

**ENVIRONMENTAL IMPACT ASSESSMENT
DEVELOPMENT OF TUNA PURCHASING AND STORAGE
FACILITY, GA. RAAVERREHAA, NORTH HUVADHU ATOLL**



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**PREPARED FOR
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Declaration of the Consultant:

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

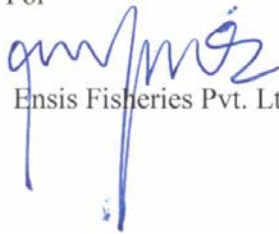
A handwritten signature in blue ink, appearing to read 'M. Riyaz', enclosed within a circular stamp or seal.

Mahmood Riyaz (EIA03/07)
January 2016

Declaration of the Proponent:

As the proponent of the proposed development in Ga. Raaverrehaa, I guarantee that I have read the Environmental Impact Assessment report thoroughly and that to the best of my knowledge all information provided here is accurate and complete.

For



Ensis Fisheries Pvt. Ltd



Acronyms used in the text

DNP	Department of National Planning
EPA	Environmental Protection Agency
GMP	Good Manufacturing Practice
HACCP	Hazard, Analysis Critical Control Points.
HDC	Hulhumalé Development Cooperation
IOTC	Indian Ocean Tuna Commission
MFDA	Maldives Food and Drug Authority
MoEE	Ministry of Environment& Energy
MoFA	Ministry of Fisheries and Agriculture
MoTAC	Ministry of Tourism, Arts and Culture
MPL	Maldives Ports Limited (a state-owned enterprise)
MRC	Marine Research Centre
MSL	Mean Sea Level
NPC	National Planning Council

2 NON TECHNICAL SUMMARY

- 1- This is the Environmental Impact Assessment (EIA) report carried out for proponent–Ensis Fisheries Pvt. Ltd.–to develop and operate fish purchase and storage facility in Raaverrehaa North Huvadhu Atoll. The EIA was prepared as partial fulfilment of the requirement by the Ministry Fisheries and Agriculture (MoFA) for acquiring permission for the Project. Environmental Impact Assessment (EIA) of development projects is a requirement by the Environmental Protection and Preservation Act (EPPA) (law 4/93) of the Government of the Republic of Maldives.
- 2- This report has been prepared in accordance with the Environmental Impact Assessment Regulations published by the Ministry of Environment and Energy in 2012 and covers both negative and positive environmental and socio-economic impact arising from the proposed project. Major findings of this report are based on information gathered during the field inspection of both the existing environment and possible effects of the project activities, and ongoing similar projects elsewhere in the Maldives and through extensive literature review and experiences gained from similar projects elsewhere.
- 3- Initially the proposed development was planned in Ga. Kedheraa Island and environmental Decision Statement was obtained to go ahead with the project. Shifting the planned development to Raaverrehaa was decided based on strategic analysis of the development, which found potential operational disadvantages that may impede smooth operation of the facility. Most importantly lack of shallow reef space to develop a harbour, which is an important infrastructure for the facility, remoteness of the island and being far from the airport and major fishing islands are also some of the shortcomings of Kedheraa.
- 4- The proposed activity will take place on Raaverrehaa Island and surrounding Falhu. Ga. Raaverrehaa Island is an uninhabited found on the North Eastern side of Huvadhu Atoll located at the periphery in an elongated, N-S oriented reef platform measuring a length of 20 km is shared by multiple islands. The reef is shared by three more islands including Villingili Island. The eastern part of the reef extends in the form shallow lagoon into eastern rim of the Atoll. The elongated-oval-shaped island of Raaverrehaa is lying in the western half of the reef. The coral reef system of Raaverrehaa is 20km long and the width is 0.8-1.8km. Reef perimeter is 43km and the area is approximately 25sqkm. The distance from the edge of the beach to the reef edge in both eastern and western sides is fairly consistent measured approximately 1km on the east and 400m on the western side. Raaverrehaa is an elongated-oval shape, N-S oriented island, with a length of 415m and width 100-119m and has an area of 4.7 ha. Average depth of the reef flat is less than -1 to -0.5m m from MSL.
- 5- Major operation that will be undertaken in Raaverrehaa Island will be loading/unloading storage and transportation of fish to Ensis processing facilities located in Hulhumalé Island. The facility will have 500 tonnes cold storage capacity and will produce ice needed for the fishermen to keep the fish fresh until they reach the storage facility from the fishing grounds. Necessary infrastructure needed to operate the facility will be developed on the island including the accommodation facilities for the staff working on the island. Electricity and water required for operations will be produced in the island. 100x3 Kva generator sets will be installed at the powerhouse to provide the electricity needed for the island. Reverse Osmosis (RO) desalination plants with total production capacity of 40MT per day will be installed to provide necessary water requirement for the operations. The proponent will ensure that the powerhouse and desalination plant implies with the relevant regulations. The exhaust chimneys, lightning conductors, sound attenuators, and CO₂-based fire fighting equipment will be installed. Ear mufflers will be provided for staff working at louder areas of the facility.

- 6- The raw material, mainly skipjack and yellowfin tuna caught by pole-and-line and handline by Maldivian on local fishing vessels will be purchased entirely from the Maldivian fishermen. With Ensis's long reputation in the country, it is expected that a large number of vessel will sell fish to the Ensis Fisheries Pvt Ltd. Ice will be provided free of charge from all the Ensis facilities as incentive for fishing and to encourage loyalty to the company. In addition the proponent will provide iceboxes for fishing operation startups in the area.
- 7- During the preparation of the EIA report an impact matrix, which is a standard tool for identifying the possible impacts of project activities, has been created for proposed development project Raaverrehaa Island. The activities carried out during the construction and operational phases are arrayed against a selection of environmental factors that may be affected directly or indirectly as a result of project activities. The impact outcomes from this analysis are considered and appropriate mitigation measures both in the development and operational phased has been provided.
- 8- The report has identified the main environmental impacts associated with the proposed activities and found that high water and energy consumption and the discharge of effluent with a high organic content are the major issues. Vegetation clearance and construction waste during the construction phase and noise, odor, solid wastes occupational health and safety issues may also be concerns of the operational phase. The study has found that most significant negative environmental impact identified during the operational phase of this project is release of untreated effluent into the sea. Liquid, solid and other forms of wastes and particularly hazardous waste generated during the operational phase has also been identified as significant impact associated with the project and appropriate mitigation measures are suggested for each and every impact identified in relation to the project.
- 9- The study has evaluated alternative options for the project and found that the proposed development is the right development for the right place. To enhance the water circulation in the reef and to limit the access to Raaverrehaa it is recommended to cut a channel through the walkway or remove it as an alternative for keeping the solid walkway which blocks cross reef water motion, increase nutrient enrichment and subsequent growth of seagrass on the eastern side of the reef and provides unlimited land access to the island. It is suggested to under-take post-development extensive monitoring programme that will keep on monitoring the environmental changes associated with the development and its operation and make necessary adjustment to the activities and its operation of the project based on the findings of various measured environmental parameters suggested in the monitoring plan.
- 10- The overall positive environmental impact from the development project is to integrate the existing product lines and the value-addition of fishery products rather than exporting the whole fish for processing. Job creation and stimulation of local economy, and exports is the most significant positive environmental impact of this activity. The long-term sustainability of the activity however, will depend on the sustainability of the fish stock. Skipjack and yellowfin tuna are highly migratory and their stocks straddle across the countries' exclusive economic zones into the high seas spreading out into the entire Indian Ocean. The stocks are being managed by the Indian Ocean Tuna Commission which among its 32 coastal and distant water fishing nations. Maldives is a full member and now heavily engaged, partly due to its existing Marine Stewardship Council (MSC) Certification of its pole and line skipjack and yellowfin tuna fishery. The current assessed status of the skipjack and yellowfin tuna stock is considered 'not overfishing'. The total average Indian Ocean catches are below the assessed maximum sustainable levels and the spawning biomass is healthy well above the point of recruitment impairment. The Maldives fishery component takes 17% of Indian Ocean skipjack and some

15% of the yellowfin. The most recent MSY is around at 680,000 Mt per year for skipjack and 350,000 Mt for yellowfin tuna.

- 11- Raaverrehaa is occasionally used for local picnic and it is the only remaining island for picnickers in the vicinity Villingili. Proposed fish purchase and storage facility development in Raaverrehaa will limit the public accessibility for local picnickers. To overcome potential social problems that may rise in association with this development, the proponent has proposed to develop a picnic facility in any location identified by the public and Villingili Council. At present council is consulting with the people to identify the most suitable area to develop for local picnickers.
- 12- On the basis of the findings of this environmental impact assessment study and the impact mitigation measures proposed in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of the planned Ensis fish purchasing and storage facility development in Raaverrehaa Island will substantially outweigh an unwelcomed demand of burden on the environment.

3 INTRODUCTION

3.1 BACKGROUND AND CONTEXT

Ensis Fisheries efforts into fisheries started with Fish Pro Pvt. Ltd., a joint venture foreign investment company with 60% shareholding by Ensis Fisheries Pvt Ltd (as the local partner) and 40% share by Sanko Bussan Co. Japan. The joint venture was approved in 2002 by the Maldivian Government to process and pack tuna and to sell bait, ice and water.

Under the joint venture, the company chartered a 5,700 Gross ton factory barge and provided services to approved fishing vessels in the exclusive economic zone as well as local fishing vessels. With this venture, the company acquired much technical expertise in processing, managing and exporting fish and fish products. Furthermore, the company established a network of buyers in the international market. The general area of fishing then became the core business activity of the Ensis group of companies (<http://ensisgroup.com/>, accessed August 2015).

Despite the success of the joint venture, the operation came to an end in 2006, when the factory barge leased by the company was acquired by another company. Ensis then decided to venture on its own into fish processing and exports as a 100 percent Maldivian company. Land was then leased from Hulhumalé Industrial Zone to set up a land based-fish processing facility, the first of its kind in Hulhumalé. When completed in 2006, the facility at Hulhumalé had the capacity to handle 40 metric tons of fresh fish with the processing capacity of 15MT per day. The facility can also produce 120 MT of ice per day.

Today Ensis Fisheries is the major private sector actor in post-harvest activities of the Maldives fishery industry. Established in early 2002 Ensis have become the most influential player in the export of fresh yellowfin for the Maldives. In order improve efficiency and wastage in the processing they have also started number of complementary business activities in an attempt to integrated product lines increasing yield from raw material.

The most import of this is the ENZI shop on Malé. The shop opened only 2 years ago operates a distribution and retail outlet for their products geared for local market. These include various products made from off-cuttings of yellowfin tuna; varieties of products of reef fish and processed products. . Under the on-going operations Ensis Fisheries cater the following products to mainly international and local markets (Figure 1).

- ✓ Processed chilled tuna (loins and chunks)
- ✓ Semi processed chilled tuna (H&G and GG)
- ✓ Steak
- ✓ Whole frozen tuna
- ✓ Canned Tuna
- ✓ Other products by products (belly, black meat etc)



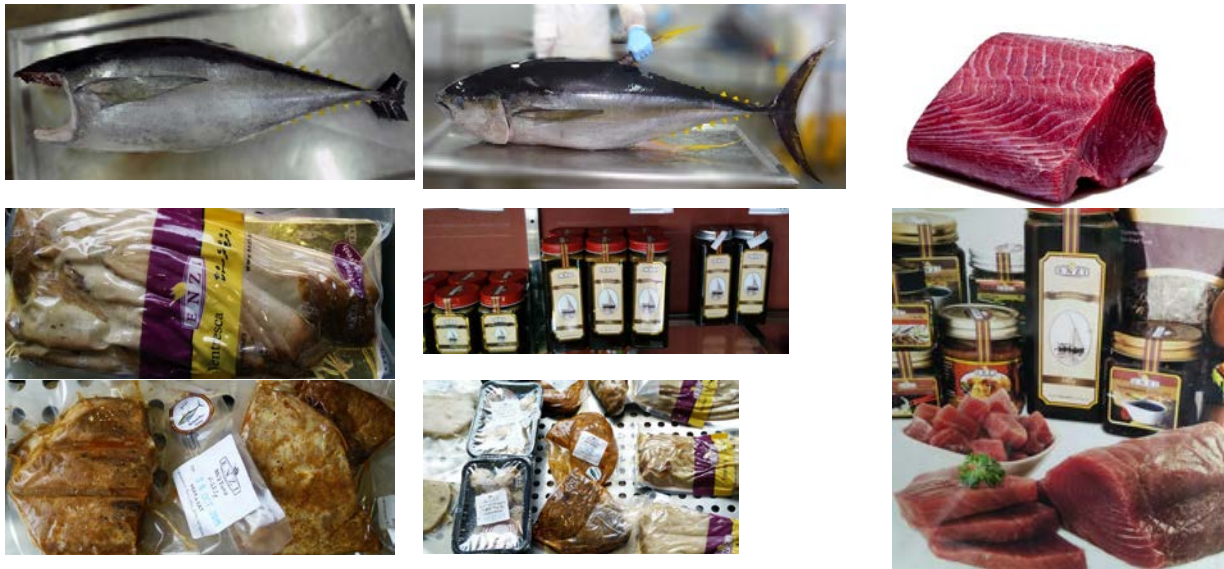


Figure 1: Ensis Fisheries (Enzi) fish products for export and local consumption

Ensis has also established a fertilizer processing plant, and a variety of product lines that makes use of fish waste, effectively integrating their product lines. These included Rihaakuru, kulhimas, and various types of curries, smoked and dried products which are sold locally.

Ensis has a Small and Medium Enterprises (SME) license, which also allows them to purchase set amount of fresh skipjack¹. Ensis have made use of the opportunity to develop fresh frozen skipjack products for export. Occasionally they also exported frozen skipjack to Thailand for canning and imported back for sale of their cans or have exported the to them EU markets.

To take Maldivian fisheries to the next level Ensis Fisheries will establish a canning plant on the Hulhumalé Island. Necessary preparation to begin the construction of canning factory is underway and is in an advance stage.

This objective of the proposal is to shift the fish purchasing and storage facility planned to develop in Ga. Kedheraa to Ga. Raaverrehaa. Shifting the planned development to Raaverrehaa was decided based on strategic analysis of the development, which found potential operational disadvantages that may impede smooth operation of the facility. Most importantly lack of shallow reef space to develop a harbour, which is an important infrastructure for the facility, remoteness of the island and being far from the airport and major fishing islands are also some of the shortcomings of Kedheraa.

The proposal is to develop a fish purchase and storage facility in Ga Raaverrehaa to supply necessary raw material for processing facilities in Hulhumalé. Ensis canning factory and Ga Raaverrehaa fish purchase and storage facility will be developed concurrently as the operations in Raaverrehaa is a necessity to support and sustain operation of processing facilities in Hulhumalé. Therefore the proposal is well integrated to the existing product lines, but more importantly tightly linked with government's policy of the value-addition of fishery products.

The pole-and-line skipjack fishery is now MSC certified and therefore to get the maximum economic rent it is import at that value addition be carried out locally

¹ Purchase of fresh skipjack for commercial export and processing was restricted to limited companies following restructuring of the industry and privatization of the some of the MIFCO assets.

The current national production of skipjack is around 60,000 MT a year and a substantial proportion is still being exported in frozen form to Thailand. These exports are being made by the state-owned enterprise MIFCO operating at a loss. MIFCO’s canning plant at Lh Felivaru is being upgraded, but their expected uptake is much less than the volume that is still being exported to Thailand in frozen form.

3.2 PROJECT SETTING

Raaverrehaa is a small-sized island with an area of 4.7 Hectares (46947.7 m²) located on the North Eastern part of Gaafu Alifu (Ga) Atoll in the south Maldives. Raaverrehaa is located 300m north of Villingili in an elongated house reef which shares with Villingili, Maamutaa and Bodehuttaa. Raaverrehaa is an uninhabited islands used by the people of Villingili as a local picnic island. Ensis Fisheries proposed to develop a fish purchase and cold storage in the island and the Ministry of Fisheries and Agriculture leased the Island to Ensis Fisheries for a period of 25 years to establish and operate the proposed developmental activities on the island.

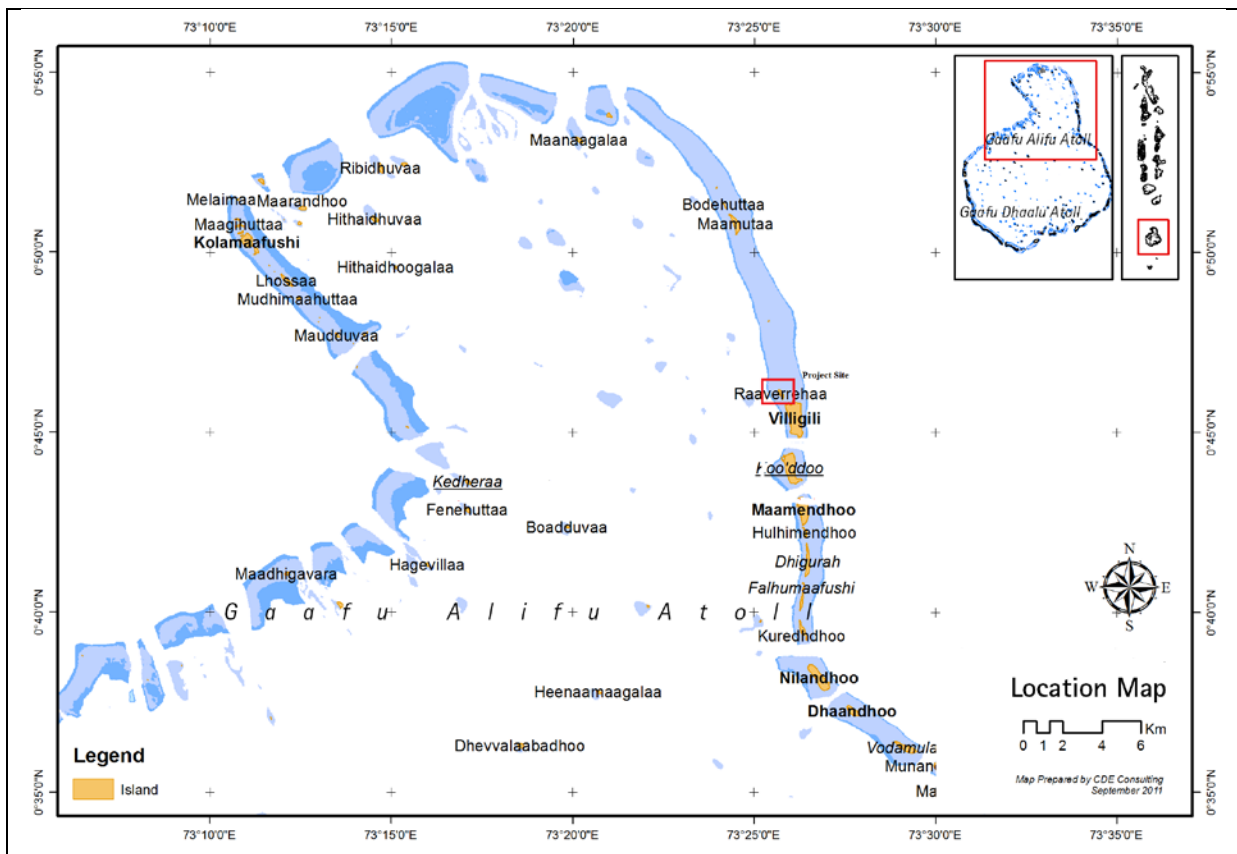


Figure 2: Location of Raaverrehaa Ga Atoll, Map by: CDE

Apart from MIFCO Ensis Fisheries will be the second establishments on North Huvadhu Atoll. Ensis proposal for development of fish purchase and storage in Raaverrehaa was approved by the Ministry of Fisheries and Agriculture in June 2015. The facility is expected to start operations by 2018. Relevant documents on approval are given in Appendix 3.

3.3 PROJECT RATIONAL AND OBJECTIVE

Today Ensis fisheries is well known among its buyers in Europe for its eco-friendly tuna. Ensis Fishereis processing and canning plants being conveniently located next to Malé international airport, Ensis is able to export fresh with the best quality as required by the highest international standards such as the European Union.

Unlike the Maldives tuna being sold as a cheap raw material to be value added in factories in Thailand, Ensis has been granted approval for development of a cannery in Hulhumalé industrial zone aimed to obtain the best premium for Maldivian fishermen.

The objective of Ensis's proposal is twofold; first to purchase fresh fish from area closer to the fishing grounds and localities such as the Huvadhu Atoll and maintain the quality and freshness of the fish by freezing and taking appropriate care to deliver as a high grade premium quality fish for the processing facilities in Hulhumale. Secondly to sustain continuous supply of best quality raw fresh fish to the processing and canning facilities in Hulhumalé to minimize fresh fish being exported to Thailand for them to process and export to European markets. These objectives are in line with government's key policy of value addition - locally. This makes lot sense and right thing to do as pole and line skipjack and yellowfin tuna are now MSC Certified.

With these in mind, the proposed purchasing and storage facility is targeted to supply fish directly to the processing facilities of the company for value addition and product integration. Fish purchase and storage facility will positively contribute to the local economy of the country and create employment particularly in North Huvadhu Atoll and open-up more avenues to fetch higher values for fish catch, particularly yellowfin tuna. This development will also increase the fish purchasing power of the company and provide diversified market opportunities for the local fishermen from various parts of the Maldives. Establishment of cold storage capacity in Ga. Raaverrehaa will increase the freezing and storage capacity added to national capacity. Along with many services for fisherman, the proposed facility in Ga. Raaverrehaa will provide ice for fishermen to preserve fresh fish, fuel and other services will also be available in the facility. Furthermore Raaverrehaa would also create a healthy completion between fish buyers in the region, providing choice for the fishermen.

The proposed development was initially planned for Ga.Kedheraa Island, however due potential operational disadvantages that may impede smooth operation of the facility the development was shifted to Raaverrehaa. Most importantly lack of shallow reef space to develop a harbour, which is an important infrastructure for the facility, remoteness of the island and being far from the airport and major fishing islands are also some of the shortcomings of Kedheraa that can be solved by the selection of Raaverrehaa Island. Also readily available deeply dredged area, which can be used as a harbour, is an important aspect for the proposed development.

Therefore the proposed development in Raaverrehaa Island will be a very important infrastructure for the fisheries related asset for the company and for the nation which will contribute to the local economy and thrive the fisheries sector in the Maldives.

3.4 PURPOSE OF THE EIA

Given the potential environmental impacts associated with the Ensis fish purchase and storage facility, the proponent seek the assistance of an EIA consultant to prepare and submit the Environmental Impact Assessment (EIA) report to EPA to comply with the Environmental Protection and Preservation Act (4/93) and EIA Regulations 2012 amended in July 2015 .

The objective of the EIA study is:

- a) To provide an assessment of the potential environmental effects of the proposed fish purchase and storage facility and to determine which of these, if any are likely to result in a significant effect on the environment and to propose ways and means of avoiding, mitigating and or compensating the perceived negatives effects of the project;
- b) To provide necessary information to EPA applicable to the proposed development; and
- c) To assess how the proposals have been developed to achieve a satisfactory level of environmental performance in line with the local EIA Regulations and other potential financing agencies.

3.5 EIA REPORT AND EIA IMPLEMENTATION PROCESS

In general the objective of an EIA report is to address the environmental concerns of the development project. The EIA will help to achieve efficient planning, aid in identifying impacts and their potential mitigation measures. The EIA report will also help to promote informed environmental and sound decision making during the development of the project.

The aim of the EIA is to identify, describe and assess in an appropriate manner, proposed development, in accordance with the provisions of guidelines and regulations of the GoM, the direct, indirect and residual effects of the project on the following factors:

- Physical and chemical characteristics of the earth (soil and landform,), water (marine and underground), atmosphere (air quality and climate);
- biological conditions including flora (trees/shrubs and endangered species), fauna (coral and endangered marine species) habitats (environmentally sensitive areas protected area etc);
- cultural factors including aesthetic and human interest (scenic views and vistas, wilderness qualities, landscape design, historical and archaeological sites and objects), and cultural status (employment); and
- Ecological relationships including eutrophication, disease and insect vectors etc..

This EIA report has been prepared by the EIA consultant selected by the proponent. Approved ToR of fish purchase and storage facility in Ga Raaverrehaa is given in Appendix 1. EIA preparation process is as follow:

- 1- The consultant prepares EIA application form with necessary relevant documentations along with a draft TOR for the proponent for submission to EPA, and the proponent submits the application along with the approved site plan and concept design.
- 2- EPA calls for a scoping meeting with proponent, consultant and relevant stakeholders from government agencies to determine the scope of the EIA study
- 3- During the scoping meeting the drafts ToR is finalized by EPA and send to the proponent and consultant
- 4- The consultant undertakes literature review and gathers relevant data and information on the project.
- 5- Consultant undertakes the field assessment work

- 6- The consultant analysis data and information gathered and identify environmental impacts, determine mitigation measures, rationally evaluate and suggest alternatives and limitations and propose a monitoring plan.
- 7- The consultant discusses major findings with the proponent and suggests possible changes to the project/project component.
- 8- Based on the discussion with the proponent the consultant reviews the EIA and makes necessary changes to the document.
- 9- The proponent should provide written commitment to undertake mitigation measures and post-development environmental monitoring as per the EIA report.
- 10- The consultant submits the final EIA to the proponent who subsequently will submit to EPA for review and to issue decision note.

Once the decision note is issued from EPA the proponent is obligated to implement the EIA and matters highlighted in the decision note. Also the proponent shall implement the periodic monitoring programme during construction and operational phase of the project and submit monitoring report as indicated in the EIA report (see Figure 3).

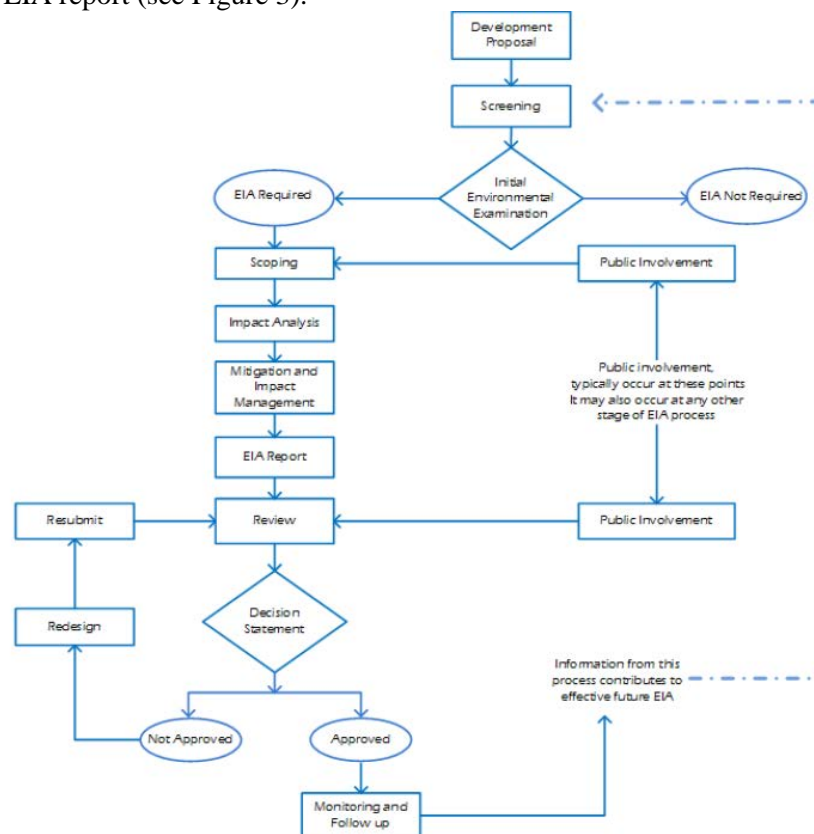


Figure 3: General flow diagram of the EIA process in the Maldives.

3.6 REVIEW OF RELEVANT STUDIES

As part of relevant literature review and preparation of the report, the following EIA studies prepared by the consultant have been used as reference;

EIA for Development of tuna purchasing and storage facility, Ga. Kedheraa, North Huvadhu Atoll, by Dr. Mahmood Riyaz, November 2015

EIA for Tuna Canning factory of Ensis Fisheries, Hulhumalé , by Dr. Mahmood Riyaz, August 2015

EIA for Ensis Fisheries Pvt.Ltd Fresh Fish Packing Facility at Hulhumalé Industrial Zone, by Dr. M. Shiham Adam, March 2013

These three projects are fisheries related projects for the Ensis Fisheries Pvt. Ltd. particularly the proposed project in Raaverrehaa is an exact replica of the project planned for Kedheraa, hence could not find a better reference material than this to understand the types, degrees and magnitudes of environmental impacts and potential mitigation measures for tuna purchase and storage facility in Raaverrehaa Island.

3.7 EIA IMPLEMENTATION METHODOLOGIES

This study was based mainly on data collected during a field investigation mission from 8 to 9 December 2015 by the consultant. Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. The field assessment methodologies are briefly described in Section 6.2 of this report. For the purpose of this EIA Report, direct and indirect environmental balance of fish purchase and storage, were assessed based on the input, process and output. International standards used for calculation of inputs and output of the fish freezing and storage is obtained from the review of relevant literature and standards followed by various international agencies such as World Bank, UNIDO, UNEP and FAO. Environmental impacts are predicted by use of widely used descriptive checklists and its significances are evaluated by use of a series of matrices. Expert judgment and professional opinion as well as review of relevant EIA studies have also been widely used throughout the impact assessment and evaluation process. These methods are described in detail at the relevant section of this EIA Report.

4 DESCRIPTION OF THE PROJECT

4.1 THE PROPONENT

Ensis is a growing brand in the Maldives. Established in 1996, the Ensis group now consists of several companies; Ensis Fisheries, Ensis Cruises, Travalpass Maldives, Thanburuma, Enzi Bakery and Ensis Embroidery and print. The group seeks to hold strong market positions in the focus business areas by scaling up the service and value to customers, whilst recognizing and rewarding the contribution of stakeholders and serving the interests of the community.

Ensis group has also ventured into the tourism sector with its own safari yacht “Felicity” and upcoming Resort development in Bandaadhidhoo Island Noon Atoll.

Since 2002, the company ventured into fisheries (with Ensis Fisheries), which started with a foreign joint venture company to long line in the Exclusive Economic Zone (EEZ) of the Maldives. The fisheries sector in Maldives provided many avenues for expansion. However, Ensis Fisheries sought to concentrate on tuna fishing and exporting fresh tuna to premium markets in Europe and USA.

Ensis Fisheries is the main company of the group and the market leader in fresh tuna exports from the Maldives. Ensis Fisheries is one of the major exporters of fresh chilled tuna from the Maldives. The state-of-the-art fish processing plant is located within 10 minutes’ drive to the airport and 20 minutes’ journey to the main seaport giving the best logistical advantages. The company owns its own fleet of refrigerated trucks to transport the products in temperature-controlled conditions that preserves the integrity of the cold chain from harvest to the customer.

Necessary permissions have been granted to the company to develop a tuna canning factory in Hulhumale Industrial Zone and preliminary construction work has already started at the site in Hulhumale .

Ensis group of companies work closely with local community, to bring change for the better. Ensis group assist the schools and community organizations with financial contributions, sponsorship and other forms of support. Also support the fishing communities and the fishermen by providing them soft loans, cool boxes for tuna and assistance in maintenance and repairs. Similarly in relation to the proposed project Ensis has proposed to develop a picnic area for the locals of Villingili

4.2 HISTORICAL USE OF RAAVERREHAA

Ga. Raaverrehaa was an isolated island used by the locals of Villingili for agricultural purposes. In the past the island can only be accessed from the sea (Figure 4). During the land reclamation project of Ga. Villingili, Raaverrehaa lagoon was used as the main borrow area for fill material for land reclamation in Villingili. A temporary sand bund (pathway) was constructed during Villingili reclamation to lay the dredger pipelines from the dredging area (Raaverrehaa lagoon) to Villingili reclamation area. The temporary sand bund (pathway) which was constructed between Villingili and Raaverrehaa became permanent and as a result more people have been using the Island for local picnics. The temporary walkway between the two islands is blocking water movement across the reef, (W-E and E-W) hence, the eastern side of the island is getting infested with seagrass due to nutrient enrichment and water stagnancy. Therefore this walkway is negatively impacting the area.

When Raaverrehaa was tendered by the Ministry of Fisheries and Agriculture to lease for development, Ensis Fisheries Pvt. Ltd. submitted a bid proposal for the proposed development and won. Hence the island was leased to Ensis Fisheries Pvt. Ltd to undertake the proposed development.

4.3 MAIN DEVELOPMENT FEATURES OF THE PROJECT

The proposed fish purchase and storing facility development in Ga. Raaverrehaa island involves development of two cold storages each with 250mt capacity, ice plant and ice storage, freezer stores, owners quarters with all the ancillary facilities including landing jetty, staff accommodation dormitories, powerhouse and desalination plants, administration building etc. Table 1. Gives requirements to sustain and operate the fish purchase and storage facility at Ga. Raaverrehaa.

Table 1: Fish purchase and storage facility requirements

Requirement	Details
2 cold storages	Each 250MT capacity, total capacity of the facility is 500 MT
2 Freezer storage	Each 70 MT total 140 MT
Ice plant and Ice storage	100 MT ice plant and 50MT ice storage
A T-Jetty	For loading and unloading of fish
Powerhouse and desalination plant	Three Gen sets 100 KVx3 during operation phase and 1 during construction phase, 20m ³ capacity RO plants during construction and 40m ³ during operational phase phase
Fuel and water storage	2x 1000 liter of fuel and 10,000m ³ water storage
Staff accommodation dormitory and manager's House	Approximately 10-30 staff during operation phase and 10-20 staff during construction
Workshop and carpentry	Engine Maintenance and repair of equipment and furniture
Admin and Cashier office	For fish purchase and storage administrative purposes
Waste collection area	Collection and segregation of waste

The concept drawing for the project is shown in Figure 4 and an enlarged map is given in Appendix 2.

4.3.1 Site Planning and Design

All buildings have been located on the western side of the southern half of the island to facilitate smooth operation of fish purchase, handling, loading, unloading, and transportation to and from storage rooms. Also the concept has taken care of vessel fuelling and ice-loading operation for local fishing Dhonis. Project boundary and directly affected zone from the project are shown in Figure 5 .

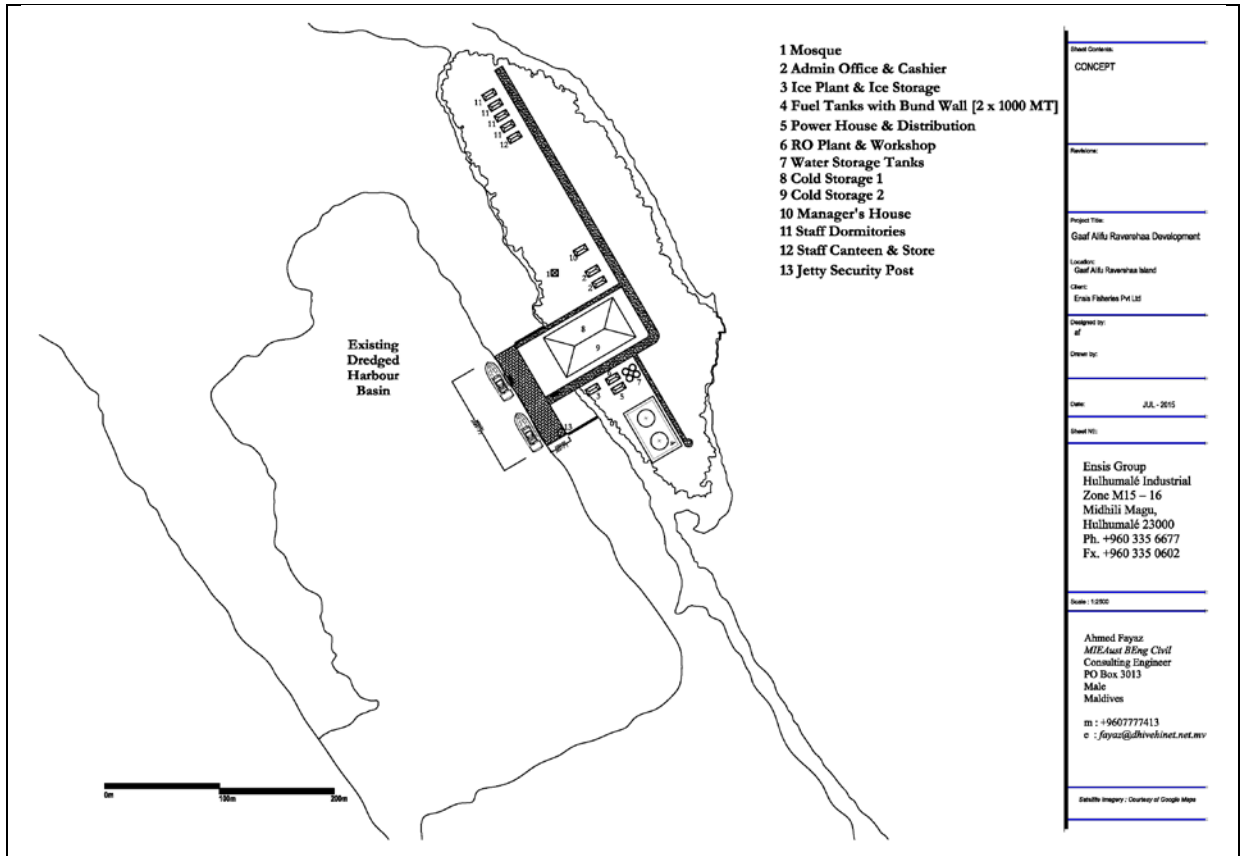


Figure 4: Ga. Raaverrehaa concept plan and design, enlarged detail map is presented in Appendix 2.



Figure 5: Ga. Raaverrehaa Project boundary and impact zone

4.3.2 Jetty

The island will be accessible from the T-shaped jetty located on the western side of the island. The jetty will be built from the island to the dredged area. The location the jetty is selected to get a good access to the facilities and make maximum use of the natural environment. There is no further need

for dredging as the jetty will extend to the deep dredged lagoon allowing alongside bathing. The jetty will be constructed on concrete piles in a way that will allow water and sediment flow underneath it.

4.3.3 Utilities and Support facilities

Utilities and Back-of-the-house facilities such as, staff accommodation units, staff facilities will be developed on the northern end of the island to avoid operation related impacts (sound, smell etc.), power and desalination complex, and, store building, waste collection building and mosque etc. will be developed on the southern part of the island where most of the operations will take place. Power and water utilities will be located in a single building. Utilities are designed and ideally placed to provide efficient support for the operation of the facilities.

4.3.4 Powerhouse and Desalination Plant

All the energy needed for the island will be produced from three diesel generators 100 KVA x3, producing about 300KvA of electricity at any given time. The facility has a dedicated power house building on the western side of the facility (Figure 6). The power house will be centrally located in the operational area in a single storey building. The power supply from the generators fed through a synch panel for feeding uninterrupted power supply. The power house will be manned 24/7 and logs are kept at hourly intervals. The power house will be equipped with safety equipment and staff is given ear-plugs. The noise levels measured outside the building about 15-10 m at ground level is about 65-75 db from the source. Noise insulation baffles are constructed to minimize the impact of noise emission from the generator sets.

Fuel will be transported to Raaverrehaa by registered or approved fuel suppliers. A fuelling system will be installed at the jetty head through fuel transportation vessels and fed into the storage tanks through secured underground pipelines Figure 6. Fuel storage tanks will be built using steel plates. Two tanks each with a capacity of 1000 Mt storage tank and a bund wall will be constructed around the fuel storage tanks as fuel storage handling and safety regulation stipulates. The tanks will be built on reinforced concrete foundations. The fuel tank would have a bund wall outside the tank with 110% capacity of the storage tanks to contain accidental spills and leakages. All building will have an offset of 7m from the oil storage bund as per the Fire and Safety Regulation.

200 litre day tanks will be utilized to provide fuel to the generator sets. Day tanks will also be banded with 110% capacity of the storage tanks to contain accidental spills and leakages. Day tanks will be located at the premises of the power house.

Raaverrehaa ground water aquifer will not be utilised for any use in the processing facility. Water needed for the facility will be drawn from a 30m deep borehole to produce fresh water through three. Reverse Osmosis (RO) Plants with total capacity of 40MT per day. Water is first collected in concrete tanks and aerated. The produced water is stored on site. Some 10,000 MT of water can be stored on site any given time on site.

Rain water will be harvested from roofs of the main building. Once cleaned the gate-valves are opened where the water is collected in storage tanks. Reject water from the RO plant is released to the eastern side of the island.

4.3.5 Ice production / Refrigeration

Production of ice is one of the key aspects of the fresh fish purchase and storage facilities. At Raaverrehaa an ice plants with a capacity of 100 MT/day will be installed and ice storage capacity of 50MT/day will be established.

Usually Ice is given free of charge for fishermen who sell their catch. Ice is also occasionally sold for fishermen who are not suppliers to Ensis as well. Unlike in block ice machines, typical refrigerant

temperature is - 20 to - 25°C, lower than in most other types of icemaker, to give rapid cooling and thus make the machine compact. The low operating temperature requires more power, but this is to some extent compensated for by the absence of a need to defrost.

Two cold storages each with capacity of 250MT will be constructed in Ga. Raaverrehaa. Similarly flake and block ice production capacity will be developed in Raaverrehaa Island to provide ice FREE of charge to the local fishermen operating in the area.

The refrigerant used in all the plants is HFC 404A which has zero Ozone Depletion Potential (ODP). Under the HCFC phase-out management plan, Maldives targets to phase-out HCFCs, and other Ozone Depleting Substances (ODS) by 2020.

4.3.6 Staff Quarters and Utilities

Accommodation will be provided on site for all the staff working in the facility. Staff will be accommodated in four dormitory buildings. Kitchen and mess-room and staff canteen will be located near the staff accommodation building. For executives and senior separate buildings developed and for owners quarters will be developed on the western side of the island.

With the proposed fish purchase and storage facility development 10-30 staffs will be employed in Raaverrehaa.

4.3.7 Fire Safety and Fuel Handling

A relatively large amount of diesel tank of 2000MT storage capacity will be developed in Raaverrehaa. Pump station for tank filling will be installed near the jetty. The tanks will be constructed of steel, and will be bounded to protect against accidental spill or partial or even total collapse of the tank. National Fire Code (NFC) will be strictly followed while storing and handling fuel in the facility.

4.3.8 Waste Collection and Disposal

The proposed facility will be used only for fish purchase and storage, no processing (such as gutting, deheading, skinning, cleaning etc.) will take place in this facility. Therefore no much of blood water will be generated in the facility. Fish used by the employees for their daily needs (cooking) will produce a small amount of blood water which will go through the effluent line into the sea. Location of effluent discharge brine discharge is shown in Figure 6:

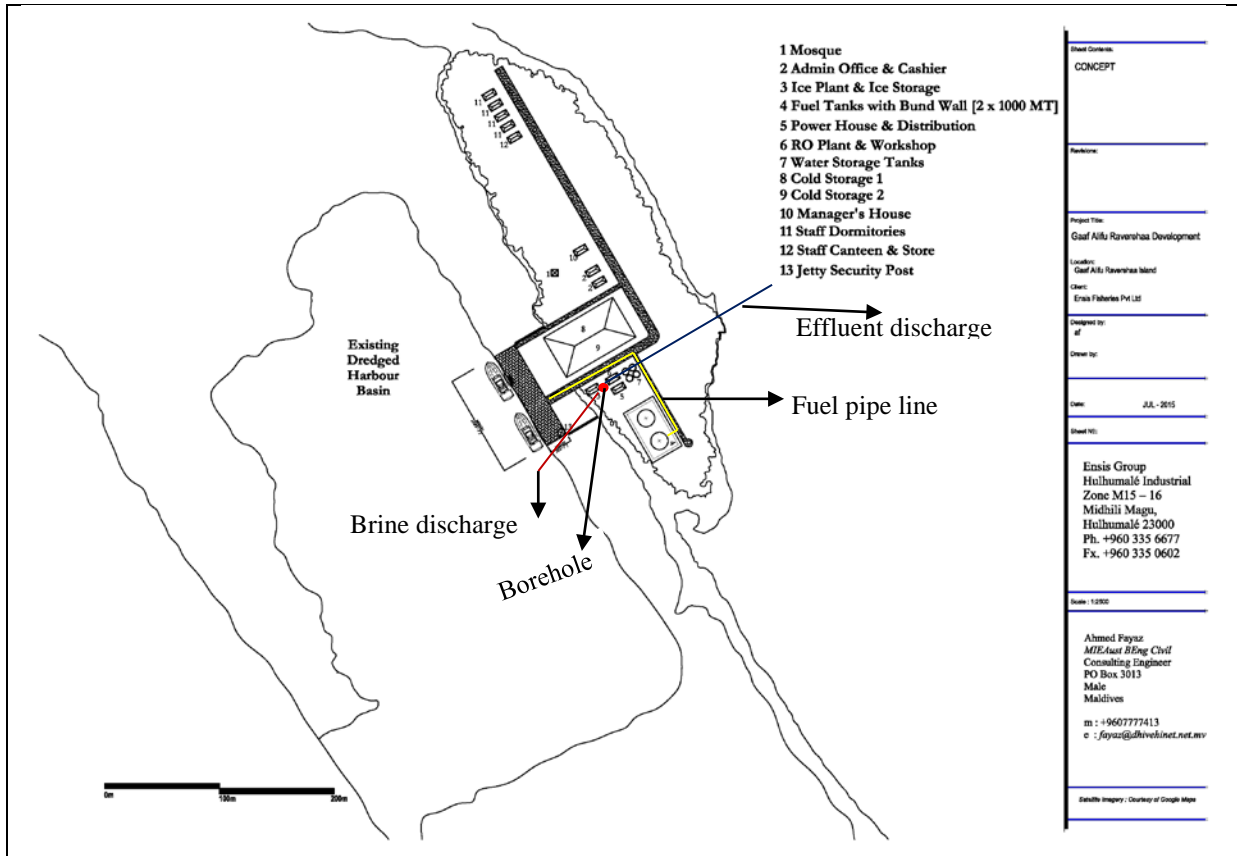


Figure 6: Map showing effluent, brine discharge and fuel pipeline and borehole location to extract water for desalination plant.

All the necessary possible measures to ensure proper disposal of waste will be implemented to ensure that environmental impacts associated with waste is avoided. Chemical and hazardous waste as well as waste oil will be appropriately contained and handled cautiously to avoid and accident prior to being disposed of at the waste management center established at Villingili Island or it will be transported to Thilafushi.

Sewage will be disposed via septic tank system. Many inhabited islands in the Maldives still use this system. With proper design the method is safe and can avoid contaminating ground water. For only 10 – 30 people on Raaverrehaa the septic tank system is considered to be effective and safe. The septic tanks will be located on the north western part of the island.

In the septic tank system sewage and waste come into septic tank and solid matters settle down at the bottom of the tank. Anaerobic Bacteria convert the sewage into liquid and gases during the process of digestion. In this way there is appreciable reduction in the volume of waste and it changes into semi solid condition, which is called sludge. It is necessary that septic tank is covered with water tight top roof slab. Following general guideline lines should be used for the use of septic tank system.

- ✓ Sufficient water is required for proper functioning of septic tank.
- ✓ The waste containing detergent should be avoided in septic tank as it had adverse effect on anaerobic bacteria.
- ✓ Septic tank should have minimum width of 0.75 meter and minimum depth of 1 meter below water level of the septic tank.
- ✓ Length of the tank should be 2 to 4 times the width.

- ✓ Every septic tank should be provided with ventilation pipe of at least 50 mm diameter.
- ✓ Minimum free board above water level should be of 30 cm.
- ✓ The floor of the tank should be of cement concrete 1:1.5:3 and has a minimum slope 1 in 10 provided towards the sludge outlet to facilitate de-sludging.
- ✓ The inner surface of septic tank should be plastered with rich cement.
- ✓ For efficient working of septic tank the sludge should be cleaned half yearly or yearly

4.4 HACCP

Hazard Analysis and Critical Control Points (HACCP) is a systematic preventive approach to food safety and allergenic, chemical, and biological hazards in production processes that can cause the finished product to be unsafe. It also deals with the design measurements to reduce these risks to a safe level. In this manner, HACCP is referred as the prevention of hazards rather than finished product inspection. The HACCP system can be used at all stages of a food chain, from food production and preparation processes including packaging, distribution, etc. HACCP is critical and key aspect of the fish process and packing facilities. HACCP begins with the layout of the production flow.

MFDA is the Competent Authority to inspect and certify fish and fishery products exported to EU from the Maldives. MFDA has a check list and see that all the requirements are met before exporting any products from any facility, which is intended for export. They will visit and see trial runs of processing and if it is satisfactory, they will send it to EU for the approval of the establishment. Every EU approved establishment would be inspected twice a year by MFDA, the Competent Authority to inspect and certify fish and fishery products exported to EU from the Maldives.

Ministry of Economic Development issues Export licensee, but for EU approval they will see if it is in compliance to their regulation, which is basically all the relevant EU Council Directives.

4.5 SOURCING OF FISH

Sustainability of fish supply and processing depends on a healthy tuna stocks and its fishery. The Maldives' fishery is the traditional one which was developed and evolved over hundreds of years. The main method of fishing is using livebait pole-and-line on locally built fibre glass vessels. Maldives fishermen also used handline fishing to catch large yellowfin tuna targeted for export markets. Many boats have made informal arrangements with the local buyers and exporters on supply of ice. Often ice is provided free of charge on condition that catches is sold to the exporters.

Quality is of utmost importance for exporters. A considerable amount of the care is required to ensure fish are delivered in Grade A condition. Fish has to be taken in minimum time from hooking to on-board. Fish are killed by stunning or destroying the brain to avoid build-up of lactic acid. Gills and guts is removed and cleaned to avoid build of up lactic acid either bled or gutted. The standard operating procedure is to kill quickly, bleed quickly and chill quickly.

Fish are graded when delivered; Grade A, B, C and Reject is identified fetching a grade of prices. These days fishermen decide the price. It is more like virtual auction as communication happens over cell phones.

The proposed purchasing and storage facility will target to purchase Grade C and rejected fish to fetch a higher market value through processing, integrate and value addition in Ensis canning factory in Hulhumalé. Mostly Skipjacks caught by using pole and line fishing method from the southern atolls of Maldives are expected to be purchased in Ga. Raaverrehaa.

4.6 PROJECT SCHEDULE

An indicative project schedule is given below. The schedule will be subject to change depending on the contractor and delivery of machine and its installations.

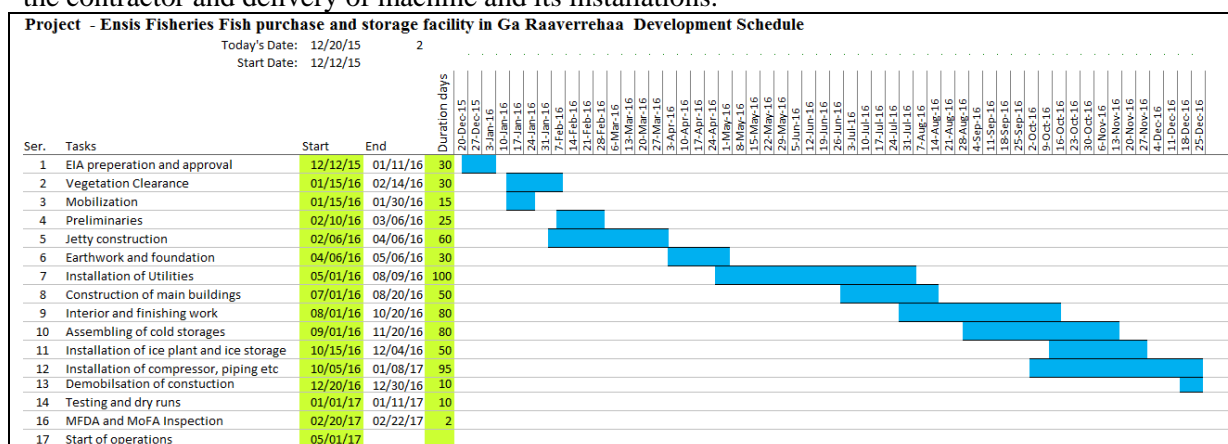


Figure 7: Indicative schedule of the project development work. It is expected that project would be complete with 12 months from the start.

4.7 PROJECT INPUTS AND OUTPUTS

Table 2: Project inputs construction and operational phase

Input resource(s)	Source/type	How to obtain resources
Construction phase		
10-20 construction Workers	Foreign/ local	Contractor's employees, 1 engineer and a 2 site supervisor Recruited through bidding and announcement in Villingili, and recruiting agencies etc.
Construction material	Reinforcement steel bars, river sand, cement, aggregates Timber; electrical cables and wires, DBs, MMCBs and MCBs, PVC pipes, light weight concrete blocks, light weight, telephone cable CAT, PVC conduits, core armored cables, PP-R pipe, Multi pump, floor and wall tiles, gypsum boards, calcium silicate boards, zinc coated corrugated metal roof, paint, varnish, lacquer, thinner, dry walls etc.	Imported and locally purchased where available
Heavy machinery (mini, excavators lorries, dumpers, concrete machine and operational tools)	Contractor's machinery	Hire locally/ contractors machinery
Maintenance tool and equipment	Maintenance parts and fluids required for the machinery	Import or purchase locally where available
Fuel and lubricant for machinery	Diesel, Petrol, Lubricants	local suppliers/ contractor
Fresh water	Desalinated water	Desalinated water from existing plant
Electricity/ energy during construction	Diesel generator	Existing from diesel generator

Operational Phase		
10-30 operational staff	80% locals and 20% expatriate,	Recruited through bidding and announcement in Villingili, and recruiting agencies etc.
10 labourer	5 locals and 5 expatriate	Recruited through bidding and announcement in local papers, and recruiting agencies etc.
Frozen Tuna	25 tonnes/day	Locally purchased from Fisherman
Drinking water	Bottled water	Locally purchased empty bottles will be sent back to the company for recycling
Electricity/ energy /thermal energy	Diesel generator	100 KVA x3
Maintenance material	Timber, electrical cables, electrical appliances, paint, thinner etc.	Locally purchased
Telecommunications	PABX system, fax machines, email and internet facilities to all guest facilities, communication hut at BoH area	Local telecom companies
Transport	Trucks speed boats, by sea and land	Trucks and speed boats
Food and beverages	For staff kitchen and canteen	Import and purchase locally (fruits, fish and vegetables).
Auxiliary process phase chemical for cleaning equipment and utensils	Alkaline Detergent, all-purpose cleaners, glass cleaners, bathroom cleaners, destainer, softener, alkali neutralizer, detergent, detergent plus, stain spots remover, etc. preference will be given to bio-degradable compounds, sodium hydroxide sodium hypochlorite Chemicals (for water)	Imported and locally purchased
Paper products	tissue roll, tissue boxes, hand tissues, / brochures office use paper products	local supply if available if not import. Recycle products and fabric material tissues will be preferred
Firefighting equipment	Fire Pumps, Fire Protection System, Smoke Detectors, Carbon Dioxide and Foam Fire Extinguishers, etc.	Local suppliers
Tools and equipment	Spare components, Other tools (e.g. scissors, knives), Equipment oil	Locally purchased/imported
Fuel, Kerosene and LPG	Diesel, LPG Gas, Petrol, Lubricants	Local suppliers

Table 3: Project outputs construction and operational phase

Outputs (s)	Anticipated quantities	Disposal method
Construction phase		
Earthwork material	Small quantity	Reused for ground leveling and construction wherever possible
Green waste	Small quantities	Burnt/buried or Sent to Villingili waste yard
Construction Waste	Small quantities	Disposed at Villingili waste yard or Thilafushi
Fuel and lubricant for machinery	Minor quantities	Disposed at Villingili waste yard or Thilafushi
Operational Phase		

Used refrigerants, Dirty plastic containers, Odors	Fish reception and storage minor quantities	Disposed at Villingili waste yard or Thilafushi, odor released to air
Portable water	100-500 plastic bottles/ month and	Plastic Bottles – crushed and sent to the bottling company Glass Reused or Returned to manufacturer
Wastewater	Waste water effluent mixed with blood from different processes, Minor quantities	Discharged into the sea through sewer network/
General Domestic waste	Over 50 kg/day	Disposed at waste yard
Kitchen and organic waste	Over 20kg/day	Disposed at waste yard
Waste oil and grease	Over 5 liters/ month	Stored in closed cans Disposed at Villingili waste yard or Thilafushi
Scrap metal/cans/plastics	10-20kg/ month	Disposed at Villingili waste yard or Thilafushi
Paper and Plastics, packaging waste	5-10 kg /month	Disposed at Villingili waste yard or Thilafushi
Glass and glass bottles	5-10 bottles/ day	Disposed at Villingili waste yard or Thilafushi
Hazardous waste	Minor quantities	Disposed at Villingili waste yard or Thilafushi

5 LEGISLATIVE AND POLICY CONSIDERATION

5.1 INTRODUCTION

The proposed Ensis fish purchase and storage facility in Ga Raaverrehaa Island will be subject to the laws, in particular Environmental Protection and Preservation Act (No. 4/93) of Maldives. The EPPA is the main legal instrument that provides statutory power for the Ministry of Environment and Energy on environmental regulation and enforcement. The EPPA states that natural environment and its resources are a national heritage, that needs to be protected and preserved for the benefit of future generation and that the protection and preservation of the country's land and water resources; flora and fauna as well the beaches, reefs, lagoons and all natural habitats are important for the sustainable development. Thus, it must satisfy the EIA process and get approval before the project starts implementation.

The main regulation stemming from EPAA for regulating environmental issues of development projects is the Environmental Impact Assessment Regulation of 2012. The Regulation provides a comprehensive outline of the EIA process including various processes from project screening, scoping, public comment, and appeal and issuing of the decision notes and implementing powers of its provisions. The line ministries require coordinating with MoEE on environmental issues in development projects and ensure regulations relating to development projects are consistent with Environmental Regulation.

With regards to projects relating to fisheries, the line ministry is the Ministry of Fisheries and Agriculture (MoFA). All matters relating to the fishery development, mariculture/ aquaculture, fishery regulation, and management and monitoring are executed and implemented by the MoFA. Development projects on fisheries and mariculture require EIA by law (as indicated in the Appendix II of the EIA Regulation) are expected to complete the EIA and provide the decision notes issuing permits for the development projects.

In the recent years, a number of developments in fishery regulatory framework have taken place with main objective of improving monitoring and enforcement. These developments are related, in part, to the requirement for Maldives to engage and play an active role in the regional fishery management organization – the Indian Ocean Tuna Commission (IOTC) and relating to requirements for export of fish into EU Territories. This section outlines and summarizes key policies, applicable laws and regulations relevant to the proposed project.

5.2 THE FISHERY LAW

The Fishery Law (Law No. 5/87) governs the fishery activities in the country. The Law contains 14 articles and there are few instances of specific reference to fisheries development and management. Articles 3a and 3b states that MoFA is 'hereby empowered to formulate and administer regulation on matters relating to fisheries' and in article 3b goes on saying that the MoFA 'shall oversee all fisheries activities in the country. It shall be the obligation of the MoFA to explore the possibilities of the development'.

Recognising the Fishery Law (5/87) is out-dated the Ministry has been working on the new fisheries bill since 2003. The bill was submitted 2007 and debated in Majlis. Due to widening differences of opinion on some of the provisions relating to development and enforcement, the Government decided to withdraw the bill for revision. Since then nation-wide consultations have been undertaken and revisions have been incorporated. It is hoped that revised fisheries bill will be submitted to Majlis for debate later in the year.

Lack of regulation and enforcement in fishery issues has been partly hampered by the delays in the new fishery bill. There appears to be a number of requirements of fishery management and monitoring that cannot be enforced with the existing Act (Law No. 5/87). Despite these shortcomings some regulation are being implemented of which most are very recent. Below is a non-exhaustive summary of the fishery and related regulations regarding export of fish and fishery products from the Maldives.

5.3 FISHERY REGULATIONS & GUIDELINES

The regulations relevant for fish processing and packing facilities are given below:

1. **Maldives Fishery Regulation:** This is a generic regulation that came into effect in late 1990s. The regulatory power for this regulation is stipulated in Article 3a of the Fishery Law (5/87) that empowers the MoFA to formulate and administer regulation on matters relating to fisheries. The Regulation covers but is not limited to the following:
 - a. Fishing on reefs and lagoons
 - b. Prohibited activities in fishing
 - c. Banned species in the Maldivian EEZ
 - d. Reporting of fishery activities
 - e. Issuing of permits in relation of fish processing and export
 - f. Conducting research in the EEZ

Article 7 of the Regulation refers to issuing permits for projects relating to fish processing and export. It states that parties or individuals wishing to start projects on fish processing and export shall obtain written permit from MoFA. This is to ensure that the investor does not face difficulties down the line due changes in the rules or otherwise.

2. **Guideline for Preparation of Fisheries Project Proposals:** This guideline is a direct outcome of the major shift of fishery policy in early part of 2000 to encourage private sector investment and cessation of state control on export of fresh tuna. The guideline (for fishery and mariculture) is intended as an information package for start-ups for submitting their business proposal. The proposal is focused on the extent and nature of investment and its economic feasibility. As such information on investment planning, and financial feasibility is required. The last requirement in the guideline is the 'Environmental Aspects', which states development proposal should include an environmental statement that gives an account of the existing environmental conditions of the proposed project locations. An Evaluation Committee consisting of officials of MoFA and (previous) Department of National Planning evaluates the project. Finally, the Minister endorses the projects except in difficult cases is submitted for Fishery Advisory Board (FAB) for advice. Before any project is given the final approval, environmental impacts assessment study is required and its Decision Note should be presented to the Ministry.
3. **Regulation on Fishing for Large Yellowfin and Export of Large Yellowfin Tuna from the Maldives:** The regulation is intended essentially to license the fishery targeting large (>60-70cm total length) yellowfin for export specifically into EU markets. This includes the handline and longline fishery, which target yellowfin and the latter bigeye and yellowfin tuna. The move is also to comply with the EU – IUU (Illegal, Unregulated and Unreported) Regulation which requires to be complied should exports occur into EU Territories. The regulation states that an export license shall be issued from the Ministry of Economic Development. It also talks of the requirement of the health and safety certificate emphasising of quality of export. Finally it requires for longline vessel to have vessel monitoring systems

and observes on-board should Ministry wants². There are also other requirements of issuing ‘catch certificate’- a signed document by the captain of the vessel stating the fish comprising in the export shipments were caught by the vessel. MoFA has institutionalized a Catch Certificate Office in Hulhumalé to deal with the paper work of export shipments. The catch certificate is essentially an instrument for used of chain of custody or in traceability of shipments.

4. **DRAFT Regulation on export of fish and fishery products in to European Union:** This is a draft regulation available on the website of the Ministry of Economic Development³. Formulated in reference to Law No 31/79 (Maldives Export Import Law), in the preamble it states that the regulation is now required due to increased volume of fish export into EU market and the need for Maldivian producers and processor to ensure the EU-Directives are complied with. It talks of various directives of the Council of the European Community and the competent authority in the Maldives, i.e., Maldives Food and Drug Authority (MFDA). The regulation has not come into force although MoFA’s regulations help to comply with most of the EU Directives.
5. **Regulation on fishing for sale to fish exporters and licensing of fish and fishery and aquaculture products:** The Regulation is also related facilitating to comply with the EU-IUU Regulation. The regulation is about licensing of the facilities (fish processing, aquaculture ornamental facilities). The license is given for one year on renewable basis. The Regulation talks of providing catch certificates for shipments exporting into Europe, which information such as vessel registration number, and the date of catch of the fish the shipment contains. Compared to the Regulation in #3 this is a general regulation aiming to regulate fishing for export or sale of fish exporters and processors intending to export or sale to exporters, parties who hold live-fish for export and aquaculture facilities.

There are other regulations that indirectly relevant for the development project under considerations. These are mainly for fishing activities, boat-building codes.

5.4 REGULATIONS ON HEALTH AND SAFETY

1. **Regulation of food advertising:** The regulation is important for fish processors as significant proportion of the produce (packed fresh fish) is marketed locally. The regulation is specifically on advertising. It talks of the obtaining prior permission from the Department of Public Health on any advertising and marketing campaigns on food products.
2. **Regulation on Food Hygiene Standards (health certificates):** The regulation is intended to giving powers to government authority to inspect health and hygiene standards of outlets processing, producing and/or selling food products. Some of the packing facilities have subsidiary outlets or they regularly supply to retail shop on Malé and on islands, and for the resort market. This regulation will apply to them.

² The requirement of having a vessel-monitoring device on board fishing vessels in now being broadened – thanks to the current government’s programme on ‘Beyas Nubeyas’ that requires having accurate and timely information on location and fish catch.

³www.trade.gov.mv/?lid=5, accessed January 2013.

5.5 ENVIRONMENTAL REGULATION

5.5.1 Regulation on Waste

Waste management Regulation (No. 2013/R-58) is more recent come into effect on 6 February 2014. The regulation was gazetted on 05 August 2013. The regulation provides set of comprehensive guidelines on collecting, storing, transporting and managing waste. In the preamble its states the objective of the regulation is in line with the Article 22 of the Constitution which requires that development activities designed for achieving socioeconomic targets should ensure that environment and its constituent living component is not compromised and that resources are utilized effectively. The regulation covers the management of general, hazardous and special waste. Wastes arising from paints and chemical solvents are considered as special waste.

Clause 7 of the regulation requires the preparation of Waste Management Plans for specific sectors or areas. Clause 7(c) requires that City and Island Councils prepare their own Waste Management Plans for EPA approval. Clause 8 is for hazardous waste management and clause 9 for special waste management. The types of hazardous waste considered under clause 8 are given in Appendix J of the Regulation.

Clause 10 is about extended producer responsibility and Clause 11 requires that waste shall be disposed in approved locations only. Clause 11(b) states the areas where waste should not be disposed at all including roads, parks, beaches, lagoon, reef, and so on. Clause 11 (c) (d) states the situations that exempt the enforcement of the regulation including situations where human life is at risk and natural disasters or national security threats. Clause 11(e) states that waste management at household level would not require any permits under the regulation. Clause 12 states the provisions for managing waste in public places; that appropriate bins placed in appropriate locations with appropriate labels distinguishing different kinds of waste and that those bins shall be emptied periodically in an appropriate manner to avoid nuisances of any sort.

Clause 13 is for waste management on sea-going vessels. Clause 14 is for waste management at harbours or ports. Clause 15 is for recycling and recovery of waste.

Clause 16 to 23 deals with waste management permits including the standards to be adhered by licensed parties, renewing licenses, types of licenses, renewal and change of licensee, cancellation of licenses, fees and charges. Clause 24 requires that EPA maintains an inventory of the licensed parties and the details required in the inventory.

Clause 25 to 28 lists the provisions for waste transport. Clause 29 talks about the responsibilities of the licensed parties. Clause 30 requires that administrative records including fines shall be maintained by the EPA. Clause 31 gives the EPA the authority to check/monitor the activities of the licensed parties. Clause 32 and 33 are also about data collection and reporting.

Clause 34 discusses the actions to be taken in case of non-compliance. Clause 35 sets the conditions for cancellation of license. Appendix M of the regulation states the different fines that will be levied upon non-compliance.

This regulation was effective from 6 January 2014 and EPA would be responsible for the implementation this regulation.

5.5.2 Regulation on Environmental Damage and Liabilities

Under the Environmental Protection and Preservation Act (No. 4/93), the Ministry of Environment formulated the Environmental Damage Liabilities Regulation in February 2011, which encompasses

the basis to avoid environmental deterioration, extinction of biological resources, environmental degradation and avoid wastage of natural resources. The main purpose of this regulation is to stop unlawful activities on environment and adequately implement a fining procedure for violations as well as implement a compensation mechanism on environmental damages. Its Schedules form the basis for levying fines on various environmental components and activities. Hence, the proposed project will be subjected to this Regulation for any activity outside of the EIA scope and EIA Decision Statement.

5.5.3 Fuel Storage and Handling

The Ministry of Defence and National Security's regulation on Fuel Storage came into effect on 12 August 2015 (R160-250). In general the regulation is enforced from the day it was published on government gazette, although areas requiring re-investment and training has been given 6-12 months to begin comply and enforcement.

The objective of the regulation is to prevent and mitigate fire accidents in the country, create awareness on the safety issues fuel handling and storage and finally to facilitate exiting and new facilities to follow and maintain the standards prescribed in the regulation.

The proponent is expected to follow the regulation in constructing, signing and maintaining the fuel storage area on the island.

5.5.4 Desalination Regulation

Desalination Plant Regulation (2002) states that all sea water desalination plants installed and intended to supply water to 200 or more people or large scale agricultural needs or tourism related activity need to be registered prior to the operation of the plant. Therefore, it would be necessary to consider the impacts of desalination plant in this EIA so that registration can be done without further environmental scrutiny. Desalination plant registration is required to be renewed every five years. Therefore, regular monitoring shall be ensured in order to carry out an efficient renewal process.

5.5.5 Borehole guidelines

Borehole Drilling Technical Specifications and Guidelines were issued by EPA dated 25 September 2011. The Guidelines covers drilling of boreholes and installation of electric pumps for source water extraction for various water supply development projects. The Guidelines state that boreholes shall be drilled at the location(s) designated by the client in consultation with Environmental Consultant and Environmental Protection Agency (EPA). It is also stated that care must be taken in handling and storage of all drilling fluids, oils, greases and fuel on site, to avoid any environmental pollution, damage and degradation. Any toxic materials, drilling fluids and other additives, cuttings and discharged water shall be disposed in a manner that do not cause damage to the environment, public and private property.

According to the Guidelines, the in-land borehole depth shall be more than 30m even if the electrical conductivity of discharge water has reached 50-60mS/cm before reaching 30m depth. If electrical conductivity of discharge water at 30m depth is measured less than 50-60mS/cm, drilling shall continue until electrical conductivity reaches to 50-60mS/cm. This aspect of the Guidelines has raised concerns especially with reference to boreholes at the periphery of the island where, according to renowned hydro-geologists, the freshwater lens may not exist and therefore shallower depths may be considered. Further studies are proposed under the scope of the proposed project in order to determine the exact nature of this.

The Guidelines also provide guidelines for the different records that ought to be made during the drilling process. For monitoring purpose, boreholes drilled shall provide water sampling tubes at the interval of 5m from top to bottom. Water quality testing that may be necessary to be performed upon completion of the borehole has also been indicated in the Guidelines.

The project will strictly follow the EPA guidelines when constructing the borehole and will obtain the necessary permit required prior to commencement of operations.

5.5.6 General guidelines for Domestic wastewater disposal

This guideline was the first public document demanding the application for a permit and subsequent approval before installation of a sewerage system in the Maldives. The guideline lack legal backing however EPA tries to implement the guidelines. The guidelines require all wastewater management systems to meet prescribed criteria for the use of ground water, design for an easy access for maintenance and durability and undertake monitoring and provide facilities for sampling final effluent.

These guidelines are set for domestic wastewater and it clearly states that industrial effluents require special permits from the authorities. The guideline states “where a sea outfall is used it should be placed away from the areas such as commercial harbours, or areas designated for recreational purposes. The sea outfall must be placed in such a way that the effluent will be flushed out into the deep sea, where it can be diluted and dispersed so that the impact on the marine environment is reduced. Untreated wastewater shall not be disposed into the near shore lagoon.”

EPA guidelines permit connection to local sewer network if the BOD and COD of the effluent are below 50mg/l and 200mg/l respectively.

5.5.7 Water production and power generation

Production of water and power generation is almost always an activity undertaken on site for fish processing and packing facilities. The regulation requires that if water production on site exceeds 10 MT/day the water plant has to be registered EPA.

Similarly all power generation units have to be registered with Energy Authority of the Maldives. This regulation came sometime in 2010 and many facilities have to require complying with this requirement.

5.6 SUMMARY

In summary, the proposed project will comply with all applicable environmental regulations requirements, relevant legislation, and legal and regulatory statutes. The consultants will work with the project proponent, the EPA and designated agencies during the EIA process to meet these requirements (Table 4). Major timelines of the regulatory process followed by the project.

Table 4: Shows major timelines of the regulatory process followed by the project.

#	Activity	Date
1	Raaverrehaa leased to Ensis	29 th June 2015
2	Concept design	July 2015
3	EIA application submitted to the EPA	22 nd November 2015
4	Scoping meeting and approval of Final ToR for the EIA issued	14 th December 2015
7	Final EIA submitted to EPA for environmental clearance	6 th January 2016

EIA process ensured that this project has followed relevant laws, regulations and related stakeholders consultative process during the EIA report preparation process.

6 EXISTING ENVIRONMENTAL CONDITIONS

Raaverrehaa Island is situated on the north Eastern side of Gaafu Alifu (Ga) Atoll, at approximately 73°25'44.38"E and 0°46'4.09"N. The island lies inside the Huvadhu Atoll, which is believed to be the second biggest atoll of the world.

Raaverrehaa is found on the North Eastern of Huvadhu Atoll located at the periphery in an elongated, N-S oriented reef platform measuring a length of 20 km is shared by multiple islands. The reef is shared by three more islands including Villingili Island. The eastern part of the reef extends in the form shallow lagoon into eastern rim of the Atoll. The elongated-oval-shaped island of Raaverrehaa is lying in the western half of the reef. The coral reef system of Raaverrehaa is 20km long and the width is 0.8-1.8km. Reef perimeter is 43km and the area is approximately 25sqkm. The distance from the edge of the beach to the reef edge in both eastern and western sides is fairly consistent measured approximately 1km on the east and 400m on the western side. Raaverrehaa is an elongated-oval shape, N-S oriented island, with a length of 415m and width 100-119m and has an area of 4.7 ha. Average depth of the reef flat is less than -1 to -0.5m m from MSL.

Distance between Raaverrehaa and Villingili is approximately 300m while the nearest airport situated on Kooddoo Island is at a distance of 3 km from Raaverrehaa. Kooddoo Island is also the main fish processing center in the southern region of Maldives. Other inhabited islands in close proximity to Raaverrehaa include, Maamendhoo (6.18 km) and Nilandhoo (14.6km).

6.1 OBJECTIVES

The purpose of this was to assess the existing environmental conditions of the island, including marine and land environment. These assessments would not only enable avoiding impacts to the environment as a result of the project but also would contribute to better planning recommendations for the proposed project. This is critical in assessing potential impacts and to determine the actual extent of damage should an unforeseen impact occur during the implementation phase.

The main aim of surveys and assessments was to establish the existing baseline environmental conditions of Raaverrehaa Island. Environmental monitoring during construction and operation phase of the islands to ensure the changes in environment are captured and remedial actions for the observed negative impacts are addressed in a timely manner. The objectives of the present assessment were to:

- Determine the general abiotic and biotic conditions of the terrestrial environment of the project area;
- determine the general abiotic and biotic conditions of the marine environment of the project area;
- determine the geological and geomorphological characteristics of the project area;
- assess the changes that will be associated with the proposed project;
- propose mitigation measures to avoid, minimise potential effects from the proposed project; and
- Propose monitoring arrangements to measure effectiveness of the proposed mitigation measures

6.2 METHODOLOGY

The section covers methodologies used to collect data on the existing environment. The key environmental and socio-economic components of the project that were considered are physical environment, social and environmental aspects of fish loading/unloading storage and transportation

operations. In order to study the existing environment of the island, the following data collection methodologies were used during the field visits undertaken in December 2015 to Ga. Raaverrehaa Island.

6.2.1 General methodologies for data collection

Conditions of the existing environment were analyzed by using appropriate analytical methods. The direct and indirect environmental balance of fish purchase and storage, were assessed based on the input, process and output as show in Figure 8. International standards used for calculation of inputs and output of the fish freezing and storage is obtained from the review of relevant literature and standards followed by various international agencies such as World Bank, UNIDO, UNEP and FAO.

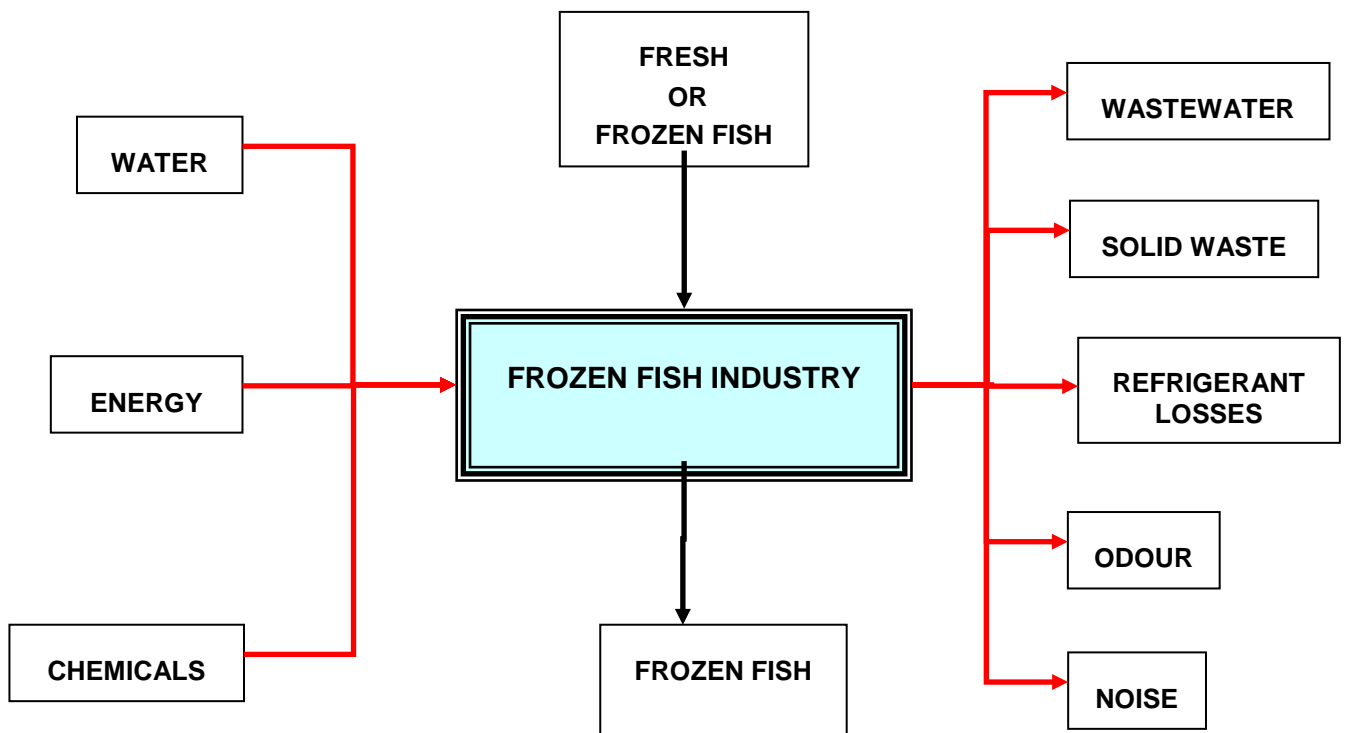


Figure 8: Environmental balance of freezing and storage of fish.

6.2.2 Water sampling

Ground water from the island was obtained in 1.5 L PET bottles after washing them with water to be sampled from existing water well used by the previous management of the island for various purposes. Parameters tested for ground water quality assessments were physical appearance, temperature, pH, electrical conductivity, total suspended solids. Necessary parameters to assess the overall quality of the ground water were analyzed at the laboratory in Maldives Water and Sewerage Company (MWSC) laboratory.

6.2.3 Mapping and location identification

The island was mapped and various location and areas of interest are marked by using a handheld GPS. These data collection points include low water mark, high water mark, vegetation line, ground water sampling locations, and sea water sampling location of Raaverrehaa proposed for development of fish purchase and storage facility. Figure 9 shows the water sampling locations, vegetation transect, and beach profile lines.

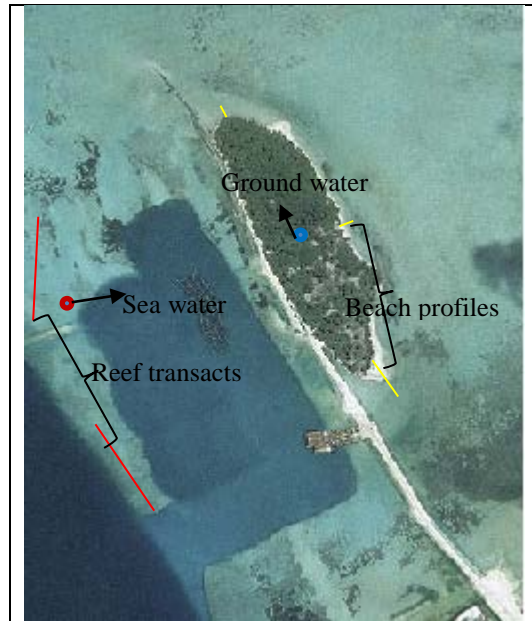


Figure 9: Map showing sampling locations and transact lines

6.2.4 Vegetation Assessment

Digital Globe, multi spectral 2.4m resolution satellite data was used for vegetation classification using image processing plugin in QGIS. Ground truthing and location of different types of vegetation locations were marked using a handheld GPS. Ground control points collected from the field were used for classification of vegetation types and calculate the vegetation cover, characteristics and patterns found in the island. The calculation is based on the DN value (reflectance) which gives a characteristic signature for each type of tree.

6.2.5 Geology and geomorphology

Aerial photographs and Digital globe, Google earth and island surveys are comparatively evaluated using GIS technology to assess the developments of the island. Three beach profiles were taken during the field visit to evaluate differences in beach morphology of the island and evaluate the island.

6.2.6 Bathymetry

Bathymetric survey of Raaverrehaa, reef was carried out by using echo sounder and a GPS. Differential GPS technique is used for post processing and correction of GPS locations points. Echo sounder measurements are corrected and related to the mean sea-level for the area. Bathymetry of the Raaverrehaa Falhu shows a fairly uniform depth on the eastern side ranging from -0.2—0.7 and the depth of the dredged area on the western side is in the range of -5 to -8m Figure 10.

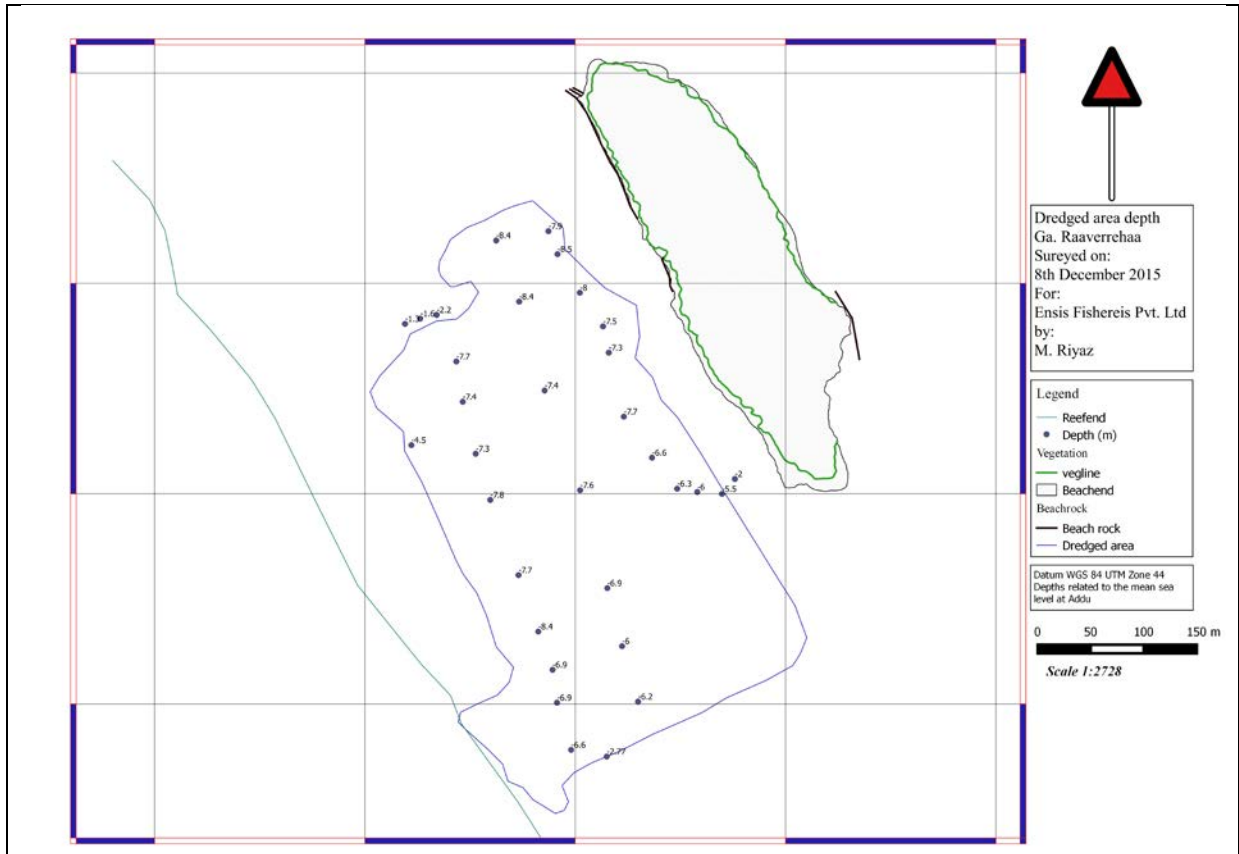


Figure 10: Bathymetry around Raaverrehaa Island

6.2.7 Coral Reef Surveys

Equipment used

- Fiberglass tape 20m
- Handheld Global Positioning System (GPS)
- Still photograph camera
- Writing sheets

The reef community is characterized using life form categories which provide a morphological description of the reef community. These categories were recorded on data sheets by snorkelling along a 20m long line which was placed roughly parallel to the reef crest at two randomly selected locations on the reef-flat at a depth of about less than 2m. GPS location of the starting point of the line was recorded for future reference and monitoring.

Series of photographs were taken along the observation line to capture all the information. Fifteen images from each transect were selected at random. By careful observations an estimate of the cover was made. Assuming absolute area of visual field captured on image is roughly the same (assuming camera was kept at the same plan and same depth), the average cover of the 15 slide was taken as the average conditions. Observation on physical formation of the reef structures were also made at all sites studied.

6.2.8 Climate and Oceanographic Regime

Climate oceanographic regime requires long-term data on climate and oceanographic conditions. Climate data collection at the Koodoo Airport began recently and therefore the data from the airport is not considered for this study. Hence published literature on climate and oceanography was used to predict climatic oceanographic conditions at the project site.

6.2.9 Status of Tuna Fishery

The current status of the tuna fishery Maldives was assessed by analyzing the relevant fisheries data provided by the Marine Research Centre and from the material available from the IOTC website (www.iotc.org, accessed August 2015).

6.2.10 Data Gaps

In the Maldives it is common to expect a detailed environmental analysis for an EIA to be undertaken in a relatively short period of time. Therefore limitation of the time spent on site has been the key limiting factor to get a more detailed assessment on all environmental aspects surrounding the island. Give the seasonal climatic variations in Maldives and the differences in island dynamics and climate settings in individual islands such a short time frame is too little to assess selected aspects of the environment. This problem is compounded by the absence or extreme difficulty in obtaining grey literature (held in technical reports in some government officers) and of long-term studies in other parts of Maldives. Hence, most EIA's end up being based on an environmental snapshot of specific point in time. However, experienced EIA specialists can deliver a close match to reality based on a number of similar assessments and expert judgments of the team. In this regard, the following gaps could be identified in information.

- Absence of long-term site specific or even regional data (at least 1- 2 years). Most critical data include current, wave and terrestrial and sea scape change history.
- Absence of historical and long-term records on reef and lagoon environment.

These gaps are seriously considered in the assessment and care has been taken to address the issue in designing mitigation measures and the monitoring programme. Nonetheless, most of the assessments, including vegetation, ground and sea water quality, island dynamics, reef health, bathymetry were done in accordance with the TOR and other relevant information are collected through literature review to reflect closest match to existing environment of the island at the time of these assessments

6.3 METEOROLOGY AND CLIMATE

6.3.1 Temperature

The daily average temperatures rarely drop below 25°C and rarely go above 32°C. The warm period of the year is from March to May with an average daily high temperature above 31°C. The hottest day of the year is during April, with an average high of 32°C and low of 28°C.

The cool periods lasts from October/November to January with an average daily high temperature below 30°C. The coldest day of the year is around mid-December, with an average low of 26°C and high of 30°C. The sea surface temperature in the Indian Ocean in July 2014 is recorded to be around 29-30°C.

6.3.2 Rainfall

Raaverrehaa is located in a high rainfall zone of the country. Rainfall data from the three main meteorological stations, HDh Hanimaadhoo, K. Hulhule and S. Gan shows an increasing average rainfall from the northern regions to the southern regions of the country. The southern atolls receive,

on average, 2,277 mm of rainfall annually, while the relatively drier northern atolls receive 1,786 mm. The nearest meteorological station to Raaverrehaa is at Kaadedhoo airport which became operational relatively recently in 1993. Rainfall data for the period 1994 – 2012 from Kaadedhoo has been used to determine rainfall pattern for Raaverrehaa Island.

The mean annual rainfall for Kaadedhoo is 2186.6 mm with a Standard Deviation of 398.1 mm and the mean monthly rainfall is 182 mm. Mean rainfall varies throughout the year with mean highest rainfall during October, November and December and lowest between February and March (See Figure 11).

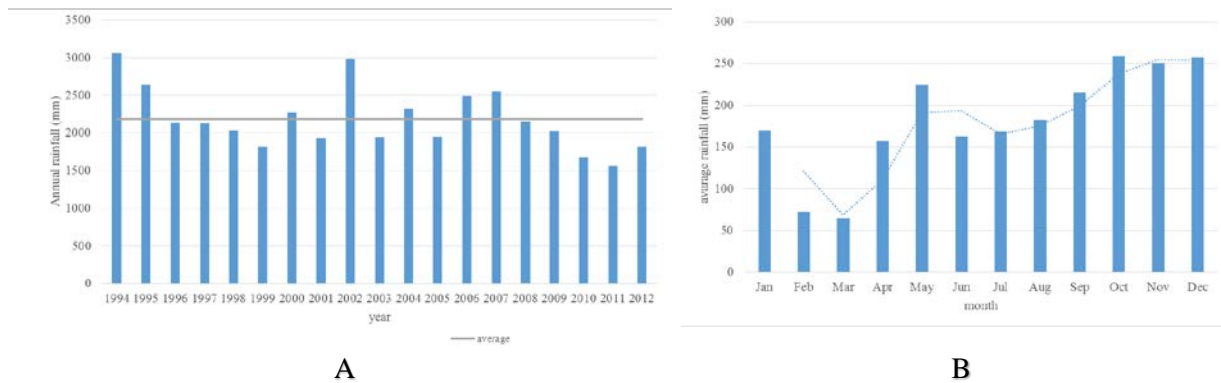


Figure 11: Variation in average rainfall at Kaadedhdhoo Island (A) annual (B) monthly from 1991 to 2012).

Available severe weather event records shows that Kaadedhdhoo received a maximum precipitation of 219.8 mm for a 24 hour period on 10th July 2002, the highest recorded anywhere in Maldives since recording began. This event caused widespread damage or disruption to personal property, road infrastructure, sewerage infrastructure, backyard crops, harbour quay wall, school operation and businesses in Villingili Island located to the east of Raaverrehaa. Flood depths in the southern part of Villingili were reported at 0.3-0.4 m. During the flooding events of November 2003, the recorded rainfall in Kaadedhoo for the 24 hour period was 64.4 mm. A month later, rainfall up to 60.3 mm was observed. These two events caused disruption to businesses, school and minor damage to household goods in Villingili Island. Flooding events experienced in Villingili Island is believed to be due to combination of high intensity of rainfall in the region in combination with substantial changes brought to the physical environment of the island and poor drainage.

6.3.3 Monsoons

The climate of Maldives is characterised by the monsoons of Indian Ocean. Monsoon wind reversal significantly affects weather patterns. Two monsoon seasons are observed in Maldives: the Northeast (Iruvai) and the Southwest (Hulhangu) monsoon. The parameters that best distinguish the two monsoons are wind and rainfall patterns. The southwest monsoon is the rainy season while the northeast monsoon is the dry season. The southwest monsoon occurs from May to September and the northeast monsoon is from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November.

6.3.4 Winds

The climate of the Maldives can be divided into two monsoon periods marked by strong seasonal reversals in wind direction that are confined to a narrow range of wind angles. Wind data records since 1964 indicate that the Maldives experience west to northwest winds (225° – 315°) from April to November during the *Hulhangu* monsoon with a mean wind speed of 5.1 m s^{-1} . In contrast the *Iruvai* monsoon, from December to March, is characterized by winds from the east-northeast (45° – 90°) with

a mean wind speed of 4.9 m s⁻¹. Wind strength is most variable during the crossover between northeast and westerly monsoons with mean wind speed falling to 3.5 m s⁻¹ in March (Department of Meteorology, 1995).

6.4 HYDROLOGY

6.4.1 Waves

Two major types of waves are observed along the coast of Maldives. The first type is wave generated by local monsoon wind with a period of 3-8 seconds and the second type is swells generated by distance storms with a period of 14-20 seconds (DHI, 1999). The local monsoon predominantly generates wind waves which are typically strongest during April-July in the south-west monsoon period.

Maldives experiences occasional flooding caused by long distance swell waves that are generated by South Indian Ocean storms (Goda 1988). The swell waves of height 3 metres that flooded Malé and Hulhumalé in 1987 are said to have originated from a low pressure system off west coast of Australia. More recently in May 2007 swell waves that originated from the southwestern side of the Indian Ocean caused flooding in 35 inhabited islands across 13 atolls, including Addu atoll.

6.4.2 Tides

Tides experienced in Maldives are mixed and semi-diurnal/diurnal. Typical spring and neap tidal ranges are approximately 1.0m and 0.3m, respectively. Maximum spring tidal range in the central and southern atolls is approximately 1.1m. There is also a 0.2m seasonal fluctuation in regional mean sea level, with an increase of about 0.1m during February to April and a decrease of 0.1m during September to November. Like in most other atolls, semidiurnal tides are experienced in Huvadho Atoll - that is two high tides and two low tides a day. The tide varies from place to place, depending on the location and on the shape and depth of the basin, channels and reefs and also time of the year. Tidal variations in Maldives are presented in Table 5

Table 5: Tidal variations at Malé International Airport

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

Astronomical tides are related to the motion of the earth-moon-sun system, and have a range of periodicities. The highest astronomical tide was recorded as 0.64 m above the mean sea level and the lowest astronomical tide was recorded as 0.56 m below the mean sea level. Tidal variation of 1.2m from lowest to the highest tide levels were recorded in the country.

7 TERRESTRIAL ENVIRONMENT

7.1 GENERAL OBSERVATION



Figure 12: Typical vegetation found from Raaverrehaa mostly comprising of coconut and young trees

Raaverrehaa is characterized by moderately old vegetation, of which Ruh (Coconut), and kashikeyo that are unevenly distributed in the island. Kuredhi Dhiggaa Kashikeyo and Magoo, are widely distributed around the coastal periphery of the island. Generally, the island's vegetation is sparsely distributed in most areas except for central part where the vegetation has been cleared for agricultural purposes in the past. Digital globe multispectral satellite data (2.4m resolution) and remote sensing techniques together with ground-truthing was used for vegetation assessment.

In general terms, the vegetation composition of the island can be summarized as having the following content; Coconut having 12% cover, Dhigga having 16%, Magoo 5%, Kuredhi 15%, Uni 14% and Kashikeyo 19% and other vegetation 4%. Result of vegetation classification is shown in and Figure 13.

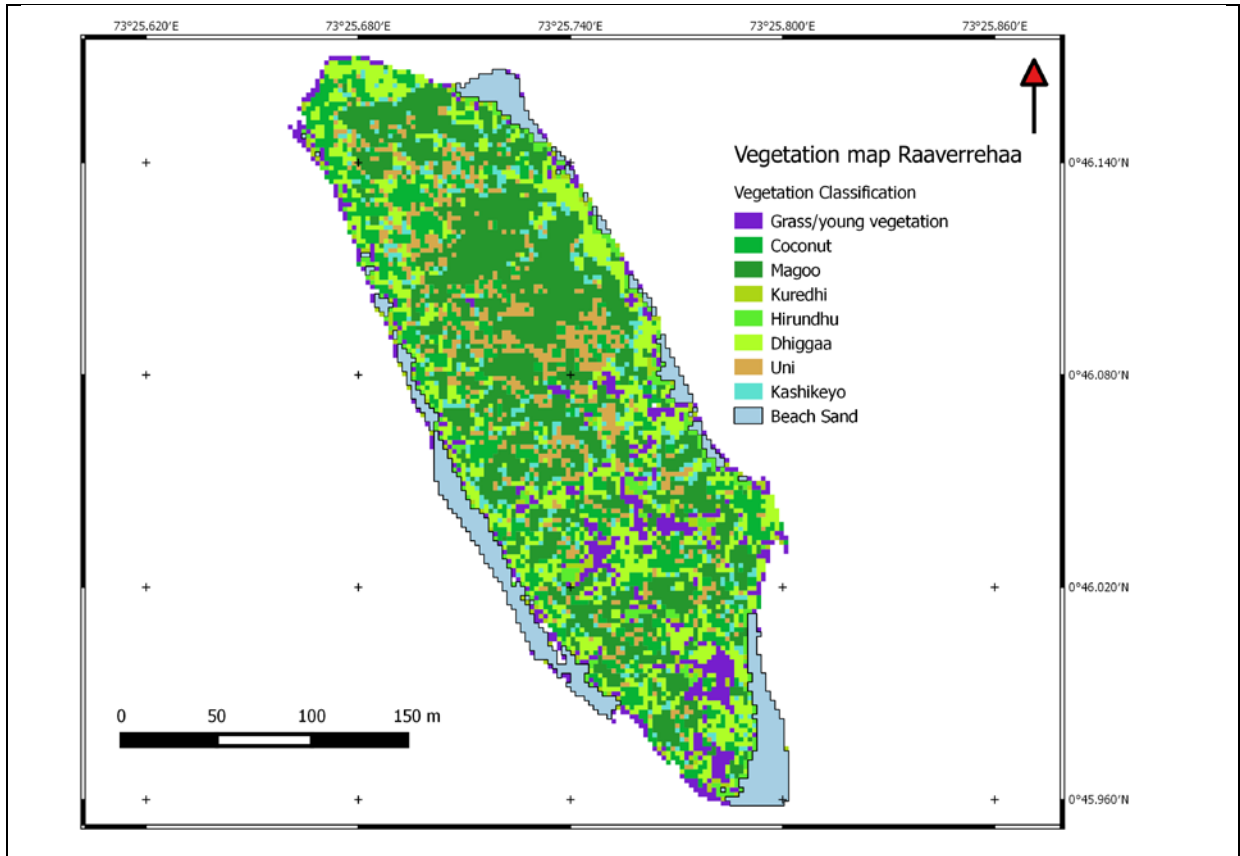


Figure 13: Vegetation classification Raaverrehaa

The locations of vegetation clearance and area required to be cleared is shown in Figure 15. The figure also shows mature coconut trees that fall into the development area. Total area covered with mature coconut vegetation that fall into the proposed development is 2298.62 sqm this is approximately 40 coconut trees. As can be seen from Figure 15 by shifting some buildings and bending the road large amount of coconut trees can be left untouched.



Figure 14: Grassland and inland vegetation

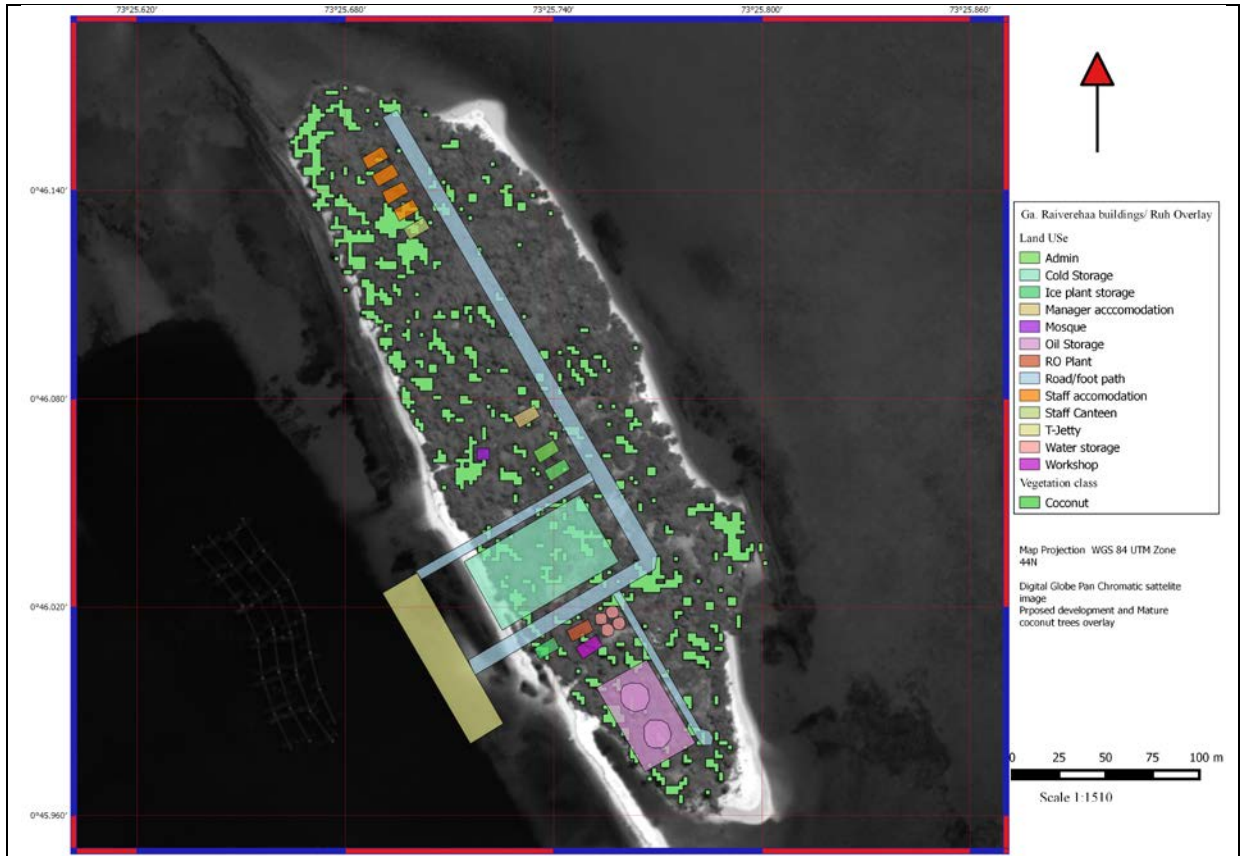


Figure 15: Map showing distribution and occurrence of mature coconut trees that fall into the planned development in Raaverrehaa

7.2 GROUND WATER QUALITY

In order to assess the baseline quality of ground water, samples from the site was taken on 8th of December 2015 for analysis at the MWSC Laboratory. Water sample was collected from well manually dug at the center of the island. The sampling bottles were washed with the same ground water at the site and the sample was transferred to Malé’ sent to the MWSC laboratory for water quality analysis. Laboratory tests results of ground water analysis sample locations are given in Table 6. Ground water from the site will not be used for any purpose during construction or operational phase of the project. However ground water quality assessments can be used as a valuable indicator to monitor seepage or spill of contaminants into the ground during the lifetime of the project activities.

The results shows that the groundwater of the island is free from contamination and do not have potential health risks. Sulphate levels identified to be little high and the salinity level is very low, this may be due the fact that the sample was taken during rainy season where large amount of ground water runoff is seepage into the ground. Groundwater will not be used for any purposes for the proposed development.

Table 6: Ground water sample laboratory results

Parameter	Ground water
Location (Geographic coordinates)	Latitude: 4°12'37.01"N Longitude: 73°32'16.96"E

Physical appearance	Cloudy with particles
Conductivity	479
pH	7.71
Nitrate (mg/l)	0.2
Salinity (‰)	0.23
Phosphate(mg/l)	0.05
Sulphate (mg/l)	32
Total dissolved solids (TDS)	237
Turbidity	142

7.3 ISLAND MORPHOLOGY AND COASTAL ENVIRONMENT

Google Earth images combined with island surveys are comparatively evaluated using GIS technology to assess the beach dynamics of the island. Co-georeferencing technique of digital globe images with the actual survey was used to map the beach end of the island and overlaid to quantify long term changes in island area.

Figure 16 coastal dynamics and beach end change 2014 2015 and 2008. The comparison shows substantial changes to beach from January 2008 to 2015. Overall As can be seen from Figure 16 beach erosion and shoreline retreat on the western side from 2008-2015 in the range of 8-30m. Similarity increase in beach on the eastern side (7-16m) was observed during same period. In the northern end a dynamic sand spit (Thundi) was observed. The sand spit that moves seasonally towards east in April and returns back to northern end in December was observed. While the sand spit on the southern end remains more or less same but the size changes seasonally.

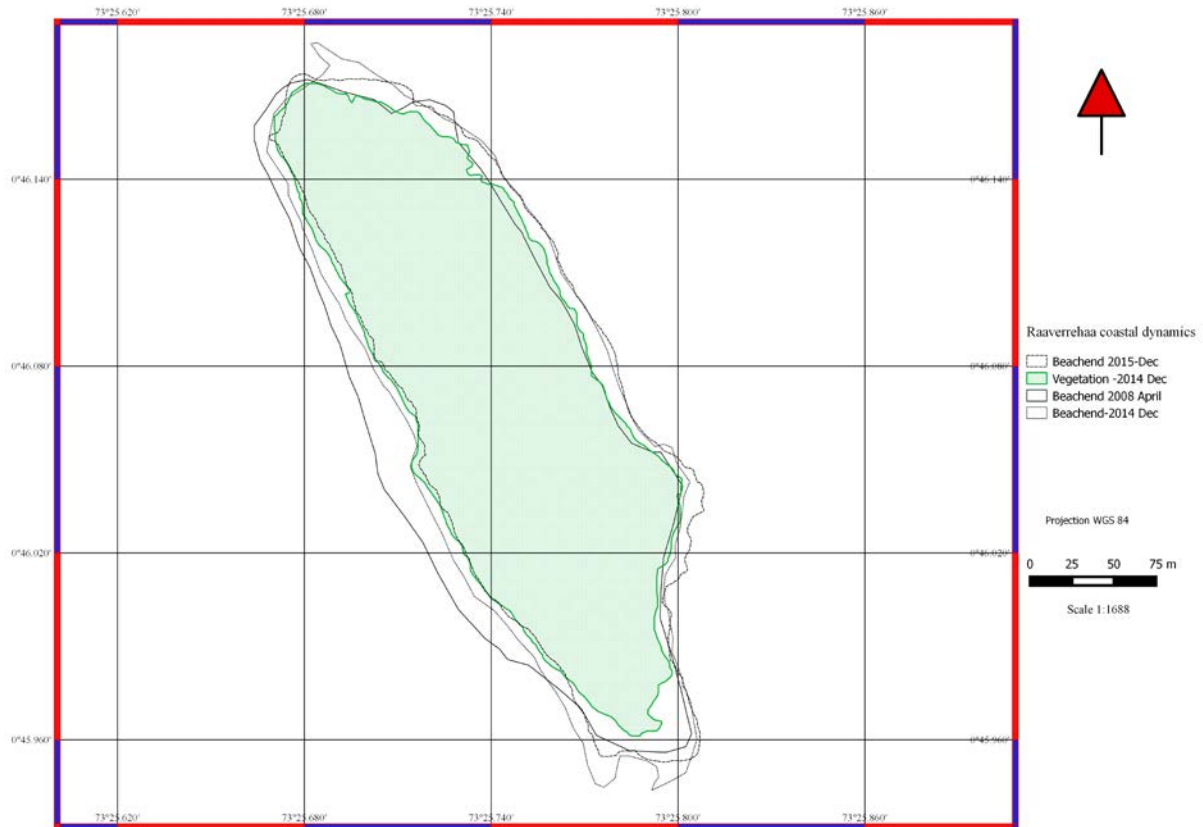


Figure 16: Ga. Raaverrehaa beach dynamics (2014-2015) shoreline and vegetation changes.

Profiles of the beach were used to evaluate differences in beach morphology of the island (Figure 19 and Table 7). Composition of beach material in Raaverrehaa is fairly uniform in areas where there is sand. Beach on the north western and western side is very narrow and comprises of large quantities of pebbles and coral rocks size of rock increases northwards on the western side. Beachrock, which is considered to be an indicator of erosion, is exposed on the North western side and south eastern side of the island. Aerial photograph taken in 1969 shows that the beach rock exposure existed in Raaverrehaa for over 45 years (Figure 18).



Figure 17: Raaverrehaa beach condition, severe erosion and exposure of beachrock

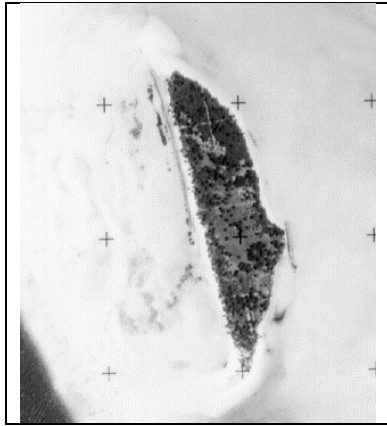
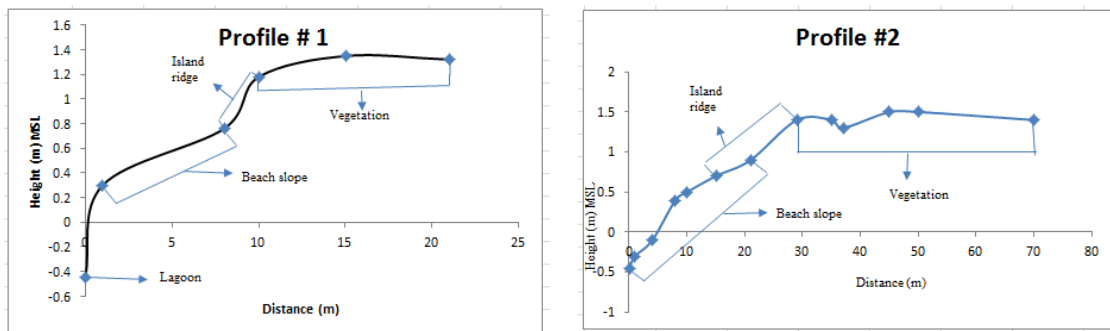


Figure 18: Raaverrehaa Aerial photograph taken in 1969 showing beachrock exposure

Three beach profiles are taken from the island, geographic coordinates of the beach profile locations are given in Table 9. The beach profile #1 taken from the eastern beach of the island shows 10-15m wide beach with a moderately steep slope abrupt rise to the vegetation berm up to 1.13m above MSL. The profile #2 taken from the southern end from the long spit of the island shows a 30m wide beach more gentle slope to the vegetation berm indicating low energy and accretion. The vegetation berm in this profile is 1.4m above MSL followed by gently inward sloping dip into the island (Figure 19). Profile #3 is profile from the northern tip of the island show beach rock just 15m from vegetation berm of the island.

Table 7: Geographic coordinates of beach profiles locations

Profile No	Latitude	Longitude
Profile #1	0°46'4.91"N	73°25'46.35"E
Profile #2	0°45'57.79"N	73°25'47.57"E
Profile #3	0°46'10.26"N	73°25'40.90"E



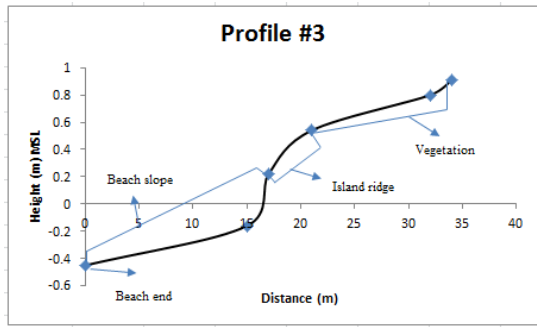


Figure 19: Beach profiles of Ga. Raaverrehaa Island and a photograph of profile location #1.

8 MARINE ENVIRONMENT

8.1 RAAVERREHAA REEF SYSTEM

Raaverrehaa is found on the North Eastern of Huvadhu Atoll located at the periphery in an elongated, N-S oriented reef. The reef is shared by three more islands including Villingili Island. The eastern part of the reef extends in the form shallow lagoon into eastern rim of the Atoll. The elongated-oval-shaped island of Raaverrehaa lies in the western half of the reef. The coral reef system of Raaverrehaa is 20km long and the width is 0.8-1.8km. Reef perimeter is 43km and the area is approximately 25sqkm. The distance from the edge of the beach to the reef edge in both eastern and western sides is fairly consistent measured approximately 1km on the east and 400m on the western side. The vast lagoon space on the western side mainly consisted of sandy bottom with occasional patches of seagrass (*Thalassia* sp). These patches were not obvious in the aerial photo of the island taken in 1969. Therefore seagrass formation in the lagoon appears to relatively recent. Most of the western side of the island has been dredged to burrow sand for reclamation of Villingili Island. Dredged lagoon depth is within the range 6-8m.

8.2 REEF FLAT AND SUBSTRATE COVER

The reef-flat is the part of the reef area between outer reef edge and inner reef edge and it is usually very shallow. The reef flats found in Raaverrehaa island is well formed on all sides.

Live coral cover on the reef flat of both transects taken from the eastern side shows completely damaged reef with very few live coral colonies. The eastern reef flat shows impacts of excessive sedimentation which has created coral graveyard consisting of dead corals, sediments, rubble and sand only with occasional live corals (Figure 20). The extent of dredging damage seems to be relatively localised as the number of live coral increases outside the immediate dredging impact area. Earlier (MEECO, 2015) reported fairly low coral cover from the reef near Maamutaa, which is less than 10 kilometres north of Raaverrehaa on the same reef system.

8.3 LAGOON AND SUBSTRATE COVER

The lagoon on the western side of Raaverrehaa has an average depth of 0.5 – 1.2m during high tide periods on the western side. It is a 1km wide lagoon and vast area of the lagoon is covered with seagrass with occasional coral colonies. Seagrass grows on nutrient rich eutrophic and slow-moving water bodies particularly in fishing islands where large amount organic waste is dumped into the lagoon.

The lagoon water on the eastern side was generally clear except for the dredged area where the visibility was comparatively lower than all other areas. The bottom substrate of the dredged lagoon consisted of mainly fine silt and sand.

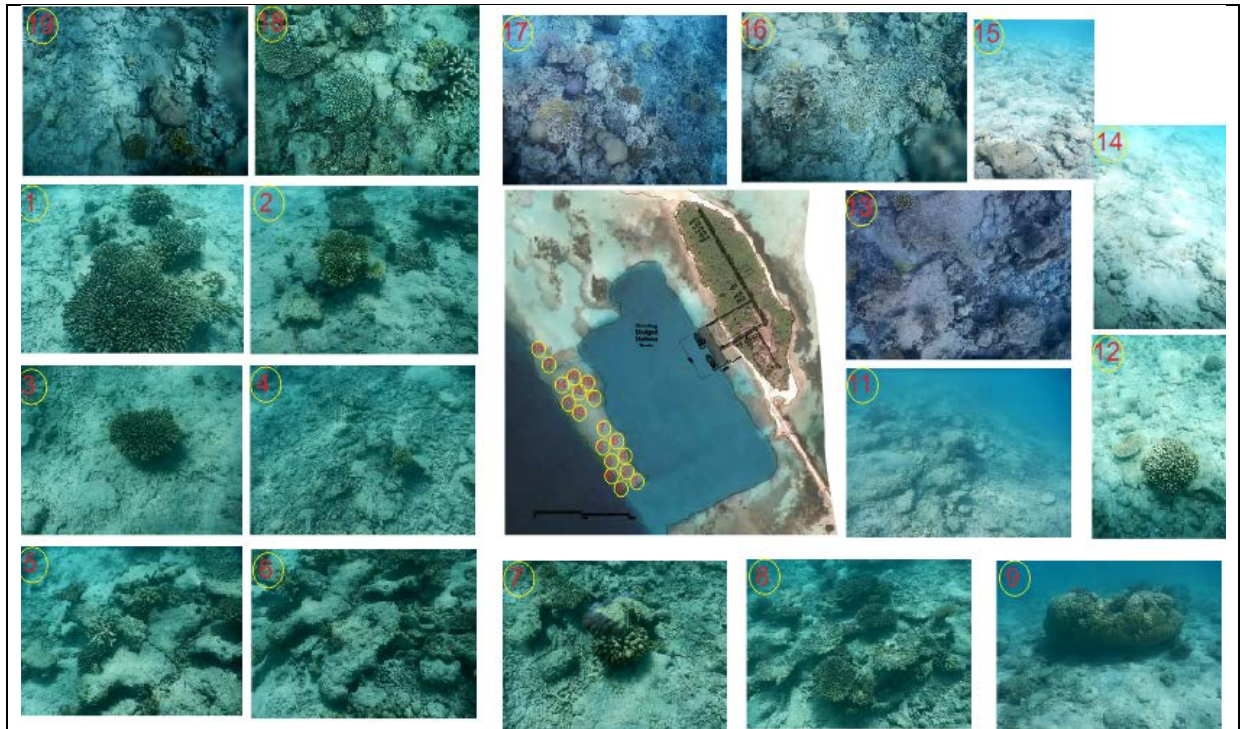


Figure 20: Photo representation of the reef survey transects on the western side of Raaverrehaa

8.4 FISH COUNTS

For each transect shown on Figure 9 where coral substrate was surveyed a visual census of the fish (fish counts) was undertaken. Observed numbers of fish in the visual field were recorded on the 20 minute swim along transects. Number of fish observed was enumerated and the results were presented in 4 main categories: very common [VC], common[C] rare [R]. Since results of the fish counts can be subjective depending on the observers, time of the day and weather (visibility) conditions, depth etc, average for both transects were used to represent the faunal composition of the reef (Figure 21 and Table 8).

Results are presented as occurrence of species by families and species of the most common species. As shows herbivores (feeds on plant) and species that live of shallow reef flat areas are common (Acanthurids and Labrids). The most common species observed were ones that feed on coralline algae. However, some species that feed on live coral are also present.

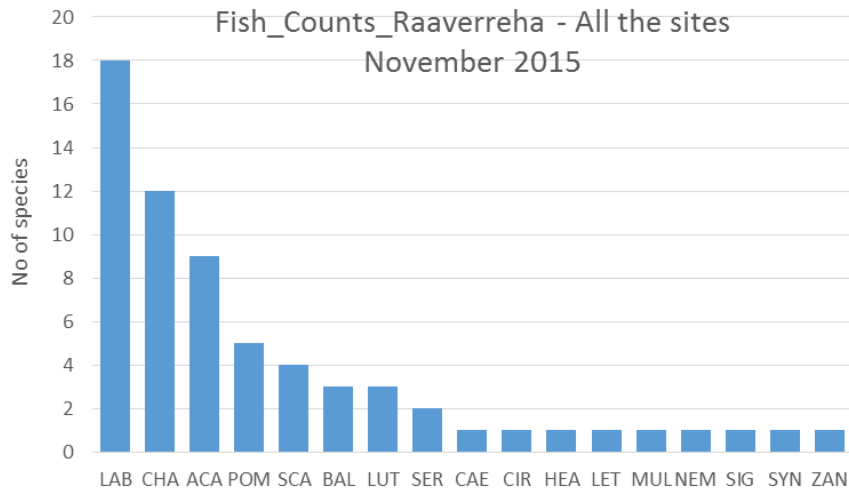


Figure 21: Summary of Fish count survey: LAB – Labridae, CHA – Chaetodontidae, ACA – Acanthuridae, POM – Pomacanthidae, SCA – Scaridae, BAL- Balistidae, LUT – Lutjanidae, SER – Serranidae, CAE – Caesionidae, CIR – Cirrhitidae, HAE – Hemulidae, LET – Lethrinidae, MUL – Mullidae, NEM- Nempridae, SIG – Siganidae, SYN – Synodontidae, ZAN – Zanclidae

Table 8: Records of in the fish count data where species have been recorded been COMMON.

fam	family	species	abundance
ACA	Acanthuridae	<i>Naso brevirostris</i>	C
ACA	Acanthuridae	<i>Acanthurus leucosternon</i>	C
ACA	Acanthuridae	<i>Acanthurus lineatus</i>	C
ACA	Acanthuridae	<i>Naso lituratus</i>	C
ACA	Acanthuridae	<i>Ctenochaetus binotatus</i>	C
ACA	Acanthuridae	<i>Ctenochaetus striatus</i>	C
ACA	Acanthuridae	<i>Ctenochaetus strigosus</i>	C
CAE	Caesionidae	<i>Pterocaseio tile</i>	C
CHA	Chaetodontidae	<i>Forcipiger longirostris</i>	C
CHA	Chaetodontidae	<i>Chaetodon klenii</i>	C
CHA	Chaetodontidae	<i>Hemitaurichthys zoster</i>	C
CHA	Chaetodontidae	<i>Chaetodon trifasciatus</i>	C
POM	Pomacentridae	<i>Chromis dimidiata</i>	C
POM	Pomacentridae	<i>Chromis viridis</i>	C
POM	Pomacentridae	<i>Dascyllus aruanus</i>	C
LUT	Lutjanidae	<i>Lutjanus kasmira</i>	C
LAB	Labridae	<i>Thalassoma harwicki</i>	C
LAB	Labridae	<i>Labroides dimidiatus</i>	C
LAB	Labridae	<i>Gomphosus caeruleus</i>	C
LAB	Labridae	<i>Bodianus diana</i>	C
SCA	Scaridae	<i>Cetoscarus bicolor (male + females)</i>	C
SCA	Scaridae	<i>Scarus frenatus</i>	C
SCA	Scaridae	<i>Scarus gibbus (males + females)</i>	C
SCA	Scaridae	<i>Scarus niger</i>	C
ZAN	Zanclidae	<i>Zanclus cornutus</i>	C

Species abundance and diversity appears to be typical of the Maldivian reefs. Similar results have been recorded in several other studies (e.g. MEECO, 2015).

8.5 CORAL COVER

Coral cover was recorded under 4 major categories; live, dead, sand, rock/rubble. Reef substrate was dominated by area of dead coral. Roughly around 98% of the transect covered dead corals. Only 2-3% was live corals, dominated by Acorporids (table and finger corals) and some missives. Vast areas of the rock/rubble were also seen. Sand cover (fine rock/rubble) is around 10-20% (Figure 22) rubble content while there is more sand in site #1.

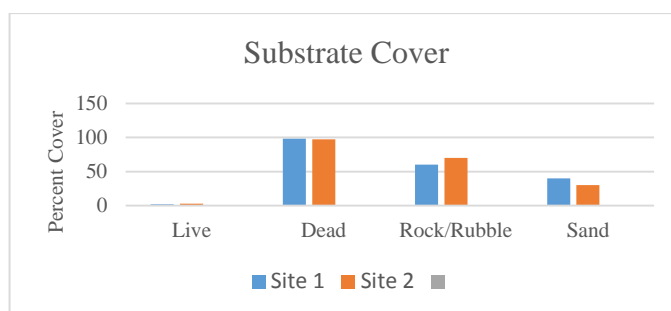


Figure 22: Reef coral cover around Raaverrehaa Island

8.6 SEA WATER QUALITY

A sea water sample from the reef area in Raaverrehaa was obtained and analysed at the MWSC laboratory. Results of this sample will be used as a baseline for comparison during seawater quality monitoring.

Table 9: Water quality test results for Raaverrehaa Island.

Parameter	Sea water
Conductivity	51800
pH	8.21
Nitrate (mg/l)	2.4
Salinity (‰)	34.07
Phosphate(mg/l)	0.06
Sulphate (mg/l)	2900
Total dissolved solids (TDS)	25900
Turbidity (NTU)	0.294

8.7 TUNA FISHERY

The cannery plans to source raw material (tuna) from local fisheries. The two main key species that will be purchased to Raaverrehaa are skipjack (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*). These are also the two most important species in the Maldivian tuna fishery. They are fished from livebait pole-and-line and handline fisheries.

The main target species in the pole-and-line is skipjack but small amount of juvenile yellowfin are also caught. Handline fishery targets surface dwelling large yellowfin tuna (> 80 cm) targeted mainly

for fresh export. The primary species sourced for canning will be skipjack tuna. Both species are straddling and highly migratory and its stock has ocean-wide distributions and are managed by regional fishery management organization. In the Indian Ocean stocks are managed Indian Ocean Tuna Commission (IOTC, www.iotc.org) where the Maldives is a full member among its 32 members. For management purposes IOTC considers single stock for both skipjack and yellowfin tuna. This means assessment of the stock is done at the stock level.

The combined catches of the skipjack and yellowfin tuna in the Maldives is currently around 120,000 MT of which around 70,000 MT is skipjack and rest is essentially yellowfin tuna. Catches of skipjack reached an all-time peak of nearly 140,000 MT in 2006 but have been declining since then although the last year's catch have shown a slight increase. These sharp declines are difficult to interpret but could be associated with number of factors including changes in oceanographic conditions or changes to gear vulnerability related to biological and physical oceanography of the area. Nevertheless an important reason for recent decline of skipjack in the Maldives is also due to reduced targeting of skipjack in favour yellowfin tuna (Figure 24).

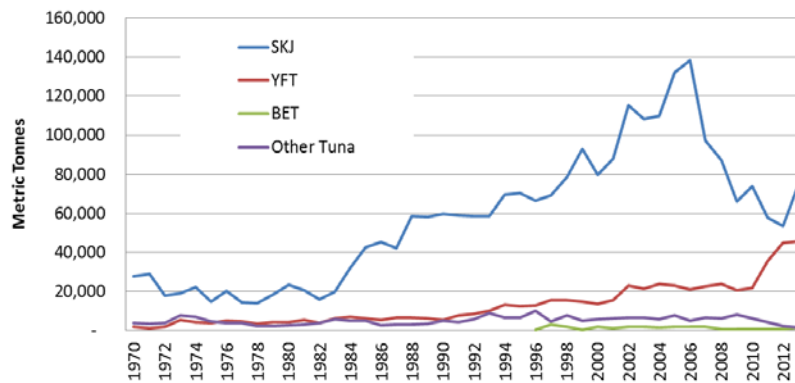


Figure 23: Catches of three main species of tuna in the Maldives tuna fishery. Source, Maldives National Report submitted to IOTC: www.iotc.org, accessed August 2015.

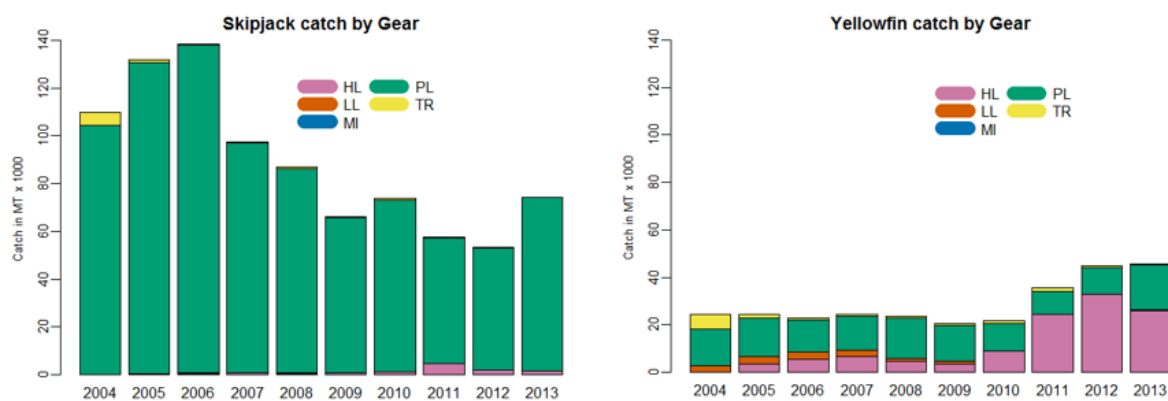


Figure 24: Catches of skipjack and yellowfin tuna by gear. Note skipjack are caught from pole and line (PL) and yellowfin tuna are caught on pole and line handline (HL) gear (source: www.iotc.org, SC report, accessed August 2015).

Elsewhere in the Indian Ocean both species are fished in the EEZ's of coastal states and on the high seas mainly by the distant water fishing nations essentially from purse seine, gillnet and longline (IOTC-SC18, 2015). The most important of this is the EU purse seine fishery which represent vessels

from the Spain and France centered on the western central Indian Ocean. Together they both take more than 200,000 MT per year which is around 50% of the total Indian Ocean harvests (Figure 25).

Maldives have always been a cooperating party of the IOTC but became a cooperating and contracting party in 2010. The Maldives has been fully engaged with the IOTC in the management of tuna. As a cooperating and contracting party Maldives submits its tuna catch and effort and data and contribute science by attending its annual meeting and stock assessment meetings.

Since November 2012 the pole-and-line fishery of skipjack and yellowfin tuna have MSC Certification⁴ – an ecolabel of international best practice in fishery management.

Stock	Indicators	Prev	2010	2011	2012	2013	2014
Skipjack tuna <i>Katsuwonus pelamis</i>	Catch 2013: 424,580 t Average catch 2209 -2013: 401,132 t MSY (1000t) (80% CI): 648 (550 – 849) F _{MSY} (80% CI): 0.65 (0.51 – 0.79) SB _{MSY} (1000t) (80% CI): 875 (708 – 1,075) C ₂₀₁₃ /C _{MSY} (80% CI): 0.62(0.49 – 0.75) SB ₂₀₁₃ /SB _{MSY} (80% CI): 1.59(1.13 – 2.14) SB ₂₀₁₃ /SB ₀ (80% CI): 0.58(0.53 – 0.62)						
Yellowfin tuna <i>Thunnus albacares</i>	Catch 2013: 402,084 t Average catch 2209 -2013: 339,359 t MSY (1000t) (80% CI): 344 (290 – 453) F _{MSY} (80% CI): n.a (n.a – n.a) SB _{MSY} (1000t) (80% CI): 881 (784 – 986) F _{curr} /F _{MSY} (80% CI): 0.69(0.59 – 1.40) SB _{curr} /SB _{MSY} (80% CI): 1.24(0.91 – 1.40) SB _{curr} /SB ₀ (80% CI): 0.38(0.28 – 0.38)	2008					

Colour key	Stock overfished (SB _{curr} /SB _{MSY} < 1)	Stock not overfished (SB _{curr} /SB _{MSY} ≥ 1)
Stock subject to overfishing (F _{year} /F _{MSY} > 1)		
Stock not subject to overfishing (F _{year} /F _{MSY} ≤ 1)		
Not assessed/Uncertain		

Figure 25: Indian Ocean stock status- Skipjack and Yellowfin tuna; Source: Data from IOTC, Scientific Report – 2014 (www.iotc.org, accessed August 2015)

The most recent Indian Ocean stock assessment of both skipjack tuna shows that stocks are not overfished and not subjected to over-fishing (Figure 25). The maximum sustainable yield (MSY) of skipjack is estimated at 640,000 MT per year with average catches of around 400,000 MT.

The total average Indian Ocean skipjack catches are below the assessed maximum sustainable levels and the spawning biomass is healthy well above the point of recruitment impairment. The Maldives fishery component takes 17% of skipjack and some 15% of the yellowfin.

8.8 TUNA FISHERY IN GA ATOLL

Traditionally the most popular fishing atolls were in the north (e.g. Lh and Raa Atolls, pers comm. S. Adam, August 2015). This trend was completely reversed over the last 10-15 years making the southern atolls more popular. The most important atolls for tuna fishing in the south are Huvadho which comprises Ga and GDh. Atolls. The reason for this reversal are due to economic factors and the establishment of Kooddo shore-based facility⁵ and presence of mother vessels and collector

⁴ https://www.msc.org/track-a-fishery/fisheries-in-the-program/certified/indian-ocean/maldives_pole_line_tuna

⁵ It should be important to note here fish fresh fish collection started in the north, from Lhaviyani – Felivaru Canning factory (around mid 1970s)

vessel in the atoll which makes them easy disposal of catch. The development of the fishery took off in the south in the late 1980s and 1980s with the advent of the fiber reinforced plastic Fibre-glass (FRP-hull) vessel. Vessel in excess of the 110 feet (34 m) LoA with the engine horse power of 600-800 is common in the south.

A key fishing area in the south is *Satoraha*, a seamount between the L and Ga Atoll in the Huvadho Channel. Seamounts in the open ocean are considered as tuna aggregation sites due its associated upwelling and consequent build of productivity around the area. There also a number of fish aggregating devices (FADs) anchored around the Huvadho which are important fishing spots in the area.

The main gear used for tuna fishing in the region is livebait pole-and-line method. Handline is not so common unlike in the centre and in the north where large yellowfin are targeted. The main target in the pole-and-line method is the skipjack, but often mixed with the juvenile yellowfin tuna.

Figure 26 provides summary for catches of skipjack and yellowfin tuna in the area. These are two most important species for tuna processing (canning and the fresh products). Catches of Huvadho atolls represent 20% of the national landings. Close to 30% of skipjack and 4% of the yellowfin tuna are caught form Huvadho atolls.

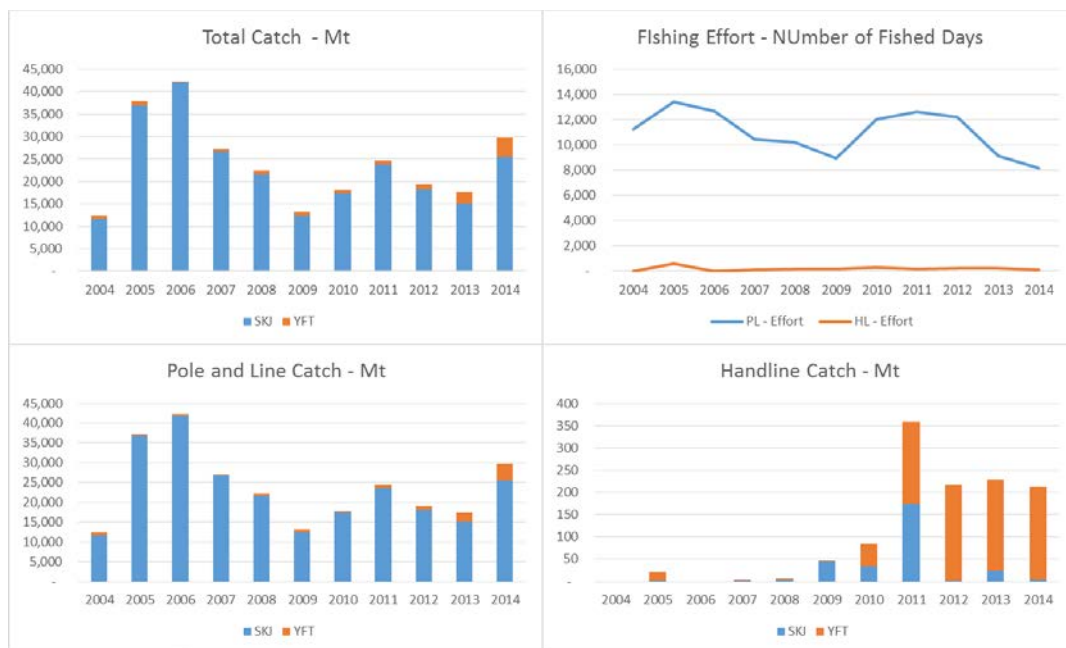


Figure 26: Catches of skipjack and Yellowfin tuna for Huvadho Atoll (GA + GD) for the years 2004-2014; Source: MRC, via MoFA.

The trends in catches in Huvadho atolls follow that of national catches with peak catches in 2006 followed by rapid decline (Figure 14). Overall catches were higher in the most recent years. Handline catches represent on average about 0.5% of the skipjack catch and most catches of yellowfin are from handline gear.

9 SOCIO-ECONOMIC ENVIRONMENT

9.1 INTRODUCTION

As part of outlining general socio-economic environmental condition for the proposed project of developing fish purchase and storage facility in Raaverrehaa in GA. Atoll, socio-economic conditions of the Atoll in general has been looked into since the project impact is expected to be highest on this island considering its close proximity to the project site as well as it being the Atoll hub for all commercial and administrative activities.

9.2 POPULATION

The total registered population of North Huvadhoo Atoll in December 2008 is 3077. The total enumerated population of the Atoll, from Maldives population and housing census of 2006 is reported as 8262 (Ministry of Planning and National Development, 2008). There were 4185 males and 4077 females (MPND, 2008). In 2006, the atoll represented 2.76 % of the national population. In 2006, almost one fourth of the Atoll population was residing in the Atoll capital of Villingili Island. The atoll had 103 males for every 100 females in 2006. Population migration to Male' for various purposes was considered high for the Atoll. During 2006 Census nearly 3000 persons belonging to the Atoll was recorded to be living in Male' of which most number of people belonged to Villingili.

The Census 2006 reports the number of households in Villingili as 344. The average household size in Villingili is 5.7 persons.

Expatriate population is on a growing trend throughout the island of the Maldives and the islands of GA are a no exception. Many foreigners are employed by the government in education and health sector in Villingili Island. Foreigners working in the private sector were reported to be small. However, field surveys revealed that their numbers were considerably higher. It is impossible to get an exact figure of foreign population in the private sector as there is no monitoring mechanism in the island office or employment ministry. The total number of foreigners on Villingili is estimated to be close to 200.

9.2.1 Poverty

In general, the population of Villingili appears relatively well-off compared to other islands within Ga Atoll. The Maldives Vulnerability and Poverty Assessment of 2004 (VPA II) reported that 7% of the island population have an income less than MVR 15 per day and 1% have an income less than MVR 10 per day. The figure 7% population below Rf 15 per day is much lower than the national average of 21% and outer atoll average of 28%. There was no observed abject poverty on the island. (UNDP, 2009).

9.3 LOCAL ECONOMY AND TRADE

According to Census 2006, most people in the atoll are employed in the manufacturing sector followed by fishing and education sector. According to 2006 Census, the atoll is considered to be among the highest in terms of working population in the country. Male employment percentage in the Atoll was found to be 76 % while 58% of female were employed. Highest male unemployment was recorded in Kanduhulhudhoo Island⁶ while female employment was highest in Dhevadhoo and Kondey Island. Important industries for the Atoll include, wholesale and retail trade, public administration, agriculture and forestry, health and social work, construction, and community social

⁶ Kanduhulhudhoo is no longer an inhabited island. Following the devastation of the island by the 2004 Indian Ocean Tsunami, the inhabitants were relocated to Dhuvaafaru on the eastern side of the atoll.

and personal services. The Atoll had an unemployment rate of 24% in 2006 and the unemployment rate for women in the Atoll was found to be significantly higher in most of the inhabited islands compared to males. Islands of Kodey, Dhiyadhoo, Dheevadhoo, Dhaandhoo had recorded female unemployment rate above 50 while in the same islands male unemployment rate was lower than 21. Of the 10 inhabited islands, Kodey Island was found to have highest unemployment for both sexes while Nialandhoo Island had the lowest unemployment rate.

Villingili is one of the major fishing islands in the Maldives. One of the largest fish collection and processing center in the Maldives is based in Kooddoo Island located next to Villingilli. Employment in Kooddoo manufacturing factory was identified as key income source in the manufacturing sector. Additionally, the airport facility developed on Kooddoo Island provides employment benefits to people of Villingili. In addition to Atoll level administrative facilities developed on Villingili makes it the wholesale and retail trade service hub for the region. The Island enjoys critical economic infrastructures such as harbour, port, power house, and communication infrastructures. The presence of the Atoll hospital and atoll school seems to provide opportunities to expand trade activities targeting temporary visitors from nearby islands (UNDP, 2009).

In terms of the employment structure for Villingili, much of the employment is in public administration (36%), fishing (22%) and manufacturing (18%). Together, these three sectors account for 76% of the employed population. The whole sale sector comprises 9% of the working population. Other non-basic service sectors comprise 15% of the working population.

The main economic activity of Villingili in terms of estimated income is fishing. It is followed by employment in civil service, and wholesale and retail trade. The mainstay of Villingili economy are the basic sectors involved in the export of goods and services – fishing, manufacturing and wholesale trade. The rest of the non-basic sectors such as transport, retail trade, hotels and other small business activities are dependent on the economic functioning of the basic sectors. Hence, a lowering of income from fisheries will reverberate through the economy. For example, a decline in fishery may lead to a reduction in demand for new housing construction and transport activities (UNDP, 2009).

Despite the availability of important facilities, Kolamaafushi island is a fishing island with a large fleet of fishing vessels. The island is still recovering from the economic impacts of 2004 Indian Ocean Tsunami. Local economy of the island appears to be extremely narrow and heavily dependent on fisheries therefore it is subjected to external shocks such as market prices of fish and fossil fuel.

9.4 SOCIOECONOMIC BENEFITS

The Proposed development in Raaverrehaa Island will contribute to the national economy through direct contributions from land rent and taxes. Fish purchase and storage facility when operational will generate approximately 10-30 new job opportunities. The new job opportunities created will bring a number of socio-economic benefits to the local communities as well as contribute in the overall development of the Atoll. Generally not many people from Huvadhu atoll is engaged in yellowfin tuna fishery but large number of fishing vessels from outer atoll come for yellowfin fishing in Huadhahoo Atoll. Most of these yellowfin tuna fishermen have to come back to Male region to sell their catch. Therefore one of the main advantages of development of Raaverrehaa is to ability to sell yellowfin tuna close to their fishing grounds and get a competitive price for their catch. Most importantly the development would diversify the local economy and increase the dependency on fisheries through integration and value addition to various types of fishery related productions. Some of the indirect benefits of the development are increase in revenues to private entrepreneurs, and contributions to the development of service oriented facilities related to fisheries and infrastructures. Therefore the proposed project will create employment and open new market avenues and opportunities particularly for the people living in North Huvadhu Atoll and generally to the people of Maldives.

10 IMPACT PREDICTION AND ANALYSIS

The proposed fish purchase and storage facility in Ga Raaverrehaa is believed to generate a series of environmental impacts, of which some can be felt immediately on the environment, while others can be reversible as well as others can be felt on a long-term basis. The primary purpose of this section is to predict the potential environmental impacts that may be associated with the proposed develop and evaluate these impacts to identify their significance. The main focus of this EIA report will be environmental impacts and mitigation measures from the construction operational phase of fish purchase and storage facility. Mitigation measures suggested in the report will focus on the existing environmental problems as well as impacts that may rise in the future based on consultations, expert opinion and observations. Fish purchase and storage process and its environment and health and safety issues will be audited regularly by the various parties (EU-Competent authority, ISO Certification auditors and regular visits from EU-buyers themselves) and therefore will not be dealt here.

Information from various sources has been used wherever possible. Data collected during field surveys can be used to predict outcomes of various operational activities on related environmental components. Data presented in this report can also be used as a baseline for environmental monitoring of the project activities.

10.1 METHODS OF IMPACT PREDICTION, EVALUATION AND ANALYSIS

First of all, most of the environmental impacts that may be generated as a result of the project is identified and is distinguished from construction and operation phases of the development. Potential impacts have been identified by using simple matrix method. Impact identification process also to a great extent incorporate expert judgment and professional opinions of the EIA consultants involved in the preparation of the report.

Secondly, the magnitude, nature and geographic distribution of environmental impacts have been evaluated and then analyzed by using descriptive checklist method in order to identify their significance.

Possible impacts arising from the construction and operation works are categorized into reversible and irreversible impacts. Reversible and irreversible impacts are further categorized by intensity of impacts (negligible, minor, moderate and major) for identifying best possible remedial (mitigation measures) action to be taken. Below are the impact categories:

- **Magnitude:** Refers to the quantum of change that will be experienced as a consequence of the impact.
- **Reversibility:** Refers to the degree of reversibility of an impact (i.e. ease of reversing the conditions).
- **Duration:** Refers to the temporal scale (i.e. duration, frequency) of the impact. It does not take into account the duration of the impact's effects.
- **Negligible:** the impact is too small to be of any significance (Reversible)
- **Minor:** the impact is undesirable but accepted (Reversible)
- **Moderate:** the impact give rise to some concern but is likely to be tolerable in short-term, or will require value judgment as to its acceptability (May or may not be Reversible)
- **Major:** the impact is large scale giving rise to great concern; it should be considered unacceptable and requires significant change or halting of the project (Irreversible)

Environmental impacts are predicted in construction and operational phase (Table 10 and Table 11) of Raaverrehaa fish purchase and storage facility.

Table 10: Raaverrehaa fish purchase and storage facility construction phase environmental impact identification and prediction

Environmental component	Site clearing	Earth works	Construction activities & construction waste	Construction machinery	Jetty Construction
Vegetation	X	X	X	X	
Soil	X	X	X	X	
Ground water	X	X	X		
Aesthetics	X		X	X	X
Sea (reef lagoon and coastal areas)			X	X	X

Table 11: Raaverrehaa fish purchase and storage facility environmental impacts of operational phase

Environmental Impact	Loading/unloading	Weighing and grading	Handling and Transportation	Storage	Cleaning & washing equipment	Tool equipment maintenance
Water consumption	X			X	X	
Waste water	X	X			X	
Fish waste		X				
Liquid media spill			X		X	
Energy			X	X		
Air emission	X		X	X	X	
Odour's	X	X	X		X	
Noise	X	X	X			
Refrigerant agent			X	X		
Other chemicals				X	X	
Detergent					X	
Oil for equipment					X	X

10.2 LIMITATION

The methods used to predict and evaluate the environmental impacts that may be associated with the proposed fish purchase and storage facility may not be the most comprehensive methods as they are quite simple methods. The main shortcoming is lack of data or published material on impacts of effluent on marine environment of the Maldives. Naturally assumptions (based on international best practice) have been made to predict the impacts which may or may not be accurate. Also, the degrees at which these impacts are either accurate or inaccurate as well as uncertainties and natural variability are the key factors that affect the accuracy of these methods. Nonetheless, the methods used are concise and provide a general overview as well as the range of impacts that can affect the environment.

Possible impacts arising from operational activities of the facility are categorized into duration, reversibility, magnitude and significance. Impact magnitude and significance is further categorized by intensity of impacts (negligible, minor, moderate and major) for identifying best possible remedial (mitigation measures) action to be taken. A summery matrix of the potential impacts and mitigation measures for fish purchase and storage facility operations in Raaverrehaa are given in Table 12.

Table 12: Impact Matrix to show environmental impact of fish purchase and storage facility operations, their magnitude, significance and reversibility

Impact Causing Activity	Type of Impact	Duration	Reversibility	Magnitude	Significance	Mitigation measures	Cost
Loss of Vegetation	Direct	Short term	Irreversible	Minor	Moderate	<ul style="list-style-type: none"> -Limit land clearing as much as possible -Provide temporary fencing to vegetation that will be retained -Use of markers and fences to direct heavy equipment traffic in the construction site and avoid damage to plants -Re-plant/ plant indigenous tree species 	Replantation program 5,000 USD
Construction waste	Direct/indirect /cumulative	Short term	Reversible	Moderate	Moderate	<ul style="list-style-type: none"> -Set-up temporary disposal mechanism within the construction area and properly dispose the generated green waste and construction wastes. -Strictly require the contractor and its workers to observe proper waste disposal 	Cost of transportation and disposal included in the project cost
Jetty construction	Direct /cumulative	Medium term	Reversible	Minor	Moderate	<ul style="list-style-type: none"> -Construction work should be completed in shortest time possible. -Lagoon excavations should take place during low tides or slack tides to minimize the release of sediment to the area. -Constantly monitor the area and respond to the changes in the coastline in a timely manner. 	Included in the monitoring cost
Release of effluent waste water (blood water) and discharge into the sea	Direct	Long term	Reversible	Moderate	Moderate	<ul style="list-style-type: none"> - removal of solid waste collect internal organs and other organic material prior to entry into the wastewater separately; -Conduct a dry pre-cleaning of equipment and production areas before wet cleaning (e.g. rubber scraping of work tables and plant floor before hosing); -Establish procedures for the dry removal of offal, using dry vacuum systems where feasible; -Equip the outlets of wastewater channels with screens and fat traps to recover and reduce the concentration of coarse material and fat in the combined wastewater stream; -Choose bio degradable cleaning agents. 	20,000USD for the cost of biodegradable cleaning agent and design of outlet of waste water channel
Ground water and soil	Direct indirect /cumulative	Long term	Reversible	Minor	Minor	-construct proper fuel storage with bund around the fuel tanks to protect against accidental	Included in the project cost

contamination						spills; -Standardise the fuel storage take to fit into local regulations ; -Regular monitoring of leaks; -Take necessary precautionary measures during fuel handling, transport and storage.	
Water consumption	Direct	Long term	Reversible	Minor	Minor	-Use enough ice to secure product quality and match ice production to requirements; -Improve efficiency by concentrating activities if the facility or process is not operated at full capacity;; -Dry clean with a scraper or broom before cleaning with water; -Avoid recycling contact process water. Recycling of cooling water, rinse water, and wastewater for some specific noncritical applications as long as hygiene considerations are observed.	
Odour	Direct	Long term	Irreversible	Minor	Minor	-Install condensers on all appropriate process equipment to treat air emissions for odor, including sulfides and mercaptans; -Install bio filters as the final method of air treatment and acid scrubbers for ammonia removal ahead of the biofilter; -Reduce fugitive odor sources from open doors, open windows, and general room ventilation through the use of negative pressure-controlled ventilation systems.	Installation of condensers, bio filters 5,000USD included in the project cost
Exhaust gases (carbon dioxide [CO ₂], nitrogen oxides [NO _X] and carbon monoxide [CO])	Direct	Long term	Irreversible	Minor	Minor	-Use of integrated smoking units with incineration and heat recovery; -Ensure that smoke from the powerhouse is emitted from a stack of sufficient height;	Included in the project cost
Physical hazards	Direct	Long term	Reversible	Minor	Minor	-Provide workers with training in the proper use and maintenance of equipment (including the use of machine safety devices, handling / storage, and emergency shutoff procedures) and personal protective equipment (e.g. protective footwear with rubber soles); -Clearly demarcate transport corridors and working areas; -Provided handrails on platforms, ladders, and	For workers training 3,000 USD annually the remain measure will be in cooperated in the design

						stairs; and use non-slip floor surfacing;	
Biological hazards	Direct	Long term	Reversible	Minor	Minor	-Provide food-approved shielding hand creams; -Avoid aerosol-generating activities (e.g. use of compressed air or high-pressure water for cleaning); -Provide proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to aerosols; -Ensure physical segregation of work and personal facilities to maintain worker personal hygiene.	To provide hand cream, 2000 USD/year
Exposure to heat and cold	Direct / cumulative	Long term	Reversible	Minor	Moderate	-Set the temperature in air-conditioned processing facilities, where stationary manual work is conducted, at a level that is appropriate according to temperature stress management procedures. -Equip cold stores and chill stores with strip curtains to avoid extensive drafts when doors are open. -Design air-conditioning systems in conjunction with strip curtain placement to minimize drafts; -Provide protective clothing in cold environments (e.g. refrigerated storage rooms). -Reduce movement of workers between different temperature zones	Included in the project cost
Solid and hazardous waste	Direct /cumulative	Long term	Reversible	Minor	Minor	-Small volumes of waste lube oil generated should be disposed of properly; -Encourage reuse of waste oil as lubricants; - Regular remove and deposal at Villingili waste yard site.	Transportation cost included in the project cost
Safety	Indirect	Long term	Irreversible	Moderate	Moderate	Install appropriate fire detection devices, fire alarms and fire extinguishers; -Install pressurized recycled/treated water supply system of network of fire hydrants and fire fighting house reels locations.	Included in the project cost
Odour and aesthetics	Direct	Long term	Reversible	Moderate	Moderate	-Daily collection and disposal of fish waste; -Daily cleaning; -Appropriate housekeeping procedures	

10.3 DESCRIPTION OF THE IMPACTS AND MITIGATION MEASURES

The following section describes in detail and discusses the main environmental impacts that are identified above for the proposed fish purchase and storage facility development in Ga. Raaverrehaa. The potential environmental impacts that are predicted are divided into construction phase and operation phase environmental impacts.

10.4 CONSTRUCTION PHASE

Environmental impacts of the associated with the proposed project during construction phase are very minor. Major impacts of the construction phase will be from vegetation clearance, impact on soil and ground water during the construction and from disposal of construction waste. Often construction activities generate large amounts of construction waste and disposal of such waste material into the island and surrounding environment often pollutes the island environment. Disposal of construction material such as cement, concrete, oil, paint, cleaning agents will damage both flora and fauna found on the island as well as will contaminate the groundwater lens of the island. Groundwater pollution negatively impacts the environment by deteriorating the flora and fauna of the island. Additionally, inappropriate disposal of construction waste into the immediate surrounding coastal and marine environment will pollute the waters as well as will have direct and indirect consequences on coral reefs and associated habitats.

Mitigation measures:

- ✓ Any sort of construction waste will not be disposed in the island or dumped into the immediate marine environment. Construction waste will appropriately disposed of to the Villingili/Thilafushi waste management site, while reusable material will be used elsewhere or donated to the community.
- ✓ A specific area should be designated in the coastal area for landing and material loading/unloading.
- ✓ Large trees and vegetation that needs to be retained must be clearly marked and communicated to the construction workers.
- ✓ Signs should guide workers to proper environmental care.
- ✓ All clearing works will be carried out during day time to minimise disturbances caused to nocturnal fauna such as birds and fruit bats that uses auditory communication.
- ✓ Those trees that can be protected in situ should be marked, clearly identified on the site construction plan, and properly protected with hoarding or a fence prior to the commencement of construction.
- ✓ The building contractor should be made subject to punitive penalties for any breaches of the tree protection plan and for damage to protected plants. These penalties should be an integral part of the works contract and specifications.
- ✓ Loss of vegetation means, loss of fauna that depend on those vegetation. Such species include birds, rats, fruit bats and invertebrates.
- ✓ Degradation of the topsoil due to exposure to sunlight and heavy rainfall.
- ✓ Earth work and ground excavations will completely denude epi-fauna, borrowing and sedentary organism on the substrate.

10.4.1 Ground Water extraction

Ground water lens of the island is very limited in the island. Extraction of groundwater for construction purposes may prolong the water lens development process and increase the potential for saltwater concentration in the groundwater aquifer. Increased salinity will generate some

environmental consequences such as vegetation that are dependent on freshwater for survival will be deteriorated. As a consequence, more salt tolerant plant species will have the potential to dominate the island environment. Although ground water will not be used for human consumption in the island, it is important for the trees and shrubs in the island. Therefore, special care should be taken when handling oil, solid waste and hazardous waste to entirely avoid any accidental spills and leakage.

Mitigation measures:

- ✓ Keep spill clean-up materials readily available
- ✓ Train workers in spill prevention and clean-up, and designate responsible individuals
- ✓ General refuse stockpiled in one central area to avoid spreading, soil pollution and subsequent transportation with the runoff and leaching into the water table
- ✓ All paints, lubricants, and other chemicals used on site will be stored in secure and banded location to avoid accidental spills and leachate to the water table.
- ✓ Oil, solid waste and hazardous waste will be handled carefully and transported in sealed containers in properly banded vehicles/vessels
- ✓ Construction activities will be carried out under the supervision of a suitably experienced person.
- ✓ Vessels, equipment and machinery used for the work should be properly maintained at all times during the operation.

10.4.2 Jetty construction

Direct impact to Raaverrehaa marine and coastal environment associated with the proposed project will mainly be from the jetty construction work. This activity will have a minor direct irreversible negative impact to the ecological habitat in the Raaverrehaa lagoon and reef on the eastern side. Direct impact of this activity is limited to Raaverrehaa lagoon and reefs only and to the island. This includes:

- ✓ Loss of habitat in lagoon area;
- ✓ Physical damage on live coral and loss of live coral: The effect of this would be in the immediate to medium term with the loss of substrate and its fauna;
- ✓ Physical damage to live corals and loss of live corals;
- ✓ Change of near shore hydrodynamic and longshore current pattern;
- ✓ Degradation of sea water quality due to turbidity;
- ✓ Sedimentation and associated impacts; and
- ✓ Physical disturbance of the lagoon substrate will result in loss of habited for some lagoon infauna such as polychaete amphipods, worms, and mollusks etc..

Mitigation Measures:

- ✓ Construction work should be completed in shortest time possible.
- ✓ Lagoon excavations should take place during low tides or slack tides to minimize the release of sediment to the area.
- ✓ Constantly monitor the area and respond to the changes in the coastline in a timely manner.

10.5 OPERATIONAL PHASE IMPACTS

The main environmental impacts associated with the proposed fish purchase and storage facility development activities are the high consumption of water, consumption of energy and the discharge of effluent with a high organic content. Noise, odour, solid wastes occupational health and safety issues are may also be concerns for loading/unloading and transportation of fish to cold storages. The following sections will describe these impacts and their mitigation measure.

10.5.1 Water consumption

Water is used during unloading, and handling the fish plus the wash-down water, as a mix will be disposed as wastewater. Disposal of fish handling, cleaning and storage waste to the marine environment has the potential to increase the nutrient level of the water body and hence impacting the biotic organisms living in the water. Proper management plan has to be formulated to address disposal of waste including wastewater.

Mitigation measures:

- ✓ Use enough ice to secure product quality and match ice production to requirements;
- ✓ Improve efficiency by concentrating activities if the facility or process is not operated at full capacity;
- ✓ Improve the process lay out to facilitate cleaning and eliminate wet transport of wastes, to minimize water consumption;
- ✓ Dry clean with a scraper or broom before cleaning with water;
- ✓ Avoid recycling contact process water. Recycling of cooling water, rinse water, and wastewater for some specific noncritical applications may be feasible as long as hygiene considerations are observed.
- ✓ During refrigeration, water savings can be achieved by recovering defrosting water.
- ✓ Water from the condensers can be recovered.
- ✓ Hoses with smaller diameters should be used when possible.
- ✓ Cleaning should be done when the dirt/material is still damp.
- ✓ Washing with spray should be used instead of tub.
- ✓ Floors and walls should be flat so that they can be easy to clean.
- ✓ Employ water sinks and outlets with automatic opening and closing valves (e.g., pedal).
- ✓ Flows should be adjusted to optimum levels in water consuming equipment.
- ✓ Water consuming equipment should be shut off during long stops.
- ✓ A maintenance program should be in place (immediate repair of leaks in valves, pipes, etc.)

10.5.2 Energy consumption

Energy is used for producing ice, cold storage and overall operations of facility. Depleting fossil fuel resources, the consumption of energy produces air pollution and greenhouse gas emissions, which have been linked to global warming.

Energy consumption in fish purchasing and storage facility operations comes in the form of electrical energy. Therefore, there is an associated environmental aspect due to: (a) the use of nonrenewable sources such as fossil fuels for generating energy required; (b) when the fuels are burnt, air emissions containing atmospheric pollutants also originate.

Electricity is used in order to operate different equipment in the facility, including: freezers, cold rooms, grading machines, air compressors and pumps etc.

Mitigation measures:

- ✓ Exhaust boxes should be insulated and designed so steam only escapes in the ends.
- ✓ Re-circulate the cooling water by using a cooling tower instead of directly draining all the water.
- ✓ Reuse the heat from the cooling water
- ✓ Registration of Power Generation plants with Maldives Energy Authority
- ✓ Registration of RO plants with Environmental Protection Agency
- ✓ Carry out regular maintenance to optimize energy efficiency of equipment
- ✓ Implement switch-off programs and installing sensors to turn off or power down lights and equipment when not in use;

- ✓ Improve insulation on heating or cooling systems and pipework.
- ✓ Improve maintenance to optimise energy efficiency of equipment;
- ✓ Capturing low-grade energy to use elsewhere in the operation

10.5.3 Effluent Discharge

Fish being highly perishable; if not properly refrigerated it spoils rapidly. The flesh becomes soft and loose, and pieces are easily lost. As the quality of the fish deteriorates over time, product yield decreases and product losses contribute to the waste loads. These losses often find their way into the effluent stream. Effluent streams generated by fish storage contain high loads of organic matter due to the presence of oils, proteins and suspended solids. They can also contain high levels of phosphates and nitrates.

Pollution loads generated from oily fish species such as tuna are much higher than from white fish species, due to the high oil content and the fact that these species are usually not gutted or cleaned on the fishing vessel. The entrails from the gutting of oily fish contain high levels of easily soluble substances, which generally find their way to the effluent stream.

The effluent streams described above are if discharged without treatment into water bodies, the pollutants they contain can cause eutrophication and oxygen depletion.

Mitigation measures:

- ✓ Install a separate outfall pipe for wastewater discharge
- ✓ using dry cleaning techniques where possible, by scraping equipment before cleaning, pre-cleaning with air guns and cleaning floor spills with squeegees;
- ✓ Fit and use floor drains and collection channels with grids and screens, and / or traps, to reduce the amount of solids entering the wastewater;
- ✓ Equip the outlets of wastewater channels with screens and grease traps to recover and reduce the concentration of coarse material and fat in the combined wastewater stream;
- ✓ Choose cleaning agents that do not have adverse impacts on the environment in general, or on wastewater treatment processes and sludge quality for agricultural application. Optimize their use through correct dosage and application.
- ✓ Avoid cleaners that contain active chlorine or prohibited, banned, or restricted chemicals
- ✓ Sweeping up solid material for use as a by-product, instead of washing it down the drain;

10.5.4 Emissions to Air

10.5.4.1 Odor

Odor is often the most significant form of air pollution in fish processing. Fish quality may deteriorate under the anaerobic conditions found in onboard storage on fishing vessels and in the raw material silos of fish processing facilities. This deterioration causes the formation of odorous compounds such as ammonia, mercaptans, and hydrogen sulfide gas.

Mitigation measures:

- ✓ Install condensers on all appropriate process equipment to treat air emissions for odour, including sulfides and mercaptans;
- ✓ Install cyclones and filtration (fabric filters normally are adequate) to remove particulates;
- ✓ Reduce fugitive odor sources from open doors, open windows, and general room ventilation through the use of negative pressure-controlled ventilation systems.

10.5.4.2 Exhaust gas and Particulates

Exhaust gas emissions (carbon dioxide [CO₂], nitrogen oxides [NOX] and carbon monoxide [CO]) in fish loading/unloading, storage and transportation sector result from the combustion of fuel oil or diesel generators, compressors and other engines for power and heat generation.

Mitigation measures:

- ✓ Consider use of integrated smoking units with incineration and heat recovery;
- ✓ Clean the kiln exhaust using filters, incinerators, and / or wet scrubbers;

10.5.4.3 Noise and Vibration

Noise and vibration exposure may result from proximity to noisy machinery (e.g. compressors, engines etc.).

Mitigation measures:

- ✓ Selecting equipment with lower sound power levels
- ✓ Installing silencers for fans
- ✓ Installing suitable mufflers on engine exhausts and compressor components
- ✓ Installing acoustic enclosures for equipment casing radiating noise
- ✓ Improving the acoustic performance of constructed buildings, apply sound insulation
- ✓ Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m² in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective
- ✓ Installing vibration isolation for mechanical equipment
- ✓ Limiting the hours of operation for specific pieces of equipment or operations,
- ✓ Reducing project traffic routing through community areas wherever possible
- ✓ Developing a mechanism to record and respond to complaints

10.5.5 Occupational Health and Safety

Occupational health and safety issues that occur during the operational phase of fish loading/unloading, storage and transportation projects primarily include the following:

- Physical hazards
- Biological hazards
- Lifting, carrying, and repetitive work injuries
- Exposure to chemicals
- Exposure to heat and cold
- Confined space

10.5.5.1 Physical hazards

Causes of accidents in fish loading/unloading, storage and transportation operations include falls caused by slippery floors and stairs; equipment safety issues associated with sharp tools; and cuts from sharp edges on process equipment (e.g. stainless steel basins).

Mitigation measures:

- ✓ Provide workers with training in the proper use and maintenance of equipment (including the use of machine safety devices, handling / storage and upkeep emergency shutoff procedures) and personal protective equipment (e.g. metallic gloves and leather aprons for cutting activities, and protective footwear with rubber soles);
- ✓ Clearly demarcate transport corridors and working areas;
- ✓ Provided handrails on platforms, ladders, and stairs; and use non-slip floor surfacing;
- ✓ Use completely enclosed conveyer belts to protect hands and fingers.

10.5.5.2 Biological hazard

Workers involved in general handling of fish and may develop infections and or allergic reactions resulting from exposure to the fish itself, or bacteria on the fish. Water spraying processes may result in the formation of aerosols with bacteria that can be inhaled.

Mitigation measures:

- ✓ Consider work rotation strategies to reduce occupational exposure to allergens;
- ✓ Provide food-approved shielding hand creams;
- ✓ Avoid aerosol-generating activities (e.g. use of compressed air or high-pressure water for cleaning).
- ✓ provide proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to aerosols,
- ✓ Provide adequate distances between workers and aerosol-generating activities
- ✓ Ensure physical segregation of work and personal facilities to maintain worker personal hygiene.

10.5.5.3 Lifting, carrying, and repetitive work injuries

Fish handling loading/unloading, storage and transportation activities may include a variety of situations in which workers can be exposed to lifting, carrying, and repetitive work, and work posture injuries. Many of the manual operations in less mechanized fish processing plants include lifting heavy boxes of raw materials. Poor working postures may result from the design of the workspace, furniture, machinery, and tools.

Mitigation measures:

- ✓ Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds
- ✓ Selecting and designing tools that reduce force requirements and holding times, and improve postures
- ✓ Providing user adjustable work stations
- ✓ Incorporating rest and stretch breaks into work processes, and conducting job rotation
- ✓ Implementing quality control and maintenance programs that reduce unnecessary forces and exertions

10.5.5.4 Exposure to chemicals

Exposure to chemicals (including gases and vapors) includes handling chemicals such as chlorine and acids that are related to cleaning operations and disinfection of work areas.

Mitigation measures:

- ✓ Respiratory protection should be used when cleaning;
- ✓ Ensure that employees handling concentrated lye, acid, and chlorine wear protective clothing and eyewear.

10.5.5.5 Exposure to heat and cold

Exposure to extreme heat and cold is common because fish loading/unloading, storage and transportation processing is often conducted in air-conditioned plants under low temperature. Improper work clothes in combination with stationary work locations can result, or be an additional factor, in respiratory and musculoskeletal ailments.

Mitigation measures:

- ✓ Set the temperature in air-conditioned processing facilities, where stationary manual work is conducted, at a level that is appropriate according to temperature stress
- ✓ Products awaiting the next processing step can be kept chilled without lowering the ambient temperature through proper use of ice, slush-ice, or water ice mixtures;

- ✓ Equip cold stores and chill stores with strip curtains to avoid extensive drafts when doors are open. Ensure freezers can be opened from the inside;
- ✓ Design air-conditioning systems for processing facilities in conjunction with strip curtain placement to minimize drafts;
- ✓ Provide protective clothing in cold environments (e.g. refrigerated storage rooms).
- ✓ Workers should always be equipped with proper working garments, including dry boots;
- ✓ Reduce movement of processing workers between different temperature zones (e.g. when packing frozen products);
- ✓ Use of protective clothing;
- ✓ Providing easy access to adequate hydration such as drinking water or electrolyte drinks

10.5.5.6 Confined space

A confined space is defined as a wholly or partially enclosed space not designed or intended for human occupancy and in which a hazardous atmosphere could develop as a result of the contents, location or construction of the confined space or due to work done in or around the confined space. Occupational health and safety impacts associated with confined spaces in fish processing operations (e.g. storage areas, boat holds) are common to most industries.

Mitigation measures:

- ✓ Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- ✓ Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible.
- ✓ The area adjoining an access to a confined space should provide ample room for emergency and rescue operations
- ✓ Access hatches should accommodate 90% of the worker population with adjustments for tools and protective clothing.
- ✓ The most current ISO and EN standards should be consulted for design specifications;
- ✓ The atmosphere within the confined space should be tested to assure the oxygen content is between 19.5 percent and 23 percent, and that the presence of any flammable gas or vapor does not exceed 25 percent of its respective Lower Explosive Limit (LEL).
- ✓ If the worker is potentially exposed to highly toxic or corrosive chemicals, emergency eye-wash and shower facilities should be equipped with audible and visible alarms to summon aid whenever the eye-wash or shower is activated by the worker and without intervention by the worker

10.6 SOCIO-ECONOMIC BENEFITS

In addition to opening up of a new avenue for employment, entrepreneurship the proposed fish purchase and storage facility will contribute to the food security and self sufficiency of the country. Other beneficial impacts are:

Activities of the facility contribute to GDP growth by providing a range of direct and indirect economic and social benefits at the national and local levels.

Direct economic effects include increased government revenue and increased employment opportunities. Indirect economic effects will include increased earnings high revenue from export of fresh fish and employment by the island's support infrastructure development including the construction, supply and transport service. Direct socioeconomic benefits of the fish purchase and storage facility on the Huvadhu Atoll region:

- ✓ Direct and preferential employment opportunities for the people of the region

- ✓ Rental arrangements of buildings / houses on Villingili islands, required for accommodation of the facility staff
- ✓ Opportunities for starting small-scale businesses related to the facility.
- ✓ Potential direct CSR assistants from facility to the local community activities.

10.7 NEGATIVE SOCIO-ECONOMIC IMPACTS

Raaverrehaa is occasionally used for local picnic and it is the only remaining island for picnickers in the vicinity Villingili. Proposed fish purchase and storage facility development in Raaverrehaa will limit the public accessibility for local picnickers. More detailed discussions on this issue are on Stakeholder Consultation Section of this report.

Mitigation measures:

- ✓ Arrangements and understandings should be reached beforehand to avoid conflicting situations.
- ✓ The proponent has agreed to develop a designated area for local picnicker in Villingili Island.
- ✓ The Island Council in close consultation with the public should identify appropriate location to develop a picnic area for locals

10.8 ACCIDENTS AND HAZARDS

Accidents and risks involved in the development project may be due to self-contained nature of the facility. Power generation takes place from building in a close proximity to the storage areas. Large fuel tanks and fuel handling operations will also take place on the jetty and nearby area. Similarly ice production and water production also takes place inside the compound in a very confined spaces.

With this arrangement the option what may be left is to make sure equipment and machinery are routinely monitored and logs are recorded as appropriate and serviced properly. Also where appropriate fire safety equipment are placed and staff are informed of the emergency procedures and regular fire drills, emergency evacuation drills are conducted and safety issues at work and with the machine being used in the compound.

To put things in perspective, there was one accident in a fish packing and processing facility on Himmafushi (on 06 January 2013), where the whole facility was burnt down. While the actual cause may never be known, it is suspected that electrical short-circuit resulted the fire.



Figure 27: Accident happened at Maldives Quality Seafood in Himmafushi on 06 January 2013 may have caused by an electrical short-circuit that exploded the diesel tanks in the compound (extracted from Adam 2013).

11 ALTERNATIVES

11.1 NO DEVELOPMENT OPTION

Huvadhu Atoll is one of the most important tuna fishing grounds in the Maldives and during the fishing season fishermen of the atoll have difficulty in selling their catch and finding a good price as the capacity of Kooddoo cannot purchase the whole catch in a good fishing season. Therefore more companies are needed in Huvadhu atoll to purchase fish from the fishermen in competitive prices. Alternatives of the project activities in the case of fish purchase and storage is not an option as this is an important development project needed for southern Atolls particularly Huvadhu Atoll. Also Raaverrehaa strategic location is very appropriate if not ideal for the proposed project. The fact that the island being closer to the fishing communities and inhabited islands, presence of dredged harbour facility and being close to the important infrastructures such as airport, and closer to the people etc., are some of the advantages of Raaverrehaa. In summary the proposed development seems to be the right for the atoll at the place.

Fish purchasing and storage is an extremely important economic activity, not only adding value to fish catch, but also provides direct employment for Maldivians and open-up new business avenues and entrepreneurship opportunities. The marine exports which constitute essentially tuna products earn over US\$ 150 million annually. Therefore no-development option is not an option for this project. Furthermore in order to get the most benefit from the MSC Certification of pole and line skipjack and yellowfin tuna fishery^{7,8} is critical that largest volume of locally caught tuna is value-added in the Maldives to minimize export for frozen fish to Thailand and elsewhere. This section of the report will focus on alternatives options to improve loading/unloading, security storage and transportation operations that will have least environment impact.

11.2 ENHANCING WATER CIRCULATION IN RAAVEREHAA FALHU

At present Raaverrehaa and Villingili Island are connected by land through a narrow walkway that has been reclaimed to lay the dredger pipeline during Villingili reclamation project. Initially the walkway was reclaimed as a temporary structure to lay the dredger pipelined but it became a permanent allowing unlimited access to Raaverrehaa Island. The reclaimed walkway also blocks the water movement E-W and W-E between the two islands doing more damage to the environment. As a result water motion on the reef has reduced allowing nutrient enrichment and subsequent growth of seagrass on the eastern side of the reef. Seagrass grows on nutrient rich eutrophic and slow-moving water bodies particularly in fishing islands where large amount of waste is dumped into the lagoon.

Therefore, to enhance the water circulation in the reef and to limit the access to Raaverrehaa it is recommended to cut a channel through the walkway or remove it as an alternative for keeping the solid walkway to provide unlimited land access to the island. From the environmental point of view the wider the channel the better the circulation.

⁷ https://www.msc.org/track-a-fishery/fisheries-in-the-program/certified/indian-ocean/maldives_pole_line_tuna

⁸ <https://www.msc.org/track-a-fishery/fisheries-in-the-program/in-assessment/Indian-ocean/Maldives-handline-yellowfin-tuna>

11.3 MINIMISING LAND CLEARANCE

As shown Figure 15 some of the mature coconut trees are in the foot print of some of the proposed buildings. Based on the space availability buildings can be adjusted to minimise land clearance and to avoid large and mature coconut palms particularly.

11.4 RESOURCE USE

Energy and water are the most important two resources used in fish loading/unloading storage and transportation operations. Even though, Ensis fisheries will use water and energy produced in the facility, the company should target continual improvements in these areas and venture into alternative measures to minimise resource use to keep up within benchmarks established by EU, IFC etc.

As mentioned earlier Ensis Fisheries is mindful to integrate their product lines so that waste is minimized. The retail outlet – selling a variety of fish products – the fertilizer plant are all geared towards to minimizing waste from Ensis’ processing and packing facilities.

12 ENVIRONMENTAL MONITORING

Environmental monitoring is essential to ensure that operational impacts identified in this report can be eliminated in a timely manner. Monitoring will help to continuously evaluate the result of mitigation measures suggested and to adjust the measures to reflect and react to the changes in environmental condition of the area.

12.1 OBJECTIVE OF MONITORING

The main objectives of the monitoring plan are:

- ✓ To verify effectiveness and the accuracy of the mitigation measures and adjust the response accordingly
- ✓ To identify observe and response to unforeseen impacts in a timely and appropriate manner at the earliest
- ✓ To eliminate or reduce environmental costs

12.2 MONITORING PARAMETERS

The parameters that are most relevant for monitoring the impacts that may arise from the proposed project are included in the monitoring plan. These include ground water and the effluent discharge (Salinity, pH, BOD, COD, Nitrogen and phosphorous, oil and grease and total faecal coliforms). Monitoring the shoreline changes that may occur due to the medium to long term impacts from the changes in coastal processes.

Table 13: Environmental Monitoring Schedule: Shoreline, and Coastal Process

Parameter	Indicators	Baseline / Reference Values	Method Technique	Frequency	Estimated cost in USD
Shorelines (high / low tides)	Beach morphology	Baseline to be re-established immediately after construction is complete	Differential GPS	4 times (once every three months) is the first two years and twice yearly thereafter	200/ trip
Beach profiles	coastal changes	Requires to re-establish the baseline following the construction	Beach profile surveys	4 times (once every three months) is the first two years and twice yearly thereafter	200 / trip
Currents	Nearshore currents	Baseline to be collected immediately construction over , especially on western side	Drogue survey	Bi-annually in the first two year and yearly thereafter	150/trip

Table 14: Environmental Monitoring Schedule: Coral reef

Parameter / Method	Frequency Monitoring	Purpose	Estimated cost (USD)
Benthic cover by major life forms (live, dead, rock rubble and sand)	Annually	Indicative of the changes in the live coral cover	200/trip

Fish population / visual census	Annually	To assess broad scale change in the ecological status of the coral reefs (increase / decrease of herbivores, etc)	
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Table 15: Environmental Monitoring Schedule: Water quality

Indicators	Measuring parameter	Survey Technique	Frequency	Baseline/References	Cost (USD)
Ground water Quality	Salinity, pH, Nitrate (ug/l), Ammonia, Chloride, Phosphate, COD, colliform and faecal colliforms	Sampling and Laboratory Analysis	Twice a year	Baseline data available.	300.00
Effluent discharge to the sea	pH, phosphates, nitrates COD, BOD and total coliform	Sampling and laboratory analysis	Twice a year	Baseline data available	300.00

12.3 MONITORING REPORT

Based on the data collected, a detailed monitoring report will be compiled annually and submitted to the relevant government authorities for compliance. The report will include methodologies and protocols followed for data collection and analysis, quality control measures and uncertainties. Table 16 is a tentative schedule for submission of monitoring reports to EPA.

12.4 MONITORING COSTS

It is understood that costs of monitoring be borne by the developer. It is also understood the mitigation measures would be accommodated in the contract costs. A commitment from the proponent is given Appendix 6.

Table 16: A tentative schedule for submission of EIA monitoring report to EPA

	2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Monitoring report, Construction Phase												
Monitoring report, Operational Phase												

13 STAKEHOLDER CONSULTATIONS

Initially EIA scoping meeting was scheduled for the 5th of December 2015, therefore the field visit was scheduled for the 8th December 2015. For some reasons the scoping meeting was postponed and rescheduled for December 14th but the field visit was conducted as scheduled 8-9 December 2015. During field visit Atoll and island council members are officially met and general public from Villingili island were discussed on the project. During the scoping meeting held at EPA on 14th December consultation relating to the project took place and officials representing Ministry of Fisheries and Agriculture, Environmental Protection Agency, Ministry of Environment and Energy and Maldives Food and Drug Authority, and Mr. Ali Ahmed as the representative of the proponent – Ensis Fisheries Pvt. Ltd were present at the meeting. Apart from the scoping meeting consultation with the following stakeholder groups were separately held.

- 1- Ga. Villingili Council
- 2- Ga Atoll Council
- 3- Ministry of Fisheries and Agriculture
- 4- General public of Villingili island
- 5- Maldives Energy Authority (Telephone communication)

In all consultation top management of Ensis fisheries and the consultant was present. Standard approach was used. The session was always lead by the managing director of Ensis Fisheries Pvt Ltd Mr. Mohamed Waseem.

First the introductions of everyone were made. It was followed by the introduction of the consultants and brief explanation of what the EIA is all about. Following the proposed development project was explained including the key development features. After the briefing the floor was opened for general remarks and issues they may have on any aspect of the project.

Notes were kept for the each meeting and photographic evidence was also taken. Points of concerns from the various discussions are presented below:

13.1 ATOLL COUNCIL AND GENERAL PUBLIC

As part of the consultation process the consultant has discussed the development with Atoll council and the general public of Villingili closest inhabited island to Raaverrehaa, during the field visit on 8th December 2015. The meeting was attended by Mohamed Sawad (Gemenafushi Dhaairaa), Saudhulla Rasheed (Villingili Dhaairaa) and Husain Adam Predident Atoll Council (Dhaandhoo Dhaairaa).

In General the people of the island are very much in favor of the project and they want the facility development in Raaverrehaa to take place as soon as possible. The island community is hoping that they will greatly benefit from the development directly and indirectly through creation of employment opportunities during construction and operational phase of the project, increased income, improved services and flow of much needed foreign currency into the economy. They are on the opinion that the project will contribute to improvement of public facilities and infrastructure, general improvement of social conditions and service industry activities, in addition to the increased national fisheries and economic infrastructure. As part of the EIA regulation requirement the proponent has shared the final EIA report with Ga. Atoll Council.

The atoll council was consulted regarding the project. They are in favor of the project and in fact they want the developments in Raaverrehaa to take place as soon as possible. They think that the project will benefit Ga, Gdh and the whole Maldives. The fact that Ensis Fisheries Pvt. Ltd., provides free ice for fishermen is an important incentive and encouragement for the fishermen to out for fishing. Also

they strongly believe that the proposed development will help to grow small and medium enterprises in the region. They also indicated that the proponent of the project and the Managing Director of Ensis Fisheries, Mr. Waseem is always seek the council's opinion and consults with them. They were aware of the proposed picnic area development and they support the idea and appreciated that Ensis Fisheries has taken the initiative to plan picnic facility. As per the proposed Ensis plan the picnic area will be handover to the council for management after development. In addition to this the council has very strongly highlighted the following benefits from the project:

- 1- Encourage local fishermen to go for yellowfin tuna fishing, (usually people of Ga Atoll don't go for yellowfin)
- 2- Large number of fishermen from other atolls, particularly from northern atolls uses Huvadho area as a yellowfin fishing ground. However, once they catch the fish they have to return back to Male area to sell it in a competitive price because there are no yellowfin buyers in this region. Therefore they believe that Raaverrehaa development will open-up the market opportunity for those fishermen to sell their catch, fresh and frozen, to Ensis and fetch a similar/higher prices as in the Male region
- 3- At present Kooddoo is the only island where fishermen can refuel the vessels and they sort of "monopolise" the fuel price. Therefore the council believe that development of Raaverrehaa will open-up competitive fuel market for fishermen.
- 4- During the meeting Mr. Waseem indicated his intention to develop a slipway in the second phase of the Raaverrehaa project. The council expressed the importance of such a facility as nowadays the nearest facility is in Addoo City. They also indicated that there is a long queues waiting to get the service Addoo City.
- 5- Council members were happy and content with the proposed picnic area development proposed by Ensis and they agreed to go with the plan.

Therefore the council strongly supports the proposed development and they are hoping that the actual practical work of the facility to start soon. List of people consulted during the stakeholder consultation is given in Table 17

13.2 SCOPING MEETING -EPA

The consultant presented an over-view of the proposed fish purchase and storage facility development project in Ga. Raaverreha and mentioned that this is the exact project that was planned in Ga Kedheraa, but due to some strategic difficulties the project activities are shifted to Raaverrehaa. He also gave an introduction of the on-going operations as well as the existing capacities of Ensis fish processing plant and upcoming cannery in Hulhumalé. He also explained how the proposed development in Raaverrehaa will support on-going operations in fish processing plant and the upcoming cannery operations. He also recognised that Raaverrehaa is currently used for local picnics and once the operations in the island it would be very difficult to accommodate local picnics in the island. Therefore the proponent has proposed to develop a picnic area near a small cay adjacent to the north eastern end of Villingili Island.

In response to this Villingili council president said that he was under the impression that part of Raaverrehaa will be accessible for local picnics during the operational phase. The proponent and the consultant confirmed that as per the discussions held with the atoll and island council member on 8th of December there is an understanding and agreed plan by the council and MoFA to develop a separate picnic area for the locals. Once the construction work starts and due to the nature of the proposed operations the proponent will adopt a strictly restricted access policy to Raaverrehaa. Despite these explanations the council insisted that he was not informed of the discussions and the communication between MoFA and island council on planned picnic area development and he believes that the general public got the impression that part of Raaverrehaa will accessible for local picnics during the operational phase of the project. Then the meeting chair requested to hold a separate meeting with the proponent and the island council to resolve the misunderstanding.

Another member of the council asked if there is any possibility use the electricity from Villingili Powerhouse which is operated by FENAKA cooperation. The proponent mentioned this could be explored further if there is enough electricity capacity in Villingili this could be a possible but he said that doubt about that as Villingili is currently undergoing occasional power failures due to overloading of generator sets. The council member replied by saying that FENAKA has plans to expand the capacity within a year or so. The proponent said if this is the case it is very premature to say anything about this but once FENAKA establishes that capacity they will explore the possibilities.

The official of the Ministry of Fisheries and Agriculture further explained government's policy on job creation and youth empowerment. She said that the primary objective of approving this development is that the Government has been given the assurance from the proponent to reserve 50% of the jobs created through this development to Maldivian youth population.

MFDA noted their responsibility lie in health and safety issues of the products. MFDA's primary role is to ensure the process of production follows internationally accepted norms of HACCP (Hazard Analysis and Critical Control Points). MFDA guidelines and approval ensures that process flow design meet those standards. As such their role at this stage of the proposed project will come after the construction and before the start of operations.

13.3 VILLINGILI COUNCIL AND PROPONENT

As requested by the chair of the scoping a separate meeting was held between the Villingili council proponent and the consult on the evening of 14th December, to resolve the issue aroused from local picnic accessibility to Raaverrehaa during the operational phase of the project. The meeting was held at 18.00 at Ensis Fisheries Pvt. Ltd Male office meeting room. The meeting was attended by two directors and operations manager of Ensis Fisheries, two members of Atoll and Villingili Council, Niyas Nizar (Villingili Council President) Mohamed Khaleel (VP Atoll council) and the consultant.

Managing director of Ensis Mohamed Waseem initiated the meeting and gave briefing on the project and explain the idea of development of a picnic are for the local public and showed the plan and relevant drawing they have send to MoFA who subsequently communicated the plan to Villingili council (Figure 28). The plan clearly shows that he the picnic facility will be developed at the small island located adjacent (walking distance) on the north eastern end of the island. He also referred to various communications had with MoFA in this regard. He also emphasized that Ensis will develop the facility in close consultation with the people of Villingili island and he will not do anything against their will. Also he emphasized that Ensis will accommodate, as much as they can, needs of the people and they will do more CSR activities once the project kicks off.

Villingili Council president indicated that he, as well as, the members were under the impression that the facility will be developed on one part of Raaverrehaa, but he recognised that there is a miscommunication between him and the council members as he has not been informed about the decision of council, may be because he has been in Male for few days. Mr. Waseem then proposed the following option:

- 1- To go ahead with the proposed picnic area development plan as proposed by Ensis
- 2- To Develop the local picnic facility in any other area in Villingili island or any other island nearby, subjected to council's and peoples approval and if it fits into the budget allocated for the picnic area development
- 3- To provide the budget allocated for picnic area development to the council, so they can develop the local picnic area by themselves.

Mr. Waseem clearly stated that once the proposed fish purchase and storage facility work starts, access to Raaverrehaa will be restricted for the local picnickers. Also the council understands that

once the facility becomes operation it would not be possible to open for local picnics due the nature of the operations that will take place in the island.

The council also agreed that they will discuss further with the public and decide on a possible location for local picnics and get back to the MoFA and Ensis soon. One such area they suggested was the south western side of Villingili Island which Ensis has no objection. In principle Ensis Fisheries is ready to develop picnic facility in any place or area other than Raaverrehaa, if it is within the proposed budget allocated for the purposed plan for local picnics.

In conclusion everyone in the meeting agreed that the EIA process should continue as planned and in the meantime the council will further discuss with the people and get back to MoFA and Ensis soon.



Figure 28: Alternative picnic island plan proposed by Ensis Fisheries Pvt. Ltd and communicated to the Atoll Council through MoFA.

13.4 MEETING WITH MOFA

As requested in the EIA Scoping meeting a meeting was arranged with the Ministry of Fisheries and Agriculture (MoFA). The Meeting was held at the meeting room of MoFA on 16th December 2015 to discuss mainly the picnic facility development issue and the Raaverrehaa border with Villingili Island. Mr. Waseem gave a an introduction and a briefing on the discussion at the EIA scoping meeting held in EPA and the meeting with council member at the Ensis Office on the 14th December 2015. The Ministry confirmed the process that has been followed to lease Raaverrehaa Island to Ensis Fishereis Pvt.Ltd. Also they confirmed about the picnic island concept plan that has been proposed by the Ensis which was send through MoFA for the council's opinion. MoFA explicitly expressed that the Ministry's policy is to ensure that the proposed development in Raaverrehaa to go ahead as planned. As for the picnic area issue they said that the Ministry will consult with the people of Villingili and decide on alternative location for local picnics.

With regard to the defining the border line between Villingili and Raaverrehaa MoFA officials indicated that since there is no 700m between the two islands the rule is to divide the area into two equal halves.

The EIA consultant expressed that the existing solid walkway which was built as a temporary structure to lay the dredging pipelines during the Villingili reclamation project has not been removed and as a result there is no water flow between the two island across the reef and this is causing water stagnancy and nutrient enrichment and subsequent increase in seagrass growth and foul smell during low tide. Therefore it is highly recommended to open up the walkway and cut a channel between the two island which will enhance water flow and lagoon flushing. MoFA expressed no objection for

cutting the as long as it will have environmental benefits as well as it will provide more security for Raaverrehaa by limiting land intrusions to the island from Villingili.

In conclusion everyone in the meeting agreed that the EIA process should continue as planned and in the meantime the Ministry will further discuss with the people and decide on the picnic issue reemphasized that the ministry's policy is to ensure that the proposed development in Raaverrehaa to go ahead as planned.

13.5 CONSULTATION WITH MEA

Stakeholder consultation with Maldives Energy Authority (MEA) was held via telephone conversation with Engineer Ms. Fizna Yousuf. The consultant gave a briefing on the project and discussed the issue of providing electricity needed for Raaverrehaa from the generators in Villingili. She said that FENAKA is providing the service in Villingili and as matter of principle and as per he MEA guidelines there is no problem in that if they have additional capacity required for Raaverrehaa. However at present she don't think that that capacity exists in Villingili as there is a public outcry due to frequent power failure in the island. Once the capacity is developed FENAKA will be in position to offer the additional capacity for Raaverrehaa. Therefore in conclusion at present situation the best option for Raaverrehaa would be to have own generator sets to generate electricity needed for the facility. Construction and installation of generator sets and electrical wiring should meet the MEA standards and once the power house is complete it should be registered in MEA as stipulated in the MEA regulations.

13.6 CONCLUSIONS OF STAKEHOLDER CONSULTATION

Following conclusion can be drawn from the various consultations held with stakeholder:

The council strongly supports the proposed development and they are hoping that the actual practical work of the facility to start soon they believe that project will have the following benefits.

- 1- Encourage local fishermen to go for yellowfin tuna fishing, (usually people of Ga Atoll don't go for yellowfin)
- 2- Large number of fishermen from other atolls, particularly from northern atolls uses Huvadhoon area as a yellowfin fishing ground. However, once they catch the fish they have to return back to Male area to sell it in a competitive price because there are no yellowfin buyers in this region. Therefore they believe that Raaverrehaa development will open-up the market opportunity for those fishermen to sell their catch, fresh and frozen, to Ensis and fetch a similar/higher prices as in the Male region
- 3- At present Kooddoo is the only island where fishermen can refuel the vessels and they sort of "monopolise" the fuel price. Therefore the council believe that development of Raaverrehaa will open-up competitive fuel market for fishermen.
- 4- During the meeting Mr. Waseem indicated his intention to develop a slipway in the second phase of the Raaverrehaa project. The council expressed the importance of such a facility as nowadays the nearest facility is in Addoo City. They also indicated that there is a long queues waiting to get the service Addoo City.

With regard to development of a picnic area Villingili council and Ga Atoll council agreed that the EIA process should continue as planned and in the meantime the council will further discuss with the people and get back to MoFA and Ensis soon.

MoFA emphasized that the ministry's policy is to ensure that the proposed development in Raaverrehaa to go ahead as planned and agreed that the EIA process should continue as planned and in the meantime the Ministry will further discuss with the people and decide on the picnic issue.

Photographic evidence of the meetings shown in Figure 29 and a list of people consulted are given in Table 17.



Figure 29: Photographic evidence of stakeholder consultations

Table 17: List of people consulted during the stakeholder consultation

Name	Designation	Office	Contact No
Husain Adam	GA Atoll Council President	Ga. Atoll	7727349
Mohamed Khaleel	GA Atoll Vice President	Ga. Atoll	7794031
Saudulla Rasheed	Council Member	Ga. Atoll	7981798
Mohamed Sawaadhu	Council Member	Ga. Atoll	7484540
Ahmed Saeed	Council Member	Ga. Atoll	7792799
Niyaz Nizar	Villingili Council President	Ga. Atoll	7984316
Ms. Fizna Yousuf	Engineer	MEA	9674646
Aishath Shabeenaa	Lab technologist	MFDA	7988078
Abdulla Jaufar	Asst. Director	MoFA	7773886
Adam Ziyad	Director	MoFA	7796453
Ibrahim Fikeree	Asst. Project Officer	MoFA	9997816
Hussain Zameel	Asst. Project Officer	MoFA	7421880
Aishath Sheneenaa Waheed		EPA	7795458
Mohamed Hamdhaan	Asst. Director	EPA	
Ahmed Anwar	Asst. Director	MEE	
Dr. Mahmood Riyaz	Consultant		Mahmood.riyaz@gmail.com
Rai Mohamed Rameez	S. Research Officer	EPA	
Mohamed Waseem	Managing Director	Ensis	

Abdulla Saeed	Director	Ensis	
Ali Ahmed	Production Manager	Ensis	bio@ensisgroup.com
Amaal Hussain	Assistant Manager	Ensis	Amaal.hussain@ensisgroup.com
Hamid Ahmed	Manager Marketing	Ensis	
Nazim Naahee	Engineer	Ensis	9887574

14 CONCLUSIONS

The EIA focuses primarily on the environmental impact and mitigation measure of constructional and operational phase of the proposed fish purchase, loading/unloading storage and transportation facility development project in Ga. Raaverrehaa Island and health and safety issues related to the process. The study has identified five main activities that would cause negative environmental impacts from the proposed development. Those, in order of significance, are:

- ✓ Vegetation clearance
- ✓ Effluent, wastewater discharge.
- ✓ Water consumption
- ✓ Energy consumption
- ✓ Construction waste

Of these a long term impact would be from effluent discharge into the sea and vegetation clearance. These impacts would be cumulative occurring over long period of time and so can be managed through proper monitoring and addressing them in a timely manner. Based on the scale of the development impacts associated with blood water discharge and vegetation clearance are minor insignificant issues. The proposed facility will be used only for fish purchase and storage, no processing will take place in this facility. Therefore no much of blood water will be generated in the facility. If the project related infrastructures are constructed exactly as proposed maximum 50 mature coconut palms will be required to clear. This amount can be significantly reduced minor adjustment and shifting are made to avoid the coconut trees.

The study has evaluated alternative options for the project and found that the proposed development is the right thing to do. To enhance the water circulation in the reef and to limit the access to Raaverrehaa it is recommended to cut a channel through the walkway or remove it as an alternative for keeping the solid walkway which blocks water motion on the reef, increase nutrient enrichment and subsequent growth of seagrass on the eastern side of the reef and provides unlimited land access to the island. The report has come-up with an extensive monitoring programme that will keep on monitoring the environmental changes associated with the development and make necessary adjustment to the activities of the project based on the findings of various measured environmental parameters suggested in the monitoring plan.

The assessment also showed there is strong positive environmental impact – the most important being the socio-economic aspect - the employment and livelihood for the fishermen and diversification of fisheries in the region. The development would also create healthy competition between MIFCI (Koodoo) and Ensis and therefore the likely to facilitate the regulation of purchase price. Harvest rates of the skipjack and yellowfin tuna from the Maldivian fishery are considered to be minimal relative to the total removal from the Indian Ocean stock.

On the basis of this environmental impact assessment study and the impact mitigation measures proposed in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of the proposed fish purchase and cold facility development in Raaverrehaa will substantially outweigh its imposition on the environment.

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16 ANNEXURE

Appendix 1: Approved ToR of the for the developing fish purchase and storage facility in Raaverrehaa

Appendix 2: Fish purchase and storage facility in Raaverrehaa concept design

Appendix 3: MoFA letter indicating Raaverrehaa leased to Ensis Fisheries Pvt. Ltd.

Appendix 4: Letter acknowledging the receipt of EIA report to Ga. Villingili Council

Appendix 5: Commitment letter from the Proponent

Appendix 6: Ground and sea Water test results