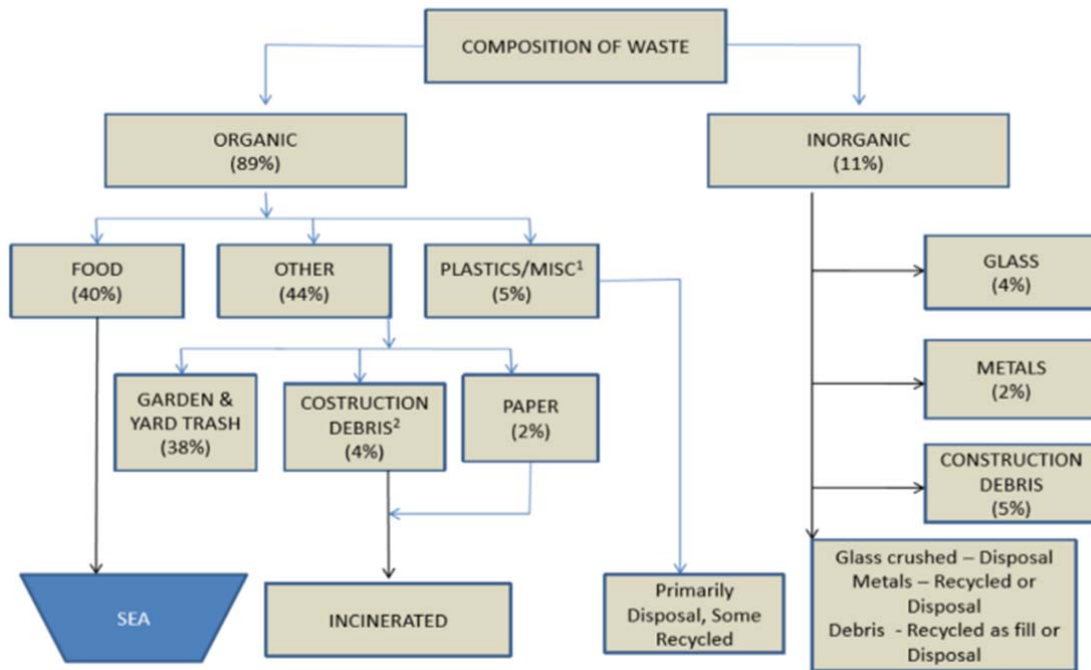


Figure 11 Waste Management flow chart (MOT 2015)

Eventual fate of the majority of non-biodegradable solid waste generated on the islands will be segregated on site at the waste management center and transported to Thilafushi. The waste generated on the resort will be carefully managed by use of the waste management equipment established. All flammable waste will be incinerated, glass bottle will be crushed, aluminum cans and tins will be compacted and food and garden waste will be composted. All residual waste such as crushed glass and compacted cans as well as hazardous waste will be transported and properly disposed at Thilafushi waste management center.

2.21 Landscaping

Local species native to the Maldives will be used for landscaping. Narrow walkways will be encouraged which allows maximum surrounding vegetated area. It is proposed to create large areas of vegetation in each island. After reclamation, a nursery is proposed to be setup on the island to meet with some of the landscaping requirements.

However, since it is going to be a newly reclaimed land, vegetation on the islands are nonexistent, and therefore mature vegetation will need to be imported into the islands for landscaping purposes. However, the details of the have not yet been finalized, including where the trees will be sourced from. Therefore, an addendum will be made to this EIA providing all the required details before importing any trees to the islands.

2.22 Shore Protection

There are few options available for shore protections measures in a project such as this. These include the following:

- Groynes
- Off shore breakwaters
- Near shore breakwaters
- Seawalls
- Revetments
- Beach nourishment

To effectively protect the shoreline a combination of these options can be implemented on site. There are a wide variety of materials that can be used for the mentioned structures as well including imported rocks, sand cement bags, nylon sand bags, geo bags, concrete structures, timber, rock filled gabions, etc.

However, at this stage the developer, together with the input from coastal engineering consultants have decided to only use groyne structures as a shore protection measure. In any case after observations and monitoring, if there is need to implement further shore protection measures, an EIA addendum will be prepared based on the change or addition to project scope.

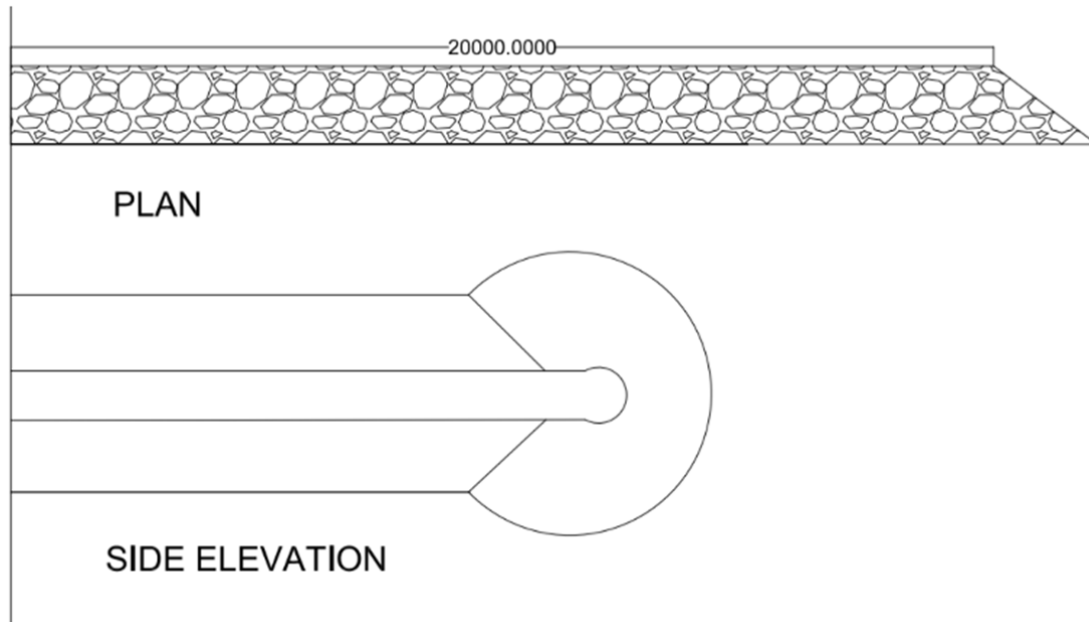


Figure 12 Proposed Groyne Section

Groyne field is proposed to be constructed to maintain the reclaimed beach and to protect the coastline. Each groyne in the groyne field will be approximately 20m in length. Between each groyne there will be an average width of 20m - 60m. Crest width of each groyne is proposed to be 1m. The rocks or geo bags are to be placed with a 1:1 ratio on both sides. Geotextile material is to be placed at the bottom of the structure to prevent scour. The geotextile shall be of polypropelene filter fabric and shall be resistant to air, water, chemical, bacterial and UV attacks. It should also have a minimum penetration strength of 3.3 kN, and tensile strength of 20kN/m. The cloth weight should have a minimum 300g/m².

The groyne will be constructed using either granite rocks or sand filled geo bags. One of the main criteria for material selection is to obtain material with enough unit weight that will not be displaced easily with wave impact, but is light enough to manually handle. Therefore, it is expected the unit weight will be between 50 – 100kg. The height of the structure shall be 1.0 to 1.5m above mean sea level.

2.23 Potential Accident and Hazard Scenarios

Accident and hazard during reclamation include those relating to health risks on the vessel and implementation of civil works at project site, oil spills and pollution. Health and safety risks arising from construction work is high, especially due to the use of specialized equipment and machinery. There may be situations of man overboard from vessels. Accidents related to equipment use can lead to injury, and fatalities. Materials used in

construction, in addition to the equipment and machinery, also involve risks to health and safety. Accidental spills/ leakage of hazardous substances can contaminate the site and pose risks to human health, including workers on the site. The project activities include measures to minimize risks to health and safety of workers.

One of the major accident and hazard scenarios for the overall project is those related to fire accidents. There is potential for such accidents in both the operation stage and in construction stage.

As a means of addressing potential fire hazards, firefighting equipment that meets the requirements of Tourism Regulations and National Fire Code will be developed with all necessary equipment including fire hydrants and fire extinguishers. Services of rescue with all necessary equipment will be made available.

An emergency response plan will be developed with details of equipment, human resource and procedures. The following will be considered in the emergency response plan:

- Setting up an emergency response team
- Emergency contacts
- Route to treatment site, i.e. the closest health facility/hospital
- Level of protection to be provided;
- Setting up equipment - firefighting equipment on site
- Response time;
- Emergency access and evacuation procedures;
- Personnel and training requirements;

All the machinery and equipment are to be properly tuned and maintained to reduce emission leakage and spill. Before mobilizing to site, status/condition of all equipment and machinery should be checked.

Proper fuel paints, lubricants, and other chemicals handling and transport measures will be strictly implemented and the fuel storage on site will be banded. All machinery that gets transported to the island will be required to be serviced.

To handle any accidental liquid spills, spill kits will be maintained in the construction site. Septic tanks system will be utilized for sewage and wastewater disposal during the construction period.

Protective equipment and clothing are to be available for all staff at all times, especially those undertaking high risk works. Safety shoes and helmets are to be worn at all times, and ear muffs are to be used in high noise areas.

Sign boards should be put up and each area of construction should be demarcated and the type of works should be pre-informed to all workers on site.

Water based fire extinguishing will be used during construction period. Pumps connected to the sea will be installed prior to commencement of major construction activities and other fire extinguishing equipment would also be readily available and employees will be trained to use it in case of fire breakout in the construction area. Potential fire prone activities such as welding and cutting will be carried out by experienced personnel and proper precautionary measures will be strictly followed in the construction site.

2.24 Tourist Activities and Services

Upon completion of the project, the 3 islands will be opened for the operation phase. Operations will be undertaken either by the same group or 3 different groups. This decision has not been made yet and the developer is actively seeking interested operators for the 3 islands.

Main objective of the development is to cater for tourist with proper activities and services targeting for them. Once tourists start coming in, the fragile marine ecosystem would be subjected to further stress from several tourist activities such as snorkeling, sea sport activities, recreational fishing and diving. These are to be carried out with caution towards the environment. Guests will also be made aware of areas of high currents, eddies and rips for their personal safety. Further awareness programs should be in place to inform all guests of the pristine and delicate nature of the environment. Staff will be provided with their own recreation areas for volleyball, futsal, badminton etc. and will be provided with a library as well as TV and Internet facilities for their entertainment and education.

Trips to nearby uninhabited islands for picnics and visits to inhabited islands will also take place, and systems would have to be in place to ensure there are no cultural clashes with the local populations. This can also be avoided by creating awareness among both locals and tourists. It is recommended to publish materials relating to such issues and distribute among locals and tourists. Protected areas, protected marine life, protected birds and banned exports should be made known to tourists, and staff. Orientation sessions will be held for the operations staff on the importance of these.

2.25 Work Undertaken

Sand search campaign has been undertaken and successfully concluded. All equipment and machinery required for the project, including the pipelines have been transported to the Maldives in April 2016. Pipelines have been assembled and was operational in Male' Atoll for another project. All equipment is ready to mobilise to site to commence construction.

Sand bunding works had commenced after initial EIA had been approved. Bunding works is currently ongoing. The wall is being constructed using excavators and material on site from the proposed reclamation area.

Dredging vessel, HAM 318 arrived in the Maldives in May 2016 and is currently in Male' area.

2.26 Project Management

The project is undertaken by the contractor, Van Oord Pvt. Ltd, which was not contracted to during the initial EIA. Founded in 1868, Van Oord is among the largest dredging companies in the world with years of experience. The group has worked internationally in different regions of the world.

2.27 Work Schedule

It has been estimated that the duration of the construction works would take 3 and a half years. Duration for each major component of the works will take the following:

- Mobilisation: 1 month
- Reclamation: 2 – 3 weeks
- Shore protection: 3 – 4 months
- Resort construction mobilization: 7 months
- Temporary facility construction and set up: 9 months
- Infrastructure works: 10 months
- Landscaping: 31 months
- Construction works: 28 months
- Finishing and furnishing, including site clearance: 16 months
- Commissioning: 2 months

Regarding dredging works as covered in this report, the works is currently scheduled to commence on 25th August 2016. The works will start as soon as the EIA approval has been obtained. The works will take 14 – 21 days approximately. It is scheduled to complete on 14th September 2016. The trailer suction hopper dredger (TSHD) will dredge from the proposed borrow area about 4 times each day. The time of dredging will depend on sailing

time. Each dredging will take 1.5 – 2 hours. Sailing from Borrow Area to Project Site will take approximately 1 hour. Pumping operation at the reclamation area will also take approximately 1.5 – 2 hours. Therefore each cycle would be about 5 hours.

2.28 Project Inputs and Outputs

Project inputs and outputs are generally the same as provided in the original approved EIA as there is no such change in scope with respect to materials and equipments. The same lists are provided below.

Table 10 Key inputs of the proposed project

Input resource(s)	How to obtain resources
Construction workers (250 – 400/island). Mostly expatriate laborers.	Contractors long term staff. Others recruited through recruitment agencies
Contractors long term staff. Others recruited through recruitment agencies	Contractors and developers long term staff
Land reclamation machinery. TSHD/CSD, 3x pontoons, 3x 330 and 3x 220 excavators, floating pipeline, hose, loaders, dump trucks, lorries, roller	Contractors equipment.
Construction materials:- timber, cement, thatch roofing materials, concrete blocks, electrical cables, circuit boards, main circuit boards, reinforcing steel bars, river sand, aggregates, telephone cables, PVC conduits, solar heaters, PVC pipes, paint, varnish, thinner, roofing sheets, floor and wall tiles, toilet fittings, diesel, petrol, tar etc	Wholesale quantities imported from abroad
Maintenance material	Imported or locally purchased
Water Desalinated water, rainwater	Desalinated in house, rainwater collected.
Electricity/Energy	Diesel-based electricity
Construction Machinery and equipment, excavators, barge, loaders, dump trucks, cement mixers, crane, etc.)	Contractor's equipment. If not available, leased from local parties
Water treatment chemicals (e.g. chlorine,	Imported or locally purchased

antiscalants, pool chemicals, etc.)	
Plants for landscaping	From nursery
Fuel & lubricant (e.g. diesel, petrol). Approximately 3000 L/day	Locally purchased
Fertilizers (e.g. for gardening)	Locally purchased or imported
Soaps and Detergents (laundry and washing)	Locally purchased
Cleaning agents (floor cleaning, toilet cleaning)	Locally purchased
Bleaching agents (laundry washing)	Locally purchased
Electrical appliances (TV, Refrigerators, Air Conditioners)	Locally purchased or imported
Communication (phones, fax machines, cables)	Locally purchased or imported
Insecticides, pesticides, fungicides (pest control)	Locally purchased
Stationary products (pens, papers, files etc.)	Locally purchased
Kerosene, LPG	Locally purchased
Diving equipment (snorkeling gears)	Locally purchased or imported
Safety equipment (safety hats, safety shoes, ear muffs, etc.)	Locally purchased
Fire fighting equipment (fire pumps, extinguishers)	Locally purchased
Water bottles	Locally purchased

Table 11 Key outputs of the proposed project

Products and waste materials	Anticipated quantities	Method of disposal
Dredged Material	975,000 m ³	Used for reclamation
Waste oils and lubricant from machinery	Minute	Collected on site and transported to designated landfill once works are over
Cleared green waste	Small	burnt/mulched on site & used for landscaping
Constructional waste (concrete and cement debris)	Considerable	Collected on site and transported to Thilafushi/other designated landfill
Used water bottles (PET)	Considerable	Collected on site and transported to Thilafushi/other designated landfill
Sludge (byproduct of sewage treatment)	Moderate	Collected on site and transported to Thilafushi/other designated landfill
Domestic waste	25 ton/month	Incinerated. Collected on site and transported to Thilafushi/other designated landfill
Kitchen and organic wastes	30 ton/month	Incinerated
Wastewater effluent	5000 ton/month	Treated and discharged via outfall
Timber, cardboard and scrap metals (construction site waste)	2 ton/month	Recovered, reused, recycled and any left overs taken to designated landfill for disposal
Used oil (waste oil), grease	1 ton/month	Reused or taken to

from facilities		designated landfill for disposal
Scrap metals/cans/plastics	2 ton/month	Collected on site and transported to Thilafushi or designated landfill for disposal
Plastic Bottles	9000 plastic bottles/month	Taken to designated landfill for proper disposal
Glass bottles	6000 bottles/month	Crushed and taken to landfill
Garden waste	Moderate	Decomposed on site
Hazardous waste (used pesticide bottles, chemicals, insecticide bottles, health care waste, etc.)	Moderate	Taken to designated landfill for proper disposal

3. Legislative and Regulatory considerations

The table below outlines the relevant legal and policy provisions with respect to this project. All components of the project shall give due consideration and abide by to all the legislative requirements provided in this chapter. Moreover, the proponent also shall ensure that the project is in line with any other such requirement brought to their attention throughout the course of the project. The proponent shall be responsible to ensure that all contractors and sub-contractors are informed of these requirements and conform to them accordingly.

Name	Main area of concern	Key components covered	Relevance to the project	Main regulatory body
Laws				
Maldives Tourism Act	Tourism industry	Covers all areas of tourism such as tourist resorts, tourist hotels, tourist guesthouses, marinas, tourist vessels, diving centers and travel agencies. The leasing, management and operation of such facilities are addressed in the Act.	Apply in all aspects of this development project	Ministry of Tourism
Environment Protection and Preservation Act (Act no. 4/93)	Environment as a whole	Mandates that Environmental Impact Assessments (EIA) are undertaken for all economic development project that may have an undesirable impact on the environment; addresses the disposal of oil, waste and toxic gas or any substance that may harmful effects on the environment within the Maldivian territory; covers non-compliance penalties.	Apply with respect to the social, economic and environmental impact of the project in the constructional and operational phase of the project. The requirement to undertake an EIA for all economic development projects that may have an undesirable impact on the environment shall be fulfilled by this EIA report.	Ministry of Environment and Energy

Land Act	Land	Encompasses the issuing, receiving, owning, selling, leasing, utilizing and using Maldivian land.	Apply with respect to utilization of Maldivian lands	Maldives Land and Survey Authority under Ministry of Housing and Infrastructure
Regulations				
Tourism related Environmental Impact Assessment Regulation 2015	Environment in tourism developments	This regulation dictates the process of Environmental Impact Assessment in any tourism related development; including new projects, redevelopment projects, major renovation works, or any other development project that may have a potential impact on the environment. It is inclusive of the roles and responsibilities of MoT, EIA consultant, project developer and project contractor in the process. The penalties are defined for non-compliances.	This EIA report shall fulfil the requirements of this regulation and is compiled accordingly.	Ministry of Tourism
Regulation on the Protection and Conservation of Environment on Tourism Industry	Environmental sustainability of tourism industry	Mandates standards for the protection and conservation of environment in tourism industry and facilitate sustainable development of tourism.	Apply in all aspects of the project including its design, construction and operation.	Ministry of Tourism
Maldives Recreational Diving Regulation	Marine	For carrying out diving expeditions in harmony with the marine environment in throughout the dive and in anchorage of the dive vessel.	Apply with respect to diving services that would be provided in operational phase	Ministry of Tourism
Dredging and Reclamation Regulations	Coastal modification and marine	Covers situations/cases to which dredging and reclamation permits can be given; types of situations in which dredging and reclamation can be undertaken; criteria to be utilized during dredging and reclamation; details conditions to be met in a borrow area including minimum buffer zone between the reel line; shore lines and also around reefs; disposal methods and its use of dredging spoil; maximum area for dredging and also reclamation	Dredging and reclamation permits need not be obtained for Tourism projects. Used as a guideline by MoT in giving reclamation approvals.	Ministry of Environment and Energy/ Environmental Protection Agency
Waste Management Regulation	Waste management	Addresses safe disposal, disposal guidelines and specifications for hazardous materials.	Apply with respect to management of waste during the construction and operational phase	Ministry of Environment and Energy/ Environmental Protection Agency
Regulation on Sand and Coral Mining	Coast and marine	While mining of corals are not allowed, the regulation further addresses the considerations which need to be made during sand mining in	This project does not involve mining of coral aggregate and sand would be dredged as borrow material with approval from EPA.	Ministry of Environment and Energy/ Environmental

		lagoons and deep sea areas of Maldives.		Protection Agency
Ban on Coral Mining	Marine	Coral mining from house reef and atoll rim has been banned through a directive from President's Office dated 26 September 1990	Any component of this project does not involve coral mining.	Ministry of Environment and Energy/ Environmental Protection Agency
The Environmental Liability regulation (Regulation 2011/R-9)	Environmental Offences	Provide the basis for levying fines on environmentally damaging violations to avoid environmental deterioration, extinction of biological resources, environmental degradation and wastage of natural resources.	Apply with respect to the environmentally relevant aspects of the construction and operation phase	Ministry of Environment and Energy/ Environmental Protection Agency
Policy Guidance				
Strategic Action Plan (SAP) of National Framework for Development 2009-2013	Development	Incorporates EIA process and EIA monitoring; biological diversity and ecosystem benefits; resilient communities in addressing impacts of climate change, disaster mitigation and coastal protection; adaptation and mitigation for beach erosion and assisting communities where livelihood and property are affected by beach erosion; management of solid waste; protection of people and environment from hazardous waste	Apply as a development project with the potential to contribute in the realization of the Action Plan goals especially under corporate social responsibility.	Ministry of Environment and Energy/ Environmental Protection Agency
		and chemicals; air quality; decentralized environmental governance system; a low carbon economy to achieve carbon neutrality by 2019; environmental values and environmental friendly lifestyle.		
Maldives National Strategy for Sustainable Development 2009-2013	Sustainable development	Seeks sustainable development through appreciation of the true value of natural environment, utilizing natural resources in a sustainable manner for national development, conserving the limited natural resources, building the capacity to learn about the natural environment and leave a healthy natural environment for future generations.	Apply with respect to the construction and operational phase of the project.	Ministry of Environment and Energy/ Environmental Protection Agency
National Biodiversity Strategy and Action Plan	Biodiversity	Aims for the Conservation of biological diversity and sustainable use of biological resources; capacity building for biodiversity conservation through a strong governance framework and improved knowledge and understanding; fostering community participation, ownership and support for biodiversity conservation.	Apply with respect to the construction and operational phase of the project.	Ministry of Environment and Energy/ Environmental Protection Agency

Waste Management Policy	Waste management	Covers polluter pay principles; integrated solid waste management; Best Practice Environmental Option (BPEO), Best Available Technology Not Entailing Excessive Costs (BATNEEC); proximity principle and private sector participation.	Apply with respect to management of waste during the construction and operational phase	Ministry of Environment and Energy/ Environmental Protection Agency
National Environmental Action Plan	Sustainable development/ Environmental Management	Protect and preserve country's environment and management of natural resources for sustainable development of the country.	Apply with respect to the construction and operation of the project	Ministry of Environment and Energy/ Environmental Protection Agency

The required approvals obtained from the Ministry of Tourism is provided in the Annex.

4. Description of the Existing Environment

This section covers the existing environmental conditions of the project site. Since this original EIA for the resort island reclamation and development has been approved, most of the environmental conditions on site has already been discussed and provided, including marine environment, terrestrial environment, and socio-economic environment. As this study only focuses on the borrow area and nearby sites, the key components with respect to the project are few. However, as per the TOR, the following conditions on site have been discussed:

- Bathymetry
- Marine environment survey
- Marine water quality

Data was collected using methods discussed in Section 1.4. Surveyed areas are given in the following Figure 1.

General weather data on Climate and Hazard vulnerability are initially provided.

4.1 Climate

The Maldives, in general, has a warm and humid tropical climate with average temperatures ranging between 26°C to 32°C and relative humidity ranging from 73 per cent to 85 per cent. The country receives an annual average rainfall of 1,950mm. There is considerable variation of climate between northern and southern atolls. Table 12 provides a summary of key meteorological findings for Maldives. General studies on climatic conditions of

Maldives were taken into account during study as local level time-series data are limited for longer periods at the nearest meteorological station.

Table 12 Key meteorological information

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

4.1.1 Monsoons

Monsoons of Indian Ocean govern the climatology of the Maldives. Monsoon wind reversal plays a significant role in weather patterns. Two monsoon seasons are observed: the Northeast and the Southwest monsoon. Monsoons can be best characterized by wind and rainfall patterns. The southwest monsoon is the rainy season which lasts from May to September and the northeast monsoon is the dry season that occurs from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November. The monsoons govern the wind, waves, and current impact on the island.

4.1.2 Temperature

The temperature of Maldives vary little throughout the year with a mean daily maximum temperature of about 32°C and mean low of 26°C and are rarely below 25°C or above 33°C. The highest temperature ever recorded in the Maldives was 36.8°C, recorded on 19 May 1991 at Kadhdhoo Meteorological Office. Likewise, the minimum temperature ever recorded in the Maldives was 17.2°C, recorded at the National Meteorological Centre on 11th April 1978. The highest recorded temperature for Male’ was 34.1°C on 16th and 28th of April 1973. The hottest month of the year is usually April reaching a peak around 24 April.

The figure below represents daily average low (blue) and high (red) temperature with percentile bands: inner band from 25th to 75th percentile and outer band from 10th to 90th

percentile (source: weatherspark.com) based on the historical records from 1981 to 2011 at Hulhulé weather station, the station closest to the project site.

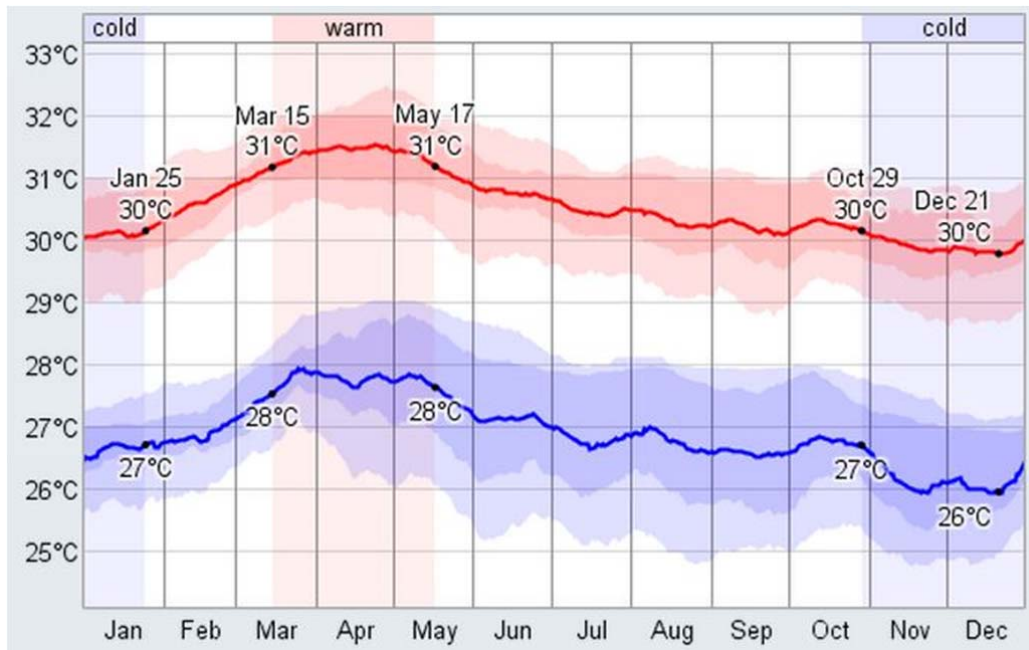


Figure 13 Daily average temperature for Central Maldives

4.1.3 Rainfall

Annual average rainfall in the Maldives is about 1900mm. There is a marked variation in rainfall across Maldives with an increasing trend towards south. The annual average rainfall in north is 1977mm and for south is 2470mm. The southwest monsoon is known as the wet season with monthly average rainfall ranging from 125-250mm. The northeast monsoon is known as the dry season with average monthly rainfall of 50-75mm.

The following figure illustrates the likelihood that precipitation may occur at some point in the day on a given day, based on the historical records from 1981 to 2011 at Hulhulé weather station (weatherspark.com).

Long term data indicate an average annual rainfall of Central, Southern and Northern parts of the Maldives receive annual average rainfall of 1924.7mm, 2277.8mm, and 1786.4mm, respectively. The intensity of rainfall is a concern in the Maldives since intensity is high with low frequency (Sandcays 2013).

4.1.4 Wind

Winds often help to regenerate waves that have been weakened by travelling across the reef and they also cause locally generated waves in lagoons. Therefore winds are important here,

as being the dominant influence on the sediment transportation process (waves and currents). With the reversal of winds in the Maldives, NE monsoon period from December to March and a SW monsoon from April to November, over the year, the accompanying wave and current processes respond accordingly too. These aspects have ramification on the seasonal sediment movement pattern on the islands and also the delivery/removal of sediments from the reef platform/island.

The two monsoon seasons have a dominant influence on winds experienced across the Maldives. These monsoons are relatively mild due to the country’s location close to the equator and strong winds and gales are infrequent. However, storms and line squalls can occur, usually in the period May to July; gusts of up to 60 knots have been recorded at Male’ during such storms.

Wind was uniform in speed and direction over the past twenty-plus monsoon seasons in the Maldives. Wind speed is usually higher in central region of the Maldives during both monsoons, with a maximum wind speed recorded at 18 m/s for the period 1975 to 2001. Maximum wind speed recorded in the south was 17.5 m/s during the period 1978 to 2001. Mean wind speed was highest during the months January and June in the central region, while wind speed was in general lower and more uniform throughout the year in the southern region. Wind analysis indicated that the monsoon was considerably weaker in the south.

The table below shows the wind direction and speed by month for the year 2013. As can be seen, the speed is highest from June – October from predominantly west.

2013 : 1.3 : WIND DIRECTION AND SPEED BY MONTH, 2013

Locality	Yearly average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
WIND SPEED (MILES/HOUR)														
Male'	9	10	8	6	6	13	11	8	10	10	11	6	10	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
HDh.Haniimaadhoo	6	5	4	4	5	8	10	8	9	8	7	4	5	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
L.Kadhdhoo	5	6	5	4	5	8	5	4	6	6	7	4	6	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
GDh.Kaadhdhoo	6	6	5	4	6	9	6	5	5	6	7	6	7	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
S.Gan	6	5	4	4	6	10	6	6	5	6	7	7	7	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
WIND DIRECTION														
Male'		ENE	ENE	E	W	W	WSW	WSW	W	W	W	E	ENE	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
HDh.Haniimaadhoo		ENE	E	NNW	NW	W	W	W	WNW	W	W	E	E	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
L.Kadhdhoo		NE	NNE	VRB	W	WSW	SSW	S	S	W	SSW	W	NE	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
GDh.Kaadhdhoo		NNE	NNE	VRB	W	W	SW	SSE	S	WNW	W	W	NW	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
S.Gan		NE	N	W	W	W	SSW	S	S	SSW	W	W	W	ދިވެހިރާއްޖޭގެ ބޭރުގެ ބަނޑުގެ ބަނޑު
Source: Maldives Meteorological Service														
Note:														
N - North		NNE - North-North-East			WNW - West-North-West			W - West			NNE - North-North-East			N - North
S - South		NE - North-East			SW - South-West			S - South			NE - North-East			S - South
E - East		ENE - East-North-East			WSW - West-South-West			E - East			ENE - East-North-East			E - East
W - West		NW - North-West			SSE - South-South-East			W - West			NW - North-West			W - West
		NNW - North-North-West			SSW - South-South-West						NNW - North-North-West			

Statistical Yearbook of Maldives, 2014. Data from MET.

4.1.5 Waves

Wave energy is important for sediment movement and settlement, and it is also a crucial factor controlling coral growth and reef development. Waves have been attributed to the diversity and the abundance of coral and algal species. They also have the power to completely erode away large chunks of the coastline.

There are two major types of waves on Maldives coasts: wave generated by local monsoon wind and swells generated by distance storms. The local monsoon predominantly generates wind waves which are typically strongest during April-July in the south-west monsoon period. Local wave periods are generally in the range 2-4 seconds and are easily distinguished from the swell waves.

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

In addition, Maldives has recently been subject to earthquake generated tsunami reaching heights of 4.0m on land (UNEP 2005). The island is well protected from wave impacts as it does not lie on the reef edge. This provides good fetch distances from other bodies on the water which reduces wave impact. Furthermore there is a strong reef around the island, which especially protects the SW side of the island, the area which otherwise would have been vulnerable. Wave energy can enter the lagoon uninterrupted from the NE, and this is something that need to be addressed for the long term future stability of the beach that faces this area.

Table 4-13: Summary of wave condition around Borrow Area

Season	Total	Long Period	Short Period
NE - Monsoon	Predominantly from E-W. High Waves from SE	From E-SE	Mainly E-NE. High waves from E
Transition Period 1	Mainly from SE-E	From S-SW	Mainly from NE-SE
SW - Monsoon	From SE-SW. Mainly from S. High Waves also from W	From S-SW	Mainly from SE-S. High waves from E
Transition Period 2	As SW monsoon	From S-SW	From SE-W. Higher waves from E

4.1.6 Tides

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

4.1.7 Currents

Water current measurements on site are not as effective as water depths in determining the existing environment as the current varies greatly throughout the year. However, during the field visits, the currents were predominantly towards North East, and East. The average current was 0.5m/s.

Generally current flow through the Maldives is driven by the dominating two-monsoon season winds. West wardly flowing currents are dominated from January to March and eastwardly from May to November. The change in currents flow pattern occurs in April and December. In April the westward currents flow are weak and eastward currents flow will slowly take place. Similarly in December eastward currents flows are weak and westward currents will take over slowly. During the field trip, the current direction was understandably eastwardly.

Under low-input wave conditions (0.5m heights) strong lagoon ward surge currents (>60cm/sec) are created by waves breaking at the crest. Studies on current flow across reef platforms have shown that long-period oscillations in water level cause transportation of fine-grained sediments out of the reef-lagoon system, while strong, short duration surge currents (<5sec.) transport coarse sediments from the breaker zone to seaward margin of the back reef lagoon. Always sediment accumulates at the lee of high-speed current zones. Generally zones of high current speed (jets or rips, 50-80cm/sec) are systematically located around islands.

Aspects relating to currents have a direct impact on the project, especially in understanding the movement of sediment plumes and the design of coastal protection measures. Therefore, long term monitoring of currents is important. Long term monitoring of data will be recommended in the monitoring programme proposed for the resort. Long term data is required to make an informed judgement.

4.2 Bathymetry

Bathymetry is provided in the Annex. The minimum bottom depth is 45m from MSL, while maximum bottom depth is 56m from MSL. The bathymetry chart is provided in the Figure below, while a more clear map is provided in the Annex.

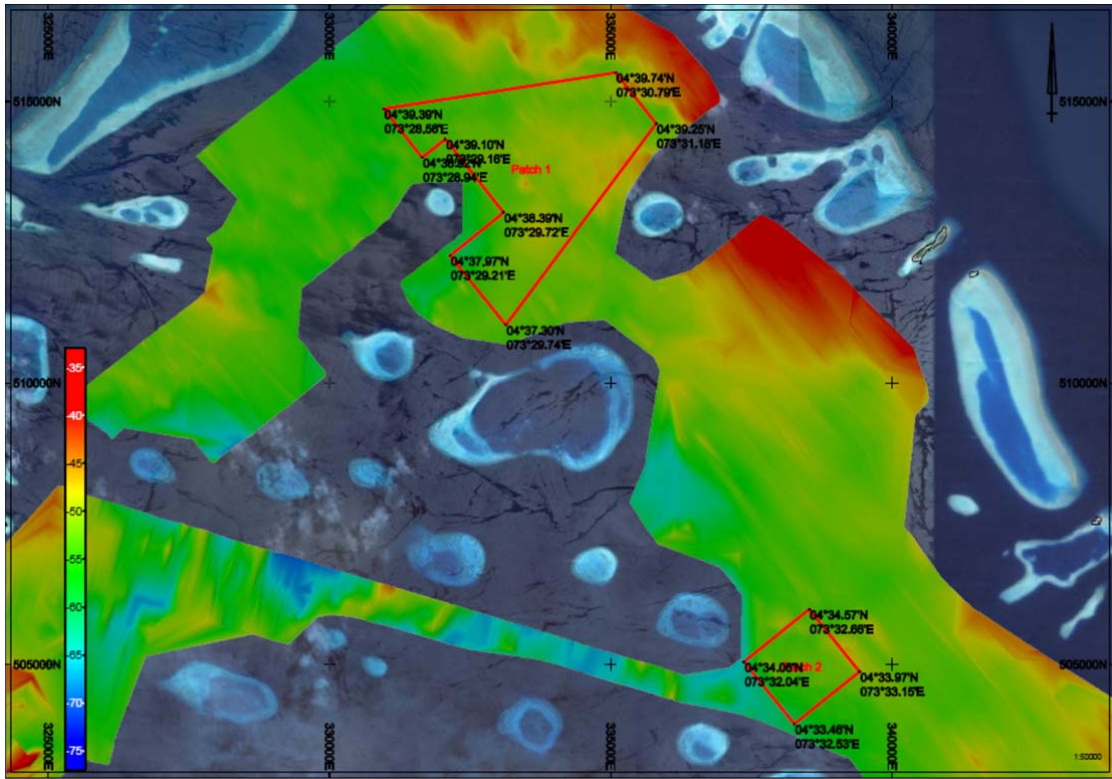


Figure 14 Bathymetry of the proposed Borrow Area

4.3 Marine Water Quality

Water quality monitoring around known dive points near the borrow area were measured. The quality was tested at the areas; ‘Ghadaffi Place’, ‘Fledermaus reef’, ‘Mahaa Thila’ and Kagi Island Lagoon. The locations are given in Figure 1.

The water quality assessment report from MWSC with results for each site is given in the Annex. As can be seen, and as expected, the turbidity levels at the site were very low. Turbidity levels should be monitored daily/weekly during dredging works to observe the change from this baseline condition.

4.4 Marine Environment Survey

General marine environment for the project area has been declared in the original approved EIA. Observation of the marine environment took place at 4 known dive points around the borrow area. The sites are indicated in Figure 1. These areas were chosen as there were no critical sensitive areas found near the borrow area. The survey was undertaken by the consultants team.

The reef fish composition at the respective sites are given below.

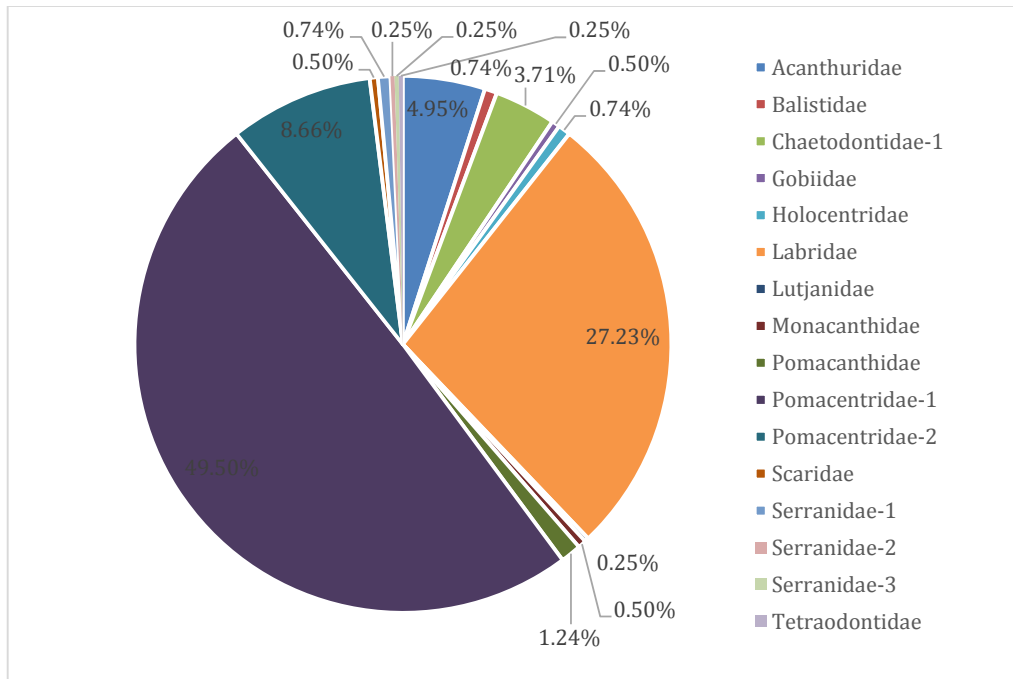


Figure 15 Fish count - Site 1

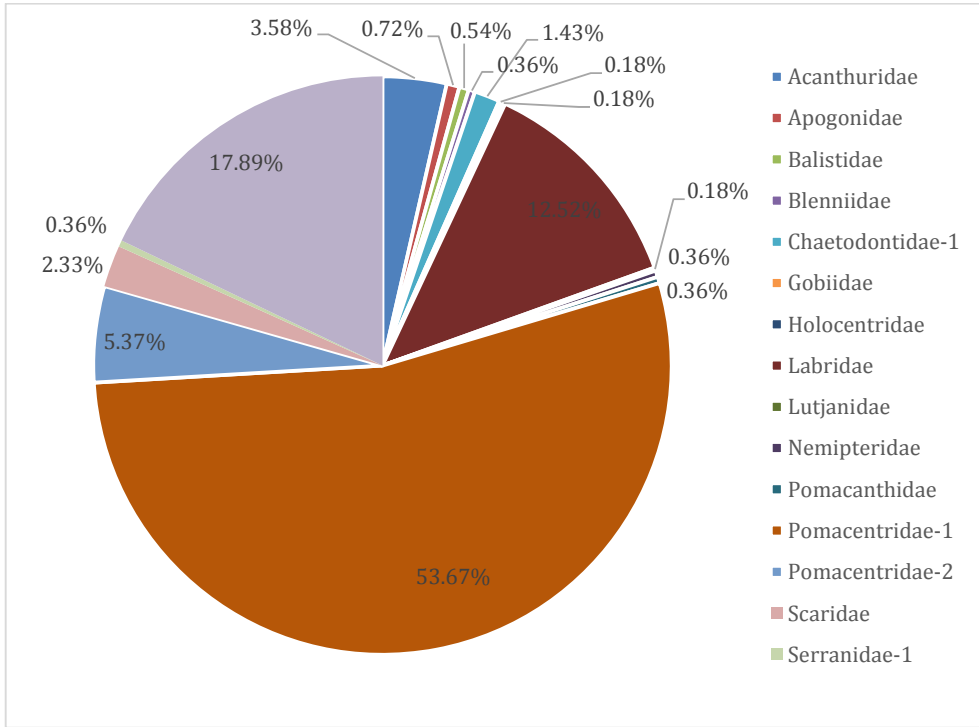


Figure 16 Fish count - Site 2

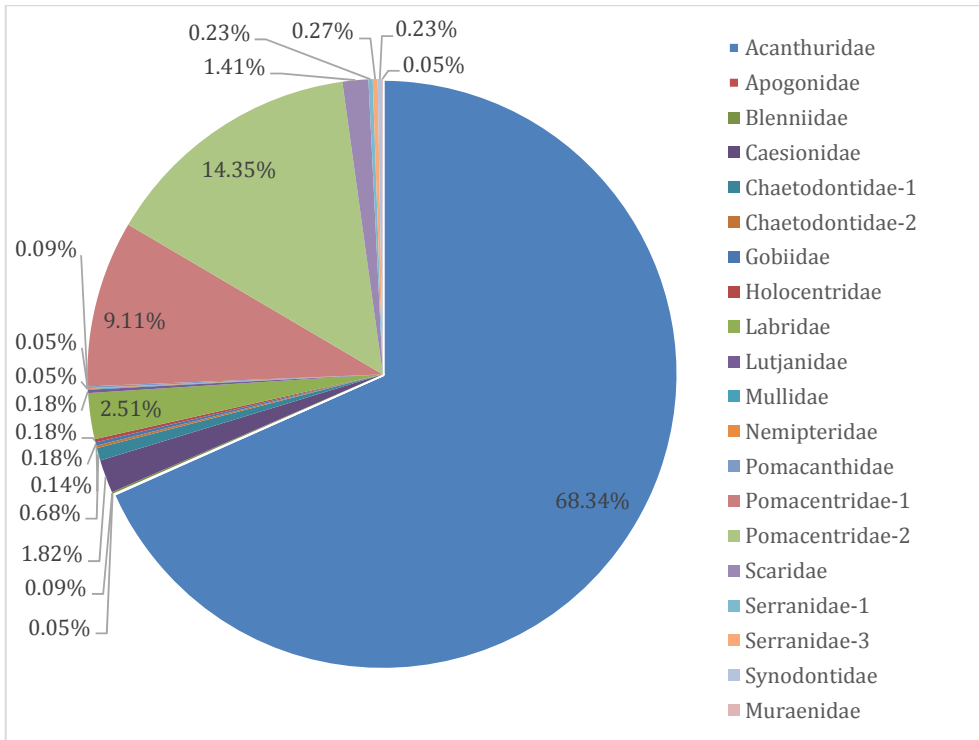


Figure 17 Fish count - Site 3

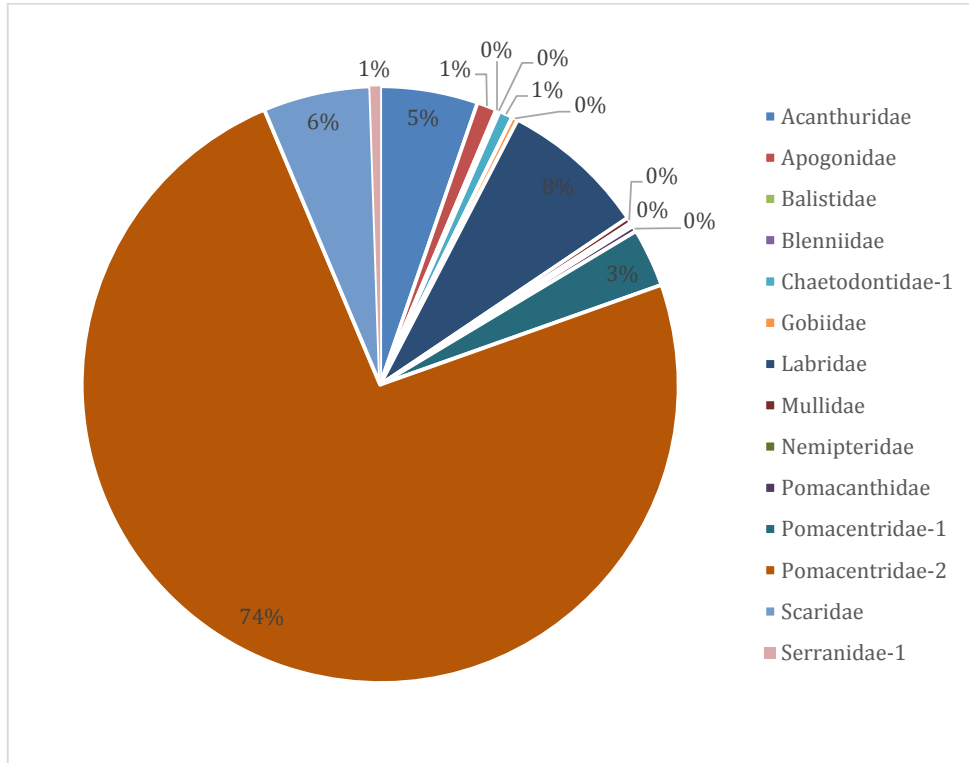


Figure 18 Fish Count - Site 4

The Dominant substrate composition at the survey sites are tabulated below:

Table 14 Dominant substrate composition at the sites

Substrate type	Percent composition			
	Site 1	Site 2	Site 3	Site 4
Live Coral	18.86	5.35	8.85	2.22
Sand	19.19	56.33	26.40	51.58
Rubble	2.56	7.78	4.28	2.01
Broken Coral Colony	0.00	0.00	0.00	0.00
Bleached Coral	0.91	0.00	1.62	0.00
Rock	9.53	6.34	15.27	3.64
Sponge	0.64	2.33	1.27	0.60
Zoantharian	0.00	0.00	0.00	0.00
Macro Algae	1.74	1.53	0.00	0.00
Turf Algae	14.57	7.15	1.56	0.60
Tunicate	0.62	0.21	0.00	0.62
Soft Coral	0.00	0.00	0.63	0.00
CCA	0.00	1.51	0.22	0.00
Bivalvia	0.00	0.00	0.00	0.00
UNKNOWN CORAL	0.42	0.00	0.64	0.27

Dead Coral with Algae	30.96	11.49	39.26	38.46
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From among these, the live coral composition are provided below:

Table 15 Live coral composition at the sites

Family	Mean composition			
	Site 1	Site 2	Site 3	Site 4
Acropora branching	2.36	0.00	1.04	0.00
Acropora table	0.21	0.00	0.00	0.00
Astreopora	1.10	0.42	0.23	0.00
Echinopora	0.84	0.00	0.28	0.00
Favites	1.72	0.00	0.21	0.00
Fungiidae	0.00	0.22	0.44	0.00
Heliopora	0.00	0.00	0.22	0.00
Merulina	0.45	0.00	0.00	0.00
Montipora	2.18	0.64	0.63	0.00
Pavona	0.63	0.84	0.86	0.00
Pocillopora	2.12	0.21	0.00	0.00
Porites branching	1.22	3.03	0.45	1.40
Porites massive	4.17	0.00	3.56	0.82
Pseudosiderastrea	1.84	0.00	0.94	0.00
	18.86	5.35	8.85	2.22

The live coral composition is further illustrated in the following Figure

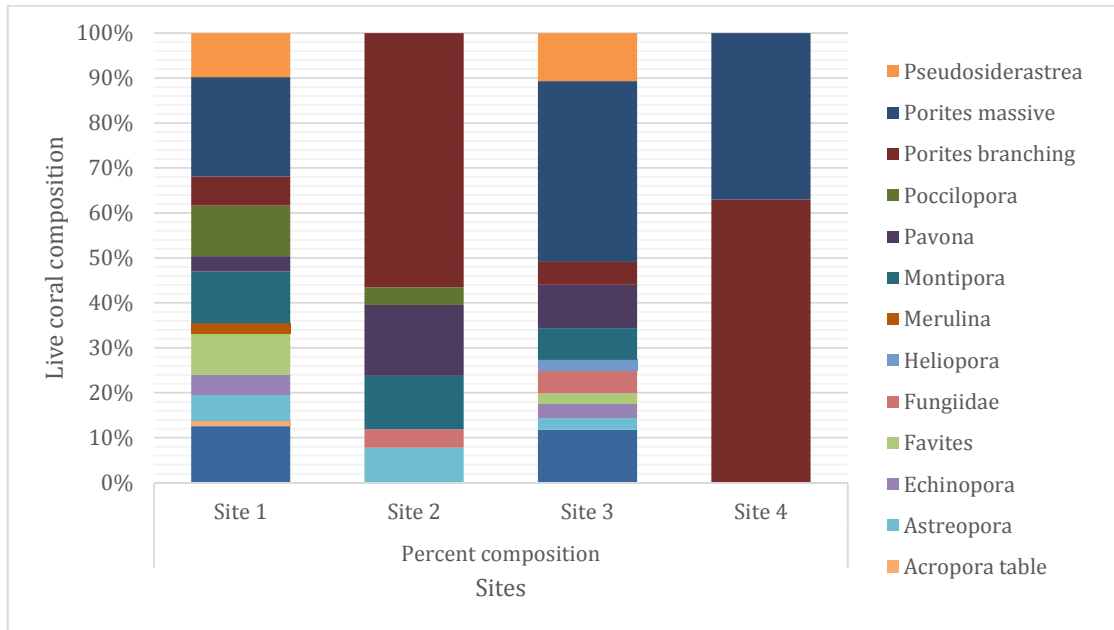


Figure 19 Percentage of live coral composition at the sites

The Marine survey photos are provided in the Annex

5. Stakeholder consultation

Consultations with the stakeholders were undertaken from 10th to 17th August 2016. Information about the project was provided, and the concerns of the councils were noted. While the councils had some concerns, they were quite optimistic about the project. The developer gave assurances that their concerns can be alleviated, and all stakeholders can observe that the impacts would be at a minimum when the project commences. The resort raised their concern on the fact that some of the dive spots they use are near the borrow area. While the Ministry’s generally required to be informed of the borrow area details. Since there were recent similar reclamations undertaken under the same project, it is envisaged that there would not be long lasting impacts from the projects and the significantly turbid area will be only within 100 – 200m from the dredging area. However, they were informed that diving within 1 km of the borrow area is not recommended during the dredging works.

5.1 Consultation with Male' Atoll council and Gaafaru council

Consultation with members from the Male' Atoll council and Gaafaru council took place in Gaafaru Island on 15th August 2016. From the Atoll council Ibrahim Shareef (7775282) was met, while from the Gaafaru Island council Ali Hashim (9706655) and Ahmed Zahid (7903888) were met along with other members of the council.

Upon briefing the project, the Atoll council was generally positive on the implementation. He had informed that there were other similar projects in the region and he is expecting great benefits to the local community for these upcoming new developments. He expressed on the importance for the developers to work in hand with the local communities and to facilitate them with issues such as waste management. The counciler further inquired on whether sand could be available from the dredge location and expressed concern whether there may not be enough for the potential expansion of inhabited islands. He was assured that, from the information collected for this project, it is highly likely that sand will indeed be available from the proposed borrow area as the available sand far exceeds than those required for this project.

Sand availability was a concern shared by the island council as well. They mentioned that they have had plans in the pipeline for a possible expansion of Gaafaru in the near future. Since the dredger was operating so close to Gaafaru, ideally they wanted the expansion to occur at this stage. However, this will probably not be possible as there are no current government plans to reclaim Gaafaru.

Regarding environmental impacts both the Atoll council and Gaafaru council expressed concern on how the dredging activities will hinder fisheries in the region. Some members of the Gaafaru council were not happy that the lagoon the proposed project is set to take place was leased out by the Ministry of Tourism without any say from them, as they had explained. They informed that the lagoon was used for bait fisheries. With respect to potential impacts from dredging from the borrow area, they did not believe there would be a major issue. They did not inform of possible dive points nearby, but mentioned the shallow reef in the region were visited by some local fisherman. Also, they expressed concern for the bottom dwelling species directly in the borrow area.

Both the councils were informed that from recent experience, there does not appear to be long term significant impact from the dredging activities. However, more data is being collected under monitoring programs and the situation will be much more clearer then. Additionally, they were informed that there will be inevitable short term impact during dredging works. They were informed that the dredging would take place for 2-3 weeks and

that it is highly advisable for all vessels, either for fisheries or diving, steer clear of the identified borrow area for this time period.

The councils also expressed the need to expedite the process and for the developments to come in place in the region soon.

5.2 Helengeli Resort Management

Contact was established with Helengeli Resort Management from 2nd August 2016. Details of the project was emailed to senior members of both the developer and operator from the said date onwards. Notable personnel contacted include Mr. Shrikan Dash (shrikant@eonresorts.com) and Mr. Krishna Chalise (krishna@eonresorts.com) from the developer side, and Mr. Solih Mohamed (solih@oblu-helengeli.com) and Mr. Rein W.M van Zandvoort (rein@oblu-helengeli.com) from the operator side.

All the details of the project was shared including the project location, scale of the project, type of dredger, and the precise location of the borrow area as well. It was also informed that it is not anticipated that there will be significant impacts in Helengeli, and even under the remote chance that there are, it will be short term and minor. They had informed that there were some dive spots frequented by their guests near the borrow area, which were then used as a basis for the monitoring locations. The resort management was informed that, in the interest of their guests, no diving should take place in the designated area for the duration of the project. They were informed that short term impacts will occur during the works.

5.3 Ministry of Housing and Infrastructure

The Deputy Minister for the Ministry of Housing and Infrastructure, Mr. Abdullah Muththalib (abdullah.muththalib@housing.gov.mv) was met on 11th August 2016 regarding the project.

Mr. Muththalib had informed that a letter stating the Ministry's concern and needs with respect to private sector deep sea dredging has been sent to the Environmental Protection Agency and the same is to be reiterated in this consultation.

The Deputy Minister does note that there may be a conflict between public sector and private sector deep sea dredging projects as the deep sea sediment budget of the Maldives is currently not fully known and there is fear that it may deplete in important areas soon. However, the Ministry has no intention of restricting private sector developments dependent upon deep sea dredging at this stage.

Furthermore, the Deputy Minister noted that the Ministry wished to obtain detailed information on the borrow sites for private sector development such as this. As such, the Ministry required the precise location of the borrow area with GPS co-ordinates, in-survey bathymetry and out-survey bathymetry of the sites. It was informed that, as things stand, there was no need for the private sector developers to correspond directly with the Ministry but rather this information will be obtained from the EPA, after the developer provides them the required information as part of the EIA and dredging and reclamation approval.

5.4 Ministry of Fisheries and Agriculture and Marine Research Center

Mr. Hussein Sinan (hussain.sinan@fishagri.gov.mv) and Ahmed Shifaz (ahmed.shifaz@fishagri.gov.mv) was met with from the Ministry of Fisheries on 16th August 2016. They informed that they have had been briefed about the project from EPA with concerns of depleting deep sea sediment budget in the Maldives., and have had discussions with the Minister regarding the project and other similar works. Nizam Ibrahim (nibrahim@mrc.gov.mv) from MRC was also met with during the initial development component of the EIA as Gaafaru council had informed of the bait fisheries in the lagoon. MRC informed that it was not an identified as a popular bait fisheries area. However, it was highlighted that nevertheless as the ecosystems are connected as a whole, all areas are important areas of marine life and it is of utmost importance that the implementation of the project takes place with minimum adverse impact on the environment and that monitoring takes place.

With respect to the letter from EPA, the Ministry of Fisheries informed that it was difficult to make a decision on the Ministry's approval or disapproval for such projects without sufficient data, which is currently not available. Therefore, they had also stressed on the importance of a data collection and sharing model within inter government agencies and Ministries similar to the feedback from the Ministry of Housing and Infrastructure.

The Ministry was generally positive on the development. They informed that since the Lagoon was already leased to a developer, and since the lagoon can only be developed by reclamation, it can be implied that the government is well aware that sand has to be borrowed to carry out the project, and as such disrupting the progress of the project at this stage is something they do not intend or recommend. They were further positive on the fact that the proposed borrow area was at a significant distance away from any environment designated as a sensitive or protected area.

The team discussed on how our deep sea sand can be regarded as a natural resources. But at the same time, they expressed concerns on how difficult it is to put a value on it without sufficient data on its availability or scarcity.

The Ministry also expressed on the importance of a sand search campaign encompassing the entire country so that the availability of sand or its lack of can be understood by all relevant authorities. This would enable to make decisions on how the public and private sector can utilise this resource, and how this resource could be valued much easier. Additionally, The Ministry also requested that marine environment survey data near the borrow site be shared with them.

5.5 Ministry of Tourism

Ministry of Tourism (MoT) was initially informed of the project via an official letter from the developer. Subsequently the Master plan has been approved and an EIA was done for the Reclamation and Development work, for which a decision statement was issued by MoT on 26th May 2016.

Regarding the identification of the borrow area, Mr. Fikry (9997816), Assistant Director, was contacted. Mr. Fikry had informed that MoT had no say in environmental activities outside designated tourism boundaries and that an EIA process had to be initiated with the Environmental Protection Agency.

6. Impacts and Mitigation Measures

This section is based on the potential environmental impacts due to deep sea dredging in the designated borrow area. The section further describes the mitigation measures for each identified impact. Other impacts and mitigation measures due to the island reclamation and resort development works are as approved by the Ministry of Tourism in the initial EIA.

Methods of identification of potential impacts and assessing the significance of the impacts are described in the following sections.

6.1 Identification of Impacts and their Significance

Impacts on the environment from various activities of the proposed project have been identified through:

- Using decision frameworks for assigning significance to impacts

- Existing environmental studies carried out similar developments in other similar environments
- Research data that has been accumulated specific to the Maldivian context.
- Baseline environmental conditions collected.
- Past experience of the consultants with similar projects.

Possible negative impacts on the environment have been considered in worst-case scenario to recommend mitigation measures in the best possible ways so that these impacts would be minimized and perhaps eliminated in the implementation phase.

The impacts highlighted in the TOR for this EIA has been used as a guideline in identifying important impacts. However, this was not used as a strict instruction for the identification. Once new impacts not highlighted in the TOR were foreseen, they were given equal importance.

Following are the major types of possible negative impacts foreseen due to the implementation of the project

- Impacts due to sedimentation
- Visual/aesthetic impacts during dredging
- Noise Pollution
- Impact on marine eco systems
- Health and safety of workers

6.2 Impacts due to sedimentation

Sedimentation is the major cause for concern in all deep sea dredging works. Sedimentation issues will occur and water will get turbid during dredging. It is therefore important to identify which locations are nearby the dredge area, and identify the resources and/or receptors that will be impacted upon.



Figure 20 Distances from the project area to nearby sites of note.

The figure above shows the distances of all notable sites to the proposed borrow area. As can be seen, there are absolutely no site designated as protected or sensitive. The only tourism venture is about 7km away and the closest inhabited island is 9.7km away. Considering the scattered manner of resorts and inhabited islands along with sensitive areas in the Maldives, this borrow area is at an almost ideal location.

With respect to the severity of the impact, the contractor, Van Oord has demonstrated during the previous two island reclamations in S. Feydhoo and Thinadhoo, that the turbidity levels during dredging can remain very low (between 0 and 3.5 NTU) while dredging course grain size sand similar to the current project. Below graph shows the turbidity (NTU) measured during dredging in Thinadhoo next to the borrow area. As can be seen, Turbidity levels vary between 0 and 3.5 NTU.

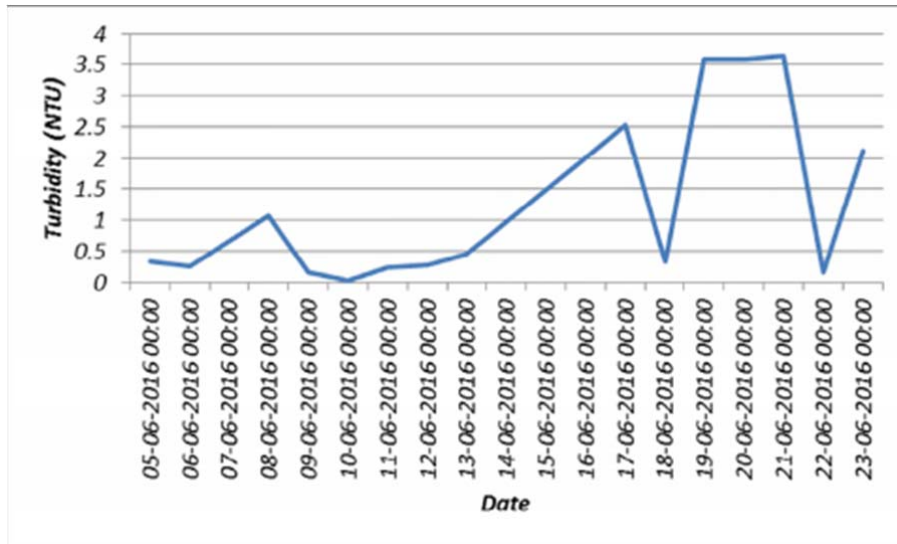


Figure 21 Turbidity values at Thinadhoo borrow area during the dredging works

Quick settlement of the coarse grained sand has been noticed on the borrow area as well as at the reclamation area. The turbidity has already been significantly reduced 4 hours to 6 hours after dredging, where the turbidity values are already reduced to 0 and 1 NTU, which is comparable to the baseline conditions.

To summarise, the environmental impact expected by the dredging activities in the North Male' atoll are very low / negligible due to the below mentioned facts:

1. Minor turbidity increase measured during previous dredging when dredging coarse sand;
2. Quick settlement seen during previous dredging when dredging coarse sand;
3. Short total duration of the entire project, approximately 14-20 days, where effects are only temporarily
4. No area designated as sensitive or protected area near the borrow site. The closest sensitive area is 'Madivaru Beyru', which is 22km SW of the borrow area. The closest protected area is 'Makunudhoo Kandhu', which is 15.8km SW of the borrow area. At these distances, even short term, indirect, minor impacts would not occur.

Possible impacts on marine species due to sedimentation

Although the region does not consist of a designated sensitive area, the marine environment survey from the shallow reefs nearby noted that environment had endured significant amounts of bleaching, and will thereby be vulnerable to the effects of the sedimentation due

to dredging. Corals in general relies on symbiotic algae zooxanthellae to produce their energy requirements via photosynthesis. Ambient light will be reduced in the borrow area due to elevated levels of turbidity, decreasing the overall photosynthetic activity of zooxanthellae. Prolonged periods of reduced photosynthetic activities will in theory lead to malnourishment and starvation coral colonies. In addition, an increased level of suspended solid in water column is reported to reduce the survival rate of coral larvae (Gilmour, 1999).

One of the most important studies was coral morphology and their sensitivity to turbidity was undertaken by Erftemeijer et al. in 2012. The most sensitive coral types to Turbidity are Soft Corals, Massive Corals and Gorgonians. Turbidity level between 4 – 16 NTU is observed to have sub lethal effects including reduced growth, bleaching, and tissue damage on these types of corals. Even for tolerant coral types, sub lethal effects are observed when turbidity levels raises to 28 – 30 NTU (Erftemeijer et al., 2012). However, it is very important to note that as stated above and illustrated in Figure 21 the turbidity levels are expected to be much lower than the figures given even within a range of 200 – 300m, while the coral reefs observed were further than 500m. This gives the indication that it is rather unlikely these impacts as stated would occur.

Duration of exposure to sediments is also an important parameter in determining the sensitivity of the corals. Experiment on the impact of short-term sediment burial of corals by Wesseling et al.(1999), showed no visible impact on Porites species after exposing to sediments for 6 hours, but minor discolorations were recorded on Porities colonies exposed for over 20 hours, and bleaching was observed when burial period extended for 68 hours. Burial period also is key determinant whether the corals recover or not, from the same study it was observed that Porites colonies that were buried for 20 hours recovered to normal levels within 3 weeks, but those buried for 68 hours left large white patches. It is not expected that the coral reefs monitored under this study will be buried as such, although they will be exposed to some amount of sedimentation.

6.3 Visual/Aesthetic impact

There will be a short term loss of visual amenity during the dredging activities. However, as there is no significant receptor close, this impact will be virtually negligible. In a situation where the dredger is placed close to an inhabited island or more importantly a resort island, the loss of visual amenity can be regarded as significant. However, as stated previously, that is not the case for this project. Visual impact for diving in the borrow area during the dredging works will be moderately significant and is covered under Sedimentation impacts. As stated this impact is short term.

6.4 Noise Pollution

Noise pollution will be minor during the dredger mobilisation. Noise will be an issue in the direct vicinity of the TSHD during the dredging activities. Dredging produces noise above and below water. Above water, noise is emitted by shop engines and from pumps used to intake sediments into the vessel. Above water noise generated is similar to any ship. Underwater, engine and propeller noise is produced. Noise is also generated at the suction intake and along the suction line in the vessel. Underwater noise levels of above 100 dB has been predicted at 100m from the dredging activity. Beyond that the noise gradually reduces. There is no noise from the dredging activity beyond 5-6km from the dredger (Marshall Day Acoustics 2016).

A positive impact from the noise is that it provides a warning for marine organisms to scatter away from the dredging area. There has been records of such behavioural changes to marine species.

6.5 Water pollution from waste

Careless management of the project may result in significant pollution of the area used by the dredger along with its route to the reclamation site. Potential sources of pollution is the disposal of household domestic waste from the dredger. Disposal of industrial non-biodegradable waste. Disposal of sewage. Waste oil disposal and any potential oil leaks. However, the probability of any of this occurring is very low as the ship is bound by local and international regulations to prevent any such disposal.

6.6 Impact on worker safety

Worker safety will be paramount during the dredging and reclamation works. The issue is mostly a concern during the reclamation component rather than dredging. During dredging, the workers will be in a safe environment of the dredger and will be exempt from external factors. However, accidents can happen and have happened in the past. The frequency of impacts is very low, but the intensity may be severe as it may result in the loss of life. Dredging contractors are bound by international safety regulations, which will be provided in some detail in the Mitigation Section. These ensure that accidents on board are kept to a bare minimum for the workers and for visitors as well.

6.7 Socio economic impact

The major socio economic impact from the project is with respect to the entire development rather than only the dredging component of the project as covered under this study. With

regards to only the dredging component, a positive impact would be the utilisation of accommodation, food and services from neighbouring communities, namely Gaafaru for the duration of the project. In addition to the dredging contractor, the 3 separate contractors assigned with bund wall construction has been in talks with the Gaafaru council as was revealed during the stakeholder consultation meeting. This will have a knock on effect on the Gaafaru community

It is not expected that a negative socio-economic impact will occur due to the presence of the dredger as it will be at a considerable distance away from any populated area or any tourism ventures.

6.8 Significance of Impact Evaluation

This section provides a summation of the impacts of the project components discussed above. The impacts of the project have been evaluated based on the criteria proposed by Posford Haskoning (2004). The decision framework is given in Figure 5.

In order to make the evaluation quantitative, the framework proposed by Haskoning has been modified. Spatial distribution of impact is also added in order to make the significance of the impacts more practical. Scores are given for each impact once it is identified that the resource is vulnerable to the impact. Scores are based on the following factors.

- Sensitivity of Receptor
- Recoverability of Receptor
- Importance of Receptor
- Spatial Distribution of impact

These factors are analysed after first of all identifying if the resource or receptor is vulnerable to the impact. If the receptor/resource is not vulnerable, due to possibly its significant distance away from the project area, it is deemed that there is no impact.

The scales associated with the above criteria are given in the Table 6.

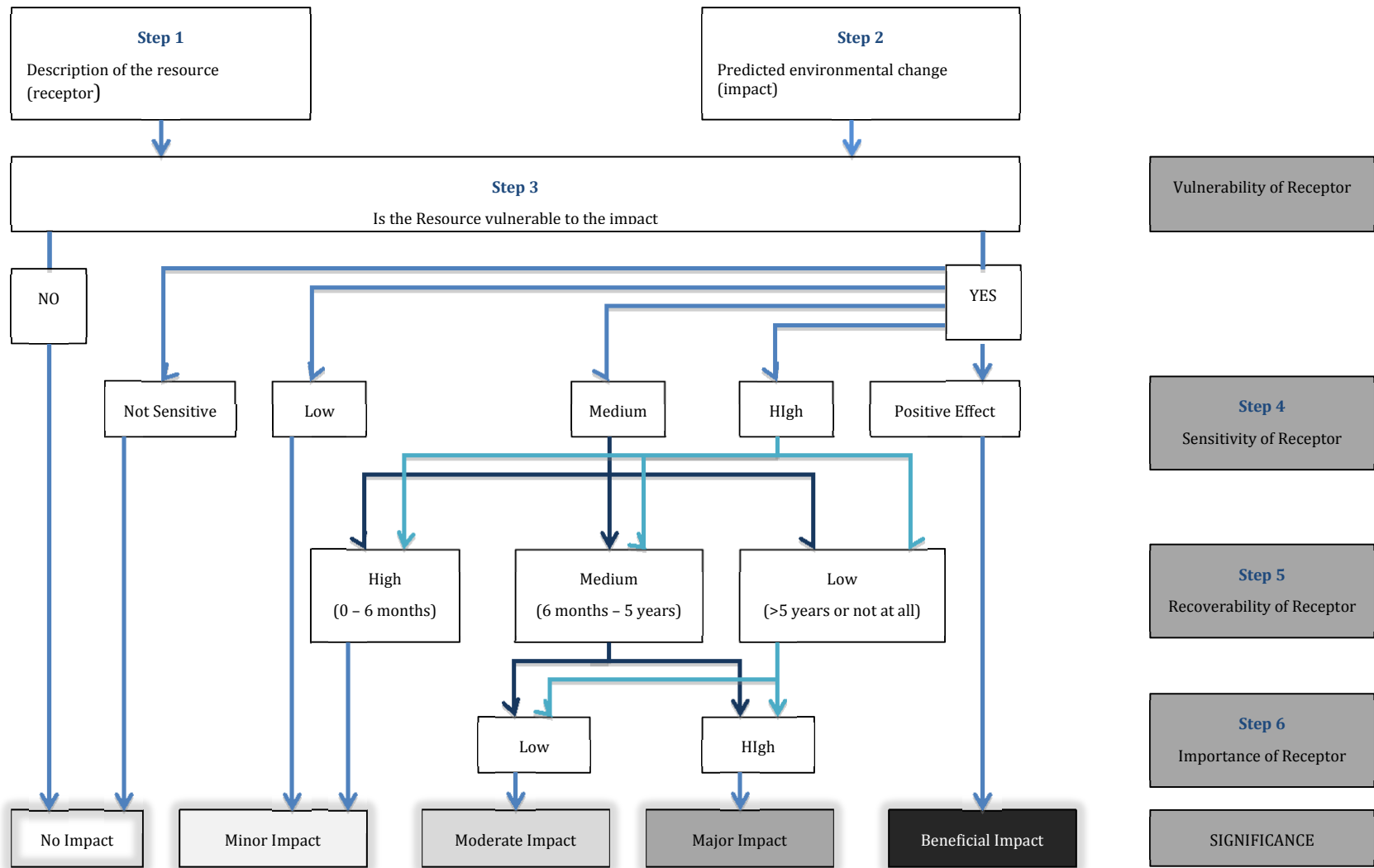


Figure 5 Decision framework to assess the significance of impacts

Table 16 Impact Evaluation Criteria

Criteria	Scale	Attribute
Sensitivity <i>How sensitive the receptor is to the impact</i>	-1	Positive Effect
	0	Not sensitive
	1	Low
	2	Medium
	3	High
Recoverability <i>How long it would take for the receptor to recover from the impact</i>	1	Short
	2	Medium
	3	Non-recoverable
Importance <i>The importance of the receptor to the environment</i>	1	Low
	2	Medium
	3	High
Spatial Distribution <i>Distribution of impact</i>	1	local scale
	2	regional scale
	3	global scale

If the impact receives a -1, it deems the impact to have a positive effect on the receptor and the other criteria is then not applied. The impact is referred to as a Beneficial impact as is done by the Haskoning framework.

The significance of the negative impacts will be given based on the following range:

- 1 – 5 : Minor Impact
- 6 – 9 : Moderate Impact
- 10 – 12: Major Impact

6.9 Justification for Impact Evaluation Method

The framework was chosen as it provides a comprehensive methodology to evaluate impacts, which is not overly technical. The advantage of this is that it will be easily understandable to the public and especially the client, who are not well versed in environmental management jargons and methodologies. It had also been successfully used in many other projects in the Maldives.

Table 17 Analysis of potential impacts for the impacts

Potential Impact	Vulnerability	Sensitivity	Recoverability	Importance	Spatial Distribution	Significance
Visual/Aesthetic impact on scenery due to dredger	Yes	1	1	1	1	4 – Minor impact
Noise impacts during dredging	Yes	1	1	1	2	5 – Minor impact
Impact on fisheries in the area	Yes	2	2	1	2	7 – Moderate impact
Sedimentation impact on designated Protected Area	No	-	-	-	-	No impact
Sedimentation impact on designated Sensitive Area	No	-	-	-	-	No impact
Sedimentation impact on nearby tourism/industrial development	Yes	1	1	2	1	5 - Minor impact
Sedimentation impact on nearby dive areas	Yes	2	1	3	2	8 - Moderate impact
Sedimentation impact on Inhabited Islands	No	-	-	-	-	No impact

Water pollution due to waste and waste water dumping and oil spills	Yes	1	1	2	1	5 -Minor Impact
Impact on worker's health and safety	Yes	1	1	1	1	4 – Minor Impact
Socio-economic impact	Yes	-1				Beneficial Impact

In general, sedimentation impact is the most noticeable impact from the deep sea dredging activities. Therefore, it has to be analysed which receptors/resources are impacted from this sedimentation and to which extent. The data presented shows that there is no significant sedimentation more than 200m away from the dredge site, and certainly not 500m away, which is the distance as given by the Dredging and Reclamation Regulation.

There is no impact to any Protected Area or Sensitive Area. No impact to any inhabited island. And a high probability there will be no impact to Helengeli Island Resort, the only tourism venture in operation in the region. There is a small probability that there may be short term, minor, aesthetic impact near Helengeli lagoon, which is not significant at all. Minor to Moderate impacts would be felt at the shallow areas within 1 – 3km from the borrow sites. However, these are mostly short term and occur during the dredging activities.

There are 2 important reasons why this impact would also be less than usual, which is the short distance from the borrow site to reclamation site, and also the short duration for the dredging activities.

Taking these into consideration, and the alternative option of using a CSD to dredge in the lagoon, the proposed dredge method and location is more environmentally favourable.

6.10 Uncertainties in Impact Prediction

The impact prediction has been carried out based on existing similar projects, literature and tested methods. However, the prediction does rely on the judgement of the consultant, and would therefore lead to uncertainties since the environmental conditions will not be precisely exact between sites. The uncertainties for this project will be considerably less compared to other similar projects. This is mainly due to other similar projects being undertaken recently, from which data had been obtained.

7. Mitigation Measures

Mitigation measures are proposed where significant impacts are expected. Once an impact is identified to have ‘moderate’ or ‘major’ impact, appropriate mitigation measures are given for the project. Successful implementation of the measures given would lead to a major reduction and/or nullification of the impacts on the environment and thereby ensuring that the project is environmentally sustainable. The

proposed mitigation measures does not entail additional costs as these are already embedded into the standard protocol of such projects.

7.1 Mitigating sedimentation impacts

The general impact from the project is due to sedimentation issues, which may result in disturbances of the marine fauna at best and mortality at worst.

Following measures are recommended:

- Complete the works within the least duration as possible. Ensure all dredging works are fully completed within 2-3 weeks
- Ensure sediments do not overflow to the surrounding environment.
- Concentrate more on the central areas of the large borrow area identified
- Prior notification to all stakeholders before commencing dredging works
- Regular monitoring of water quality of the identified location as given in Section 6.

The Figure below illustrated impact area from the borrow area. From recent experience, any location greater than 200m will not endure a significant impact, and all sensitive locations are much greater than 500m away from the borrow site.

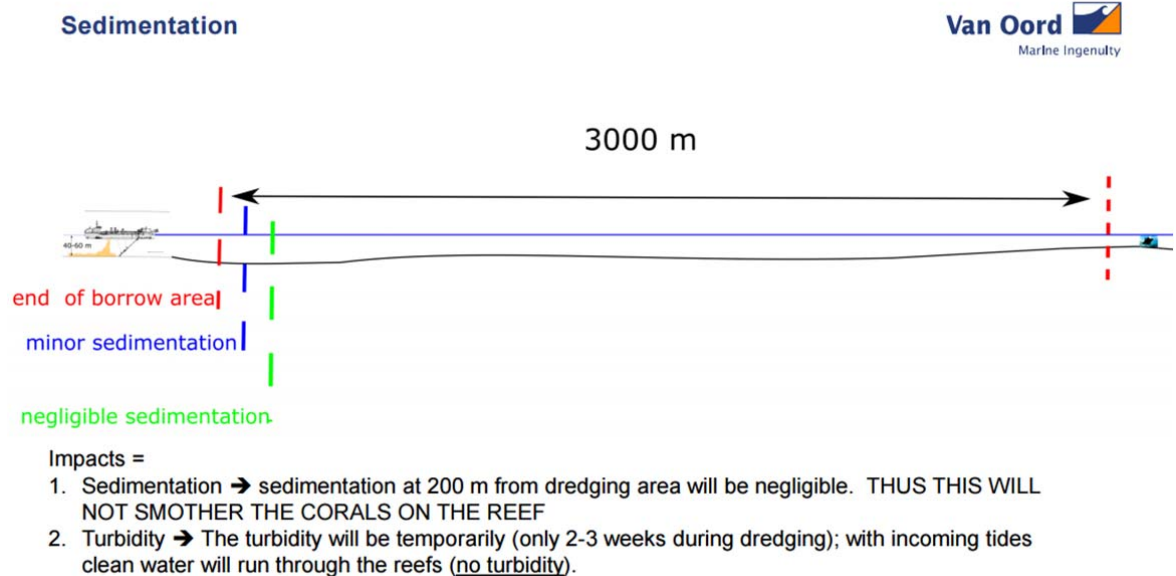


Figure 22 Expected sedimentation impact area from borrow area

Due to these justifications, no additional mitigation measures will be employed at the borrow area. However, mitigation measures that are always in place under this project will be implemented as part of this dredging as well.

This includes the practice is overflow discharging at the bottom of the vessel instead of on the water surface. More importantly, a ‘green valve’ is utilized on the dredger as a major mitigation measure to prevent sedimentation issues from over flow. The green valve results in a major reduction of turbidity. The water overflow typically consists of water, sediments and fines and last but not least, air. The larger sediments will be discharged to the sea but as the air rises from the underwater outlet to the surface of the water, it takes the fines with it. As a consequence, the fines spread over a much larger area which increases turbidity. The green valve reduces the air entrainment and sediments and fines will sink to the sea and therefore reduce the turbidity resulting in less turbidity and less environmental impact.

Furthermore, environmental monitoring at the identified dive sites is also proposed. As such, baseline monitoring will be undertaken before dredging commences, and daily monitoring will be undertaken for the duration of the works. The dredging operation is expected to complete before September ends.

7.1 Mitigating visual/aesthetic/noise impacts

These impacts are to be mitigated by putting in place good management practices. Before commencing the project, it is important to notify all stakeholders within a 10km radius of the project site and government authorities, agencies and councils, relevant to the project including the Ministry of Tourism, Atoll council, Island council, EPA.

Inform the neighbouring sites on the dredgers routes from the borrow area to the project site and when the dredger is expected to be located at the borrow site and reclamation site.

7.2 Mitigating water pollution from waste

The contractor already has many mitigation measures in place to mitigate any water pollution from the project activities. Waste management will be in accordance with the best practice and local legislation in force and will be per the MARPOL 73/78 Annex V requirements

- Waste will be segregated in order to maximise re-use and recycling

- methods
- The production of wastes will be minimised, and wherever possible
- waste shall be re-used on the site where it was produced
- Where waste cannot be re-used on site, it will be ensured to use it in an environmentally beneficial manner, by recycling for an example
- Only in a last resort, waste will be disposed. And that will be at a permitted landfill site, in this case, Thilafushi.
- Waste stored on site shall be kept safe and contained
- Waste generated on board of vessels will be shipped onshore
- If waste material is noted on the deck it will be immediately cleaned up
- In the event that waste is lost overboard the reasonable and practicable
- measures will be undertaken to retrieve the waste
- Waste generated will be disposed of by a local licensed firm

Regarding handling and managing hazardous goods, the following will be in place:

- The storage of dangerous goods such as diesel, hydraulic oil, paint and other chemicals that pose potential environmental hazards are stored in a manner that minimizes the risk for contamination of the environment
- Storage of liquid dangerous goods in secondary containment (drip trays)
- Secondary containment capacity will be 110% of the largest container
- Volume of dangerous goods stored on vessels will be limited to fit for purpose
- Storage will be done according to the Material Safety Data Sheet (MSDS)
- If hazardous materials are stored in a confined space, the space must be properly ventilated
- A register of the dangerous goods will be kept on site (or in storage facility)
- The register will include the MSDS

Regarding sewage waste water, Sewage management will be in accordance with the MARPOL 73/78 Annex IV requirements

- The contractor will provide tanks that are designed or constructed to receive sewage and store it inside when the ship is less than 3 nautical miles from the nearest land and prior the disposal, with appropriate capacity, considering the ship's operation and the number of persons on board
- Treated sewage will either be discharged or disposed onshore, depending on conditions and local legislation in force
- Discharge of treated sewage is only undertaken outside restricted waters as per MARPOL 73/78 Annex IV requirements and local legislation in force
- The sewage water treatment plants will be checked and maintained as per MARPOL 73/78 Annex IV requirements
- If a vessel does not have a sewage treatment system it will have a suitable holding tank, waste water will then be brought back to shore

- for treatment by a licenced contractor
- Onshore:
- Onshore generated sewage will be managed according to best practice and local legislation in force

Fuel handling related to marine equipment will be in accordance with the MARPOL 73/78 Annex I requirements

- Fuel storage tanks are preferably double-walled and are protected by a
- secondary containment (e.g. tank standing in bunded area)
- Secondary containment must be capable of holding 110% of the capacity of the primary tank
- Fuel storage tanks will be situated where they are easily accessible but
- where the risk of impact from passing vehicles is minimised, and as far
- away from surface waters or surface drains as possible
- Regular training will be provided in spill response
- Spill response materials will be situated at key areas close to fuel and
- oil storage areas, and refuelling locations
- Fuel and oil will be stored away from environmental sensitive areas
- (and also pathways to environmentally sensitive areas)
- Offshore:
- Storage and handling of fuel will be done as per MARPOL 73/78 Annex I requirements

An Oil Spill Contingency Plan will be made as part of the Project Plan.

7.3 Mitigating impact on worker safety

All staff on deck are to wear safety shoes and safety helmets. Those working at close proximity to the engines will be equipped with ear muffs. Personal Protective Clothing and Equipment will be given high importance. Before access to the dredger is granted, each individual or team will have to undergo a mini orientation briefing them of the safety procedures on site. These will have to be adhered to at all times.

First Aid kits will be available on the dredger. An Emergency Response Plan will be made as part of the Project Plan, this will include:

- Set up of Emergency Response Team on site
- Emergency scenarios
- Emergency contacts list
- Route to nearest health facility

The Captain or Vessel/Dredge master of the marine equipment are responsible for the implementation of the health and safety procedures and emergency preparedness and response on vessels.

8. Alternatives

This section looks at different alternatives for the proposed works. As the proposed works is only based on the deep sea dredging activities, Alternatives based on this would be discussed. The main alternative is the No project option.

These alternatives are not as intensively investigated as the original scope of the project. However, investigating and discussing alternatives is important so that it is ensured that the best available option(s) is/are chosen to solve the issues/problems of the project.

8.1 No project option

The No Project option in this study only entails the deep sea dredging activities, and not the development project as a whole. However, the No Project option analysis for the entire development is also presented below.

Table 18 No Project Option for entire development

Advantages	Disadvantages
Costs related to increasing capacity of airports and related infrastructure may be avoided	Job opportunities would be hindered. Direct and indirect benefits of the project may not be felt. Loss of national revenue for current and future growth of the industry
Costs related to the proposed development may be avoided. Lagoon's fragile ecosystem may be protected from potential negative impacts of development	Island's fragile environment already vulnerable to impacts from local communities, albeit at a much smaller scale. However, the impacts would be unmonitored and unregulated.
The lagoon can be used for local communities as a recreational area	Benefits to the local community will be minor as the area is currently rarely used. Positive economic impact to local communities will be hindered
Marine Eco system of the lagoon will be preserved from human interventions	Although there would be no human interventions, the area will still be open for unmonitored disruption. Although such impact would be infrequent, the magnitude may be high.

Direct and indirect economic ventures other than tourism in the lagoon as a result of the islands	Other industries are not as lucrative as tourism and therefore may not be as beneficial to local community
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The resort development will bring numerous benefits to the neighbouring communities as well as benefits to environmental management of the surrounding area. In terms of socio-economic benefits, the proposed resorts will create job opportunities and various small business opportunities to the communities as is the case in other regions. The development will bring more revenue to these communities, and therefore provide a platform for a better life. Resort development in the lagoon will also contribute to meet current and projected bed capacity needs in the Maldives to reach the strategic targets outlined in the 4th Tourism master Plan 2013-2017 and contribute to the economy through tax revenue and annual rent.

In addition to socio-economic benefits to local communities, resort development may also lead to certain environmental benefits with a more rigid environmental monitoring in place. Eventually, there will be rules and regulations in place to protect the new vegetation and existing coral reefs upon which the resorts will be dependent upon.

Given the range of benefits that the proposed development of the resorts will bring, and considering the fact that it was this location that was leased to the developer, the no project option for the entire development is not viable at this stage. The project should nevertheless be implemented given appropriate mitigation and management practices are incorporated in the development and considering further alternatives as given below. The no project option is further elaborated by focusing on the content of this study; i.e. the deep sea dredging. No project option for deep sea dredging would entail opting for dredging from the lagoon and the comparison is made based on this.

Table 19 No Project Option for Deep Sea Dredging

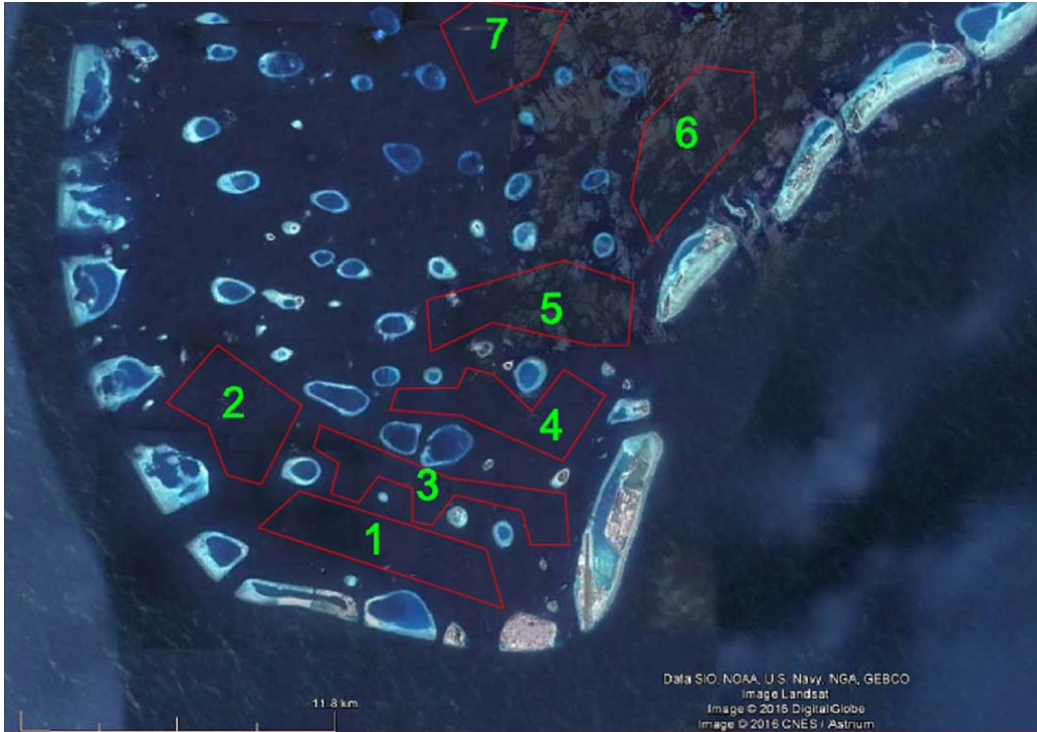
Advantages	Disadvantages
Can avoid high capital costs and operation costs of a trailer suction hopper dredger	Cumulative costs will be higher in other options as it would take a longer duration, and subsequently greater opportunities for operation disruptions
Intensity of any possible impact will be low as	The cumulative impact over a longer duration will be higher than the supposedly high impact

project will span out over a longer duration	over the longer duration
Impacts on nearby dive points and shallow reefs will be avoided	Nearby shallow reefs are not really designated as sites of any significant environmental note. Borrowing sand from the site lagoon will have detrimental impacts on the house reef of the site, which is now home to a critical tourism venture
The impacts will be more localised and there is less chance of any impact on other reefs	The highly localised impacts would cause greater damage to critical eco system, then the dispersed indirect nature of impacts from alternative.

8.2 Project Alternatives

The southern end of Male’ atoll was also investigated for sand availability. However, the investigations for the Male’ Industrial Village project showed that there was no sand available from this region of Male’ Atoll. The areas studied under this are shown in the Figure below.

The Figure shows wide areas that were studied as part of the sand search campaign. Seven broad areas were studied in addition to the proposed borrow area from which, none yields sufficient quantities of quality sand required for the reclamation.



The coordinate of the borrow areas are given below.

Male' Area 1:
4°12'10.32"N
73°28'7.41"E

Male' Area 2:
4°14'46.10"N
73°23'52.98"E

Male' Area 3
4°13'14.43"N
73°28'23.93"E

Male' Area 4
4°14'41.70"N
73°30'14.80"E

Male' Area 5
4°17'0.90"N
73°30'30.00"E

Male' Area 6
4°20'50.16"N
73°33'39.31"E

Male' Area 7
 4°22'27.25"N
 73°29'34.24"E

An alternative close to the project site was also investigated. It was found that sand could be obtained from this area shown in Figure XX below.

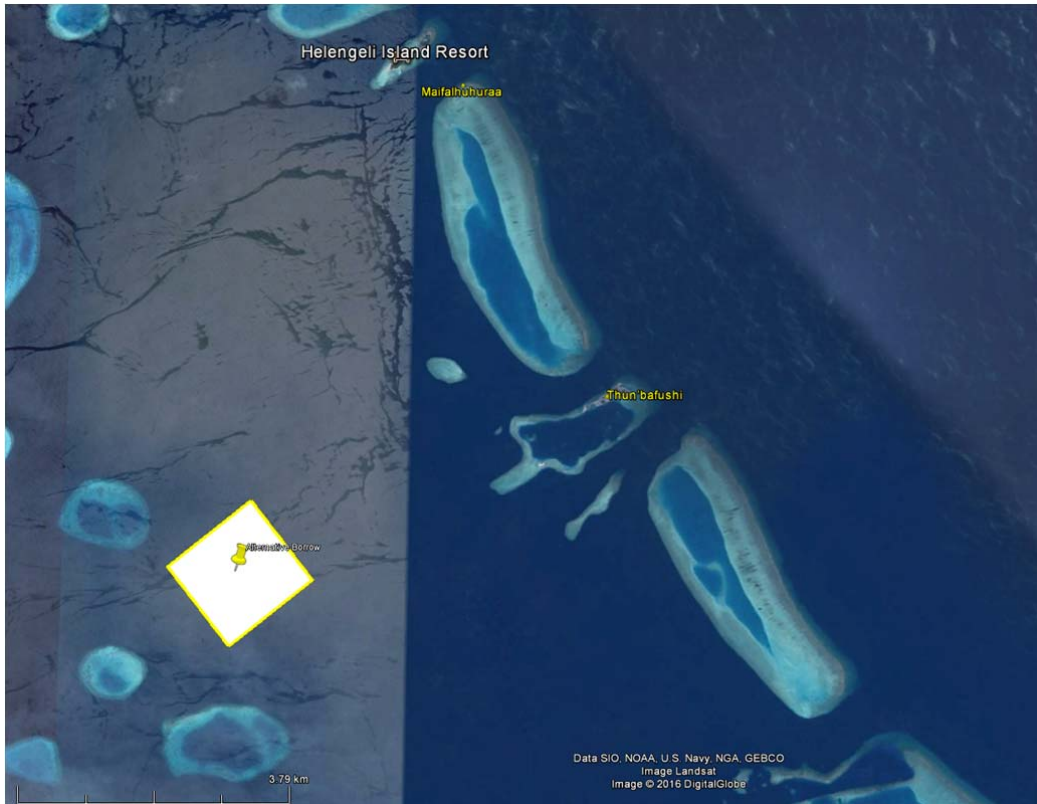


Figure 23 Alternatives area for sand borrowing

These locations are over 11.3 km South from the Project site. From the proposed borrow area the alternative borrow area 10 km South. The coordinates of this site is 4°34'0.65"N, 73°32'33.88"E.

While this is the only possible alternative, it is not particularly attractive. The site is also away from all designated Protected Areas and Sensitive Areas. However, the greater distance from the project site would significantly increase the cost of the project. Furthermore, the amount of sand required for the project is very likely not available from this location.

Therefore there was no other realistic alternative as part of the project. The other options is to carry out further sand search campaigns, which were also not feasible under this project due to the wide area the contractor had already covered within the entire North Male' Atoll.

8.3 Recommended Alternatives

In conclusion, No project option for the entire development is not an option, since the project needs to be feasible and doable. Likewise, the not going ahead with deep sea dredging does not make environmental or economical sense for a project of this scale.

The only realistic option based on the surveys and studies undertaken and data obtained, is the currently proposed area west of the Project Site.

9. Environmental Monitoring

This section deals with the Environmental Management and Monitoring plan for North Male' Lagoon with respect to the changes in scope from the original EIA. The data collected for this assessment and previous assessments will be used as baseline data while undertaking the monitoring plan. Undertaking environmental monitoring is essential for several reasons including:

- To ensure that potential impacts are minimized and to mitigate unanticipated impacts.
- To aid in impact management,
- To improve impact prediction and mitigation methods.
- To gather long term data to minimise uncertainty
- To ensure sustainable development

The proposed monitoring programme will yield beneficial results if it is undertaken for a long period. As required in the TOR, the monitoring is to take place during the construction phase up and afterwards for a period of 1 year.

The proponent expressed their full commitment to carry out the monitoring program outlined in this report. The proponent's commitment to undertake the environmental monitoring and mitigation measures is given in the **Proponents Declaration**.

9.1 Monitoring Methodology and Costs

The methodology used for monitoring will be similar if not the same as those used in this environmental assessment. However, field water quality testing equipment can be employed to decrease the uncertainties of the results.

The costs given in Table 11, and Table 12 are calculated for monitoring to be undertaken by hiring environmental consultants for each monitoring program.

Additionally, it is a requirement that the annual environmental monitoring report needs to be compiled and formulated by a registered environmental consultant with a **permanent** EIA consultant license.

The parameters that are most relevant for monitoring the impacts that may arise from the project are included in the monitoring plan. Therefore, the monitoring programme will cover the following aspects of the project:

- marine water quality

- coral monitoring

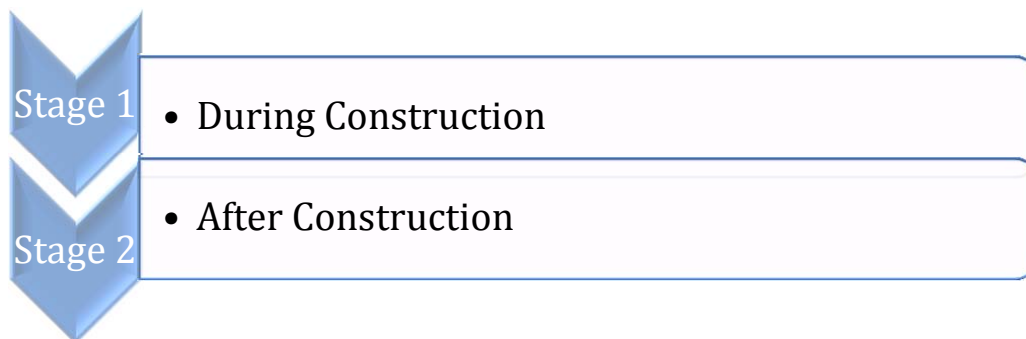
The monitoring program can be undertaken together with the main monitoring program for the entire reclamation project, which would make the proposed program more feasible and cost effective.



Figure 24 Proposed points for water quality monitoring at borrow area (S1, S2, S3, and S4)

9.2 Recommended Monitoring Programme

The monitoring programme will be divided into 2 stages.



Stage 1

- Marine water quality for pH, EC/salinity, temperature and turbidity at locations given in the EIA.

- Observation and quantitative monitoring condition of marine environment from the transects given in the EIA. Check for coral cover and fish count.

Stage 2

- Marine water quality for pH, EC/salinity, temperature and turbidity at locations given in the EIA.
- Observation and monitoring condition of marine environment from the transects given in the EIA. Check for coral cover and fish count.

9.3 Cost of monitoring

The following tables outline the cost estimate for each stage of the monitoring plan given. The costs are calculated assuming the monitoring will be undertaken by hiring environmental consultants on a project basis.

Table 20 Estimated cost of Stage 1 of the Monitoring Program

Item No.	Details	Unit cost (US\$)	Frequency	Total (US\$)
1	Field allowance for 2 consultants for 1 day	500.00	4	2000.00
2	Surveying and monitoring equipment depreciation and water quality testing	200	4	800.00
3	Data analysis and report write up	1200	1	1200
	Total			4000.00

The monitoring is for a period of 1 month, where marine environment data is collected weekly and water quality testing is done daily.

Table 21 Estimated cost of stage 2 of the monitoring program

Item No.	Details	Unit cost (US\$)	Frequency	Total (US\$)
1	Field allowance for 2 consultants for 1 day	500.00	4	2000.00
2	Surveying and monitoring equipment	200	4	800.00

	depreciation and water quality testing			
3	Data analysis and report write up	1200	4	4800.00
	Total			7600.00

The monitoring is for a period of 1 year and to be undertaken quarterly.

It should be noted that the costs are subjective. It may vary depending on the consultant and also due to changes in price with time. Also, in the case that a long-term arrangement is made with a consultant, the price may decrease and may be more feasible for the proponent. Moreover, the costs will further reduce if the monitoring is undertaken along with the monitoring program proposed in the original EIA.

9.4 Monitoring Report

Monitoring report should be compiled based on the baseline data collected. This report should be submitted to the Environment Protection Agency and/or any other relevant government agencies for compliance. The report structure may include but not limited to;

- Introduction
- Details of the site at the time of investigation,
- Data collection and analysis,
- Details of methodologies and protocols followed
- Quality control measures,
- Sampling frequency and monitoring analysis
- Conclusion and recommendations

10. Conclusion

The proposed dredging location is about 3km west of the project site as proposed in the original EIA. The overall environmental impacts of the project have been assessed using frameworks found on literature and the results indicate that the proposed project has minimum negative impact. However, the identification of the borrow area brings with it additional impacts in an additional region.

The proposed area is considerably away from any sites designated as a Protected Area or Sensitive Area or an inhabited island, and it can be said with certainty that there will not be any impact in such areas. There is a high probability there will be no impact to Helengeli Island Resort as well, which is the closest operating tourist island.

If under any circumstances there is impact, it will be minor. Within a radius of 500m from the borrow area, there will be moderate impacts, and diving and fishing in a radius of 1-3km from the borrow area during dredging, which will take 2-3 weeks, should not take place.

Important stakeholders for dredging from the borrow area were similar to those that were consulted for the initial EIA. While the stakeholders had concerns for the overall deep sea available sediment budget of Maldives, how best to administer such activities, impact on fishing and diving in the area, the general outlook was positive. The stakeholders highlighted the importance of regular monitoring and follow up and the importance of collecting data, which will help other projects of similar nature in the future.

Alternative borrow area options are not really viable as the sand search campaign concluded only other possible sand depots in the vicinity. However, as the expected amount of sand available from the proposed area far exceeds the volume required, it is not envisaged another alternative borrow location will be required.

It is recommended to continue to monitor the impacts of the proposed project by regular monitoring of marine water quality. The monitoring plan proposed in the original EIA is slightly updated to include more monitoring locations, near borrow area. A two stage monitoring plan is given, which recommends quarterly monitoring during the 1st year and less frequent monitoring for the next 5 years. Undertaking the monitoring, along with the mitigation measures is necessary to ensure the sustainable development of the project with minimum harm to the environment.

It is thus recommended that given the positive environmental impact relative to dredging from the lagoon using a CSD, and given consideration that the socio economic impacts from the project far outweighs the minor negative impacts, it is advisable to allow the project to proceed as proposed.

11. References

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Annex 1 – Terms of Reference

203-EIARES/PRIV/2016/418

Terms of Reference for EIA for the Proposed Deep Sea Dredging to Reclaim and Develop 3 Resort islands on the lagoon located at North Male' Atoll (4°40'28.8"N 73°32'02.2"E AND 4°40'18.4"N 73°32'24.6"E),

The following ToR is based on the application form and the scoping meeting held on 9th August 2016 for undertaking the EIA for the proposed Deep sea dredging project to reclaim 3 islands of the following sizes; 6 Ha, 10.7 Ha, and 13.2 Ha respectively, on the lagoon located at North Male' Atoll (4°40'28.8"N 73°32'02.2"E AND 4°40'18.4"N 73°32'24.6"E), for the purpose of resort development. The initial EIA for the reclamation and resort development has been approved by the Ministry of Tourism and this study will therefore focus only on the Deep Sea Dredging component. The proponent of the project is Bodufaru Beach Resort Private Limited.

While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the EIA report. ***In-text referencing needs to be provided in the report where information is obtained from any published or unpublished source.***

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

economic ventures and cultural sites.

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

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

The main activities of the resort development are:


- Dredging and Reclamation
- Overall establishment of utilities and similar infrastructure including power house, water desalination plant, sewage treatment plant, oil storage tanks, waste management facility and carpentry/workshop; (the details of which will not be part of the scope of this study)
- Construction and operation of accommodation, restaurants, spa, sports, dive centre facilities and other such guest facilities;
- Construction of overwater structures.
- Coastal protection works, if any;
- Environmental monitoring during construction activities;
- Measures to protect environmental values during construction and operation phase;
- Project management (include scheduling and duration of the project)

The scope for this EIA is only the Dredging component, as the other components have studied under recently approved EIA. The scope of works for this EIA only includes the following

- Dredging from the newly identified borrow area

Dredging

- Location and size of borrow areas (s) on a map;
- Justification for the selection of the location(s);
- Quantity, quality and characteristics of fill material;
- Indication of guarantees for sufficient availability of fill material;
- Method and equipment used for dredging, including description of positioning system, depth control system and operational control procedures;
- Justification for selecting the methods and equipment;
- Duration of dredging activity;

Task 2. Description of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the project(e.g. ).

monsoon season). Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that data collected is suitable for use as a baseline. As such all baseline data must be presented in such a way that they will be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized. Existing environment for the reclamation sites have been defined in the previously approved EIA. This EIA will therefore focus on the newly identified borrow areas.

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

Climate

- Temperature, rainfall, wind, waves, evaporation rates (including extreme conditions)
- Risk of hurricanes and storm surges;

Geology and geomorphology

- Bathymetry (bottom morphology) (use maps);
- Characteristics of seabed sediments to assess direct habitat destruction and turbidity impacts during construction;

Hydrography/hydrodynamics (use maps)

- Sea water quality measuring these parameters: temperature, pH, salinity, Electrical conductivity, and turbidity


Ecology

- Identify marine protected areas (MPAs) and sensitive sites such as breeding or nursery grounds for protected or endangered species (e.g. coral reefs, spawning fish sites, nurseries for crustaceans or specific sites for marine mammals, sharks and turtles; and significant inland flora
- Benthic and fish community monitoring around sensitive sites near borrow area, if any

Hazard vulnerability:

- Vulnerability of area to storm surges.

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Include permits and approvals in the EIA document.

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages – The EIA report should identify all the impacts, direct 

and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

Impacts on the natural environment

- Impacts on marine habitats including damages to coral reefs, seagrass communities, fish stocks, protected areas and protected species;
- Loss of marine bottom habitat, resulting in temporal loss of bottom life, which may impact fish stocks and species diversity and density of crabs, shellfish, etc.
- Temporary sediment dispersal in water column (turbidity at the dredging site), possibly resulting in changes in visibility, smothering of coral reefs and benthic communities and affecting fish and shellfish etc.;
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment

- Impacts on employment and income, potential for local people to have (temporary or long term) job opportunities (and what kind) in the execution of the works;
- Disturbance to local natural resource users such as fishing areas, other tourism ventures;
- Impacts to nearby resorts and dive sites;
- Impact equity (economic activities, employment, income);

Construction related hazards and risks

- Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including dredging waste);
- Risk of accidents and pollution on workers and local population.
- Impacts of noise, and work related safety issues.

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

Task 5. Alternatives to proposed project – Describe alternatives including the “no action option” should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the “no action alternative”. The report should highlight how the location was determined. All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. The EIA report may focus on alternatives such as:

- Alternative dredging methods



- Alternative borrow areas: have these been considered and if so, justification for preferred option

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures. Mitigation measures to avoid or compensate habitat destruction, e.g. temporal sediment control structures, MPA replacement areas. Measures for both construction and operation phase shall be identified. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan (see appendix)– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for the borrow area and sensitive sites in the vicinity. Ecological monitoring will be submitted to the EPA to evaluate the damages during dredging, and after project completion, up to one year. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

- Water quality, especially turbidity;
- Condition of the sensitive ecosystems and marine resources;
- Environmentally sound removal of dredging equipment

* This TOR contains an outline of the parameters that have to be tested (see appendix). All projects are different, therefore additional or less data will be collected for recovery and impact assessments.

Task 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation) – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders, government authorities such as, Tourism Ministry, government agencies, NGOs, engineers/designers and development managers. The EIA report should include a list of people/groups consulted and summary of the major outcomes. The following should be consulted

1. Helengeli Island Resort
2. Ministry of Tourism
3. Marine Research Center
4. Gaafaru Council
5. Ministry of Fisheries and Agriculture
6. Ministry of Housing and Infrastructure
7. Atoll council





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Environmental Protection Agency



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

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

9 August 2016



Annex 2 – Commitment Letter

BODUFARU BEACH RESORT PRIVATE LIMITED

No. 2-C Faamudheyriige Building, Orchid Magu, Male'
COMPANY REGISTRATION NO: C-0890/2014

Mr. Ibrahim Naeem
Director General
Environment Protection Agency
Ministry of Environment and Energy
Male', Maldives

17th August 2016

Dear Mr. Ibrahim Naeem,

Project: Proposed Deep sea Dredging to Reclaim and Develop 3 Resort Islands on the Lagoon (4°40'28.8"N 73°32'02.2"E AND 4°40'18.4"N 73°32'24.6"E) in Kaafu Atoll.

Subject: Proponents Declaration and Commitment for Monitoring and Mitigation

As the proponent of the project, we guarantee that we have read the report and to the best of our knowledge, all non-technical information provided here are accurate and complete. We are aware that this EIA report has been prepared in accordance with the EIA regulations.

We confirm our commitment to undertake all mitigation measures and carry out the monitoring program as specified in the report.

Thanking you

Yours Sincerely



Mohamed Niham
Director

Annex 3 – Approvals

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



MINISTRY OF TOURISM
REPUBLIC OF MALDIVES

Ref no: 88-DS/PRIV/2016/432

16th February 2016

Mr. Mohamed Niham,
Director
Bodufaru Beach Resort Private Limited,
No. 2-C Faamudheyri Building,
Male',
Republic of Maldives.

Dear Mr. Niham,

Re: Conditional Approval for the Proposed Development Concept for the Development of a Tourist Resort at a Lagoon (4° 40' 28.8 " N 73° 32' 02.2 " E AND 4° 40' 18.4 " N 73° 32' 24.6 " E) in Kaafu Atoll.

We refer to the documents submitted along with the application on 31st January 2016 regarding development concept, for the development a Lagoon (4° 40' 28.8 " N 73° 32' 02.2 " E AND 4° 40' 18.4 " N 73° 32' 24.6 " E) in Kaafu Atoll.

A conditional approval is hereby granted to the development concept submitted for the project subjected to the fulfillment of the following requirements and procedures;

- One of the Speciality Restaurants & Wine cellars built up area (in 200 Room Island) is not calculated.
- Legend/ Area program needs to be revised.
- Executive Staff Villas (in 200 Room Island) is not marked in the development concept.
- Submission and approval of the Environmental Impact Assessment report for the project.
- Submission and approval of the detail drawings for the project.
- Built up area percentage and carrying capacity of the facility shall comply with the existing regulations.
- Submission of Land Survey Report for registration of the land area of the resort upon completion of the proposed reclamation works.
- Development shall comply with all conditions specified in the lease agreement.
- Submit a revise concept plan with the detail drawings for the project.

Please note that, the development should be conducted in accordance with the rules, regulations and practices of this Ministry and concerned government authorities.

We make note that upon completion of the project, the bed capacity of the resort would be 470 guest rooms (940 beds).

Thank you,

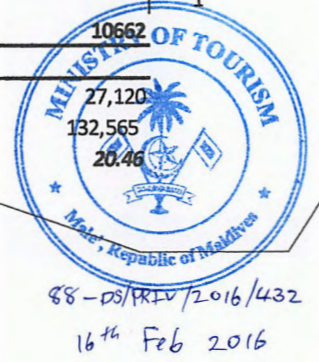
Yours sincerely,

Fathimath Samaah
Assistant Director

LEGEND / AREA PROGRAM

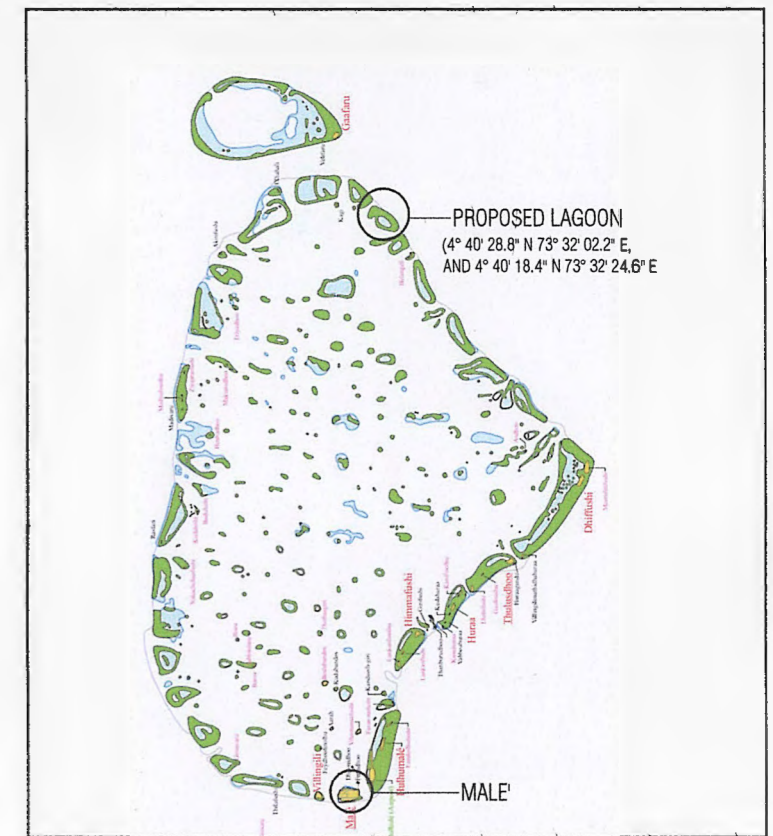
Legend	BUILDING / FACILITY	UNITS	Total Rooms	BUILT UP AREA PER ROOM (SQM)	TOTAL AREA (SQM)	NO STOREYS
GUEST ROOMS						
1	WATER SUITES	2	2	57	114	2
2	BEACH VILLAS	74	74	45	3330	1
3	WATER VILLAS	60	60	50	3000	1
4	GARDEN CLUSTER	16	64	57	3648	2
Total guest rooms		200		10092		
PUBLIC AREA						
5	Arrival pavilion	1		40	40	1
6	Diving School	1		200	200	1
7	Reception / Back Office	1		976	976	1
8	Main Restaurant, Kitchen, Bar, Boutique	1		3000	3000	1
9	Water Sports Center	1		54	54	1
10	Public Pool	1				1
11	Speciality Restaurant & Wine Cellar	1		476	476	1
12	Clinic & Wellness Center & Gym	1		200	200	1
13	Child Care Centre	1		120	120	1
14	Health and Beauty Spa	1		1300	1300	1
15	Tennis Court	2			0	1
Total Public Area				6366		
SUPPORT FACILITY						
16	Staff Accomodation Building	6	192	928	5568	2
17	Executive Staff Villas	6	24	57	1368	2
18	Staff Restaurant & Complex	1		680	680	1
19	Staff Multi-Court	1			0	1
20	Power House & Desalination Plant	1		700	700	1
21	Laundry & Housekeeping	1		540	540	1
22	recycle House	1		100	100	1
23	carpentry & workshop	1		50	50	1
24	Mosque	1		180	180	1
25	Water Tanks	2				1
26	Fuel Farm	1				1
27	Security Post	1		36	36	1
28	Service Jetty	1				1
29	Main Stores	2		600	1200	1
30	Harbour	1				1
31	Houskeeping Stores	15		16	240	1
32	STP	1				1
Total Support Facility Area		216				

TOTAL BUILT UP AREA
 LAND AREA (HIGH TIDE LINE)
 TOTAL BUILT UP PERCENTAGE





PROPOSED 200 KEY RESORT MASTER PLAN

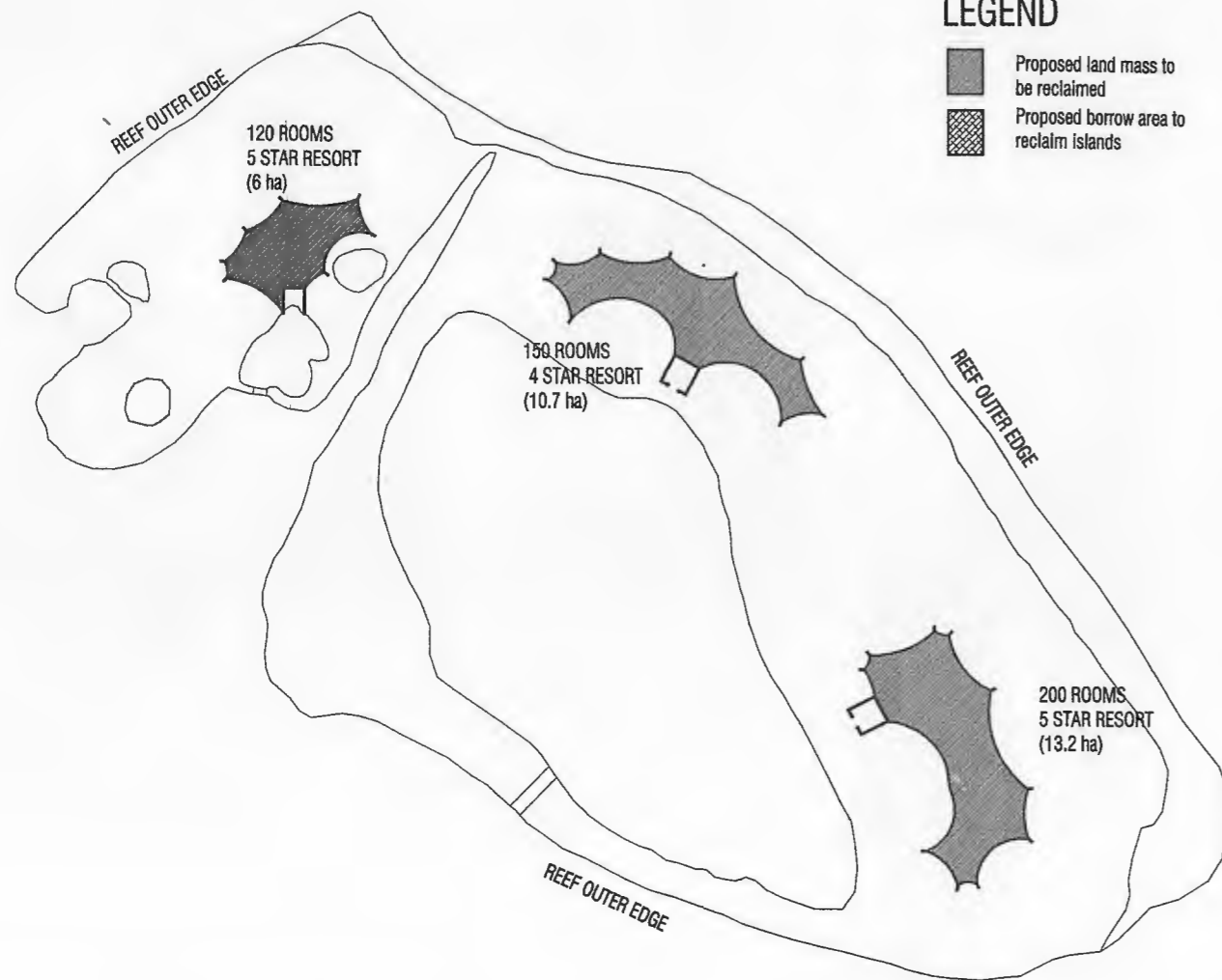




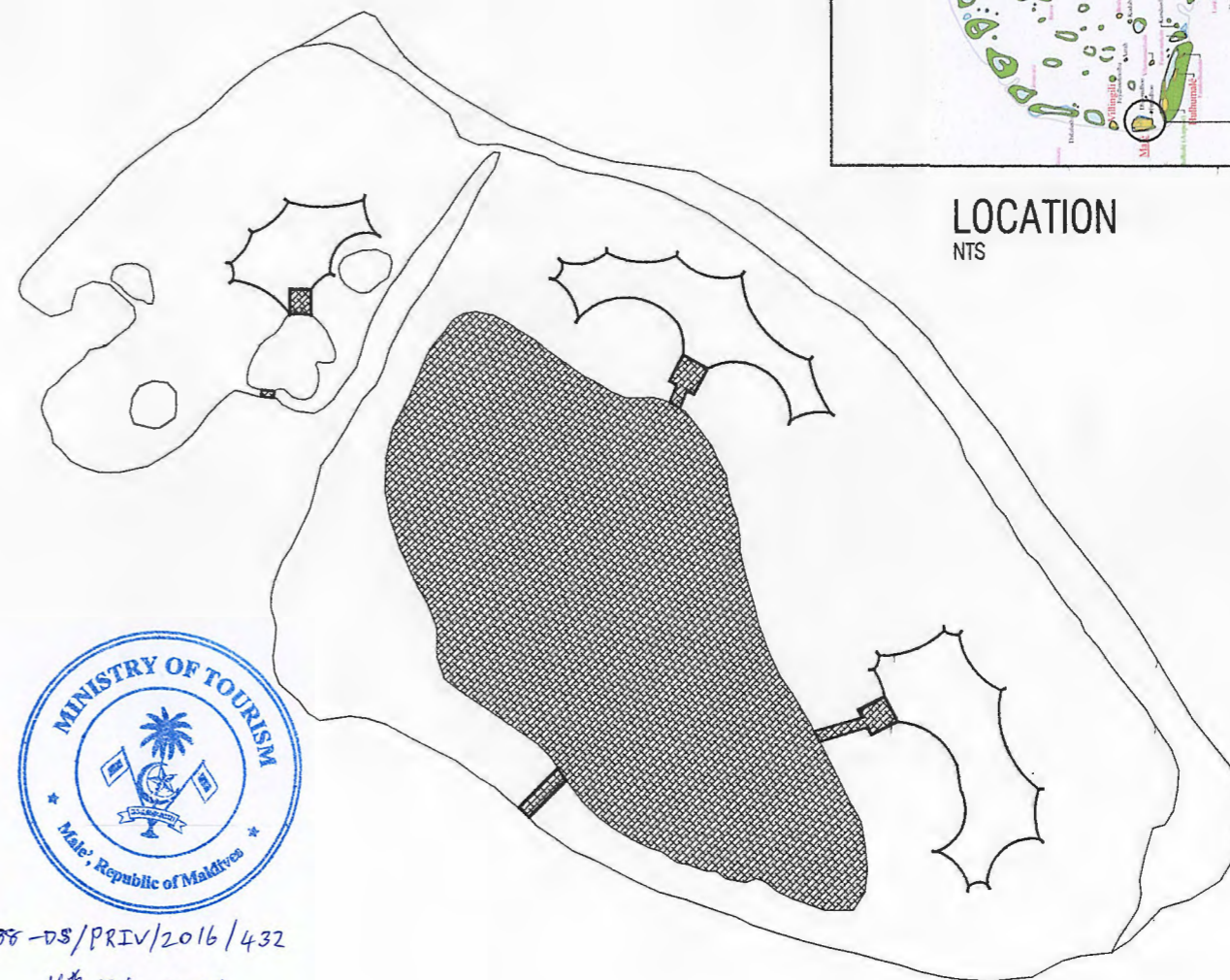
LOCATION
NTS

LEGEND

-  Proposed land mass to be reclaimed
-  Proposed borrow area to reclaim islands



PROPOSED MALE' ATOLL LAGOON DEVELOPMENT MASTER PLAN



PROPOSED RECLAMATION PLAN

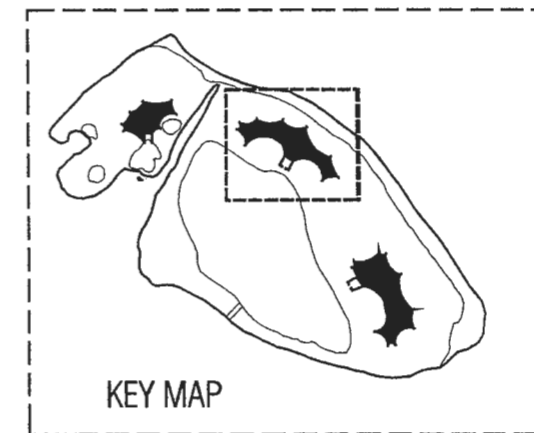


88-DS/PRIV/2016/432

16th Feb 2016

To Dispersed.

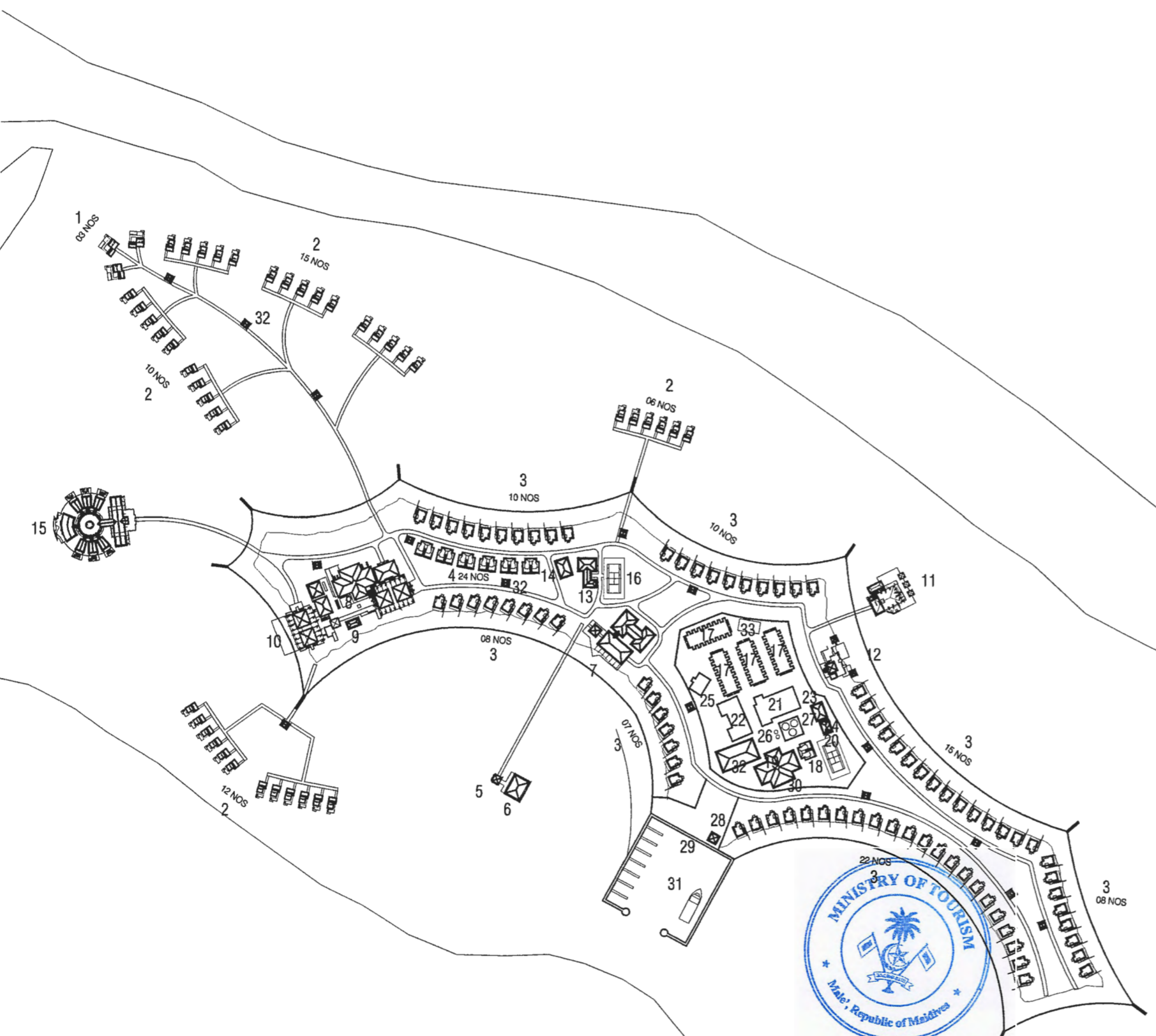




LEGEND / AREA PROGRAM

Legend	BUILDING / FACILITY	UNITS	BUILT UP		TOTAL AREA (SQM)	NO STOREYS
			Total Rooms	AREA PER ROOM (SQM)		
GUEST ROOMS						
1	WATER SUITES	3	3	57	171	2
2	WATER VILLAS	43	43	50	2150	1
3	BEACH VILLAS	80	80	45	3600	1
4	GARDEN CLUSTER	6	24	57	1368	2
Total guest rooms			150		7289	
PUBLIC AREA						
5	Arrival pavilion	1		40	40	1
6	Diving School	1		200	200	1
7	Reception / Back Office	1		976	976	1
8	Main Restaurant, Kitchen, Bar, Boutique	1		2390	2390	1
9	Water Sports Center	1		54	54	1
10	Public Pool	1				1
11	Speciality Restaurant & Wine Cellar	1		476	476	1
12	Grill Bar & Bistro	1		113	113	1
13	Clinic & Wellness Center & Gym	1		200	200	1
14	Child Care Centre	1		120	120	1
15	Health and Beauty Spa	1		1300	1300	1
16	Tennis Court	2				1
Total Public Area					5869	
SUPPORT FACILITY						
17	Staff Accomodation Building	4	128	928	3712	2
18	Executive Staff Villas	1	4	57	228	2
19	Staff Restaurant & Complex	1		680	680	1
20	Staff Multi-Court	1				1
21	Power House & Desalination Plant	1		700	700	1
22	Laundry & Housekeeping	1		540	540	1
23	recycle House	1		100	100	1
24	carpentry & workshop	1		50	50	1
25	Mosque	1		180	180	1
26	Water Tanks	2				1
27	Fuel Farm	1				1
28	Security Post	1		36	36	1
29	Service Jetty	1				1
30	Main Stores	1		600	600	1
31	Harbour	1				1
32	Houskeeping Stores	11		16	176	1
33	STP	1				1
Total Support Facility Area			132		7002	

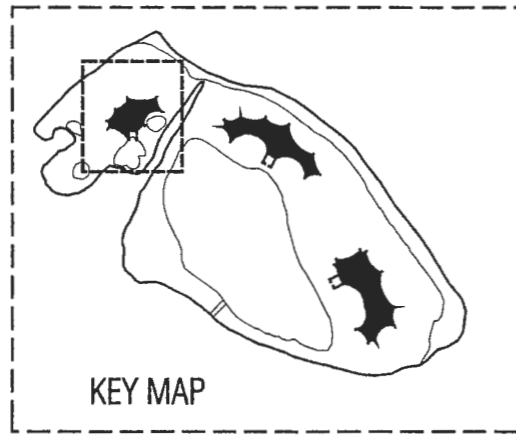
TOTAL BUILT UP AREA 20,160
 LAND AREA (HIGH TIDE LINE) 106,898
 TOTAL BUILT UP PERCENTAGE 18.86



PROPOSED 150 KEY RESORT MASTER PLAN

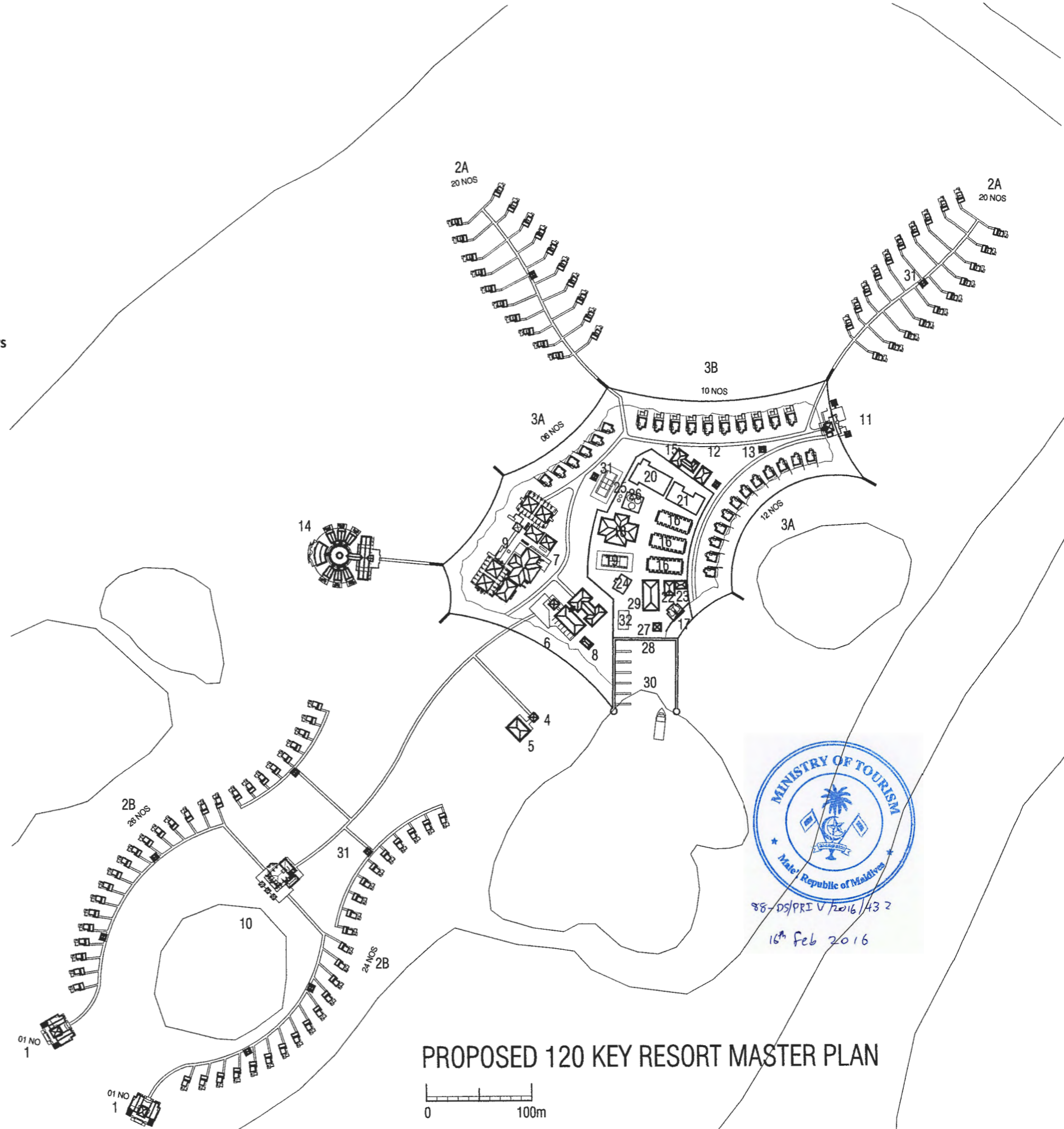


88-DS/PR IV/2016/432
 16th Feb 2016



LEGEND / AREA PROGRAM

Legend	BUILDING / FACILITY	UNITS	BUILT UP		NO STOREYS
			Total Rooms	TOTAL AREA (SQM)	
GUEST ROOMS					
1	WATER SUITES	2	2	400	2
2A	WATER VILLAS	40	40	2,000	1
2B	POOL WATER VILLAS	50	50	2,500	1
3A	BEACH VILLAS	18	18	810	1
3B	POOL BEACH VILLAS	10	10	450	1
Total guest rooms			120	6,560	
PUBLIC AREA					
4	Arrival pavilion	1		40	1
5	Diving School	1		200	1
6	Reception / Back Office	1		976	1
7	Main Restaurant, Kitchen, Bar, Boutique	1		2,390	1
8	Water Sports Center	1		54	1
9	Public Pool	1		-	1
10	Speciality Restaurant & Wine Cellar	1		476	1
11	Grill Bar & Bistro	1		113	1
12	Clinic & Wellness Center & Gym	1		200	1
13	Child Care Centre	1		120	1
14	Health and Beauty Spa	1		1,300	1
15	Tennis Court	1		-	1
Total Public Area				5,869	
SUPPORT FACILITY					
16	Staff Accomodation Building	3	96	784	2
17	Executive Staff Villas	1	4	57	2
18	Staff Restaurant & Complex	1		680	1
19	Staff Multi-Court	1		-	1
20	Power House & Desalination Plant	1		700	1
21	Laundry & Housekeeping	1		540	1
22	recycle House	1		100	1
23	carpentry & workshop	1		50	1
24	Mosque	1		180	1
25	Water Tanks	2		-	1
26	Fuel Farm	1		-	1
27	Security Post	1		36	1
28	Service Jetty	1		-	1
29	Main Stores	1		364.5	1
30	Harbour	1		-	1
31	Houskeeping Stores	11		16	1
32	STP	1		-	1
Total Support Facility Area			100	5,407	
TOTAL BUILT UP AREA				17,836	
LAND AREA (HIGH TIDE LINE)				60,363	
TOTAL BUILT UP PERCENTAGE				30	



88-DS/PRI V/2016/43 Z
16th Feb 2016

PROPOSED 120 KEY RESORT MASTER PLAN



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MINISTRY OF TOURISM
REPUBLIC OF MALDIVES

Ref: 88-DS/PRIV/2016/1377

26th May 2016

Mr. Mohamed Niham,
Director,
Bodufaru Beach Resort Private Limited,
No. 2-C Faamudheyri Building,
Male',
Republic of Maldives

Mr. Mohamed Niham,

EIA approval for proposed reclamation and development of 3islands on the lagoon (4°40'28.8"N 73°32'02.2"E to 4°40'18.4"N 73°32'24.6"E) , North Male' Atoll, Republic of Maldives.

We are pleased to inform you that the Environmental Impact Assessment (EIA) report for the proposed reclamation and development of 3 islands on the lagoon (4°40'28.8"N 73°32'02.2"E to 4°40'18.4"N 73°32'24.6"E), North Male' Atoll, Republic of Maldives., has been approved.

We would like to remind you that the commencing date of the project must be informed to the Ministry of Tourism in writing once the project begins.

Also, we would like to remind you that the validity of the Environmental Decision Statement is for a period of 1 year from the date of this letter.

Yours sincerely,

Hussain Lirar
Deputy Minister



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



MINISTRY OF TOURISM
REPUBLIC OF MALDIVES

Ref: 38-DS/PRIV/2016/1377

**EIA DECISION STATEMENT FOR THE PROPOSED RECLAMATION AND DEVELOPMENT
OF 3 ISLANDS ON THE LAGOON (4°40'28.8"N 73°32'02.2"E TO 4°40'18.4"N 73°32'24.6"E),
NORTH MALE' ATOLL, REPUBLIC OF MALDIVES**

This Decision Statement is issued for the purpose of communicating the decision based on the Environmental Impact Assessment Report for the proposed reclamation and development of 3 islands on the lagoon (4°40'28.8"N 73°32'02.2"E to 4°40'18.4"N 73°32'24.6"E), submitted to the Ministry of Tourism on 15th May 2016 for evaluation by the proponent Bodufaru Beach Resort Pvt. Ltd.

This Environmental Decision Statement has been issued by the Ministry of Tourism ("Ministry") pursuant to the amended Article 15 of the Maldives Tourism Act (2/99), to advise that the Ministry has decided that the proposed project can proceed.

The decision has been made by the Ministry on the following conditions;

1. In the event that the project activities has not commenced within 1 (one) year from the date of issue, this Decision Statement shall be considered null and void.
2. In the event that the project has been delayed for more than 1 (one) year due to unforeseen circumstances, the Ministry shall have the discretion to extend the duration of the Environment Decision Statement, or to terminate it. In such circumstances, the project proponent shall write to the Minister for an extension 30 (thirty) days before the date of expiry clearly stating out the reasons for the delay.
3. The Minister or the Ministry's representative, may issue a cessation order requiring persons working on the proposed project to cease working until the order is withdrawn, if;
 1. This Environmental Decision Statement has been withdrawn, or;
 2. There has been a breach of conditions of this Environmental Decision Statement.
4. It is the responsibility of the project proponent to undertake all project activities in accordance with relevant laws and regulations of the Maldives and as stated in the EIA Report. As per the TOR, the proposed activities of the project are;
 - Construction of bunds and shore protection structures
 - Dredging for a new entrance channel
 - Dredging from borrow areas to obtain sand for the reclamation.
 - Temporary Jetty construction;
 - Pump dredged material to reclaim proposed island
 - Levelling the reclamation area to required levels
 - Overall landscaping (transplanting trees from other locations will not be part of the scope of this study)
5. The project proponent shall inform the Ministry in writing the date of project commencement.
6. The project proponent shall implement all mitigation measures outlined in the EIA Report in the pages 122 till 131 and in the additional information submitted. Failure to implement the mitigations measures may result in the suspension or revocation of the approval given in the Environment Decision Statement.





7. The project proponent shall implement the environmental monitoring programme outlined in the EIA Report in the pages 143 till 151 and in the additional information submitted, and monitoring reports shall be submitted to Ministry of Tourism. Failure to implement the mitigation measures may result in the suspension or revocation of the approval given in the Environment Decision Statement.
8. The project proponent is aware that under the Article of 15 of Maldives Tourism Act (2/99), the Ministry reserves the right to terminate any activity without compensation if found that such an activity has caused significant, irreversible environmental impacts.

The document has been authorized on behalf of the Ministry of Tourism by;

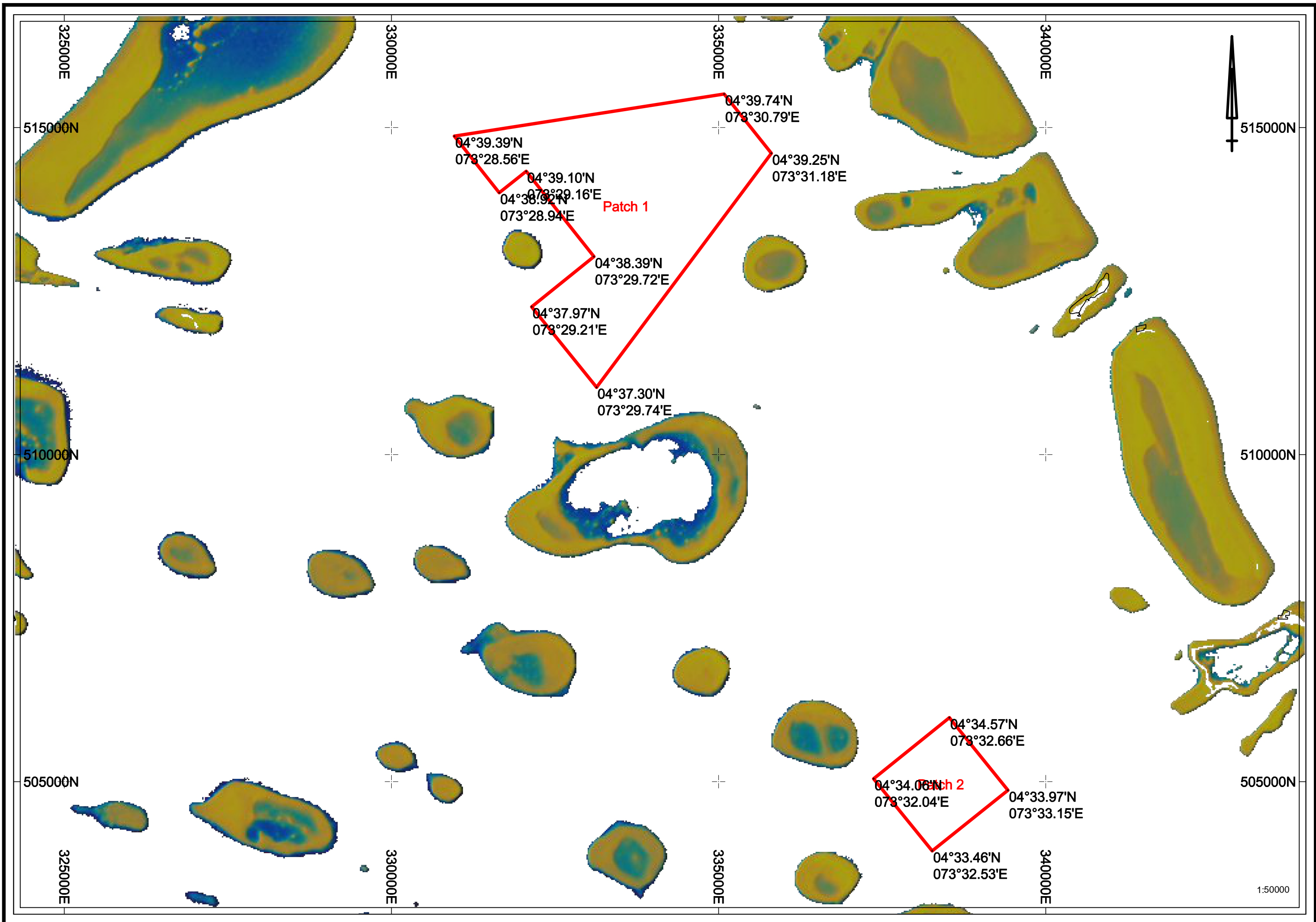
Hussain Lirar
Deputy Minister

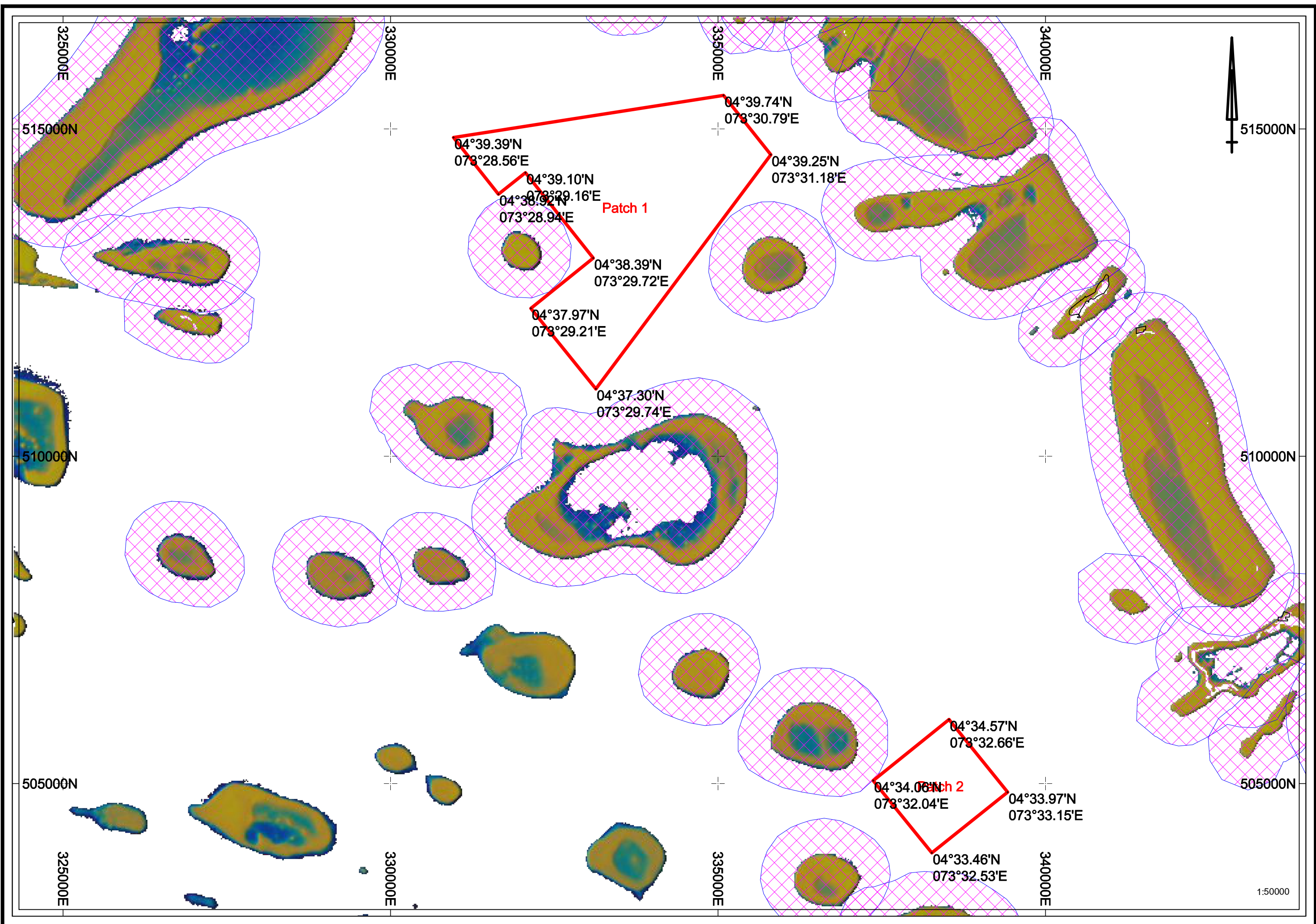


Date of Issue:
Date of Expiry:

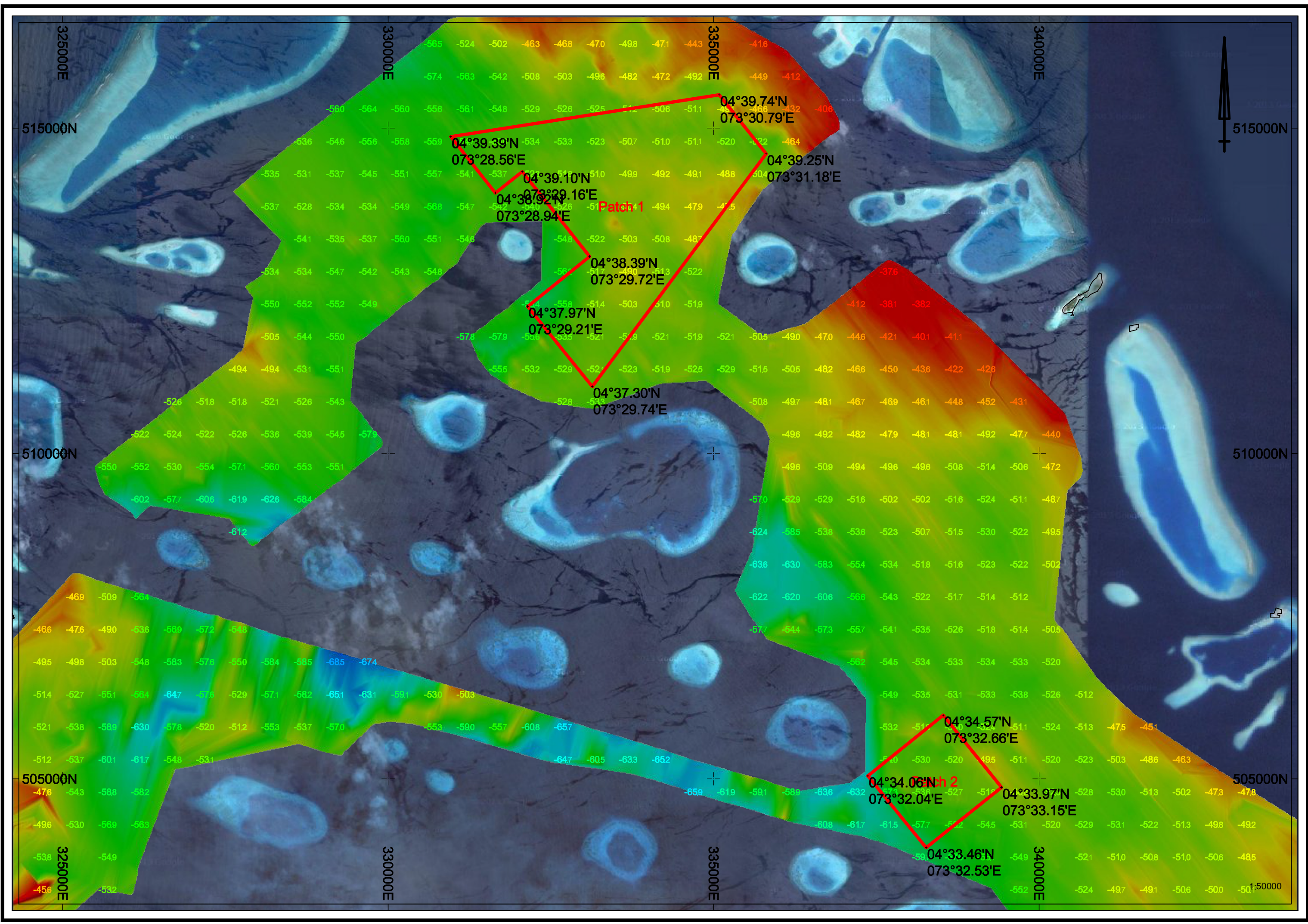
26/5/2016
26/5/2016

Annex 4 – Borrow Area





Annex 5 – Bathymetry



Annex 6 – Marine Survey Photos

SITE 1



SITE 2





SITE 3



SITE 4

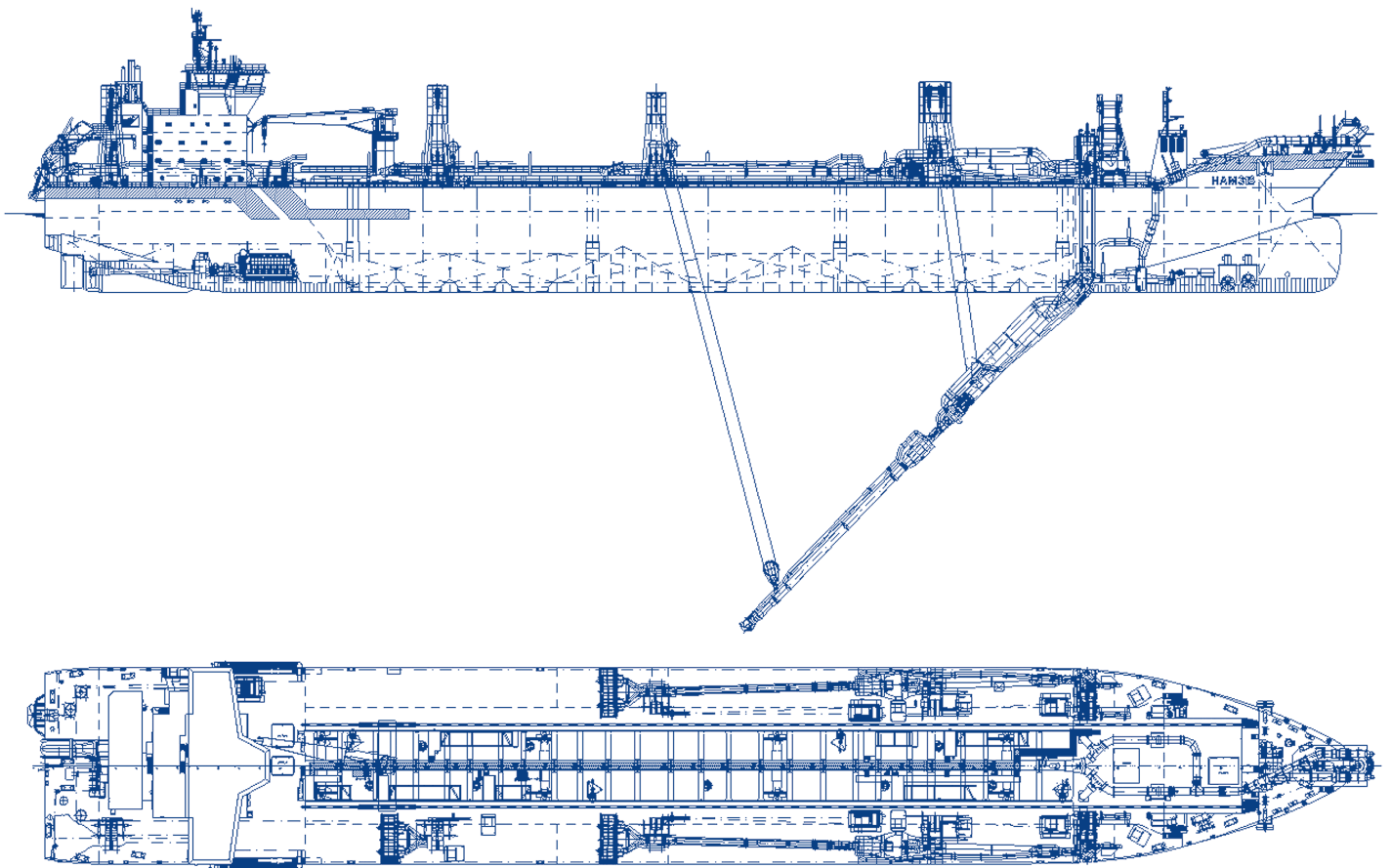


Annex 7 – TSHD Profile



Equipment

Trailing suction hopper dredger HAM 318



HAM 318

Name	HAM 318	
Type	Trailing suction hopper dredger	
Classification	Bureau Veritas, I ✕ Hull ✕ Mach ✕ AUT-UMS ✕ SYS-NEQ-1, hopper dredger, unrestricted navigation, dredging within 15 miles from shore or within 20 miles from port, dredging over 15 miles from shore with H.S. \leq 3.5 m, dredging within 8 miles from shore, dredging over 8 miles from shore with H.S. \leq 2.0 m	
Year of construction	2001	
Year of upgrading	2008	
Dimensions	Length overall	227.20 m
	Breadth overall	32.05 m
	Moulded depth	17.12 m
	Dredging draught	13.00 m (15 miles) and 13.55 m (8 miles)
Hopper capacity	37,293 m ³	
Deadweight	61,071 tons	

Maximum dredging depth	70.0 m / 101.0 m
Suction pipes	2 x \varnothing 1,200 mm
Discharge pipe	\varnothing 1,100 mm
Speed loaded	15.5 kn
Propulsion	2 x 12,600 kW
Bow thrusters	2 x 1,500 kW
Bow jet	2,250 kW
Total power installed	28,636 kW
Inboard dredge pumps	2 x 2,750 kW
Submerged dredge pumps	2 x 2,500 kW
Jet pumps	2 x 2,150 kW

Contact

Van Oord
 PO Box 8574
 3009 AN Rotterdam
 The Netherlands
T +31 88 8260000
F +31 88 8265010
E info@vanoord.com
I www.vanoord.com

Annex 8 – Water Quality test results

Male' Water & Sewerage Company Pvt Ltd

Water Quality Assurance Laboratory

FEN Building 5th Floor, Machangoalhi, Ameenemagu, Male', Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



WATER QUALITY TEST REPORT

Test Report No: 300827/2016/17

Customer Informations :

Mr. Amir Musthafa

Flat 11-2-3,
Hulhumale'
Rep. of Maldives



Date: 16/08/2016

Sample Description / Location~	North Male' Lagoon				TEST METHOD	UNIT
	Site 1	Site 2	Site 3	Site 4		
Sample Type~	Sea water					
Sampled Date~	9/8/2016					
Sample Received Date	10/8/2016					
Test Requisition Form No.	900165535					
Sample No.	825940	825941	825942	825943		
Date of Analysis	10/8/2016-16/8/2016					
PARAMETER	ANALYSIS RESULT					
Physical Appearance	Clear	Clear	Clear	Clear	Visual	-
Conductivity	53300	53200	52600	52700	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 21st edition)	µS/cm
pH	8.21	8.20	8.25	8.20	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 21st edition)	-
Salinity	35.01	34.90	34.54	34.62	Method 2520 B. (adapted from Standard methods for the examination of water and waste water, 21st edition)	‰
Temperature	20.0	20.0	20.1	19.9	Electrometry	°C
Total Suspended Solids (TSS)	6	<5 (LoQ 5mg/L)	<5 (LoQ 5mg/L)	<5 (LoQ 5mg/L)	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Turbidity	0.171	0.138	0.121	0.103	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

Keys:

µS/cm: Micro Seimen per Centimeter, ‰: Parts Per Thousand, mg/L: Milligram Per Liter, °C: Degree Celcius, NTU: Nephelometric Turbidity Unit

LoQ: Limit of Quantification

<p>Checked by:</p>  <p>Afnan Farooq Laboratory Executive</p>	<p>Approved by:</p>  <p>Mohamed Eyman Senior Technical Officer</p>
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Notes:

Sampling Authority: Sampling was not done by MWSC Laboratory

This report shall not be reproduced except in full, without written approval of MWSC

This test report is ONLY FOR THE SAMPLES TESTED.

~ Information Supplied by the customer

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

Annex 9– CVs of Team Members

Curriculum Vitae



AHMED BASHEER

Current Address: G.Ranfepi
Male'
Maldives
20139

Permanent address: Dhaftharu No. 417
Male' City
Maldives

Cell Phone: +960 7785177
Email: ahmed.bashyr@gmail.com

Personal Details

Date of Birth	24 th April 1984
Place of Birth	Maldives
Citizenship	Maldivian
Gender	Male
ID card number	A-065088

Work Experience:

- February 2005 to present: Customs Officer - Maldives Customs Services
- 2002-2004 Assistant Secretary – Presidents Office
- January 2013 to present: Assessor - Green Fins Project (UNEP)

Academic Qualification:

- 2001: **O level** (General certification of Education Ordinary level)

Other Qualification:

- Certified PADI *Open Water Diver* (Male', Maldivers)
- Certified PADI *Advanced Open Water* (Male', Atoll Scuba)
- Certified PADI *Enriched Air Diver* (Maafushi , Maafushi Dive)
- Certified PADI *EFR* Emergency First Response (Male', Dive Desk)
- Certified PADI *Rescue Diver* (Male', Dive Desk)

Other Trainings:

- Participated in 4 day training at Environment Protection Agency on Greenfins Assessors Training – Green Fins Project (UNEP)
- Participated in 2 day ecological monitoring training on 19th - 20th April at Nasandhura hotel (I.U.C.N)
- Participated in I.U.C.N expedition in North Ari 21 April - 5 May (MRC-UQ-IUCN Science Expedition) (I.U.C.N)
- Participated in 1 day workshop on a national coral bleaching monitoring protocol for the Maldives on 25th June 2015 at The Maldives National University (Central Auditorium) The International Union for Conservation of Nature (IUCN) in collaboration with Maldives Marine Research Centre (MRC)

Sports & Interests:

Diving, Football, Swimming, Traveling and Gaming



CURRICULUM VITAE

1. Personal information

Name: Amir Musthafa
Date of Birth: 24 August 1984
Permanent Address: Dhashukubaige, Gn. Fuvahmulah, Republic of Maldives
Contact Address: Flat 11-2-03, Hulhumale', 23000, Republic of Maldives
Marital Status: Married
E-mail: amir.musthafa@gmail.com
Cell phone: +960 7981711

2. Key Qualifications

2010 Bachelor of Engineering (Hons) in Environmental Engineering – University of New South Wales

Courses undertaken include but not limited to the following:

- Ecology, Sustainability and Environmental Science
- Transport Engineering and Environmental Sustainability
- Engineering surveying and GIS
- Environmental Principles and Systems
- Water and Atmospheric Chemistry
- Environmental Frameworks, Law and Economics
- Environmental Engineering Practice
- Coastal Resource Management
- Coastal Engineering (post-grad module)
- Coastal Management (post-grad module)

3. Other Certificates and Licences

1. EIA Licence. No. (2013 – 2018)
2. International English Language Learning Systems (IELTS)

Listening 8.0. Reading 8.5. Writing 7.0. Speaking 8.0 Overall Band 8.0.

3. **Project Management online course (2014) via www.udemy.com**
4. **Programming for Everybody – Python online course (2014) via www.coursera.org**
5. **GCE Advanced Level, Cambridge**

4. Work Experience

1. Project Engineer : July 2015 – to date
Islamic Development Bank: Tsunami Harbour Reconstruction Project Phase II – 10 Harbours

- Environmental Management of Projects
- Evaluate Environment Impact Assessments and ensure the environmental performance of the projects
- Coordinate with project management team
- Project status follow up
- Provide engineering solutions in coordination with Project Consultants

2. Engineer : December 2013 – July 2015

Ministry of Housing and Infrastructure

- Developing project plan,
- Preparing tender documents,
- Managing communication between project stakeholders,
- Managing project team,
- Monitoring and reporting progress,
- Undertake site visits to monitor quality of work,
- Environmental management of projects
- Evaluate Environment Impact Assessments and environmental performance of projects

Name of Project: GA. Kanduhulhudhoo Harbour Breakwater Construction Project

Contractor: MTCC

Project Value: 20.5 million MVR

Year: 2015

Name of Project: Lh. Naifaru Harbour Construction Project

Contractor: MTCC

Project Value: 67.5 million MVR

Year: 2015

Name of Project: HDh. Nellaidhoo Harbour Construction Project

Contractor: MTCC

Project Value: 24.0 million MVR

Year: 2013 – to date

Name of Project: HDh. Kurinbi Harbour Construction Project

Contractor: MTCC

Project Value: 17.7 million MVR

Year: 2013 – to date

3. Assistant Engineer: 2011 – 2013

Ministry of Housing and Infrastructure

Project Manager for following harbour construction projects:

Name of Project: Dh. Kudahuvadhoo Harbour Breakwater Construction Project

Contractor: MT Hojgaard

Project Value: 30 million MVR

Year: 2012 - 2013

Name of Project: Dh. Meedhoo Harbour Construction Project

Contractor: MT Hojgaard

Project Value: 35 million MVR

Year: 2012

Name of Project: Construction of Harbour at AA. Ukulhas & Channel Dredging work in AA. Bodufulhadhoo

Contractor: MT Hojgaard

Project Value: 32 million MVR

Year: 2011 - 2012

Name of Project: GDh. Gahdhoo Harbour Project (Design and Build)

Contractor: Amin Construction Pvt. Ltd.

Project Value: 32 million MVR

Year: 2011 - 2013

Name of Project: Th. Kibidhoo Harbour Project

Contractor: Amin Construction Pvt. Ltd.

Project Value: 29.5 million MVR

Year: 2011 - 2013

Name of Project: Sh. Noomara Harbour Project (Design and Build)

Contractor: MT Hojgaard

Project Value: 30 million MVR

Year: 2011 - 2012

Name of Project: F. Feeali Harbour Construction Project

Contractor: MTCC

Project Value: 16 million MVR

Year: 2012 - 2013

Name of Project: M. Mulah Harbour Construction Project

Contractor: MTCC

Project Value: 14.8 million MVR

Year: 2012 - 2013

Responsibilities:

Developing project plan, making cost estimations, preparing tender documents, managing communication between project stakeholders, managing project team, managing project schedule, managing project budget, monitoring and reporting progress, undertake site visits to monitor quality of work, maintain documentation, Evaluate Environmental Impact Assessments and environmental performance of projects.

Project Engineer for following harbour construction projects:

Name of Project: K. Huraa Harbour Reconstruction Project (Design and Build)

Contractor: MT Hojgaard

Project Value: 26.0 million MVR

Year: 2012 – 2013

Name of Project: GA. Maamendhoo Harbour Construction Project

Contractor: MT Hojgaard

Project Value: 49.6 million MVR

Year: 2013 – 2014

Name of Project: GA. Gemanafushi Harbour Construction Project

Contractor: MTCC

Project Value: 46.0 million MVR

Year: 2013 – to date

3. Environmental Impact Assessment Consultant : 2009 – to date

Freelance

- Have provided consultancy and involved in EIA documentation for the following projects as an assistant and as a registered consultant.
- EIA addendum for ADh. Thundufushi Redevelopment (2009)
- EIA for the ADh. Athuruga Redevelopment (2009)
- EIA for K. Olhahali Redevelopment (2010)
- IEE for beach nourishment works at Dh. Velavaru (2011)
- IEE for powerhouse expansion works at K. Kudahuraa (2011)
- EIA for K. Kudahuraa Reef Club Development and Coastal Works (2012)
- EIA for the Coastal Protection Works at K. Ihuru (2012)
- EIA for Mariculture project for Sea cucumber harvesting in HDh. Makunudhoo (2013)
- EIA for B. Kihavah Beach nourishment project (2013)

- EIA for Sewerage systems project in HDh. Hanimaadhoo (2013)
- EIA for shore protection project at Emboodhoo Island (2014)
- EIA for R. Lundhufushi Resort Development Project (2015)
- EIA for K. Dhiyaneru Mooring Area Development Project (2015)
- EIA for Male' West Area Redevelopment Project (2015)
- EIA for Dh. Maagau Resort Development Project (2015)
- EIA for HA. Filladhoo Sewerage System Development Project (2015)
- EIA for Th. Dhiyamigili Sewerage System Development Project (2015)

Have provided consultancy for Environmental Audits and Environmental Screening for several more projects including for;

M. Medhufushi, K. Iruveli, F. Filitheyo, K. Fihalhohi, GDh. Meradhoo, Sh. Vagaru Island resorts

4. Environmental Impact Assessment Evaluator : 2011 – to date

Freelance

Have evaluated Environmental Impact Assessment reports for over 20 projects.

Including;

- Coastal Protection Projects
- Sewerage and Water network projects
- Agriculture Projects
- Building Construction Projects
- Resort Development Projects
- Beach Nourishment Projects
- Airport Development Projects

5. Environmental Engineer (intern) : 2009

Water Solutions Pvt. Ltd.

6. Computer Technician : 2006 - 2007

Faculty of Engineering Technology

4. Major Trainings/Workshops and Meetings attended

- 1. WODCON XX – The Art of Dredging (2013), Brussels, Belgium.**
- 2. Training workshop on Maintenance of Infrastructure (2011), Hyderabad, India.**

5. Referees

Mr. Abdullah Muththalib

Deputy Minister
Ministry of Housing and Infrastructure
Maldives, Male'
Mobile: +960 7958100
E-mail: abdullah.mutholib@housing.gov.mv

Dr. Stuart Khan

Bsc (Hons), PhD
Senior Lecturer
University of New South Wales
Kensington, NSW, Australia
E-mail: s.khan@unsw.edu.au

6. Certification

Certification

I, the undersigned, certify that to the best of my knowledge and belief, the information given above correctly describes my qualifications and experience:



Amir Musthafa

2015

Curriculum Vitae

Personal Details

Name: **YOOSUF RILWAN**
Date of Birth: 08 January 1979
Gender: Male
Marital Status: Single
Nationality: Maldivian

Present Address: Saamiyaanaa Uthurubai
Galohu
Bodu Rasgefaanu Magu
Male'
Republic of Maldives

Permanent Address: Adimaguge
Galholhu
Kashimaa Hingune
Male'
Republic of Maldives

Contact No: (960) 7791202
Email: yirilwan79@hotmail.com

Qualifications

Handicapped Scuba Association Instructor HSA	August 2005
Open Water Scuba Instructor PADI	October 2003
Emergency First Response Instructor Course AED	October 2003
Dive Master PADI	July 2003
GCE Ordinary Level Majeediyya School, Maldives	January 1999

Work Experience

- Organization and supervision of daily snorkeling and diving excursions including night dives
- of scuba tune up, discover scuba diving experiences and check dives
- Conduct Conduct of dive courses (mainly DS, DSD and OWD) according to PADI standards in English
- Retail sales customer services and information briefings
- Participations at Diver's night (weekly presentation to promote dive center activities)
- Assistance in servicing and repairing dive equipment

Organizations worked

Ocean-Pro Dive Team / Meerufenfushi Island Resort:*PADI Instructor**January 2007 – August 2007***Ari Divers / Ranvelli Village:***(Post: Dive Centre Manager)**PADI Instructor**November2006 - December2006***Villa Diving / Holiday Island Resort:***(Post: Assistant Dive Centre Manager)**PADI Instructor**April 2004 – October 2006***Ocean-Pro Dive Team / Meerufenfushi Island Resort:***PADI Instructor**December 2003 – March 2004***Little Mermaid Dive Centre / Sun Island Resort:***PADI Dive Master**February 2003 – June 2003***Marine Research Centre / Ministry of Fisheries and Agriculture:***Research officer**June 2009 – Till now*

Work Experience

** Worked under a project of Reef fish unit at Marine Research Center (MRC) to study the migration of reef fishes by tagging them in Baa atoll.*

- * Worked in (Biological Identification Of Pelagic Species)BIOPS Maldives project to study the fishes living around the Fish Aggregating Devices (FAD's) in 2009. In 2010 took over the project and conducted all the trips and surveys till the end of the project.*
- * Worked in FAD Maldives project to study the migration of Tuna. In FAD Maldives project we attached acoustic receivers in the FAD and tagged Tuna with acoustic transmitters to study the migration of Tuna. From 2010 took over the project and collected all the data and was responsible for sending the data to the head scientists based in Seychelles.*
- * Worked in Baa atoll mapping project undertaken by French IRD and Marine research center. In this project worked in the field helping to lay baseline for the sites and collecting data. Under the same project went to New Caledonia to help the research team to put the data together and to map the Baa atoll.*
- * Working since 2008 in the Coral Reef Unit under MRC, monitoring 15 sites established on 6 atolls throughout the Maldives. Since 2011 onwards I was working as the head of the coral reef unit organizing, training and conducting the surveys on the 15 sites in 6 atolls.*
- * Working on Maldives Environment Management Project (MEMP) community based coral reef monitoring project from 2008 and from 2011 onwards took over the project and had laid baseline for the 12 sites in four atolls and currently involved in organizing and conducting the survey trips to these 12 sites.*
- * Worked with Save our Sea foundation research vessel to study the abundance of Sharks in the southern atolls of Maldives by deploying small baited cameras and satellite tagging tiger Sharks.*
- * Completed a workshop in Coral reef resilience adaptive management strategies in Bali. And under this workshop I will be strengthening our bleach watch methodologies and creating an internet link to the current MRC website to download the bleach watch forms and information.*
- * Completed a scientific paper writing workshop held in Phuket by BOBLME in September 2012.*
- * Completed a scientific presentation preparing and presenting workshop held in Phuket by BOBLME in October 2012.*
- * Completed an online course and a six day training on coral reef resilience and climate change in Zanzibar in June 2013.*
- * Completed a climate change and coral reef resilience workshop in South Africa 2014.*
- * Completed a climate change and coral reef resilience and mitigation workshop in Zanzibar 2014.*
- * Currently under taking a bachelor's degree in marine science in Sabah, Malaysia.*

Language and Other Skills

English (Spoken and Written) - Level of fluency: good
 Dhivehi (mother tongue) - Level of fluency: good
 Computer Literacy – Basic Course

Curriculum Vitae

Ahmed Najeeb

Date of birth: 3rd November 1985

Contact Information

Address: G. Villa
Male'
Republic of Maldives

Numbers: (960) 332 3189 (H)
(960) 790 1147 (M)

Email: anajeeb.drfp@gmail.com
anajeeb@mrc.gov.mv

Educational Background

September 2015 onwards studying for: Bachelor's Degree in Marine Science with Honors
University Malaysia Sabah
Kota Kinabalu, Sabah, Malaysia

February 2008 – December 2008: Advanced Certificate in Shari'ah and Law
Maldives College of Higher Education
Male', Republic of Maldives

1997 – 2002: Secondary School and GCE Ordinary Levels
Majeediyya School
Male', Republic of Maldives

Employment Record

June 2003 – November 2007: Project Officer Trainee,
Marine Research Centre,
Ministry of Fisheries, Agriculture and Marine Resources,
Male', Republic of Maldives.

November 2007 – February 2009: Assistant Project Officer,
Marine Research Centre,
Ministry of Fisheries, Agriculture and Marine Resources,
Male', Republic of Maldives.

February 2009 – June 2009: Project Officer,
Marine Research Centre,
Ministry of Fisheries, Agriculture and Marine Resources,
Male', Republic of Maldives.

June 2009 – May 2013: Fishery Project Officer,
Darwin Reef Fish Project,
Marine Research Centre/ Marine Conservation Society (UK),
Ministry of Fisheries and Agriculture,
Male', Republic of Maldives.

May 2013 – February 2014: Assistant Project Officer,
Marine Research Centre,
Ministry of Fisheries and Agriculture,
Male', Republic of Maldives.

February 2014 – September 2014: Research Officer,
Marine Research Centre,
Ministry of Fisheries and Agriculture,
Male', Republic of Maldives.

Work experience and training

- 2004 - Participated in the Focus Computers Apprenticeship program – a basic course in computing, hardware, troubleshooting, internet and office skills, Male', Maldives.
- 2006 - Participated in the Population and Housing Census of the Maldives conducted by the Ministry of Planning and National Development, Male', Maldives.
- 2008 - Participated in the Coral Reef Resilience Field training for South Asia and the Andaman Sea organized by the World Conservation Union in collaboration with CORDIO (Coastal Oceans Research and Development in the Indian Ocean) and the Marine Research Centre, Ari Atoll, Maldives.
- 2008 - Participated in carrying out the Behavioral and Biological Survey conducted by Department of Public Health and Global Fund, Male, Maldives
- 2009 – 2011 – Worked in the formulation of the Grouper fishery Management plan of Maldives and played a lead role in organizing all the survey trips, data collection and the stakeholder workshop held to finalize the Management plan.
- 2009 – 2013 – Conducted training to local resorts and Dive Centres in order to collect data for the FishWatch Maldives and SharkWatch Maldives programs carried out by the Darwin Reef Fish Project.
- 2012 – Participated in the International Coral Reef Symposium 2012, Cairns, Australia.
- 2013 – Participated in the BOBLME Indian Mackerel Genetics Harmonization Training Workshop, Cochi, India.
- 2013 – Conservation and Management of Coral Reef Ecosystem in South Asia Region, Paradise Island Resort & Spa, Maldives.
- 2014 – Participated in the Green Fins Assessor training
- 2014 – Participated in the Green Fins Review and Network meeting organized by Mangrove For the Future and UNEP, Bangkok, Thailand.
- 2014 – Participated in the Stakeholder consultation workshop to finalize the Maldives National Plan of Action on Sharks.
- 2014 – Participated in the Wetland Conservation and Coral Reef Monitoring Project training on the National Coral Reef Monitoring Framework, Paradise Island Resort and Spa, Maldives.

Other qualifications

- PADI Open Water Diver – MALDIVERS Diving Centre, Maldives
- PADI Advanced Open Water Diver – MALDIVERS Diving Centre, Maldives
- PADI Enriched Air Dive – Sun International Diving School, Maldives
- PADI Rescue Diver – Dive Desk, Maldives
- Emergency First Responder (EFR) – Dive Desk, Maldives
- and has been certified as a Green Fins Assessor since February 2014.

Publications

- Shahaama, A.S, Najeeb, A., Afzal, M.S, Islam, F., Wood, E. (2011) Review of the Maldivian Grouper Fishery and Exports Industry. Darwin Reef Fish Project (Marine Research Centre/Marine Conservation Society - UK). 36pp.
- Shahaama, A.S, Wood, E., Islam, F., Najeeb, A. (2014) Current status of the reef fisheries of Maldives and recommendations for management. Darwin Reef Fish Project (Marine Research Centre/Marine Conservation Society - UK). 85pp.

References

Dr. Mohamed Shiham Adam

Director General,
Marine Research Centre,
Ministry of Fisheries and Agriculture,
Male', Republic of Maldives.
Contact No.: (960) 332-2242

Dr. Elizabeth Wood

Coral Reef Conservation Officer,
Marine Conservation Society,
United Kingdom.
Email: elizabeth.wood@mcsuk.org,
ewood@f2s.com

Mr. Hussein Zahir

Senior Reef Ecologist,
Marine Research Centre,
Ministry of Fisheries and Agriculture,
Male', Republic of Maldives.
Contact No.: (960) 332-2242

Mr. Ali Hussein

Course Lecturer – Constitutional and
Administrative Law,
Advanced Certificate in Shari'ah and Law,
Faculty of Shari'ah and Law,
Maldives College of Higher Education,
Male', Republic of Maldives.
Contact No.: (960) 793-4432