

# ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Upgrading of Island Waste Resource Management  
Centre with Anaerobic technology at  
Kudahuvadhoo, Dhaalu Atoll



**Report Prepared by LAMER Group Pvt Ltd**

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February 09 2021

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## Consultants Declaration

I certify that to best of my knowledge the statements made in this Environmental and Social Management Plan for the upgrading of the Island Waste Resource Management Centre with Anaerobic Digestion (AD) Technology at Kudahuvadhoo, Dhaalu Atoll, are true, complete and correct.

Name: Hussein Zahir

Consultant Registration Number: EIA P04-07



Signature:

Company Name: Land and Marine Environmental Resource Group Pvt Ltd

Date: 14<sup>th</sup> February 2021

## **Proponent's Declaration**



Ministry of Environment  
Male', Republic of Maldives.



PREVENT  
DOMESTIC  
VIOLENCE

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ދާއިރާ: ބައްލަވާލެވިފައިވާ ގަވާއިދު

Date: 8 February 2021

No: 438-MCEP/INDIV/2021/15

**To Whom It May Concern**

**Sub: Commitment to undertake Mitigation and Environmental Monitoring**

The Environmental and Social Management Plan (ESMP) prepared for the proposed establishment of the Island Waste and Resource Management Centre (IWRMC) in Dh. Kudahuvadhoo has been prepared in accordance with the Environmental and Social Assessment and Management Framework (ESAMF) of the Maldives Clean Environment Project (MCEP) and the safeguards requirements of the World Bank.

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

Sincerely,

Ahmed Murthaza,

Director General, Waste Management and Pollution Control Department



# **1 Executive Summary**

## **Background**

Kudahuvadhoo of South Nilande Atoll with a residing population of 4,500 people is equipped with an Island Waste Resource Management Center (IWRMC) of area 0.22 ha built at the south eastern end of the island. The existing center is built and operated by the island council. Recently in 2019, an operation license was also issued by the EPA to the council for managing the island waste in Kudahuvadhoo. However, the center is now in need of repair and upgrade as currently most of the machineries are not functional. This has led to open burning of waste and accumulation of excess unorganized waste within the center. As per the feasibility study (CITRES & MEECO, 2019) that was carried out for regional solid waste management system in Zone 4&5, it was recommended and later decided that anerobic digestion (AD) is the most feasible technology for treating organic waste generated in Dh. Kudahuvadhoo

The project would primarily involve construction of a 1.5-ton AD plant within the boundary of the existing IWRMC and undertaking certain upgradation works to allow better waste management at the center.

The project will include construction of new infrastructure inclusive of an organic waste processing area. Once the infrastructure is in place, an anaerobic digester plant will be set up at the facility to facilitate treatment of the organic waste. Upon completion of the project, the operations of the facility will be handed over to the Island Council. Training needs for the proper operation of the facility will be identified through the assessment and will also be incorporated into the report.

## **Key impacts**

Impacts on the environment during construction and operation of the facility have been identified through interviews with the project management team, field data collection and surveys. Assessment of the environmental impacts associated with project components has been carried out using the Rapid Impact Assessment Matrix (RIAM) which allows both subjective and quantitative assessment of the project components and natural environment to understand various impacts that may arise from the project. The environmental components of the project are categorized into physical/chemical, biological/ecological, social/cultural and economic including operational aspects. The outcome of the matrix based on the project components against environmental components showed positive and negative outcomes. Significant negative impacts of the project are:

- Impacts due to sorting and storage of hazardous waste
- Health and safety risks to the workers during construction and operational work

- Air pollution due to emissions associated with construction machinery
- Potential impacts due to discharge or excess digester liquid to the ground

Lesser negative impacts from the project includes impacts on the environment due to accidental spills during transfers and material handling.

Significant positive impacts and benefits of the project are:

- Benefits to the island community (both social and economic) due to improved waste management practices and operation of the facility,
- Changes to the environment due to improved waste processing methods

## **Mitigation measures, monitoring and alternatives**

The ESMP identified in this document gives mitigation measures for all significant impacts due to the project. Mitigation measures such as the following have been identified in the ESMP:

- Provision of adequate training in proper method of handling of machinery and materials during both construction and operational phase.
- Provision of adequate training in proper method of handling of waste during collection and disposal during operational phase.
- Provision of all protective gear to workers during both construction and operations.
- Implementation of the Grievance Redress Mechanism which has been formulated by the proponent, both during construction and operations.
- Care should be taken to maintain the flaring vent and the flame so as to have controlled burning (to prevent CH<sub>4</sub> emissions).

Monitoring programme identified in the report will enable the proponent to assess whether the mitigation measures which have been identified in the report are effective. Early identification of negative impacts will enable the proponent to rectify the issue.

Alternatives have also been discussed for the method of organic waste treatment and source of power generation. After consideration of all alternatives, the proposed components have been selected for both.

To conclude, with due consideration to the environmental components identified and the extent of the project activities and their likely and predicted impacts identified, with proposed mitigation measures and monitoring followed, it is concluded that the project is feasible and justified. Furthermore, the positive benefits due to the project, both to the environment and island community outweigh the negative effects on the environment during the project. The Consultant further recommends the following:



1. Adherence to all relevant legislations, regulations, guidelines and standards during construction and operation of the IWRMC;
2. Establish environmental and occupational health and safety procedures for all relevant components;
3. Installation of renewable energy sources at IWRMC, such as solar panels to source power for operations;
4. Utilise the biogas produced to generate electricity which can be used to power the IWRMC operations
5. Ensure that measures are in place to address the issue of excessive digester liquid (liquid fertilizer), so as to enable its utilization or disposal in an environmentally friendly manner
6. Carryout awareness raising campaigns to increase awareness of the public regarding proposed work;
7. Ensure all trainings identified under the Training programme of this report are properly implemented to ensure proper implementation of the project at all phases;
8. Encourage greater participation of women, especially during operational stage;
9. Ensure proper supervision and inspection of the IWRMC at regular intervals.





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۱. جَدِّسُوْجِدَّارِ دُغْدَغَرِ رِمَّرَ كَسْرَتِ مَوْرِ اَرْتِرِ اَبْسُوْمَاوَارِ اَنِيْ مَوْرِ حَسُوْمَاوِ  
نَمَزَرِ يَمَزَرِ

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8. دَسْمُو جَرْدِي دَجَرُو مَوْدِي اِر (بَرَسُو سَوْدُو مَوْدِي جَرْدِي) اِر سَرُو سَرَسُو مَوْدِي جَرْدِي مَوْدِي مَوْدِي

9. اِس دَسْمُو جَرْدِي دَجَرُو مَوْدِي اِر (بَرَسُو سَوْدُو مَوْدِي جَرْدِي) اِر سَرُو سَرَسُو مَوْدِي جَرْدِي مَوْدِي مَوْدِي

## **2 Introduction**

### **2.1 Background and justification**

Kudahuvadhoo of South Nilande Atoll with a residing population of 4,500 people is equipped with an Island Waste Resource Management Center (IWRMC) of area 0.22 ha built at the south eastern end of the island. The existing center is built and operated by the island council. Recently in 2019, an operation license was also issued by the EPA to the council for managing the island waste in Kudahuvadhoo. However, the center is now in need of repair and upgrade as currently most of the machineries are not functional. This has led to open burning of waste and accumulation of excess unorganized waste within the center.

As per the feasibility study (CITRES & MEECO, 2019) that was carried out for regional solid waste management system in Zone 4&5, it was recommended and later decided that anerobic digestion (AD) is the most feasible technology for treating organic waste generated in Dh. Kudahuvadhoo. Hence, the Ministry of Environment (ME), through the World Bank funded Maldives Clean Environment Project (MCEP) intends to pilot AD in the existing IWRMC of Dh. Kudahuvadhoo. The project would primarily involve construction of a 1.5-ton AD plant within the boundary of the existing IWRMC and undertaking certain minor upgradation works to contemporaries the center.

In addition to introducing AD technology with its setup, the project also proposed to bring some additions and changes to the layout of the existing setup, though the size of the IWRMC will remain the same, where all the civil works will be confined to the previously demarcated boundary. New infrastructure to be constructed as part of the project include:

- Organic waste processing area:
- Waste unloading, loading and weighing area
- Processed inorganic waste storage area
- Bulk waste storage area
- Hazardous waste storage area
- Drains installation
- Water and electricity connections
- Connecting water
- Fire safety equipment

Additional details of these structures are given in Chapter 4. Once the infrastructure is in place, 1.5-ton capacity Plug Flow Reactor or PFR anerobic digestion (AD) plant will be set up at the facility to allow the digestion of the waste using anaerobic technology. Detailed description of this technology is also given in Chapter 4 of this ESMP.

The proponent of this project is the Ministry of Environment through the World Bank funded Maldives Clean Environment Project. Upon completion of the civil works and set up of AD plant, the operations of the plant will be handed over to the Island Council. Training needs for the proper operation of the plant will be identified through the assessment and will also be incorporated into the report.

The Island Council has formulated and published in the government gazette a Regulation on waste management and disposal for the island (2013/R-1654). As per the Regulation, waste management and disposal areas have to be demarcated, based on the Land use plan of the island and within 3 months of the implementation of the Regulation. Furthermore, all plans and guidelines to ensure proper implementation of the Regulation should be formulated and publicized within 3 months of the implementation of the Regulation. In this aspect the Island Waste Management Plan (IWMP) for a 5 year period was formulated in November 2016 and approved by EPA on the 22<sup>nd</sup> of September 2017. The main components of the IWMP are as given below.

### **2.1.1 Island Waste Management Plan (IWMP) of Kudahuvadhoo**

The island Waste Management plan was formulated to implement waste management of the island in a planned, environmentally friendly and sustainable manner. The plan was formulated in consultation with the members of the Island Council, institutions and NGOs on the island and other relevant stakeholders of the island. The IWMP has 11 targets:

1. Formulate and implement the Island waste management regulatin
2. Reduce waste produced on the island
3. Implement Reuse and Recycle concepts
4. Promote waste as a resource
5. Ensure to operate a sustainable waste management system
6. Segregation of waste at household level
7. Segregation of waste at the IWRMC
8. Establish a system to remove waste from the island
9. Create awareness amongst the community about the importance of having a clean environment
10. Construct and develop the IWRMC
11. Implement a mechanism to ensure safe disposal of hazardous waste

Key measures identified in the IWMP to achieve these targets are:

- Run awareness campaigns about importance of waste management to increase awareness of the island community
  - Install dustbins are different areas of the island



- Implement a system to segregate waste at household level and transport segregated waste to the IWRMC
  - Provide dustbins for the households
  - Council to collect segregated waste from households and transport to IWRMC
- Transport of waste which cannot be disposed at the IWRMC to the RWMF
- Increase awareness of the school community, and others regarding the reduce, reuse and recycle concept
  - Reuse of plastic containers for different purpose, such as gardening
  - Metal can compaction
  - Installation of plastic shredder and glass crusher
  - Use organic waste to make compost
  - Sale of recyclable waste such as plastics, metal and glass

Further to these measures, the plan identifies specific actions to be taken to achieve each of the 11 targets. The plan also identifies parties responsible for implementing the actions, as well as costs to be incurred. Overall, implementation of the plan will be overseen by the Waste Management Committee formulated as part of the IWMP.

Details of set of fees to be taken from households, institutions, businesses etc. are also identified in the plan. Details of monthly charges from different sectors are as follows:

- |                                     |              |
|-------------------------------------|--------------|
| • Households                        | – MRF 150    |
| • Office buildings                  | – MRF 250    |
| • Guesthouses                       | – MRF 200    |
| • Café's / shops                    | – MRF 300    |
| • Boat yards / Industrial areas     | – MRF 750    |
| • Management of waste from a resort | – MRF 10,000 |

## **2.2 Purpose of the report and need for the ESMP**

The Environmental Impact Assessment (EIA) Regulation of Maldives (2012/R-27) and amendments gives a list of development projects for which an EIA is required (Schedule Raa of the Regulation). With respect to waste management, EIA is required for three types of projects; installation of incinerators with a capacity of 10 or more tonnes/day, development of landfill using waste and development of large-scale waste management centres (capacity of treating 10 tonnes/day).

As per due process for projects not listed in this Schedule, a screening form for the project was submitted to the Environmental Protection Agency, to assess the level of impact due to the project. Based on this project description and areas of impact, EPA has stated that no further assessment is necessary for the proposed project. At the same time, World Bank (WB), as the funding agency

has also carried out screening of the project and stated that an Environmental and Social Management Plan should be prepared, based on the TOR issued by WB. As EPA does not require any further document, this ESMP is prepared as required by the WB based on the TOR issued by WB (see Appendix 3).

## **2.3 Terms of Reference (TOR)**

As stated above, the Terms of Reference issued by World Bank for the project titled “ESMP or ESIA for the establishment or upgrading of IWRMC with Anaerobic Digestion (AD) Technology”, will be followed for the formulation of this ESMP. The chapters of this report are as per the structure given in the TOR and are as follows:

1. Executive summary
2. Introduction
3. Legislative and Regulatory considerations
4. Study Area and Project Description
5. Existing environment
6. Impact Identifications
7. Project Alternatives
8. Mitigation and management of negative impacts
9. Monitoring and reporting plan inclusive of Grievance redress mechanism
10. Training recommendations
11. Contingency plans
12. Stakeholder consultations
13. Gender empowerment / Preparation of Gender Action plan
14. Conclusion

## **2.4 Literature review**

The following documents have been reviewed to get a better understanding of the project and formulation of ESMPs for similar projects.

- Environmental and Social Assessment and Management Framework (ESAMF) & Resettlement Policy Framework (RPF) - Maldives Clean Environment Project (Ministry of Environment and Energy, 2016)
- Environmental Management plan for the upgrading of Island Waste Management Centre in N. Holhudhoo. Prepared for Ministry of Environment (Ahmed Hassaan Zuhair, October 2019)
- Environmental and Social Management plan for the establishment of Island Waste Management Centre - Th. Kin'bidhoo. Prepared for Ministry of Environment and Energy (MEECO, July 2018)

- Environmental and Social Management plan for the proposed establishment of Island Waste and Resource Management Centre in Th. Madifushi. Prepared for Ministry of Environment and Energy (Ahmed Hassaan Zuhair, January 2021)
- Feasibility Study for a Regional Solid Waste Management System in Zone IV and V, Maldives - Report Phase 2 – Draft 1 Final Version. Prepared for Maldives Clean Environment Project - Ministry of Environment (CITRES and MEECO, November 2019)
- Waste Management Regulation (R-58/2013) and amendments
- Island Waste Management Regulation – Dh. Kudahuvadhoo (2013/R-1654)
- Regulation on protection of the environment – Dh. Kudahuvadhoo (2013/R-1658)
- Island Waste Management Plan (5 years) – Dh. Kudahuvadhoo Council (24<sup>th</sup> November 2016)

### **3 Legislative and Regulatory considerations**

This chapter describes national relevant laws and regulations, as well as international agreements that are pertinent to the construction and operation of the project. The Environmental Protection and Preservation Act of the Maldives (Law No. 4/93) is the governing legislation for the protection of the environment. Several regulations have been implemented pertaining to this legislation and those of relevance to the project are given in Table 1. The Government agencies that are specifically related to the project are;

- Ministry of Environment (ME)
- Environmental Protection Agency (EPA)
- Dh. Kudahuvadhoo Island Council

The national laws and regulations and the international conventions relevant to the proposed project are outlined in the following table (Table 1) with specific relevance and level of compliance.

**Table 1. Legislation relevant to the project**

Legislation	Description	Relevance to the project
<b>National Laws and Regulations</b>		
Environmental Protection and Preservation Act (Law 4/93)	<p>This is a framework law related to overall aspects of environmental protection in the Maldives.</p> <p>The Environmental Protection and Preservation Act (EPPA) states that any developmental project which has a potential impact on the environment should have an EIA carried out prior to commencement of the project. List of such projects are given in the EIA Regulations 2012. Those developmental projects which do not require an EIA undergo screening to assess level of impact based on which EPA issues a decision.</p> <p>Article 2: Government Authorities shall provide necessary guidelines on environmental protection and all concerned parties shall take due consideration to these guidelines,</p> <p>Article 7: Any type of waste, oil, gas or any substance that may be harmful (e.g. toxic/hazardous or nuclear) to the environment shall not be disposed within the territory of Maldives.</p>	The proponent (developer) shall be aware of these requirements and inform the contractor. It is advised to the proponent that the contractor is appropriately informed.
Decentralization of Administrative Areas Act (Law 6/2010)	<p>The Decentralisation Act (2010) (D Act) formalised the roles and responsibilities of Atoll and Island Councils and required that they be democratically elected. The Constitution mandates Councils to provide democratic and accountable governance; foster the social and economic well-being and development of the community; and establish safe, healthy and ecologically diverse environment. The Decentralisation Act requires Island and City Councils to provide and maintain basic public services such as water, electricity, and sewage systems; to organise to sweep and clean the roads, maintain cleanliness of the island and its beauty and to build and maintain roads.</p> <p>Hence establishment of good waste management system with a waste management plan for the island is one of the many responsibilities of the island council. According to the act, the island council are required to prepare their own regulations to provide waste management services. This regulation may</p>	

	include the grievance redress mechanism proposed in the monitoring plan to this report.	
Environmental Impact Assessment Regulation (2012/R27) and amendments (5)	<p>The regulation details out the screening process for environmental assessments, and the contents that need to be covered in the different types of assessments. It includes Initial Environmental Examination, Environmental Impact Assessment and Environmental Management Plans.</p> <p>The regulation also provides a list of the types of development projects that have a socioeconomic environmental relevance in Appendix Raa (D) of the regulation that would require to carry out a detailed Environmental Impact Assessment.</p> <p>The amendments included</p> <ul style="list-style-type: none"> <li>• Revision of EIA review period and associated costs, qualification required for monitoring the Environmental Management Plan,</li> <li>• Revision to the list of projects that requires EIAs, projects that can be undertaken by simply applying mitigation measures for projects such as for maintenance dredging of harbors, clearance of vegetation within allocated plots for households and for roads,</li> <li>• Transferring of Tourism related EIA decision making to Minister of Tourism for tourism related activities and subsequent reversal of decision making to EPA</li> <li>• Categorization of EIA consultants, point system for consultants to assess performance and license suspension, a code of conduct for consultants, and increment to the fine for non-compliance of regulation and violations.</li> </ul>	The project has been screened by EPA for environmental compliance level categorization and screening decision by EPA was that the proponent should attain environmental clearance through submission of an EMP for the project.
Regulation on Environmental Liabilities (2011/R-9)	<p>The main objective of this regulation is to ensure prevention of actions violating the EPPA 4/93. The regulation also aims to ensure compensations for all the damages that are caused by environmentally detrimental activities.</p> <p>The regulation sets measures and standards for different types of environmental liabilities and equal standards that shall be followed by the implementing agencies while implementing the regulation.</p> <p>According to this regulation the Government of Maldives reserves the right to claim compensation for all the activities which have breached the EPPA 4/93.</p>	<p>The proponent, developer and operators of the proposed project will be liable to any environmental damage caused during both construction and operation phase of the project. All parties should be well informed of such requirements.</p> <p>The project should ensure proper mitigation measures are in place to avoid any such damage.</p>



<p>Utility Regulation Authority Act (2020):</p>	<p>The Utility Regulatory Act establishes the powers and responsibilities of the Authority formed to plan and implement the activities with respect to utility service provision. The Act also identifies the policies and guidelines to be followed in planning such service provision.</p> <p>In this act Utility services are referred to provision of freshwater, sewerage, power and waste management services for a fee or as a business.</p> <p>The Act has 7 key objectives, which are as follows:</p> <ul style="list-style-type: none"> <li>• Ensure that utility services are available to the whole population at a reasonable price, and in a trustworthy, robust and sustainable manner;</li> <li>• Ensure that utility services are planned in an efficient and environmentally friendly manner</li> <li>• Ensure that the utility service provision is successful, of good quality and are able to meet the needs of the population</li> <li>• Ensure that utility service provision is done in a just manner, and that there is continued development of the services through a competitive market</li> <li>• Formulate and implement policies and guidelines to be followed in utility service provision</li> <li>• Ensure utility service providers abide by this Act and all other relevant acts and regulations and establish a penalization system for those who break the law</li> <li>• Increase awareness about the rights provided to those who receive the services and the service providers</li> </ul> <p>The regulatory works for waste management has been transferred to newly established Utility Regulation Authority (URA).</p>	<p>Operator of the IWRMC shall abide by all requirements under the Act</p>
<p>Waste Management Regulation (R-58/2013)</p>	<p>The Waste Management Regulation of the Maldives was gazetted on the 5th of August 2013 and came into effect 6 months from the date, on 5th of February 2014. The Regulation was enacted through the powers given to the Ministry through Law 4/93. The main objective of this regulation is to implement the national policy on waste management and through its implementation, facilitate the following so as to preserve the environment:</p>	<p>The development of the Waste management centre on the island will follow all guidelines and protocols set under this regulation. The operations will commence after</p>

	<ul style="list-style-type: none"> <li>• Minimise both direct and indirect impacts due to waste on environment and human health.</li> <li>• Establish standards for waste management</li> <li>• Formulate an integrated framework for waste management, and establish environmentally sound and sustainable means for waste management</li> <li>• Encourage waste minimisation, reuse, recycling and recovery</li> <li>• Implement “Polluter Pay” principle</li> <li>• Introduce “Extended Producer Responsibility”</li> </ul> <p>The regulation has five focus areas:</p> <ul style="list-style-type: none"> <li>• Waste Management Standards; defines standards for waste collection, transfer, treatment, storage, site management, landfills and managing of hazardous waste</li> <li>• Procedure for approval of Waste management permits (for waste management sites)</li> <li>• Standards and permits required for transport of waste (land and sea)</li> <li>• Monitoring and reporting requirements</li> <li>• Enforcement and implementation procedures and penalties</li> </ul>	obtaining all the required licenses and permits.
Environmental Guidelines for site selection of waste management centers	This set of guidelines formulated by EPA provides guidance in selecting an environmentally suitable site for the waste management centers in inhabited islands. It also aims to provide guidance in ways to minimize and mitigate potential environmental and social impacts from the activities that shall be carried out in the waste management center	Site allocation for IWRMC at Kudahuvadhoo was done prior to initial development of the IWRMC by council, in 2019 and meets all requirements of EPA.
Island Waste Management Regulation- Dh. Kudahuvadhoo (2013/R-1654)	<p>This regulation states that waste management and disposal areas have to be demarcated, based on the Land use plan of the island and within 3 months of the implementation of the Regulation. Furthermore, all plans and guidelines to ensure proper implementation of the Regulation should be formulated and publicized within 3 months of the implementation of the Regulation.</p> <p>The regulation outlines the measures the Council should consider when allocating a waste disposal site, guidelines to follow when carrying waste from one place to another, during disposal of waste and burning, both at the disposal site and within own plot.</p> <p>The regulation also includes the fine structure in case of breach of the articles of the regulation in managing waste in the island.</p>	The land area allocated is in conformance to the regulation

Regulation on protection of the environment – Dh. Kudahuvadhoo (2013/R-1658)	<p>This regulation was formulated to enable the Island Council to protect the environment of the island and identify the measures to be taken against those who harm the environment of the islands under the Council jurisdiction.</p> <p>With respect to waste, the regulation states:</p> <ul style="list-style-type: none"> <li>a) Disposal of hazardous/ dangerous waste, fuel or oils should not be carried out in a manner which is harmful to the environment, at any area under the Council jurisdiction</li> <li>b) The council should designate a specific area for disposal of material if required</li> <li>c) Disposal of such waste through burning can only be carried out by the Council or through Council authorization</li> <li>d) If the Council does undertake disposal of such waste through burning it should be done so in a manner which is not harmful to the health and wellbeing of the personnel involved as well as the community</li> <li>e) The regulation does not impede the Council from taking a fee for such service provision</li> </ul>	Disposal of hazardous waste through this project will follow this regulation as well as the Waste Management Regulation
Maldives Land Act	<p>The act governs allocation of Maldivian land for different purposes and uses and other issues regarding the issuing of land, issuing of state dwellings or private dwellings constructed for residential purposes and the sale, transfer and lease of Maldivian Land.</p> <p>Under article 2, all transactions concerning issuing, receiving, owning, selling, lease, utilizing and using Maldivian land shall be conducted in compliance with this Act.</p>	Land allocation for development of IWRMC has been approved by the Maldives Land and Survey Authority (Letter from MLSA in Appendix 4)
Land Use Planning regulation (2002)	<p>Land Use Planning (LUP) regulations were first issued in 2002 by the former Maldives Housing and Urban Development Board (MHUD) to provide the necessary policy framework and guidelines to improve land use and development activities nationally, with an emphasis on optimizing the use of the limited land available. It sets out a broad framework for land use activities in planning policies and processes including planning procedures and categories, plan preparation, consultation and approval processes and implementing strategies</p> <p>Clauses specific to waste management in the LUP regulation states that:</p>	The site proposed for development of the IWRMC has been allocated with due consideration to the guidance given in this regulation.

	<p>a) Consideration shall be given to allocation of a waste management site. The waste management site shall be located away from the population and consideration given to wind direction, smell, smoke, flies and other nuisances that impact on local amenities.</p> <p>b) There shall be a buffer zone between the waste management site and the population. The buffer zone can be used to accommodate industrial activities or may consist of vegetation.</p> <p>c) The exact details and stages of how the waste is managed need not be given on the land use plan. However, the land use plan should be prepared in such a way, that it would accommodate a sustainable waste management practice.</p> <p>d) The rules and regulations of the Government agencies on waste management should be followed in terms waste management.</p>	
By-law on cutting down, uprooting, digging out and export of trees and palms from one island to another	<p>The bylaw states that the cutting down, uprooting, digging out and export of trees and palms from one island to another can only be done if it is absolutely necessary and there is no other alternative. It further states that for every tree or palm removed in the Maldives two more should be planted and grown in the island.</p> <p>The bylaw prohibits the removal of the following tree types;</p> <ul style="list-style-type: none"> <li>• The coastal vegetation growing around the islands extending to about 15 meters into the island are protected by this bylaw;</li> <li>• All the trees and palms growing in mangrove and wetlands spreading to 15 meters of land area are protected under this bylaw;</li> <li>• All the trees that are in a designated protected area;</li> <li>• Trees that are being protected by the Government in order to protect species of animal/organisms that live in such trees</li> <li>• Trees/palms that are unusual in structure</li> </ul>	The proposed work does not require any vegetation clearance, as work will be carried out at site which was allocated for IWRMC in 2017 and where development work had already commenced
Protected Areas  Regulation on Protected Areas Regulation (2018/R-78)	<p>This regulation was published in 2018 under the EPPA 4/93 pursuant to Article 4. The objectives of this Regulation are;</p> <p>(a) to establish effective guidelines for declaration and management of protected areas;</p> <p>(b) to ensure that the process of protected area declaration is consultative transparent;</p>	There are no protected sites within vicinity of project site or even within the Atoll

	<p>(c) to enlist environmentally significant areas in the Maldives; (d) to establish and sustainably a mechanism to maintain a framework for protected areas; (e) to enhance awareness and participation of community in protected area designation and management; (f) to ensure future generations benefit from natural resources, ecosystem services and biodiversity richness of the country.</p> <p>61 sites as of July 2019 has been declared as protected areas in the Maldives. These include dive sites, mangroves and some ecologically significant islands.</p>	
Environmentally Sensitive Areas (ESAs)	<p>ESAs include possible fish breeding areas, bird sanctuaries, micro atolls, islands, mangroves and marine areas. A total of 274 ESAs has been designated as of 2017.</p> <p>Ministry of Environment has designated these areas as Environmentally Sensitive Areas (ESAs) with regards to the richness of its biodiversity and significance to the ecosystem.</p> <p>These areas are given careful consideration before approval of any type of development to ensure sustainable development which mitigates any negative impact to the environment.</p>	<p>There is one ESA on the western side of the island, approximately 400m from project site (outside impact boundary). Other sensitive areas although not listed on the EPA list also include additional smaller mangrove areas on the NW side of the island and SW side of the island, both outside of the 30m impact boundary area</p>
Regulation of Health and Safety measures specific for the Construction industry (2019/R-156)	<p>The Regulation on Health and Safety measures specific for the Construction industry was published in the government gazette on 30th January 2019 and came into effect on the same day. The implementing agency for the regulation is the Ministry which is mandated with enforcing the legislations relevant to the Construction industry at any given time (at present MNPHI).</p> <p>The main purpose of the Regulation is twofold:</p> <ol style="list-style-type: none"> <li>1. Identify and specify the minimum measures which need to be in place to ensure safety of the workers and the general public</li> <li>2. Identify the penalties which will be given and personnel responsible for this action, in instances where construction projects do not abide by the Regulation</li> </ol> <p>Second chapter of the Regulation identifies the roles and responsibilities of the Contractors and Construction companies/workers. Key points include:</p>	<p>The proposed project will have to adhere to this regulation taking all precautionary measures identified in the regulation during the construction phase of the project.</p>

	<ul style="list-style-type: none"> <li>• Formulation of a Health and Safety operations manual for projects exceeding MVR 1.5million in cost. These manuals will be used to train the workforce in this aspect</li> <li>• Formulation of an Emergency response plan</li> <li>• Appointment of a Site Safety Supervisor and details of their roles and responsibilities</li> <li>• Insurance scheme (to ensure compensation of workforce and/or neighboring houses should the need arise during construction work)</li> <li>• Measures to ensure public safety during construction work</li> <li>• Proper use of Personal Protective equipment (Contractor's responsibility to provide these to their workforce)</li> <li>• Regulation further specifies measures to be in place when working on different phases of the project and while using different equipment for work (working at levels 3m high from ground level, on rooftops, in enclosed areas, using scaffoldings, ladders, working with electricity, use of chemicals and welding, use of electric power tools and mechanical tools, heavy machinery)</li> <li>• Measures to be in place when storing materials for construction</li> <li>• Use of safety boards issued by relevant authorities</li> <li>• Use of safety measures (such as demarcation tape) to clearly demarcate construction site, so as to ensure safety of public</li> <li>• Operation procedures in instance of accidents at the site</li> </ul> <p>Chapter 3 of the Regulation identifies measures to be taken by enforcement authority in instances of an accident at the construction site. The chapter also details penalties to be issued in instances where the Regulation is not adhered to during construction projects.</p>	
Public Health Protection Act (07/12)	<p>The Public Health Protection Act aims to establish policies to protect public health and identify the institutional arrangement for implementing the policies, regulations and guidelines.</p> <p>The act has a chapter on health hazards which should be adhered in any development project as well.</p>	<p>The proposed project should adhere to this act in relation to identifying the potential health hazards during construction and operation stage of the IWRMC.</p> <p>Furthermore, as per this act the policies and guidelines formulated</p>



	It also includes a section on establishing policies to respond to public health emergencies.	<p>under this act and the ones formulated for the ongoing COVID pandemic should be strictly followed during the development phase of the project.</p> <p>During the preparation of the ESMP, HPA guidelines are followed in carrying out the field surveys and also the stakeholder discussions.</p>
Guideline on travel related quarantine among people travelling in 10 or more groups (HPA Guidelines of relevance to present COVID 19 situation)	<p>This guideline highlights the measure to observe if group of 10 people or more stays in a shared accommodation (room or barracks or dormitory) during travel related quarantine. This guideline also applies to those who are travelling to an island where there is no community spread, from any island where there is community spread of COVID19. Clauses of this guideline of relevance to this project include:</p> <ul style="list-style-type: none"> <li>• If Maldivians and expatriates living in an island where there is community spread of COVID-19 travels to an island where there is no community spread of COVID-19, PCR test must be done not more than 72 hours prior to the scheduled time of departure to the island and should have a negative PCR result prior to travel.</li> <li>• People who have COVID-19 like symptoms such as fever, cough, respiratory symptoms etc., must not travel until 48 hours after resolution of symptoms even if their PCR test results are negative.</li> </ul> <p>The Guidelines also details procedures for travel applications, procedures to be followed during quarantine period inclusive of accommodation (such as accommodation in small groups, without meeting people from outside, distance between beds of 3ft etc.) during this period. It also gives details on procedures to be followed if someone who is in quarantine shows symptoms of COVID 19.</p>	<p>Construction workforce will abide by these guidelines prior to departure to the island and during their stay on the island.</p> <p>During the preparation of the ESMP, HPA guidelines are followed in carrying out the field surveys and also the stakeholder discussions</p>
<p>Labour and Working Conditions</p> <p>National Laws</p>	<p>The national laws and regulations relevant to labour and working conditions include:</p> <ul style="list-style-type: none"> <li>• Employment Act (2/2008)</li> <li>• Immigration Act (1/2007)</li> <li>• Anti-Human Trafficking Act (12/2013)</li> <li>• Pensions Act (8/2009)</li> </ul>	Contractors should ensure that all workers are treated according to the Employment Act.

	<ul style="list-style-type: none"> <li>• Human Rights Act (6/2006)</li> <li>• Regulation on Employment of foreign workers in the Maldives (2011/R-22)</li> <li>• Work Visa Regulation (2010/R-7)</li> </ul>	Contractor should ensure that all foreign workers have relevant documentations including the work visa as per Immigration Act and Work Visa Regulation.
<b>National Policies and Action Plans</b>		
National Biodiversity Strategy and Action Plan 2016 – 2025 (NBSAP) prepared under the Convention of Biological Diversity (CBD)	<p>NBSAP is a 10 year plan with the vision of Maldives is to be <i>“a nation of people that co-exist with nature and has taken the right steps to fully appreciate, conserve, sustainably use, and equitably access and share benefits of biodiversity and ecosystem services.”</i> by integration of biodiversity conservation into all areas of national planning, policy development and administration (MEE, 2015).</p> <p>The 6 strategies developed to achieve this includes;</p> <p>S1: Strengthen governance, policies and strategies for biodiversity, S2: Enhancing communication and outreach through awareness programs and capacity building, S3: Work together globally for biodiversity conservation, S4: Ensure sustainable use of biological resources, S5: Address threats to conserve biodiversity, S6: Strengthen information management and resource mobilization.</p> <p>Among these strategies, includes identifying ways to address threats to conserve biodiversity conservation (Strategy 5) under which targets includes:</p> <p>Target 17: By 2025 pressures on coral reefs and other vulnerable ecosystems due to anthropogenic activities and climate change are minimized</p> <p>Target 19: By 2025, impacted ecosystems that provide essential services related to water, human health, wellbeing and livelihood are restored significantly</p> <p>Target 23: By 2020 pollution from waste and sewage has been brought to levels that are not detrimental to ecosystem functions and biodiversity.</p>	The current project conforms to these policies, by carrying out the ESMP work prior to commencement of the project, so as to minimize impact on the environment and to incorporate ways of environmental monitoring and management during the project works.
National Waste management policy (2015)	<p>The key objective of the National Waste Management Policy is to ensure that all the policies, regulations, standards plans and masterplans are prepared with a common basis.</p> <p>The policy includes roles and responsibilities of waste management at individual level, household level, atoll level, regional level and national level.</p>	Operations of the waste management centre will be as per this policy and other waste management guidelines. Island Waste management plan will be implemented to ensure proper operations.

	<p>The policy outlines 10 strategies to address the issue of waste management in Maldives. These include the individual responsibilities of managing waste and island councils' responsibilities to prepare waste management plans and manage the waste at island levels; Collecting fees from households to manage waste; Encourage the utilities companies to carry out the task of managing waste at the islands; Establishment of regional waste management centers; Encourage and provide means to generate income using waste products; carry out trainings on waste management at national level.</p>	
<b>International legal frameworks</b>		
<p>IFC guidelines</p> <p>Environmental, Health and Safety guidelines for Waste management facilities</p>	<p>This set of Guidelines are applicable to all projects involving the management of municipal solid waste and industrial waste, including waste collection and transport; waste receipt, unloading, processing, and storage; landfill disposal; physico-chemical and biological treatment; and incineration projects</p> <p>The Guideline has two main parts:</p> <ol style="list-style-type: none"> <li>1. Industry specific impacts on the environment, occupational health and safety and community health and safety. Recommendations on ways to mitigate and manage these impacts are also given in the guideline.</li> <li>2. Performance indicators and industry benchmarks for environmental performance and occupational health and safety performance.</li> </ol>	
<p>Labour and Working Conditions</p>	<p>Maldives has signed 10 convention of the International Labour Organization with regards to labour and working conditions</p> <p>These includes:</p> <p>Fundamental 8 conventions</p> <ul style="list-style-type: none"> <li>• C029 - Forced Labour Convention, 1930 (No. 29) <i>ratified on 04 Jan 2013</i></li> <li>• C087 - Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87) <i>ratified on 04 Jan 2013</i></li> <li>• C098 - Right to Organize and Collective Bargaining Convention, 1949 (No. 98) <i>ratified on 04 Jan 2013</i></li> </ul>	<p>The contractor (s) should adhere to the measures mentioned in these conventions where relevant.</p> <p>Among the many things, abiding to these laws would ensure no exploitation of foreign migrant. The contractors should make timely payment to the workers (in full) and</p>

	<ul style="list-style-type: none"> <li>• C100 - Equal Remuneration Convention, 1951 (No. 100) <i>ratified on 04 Jan 2013</i></li> <li>• C105 - Abolition of Forced Labour Convention, 1957 (No. 105) ratified on 04 Jan 2013</li> <li>• C111 -Discrimination (Employment and Occupation) Convention, 1958 (No. 111) ratified on 04 Jan 2013</li> <li>• C138 - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 16 years <i>ratified on 04 Jan 2013</i></li> <li>• C182 - Worst Forms of Child Labour Convention, 1999 (No. 182) <i>ratified on 04 Jan 2013</i></li> </ul> <p>Technical 2 conventions</p> <ul style="list-style-type: none"> <li>• C185 - Seafarers' Identity Documents Convention (Revised), 2003, as amended (No. 185) <i>ratified on 05 Jan 2015</i></li> <li>• Amendments of 2016 to the Annexes of the Convention No. 185 <i>ratified on 08-Jun-2017</i></li> <li>• MLC, 2006 - Maritime Labour Convention, 2006 (MLC, 2006) <i>ratified on 07 Oct 2014</i></li> </ul> <p>All these conventions are considered in-force in the Maldives. Hence these should be strictly adhered in relation to all labour and working affairs.</p>	<p>they should not hold documents of the workers against their will.</p> <p>It is important to know that foreign migrant workers are not required to pay recruitment fees and there should not be any forced labour.</p> <p>Contractors should ensure that all workers local or foreign should be treated with equality, dignity and respect.</p>
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## 4 Project Description

### 4.1 Study Area

The proposed project will be undertaken in Kudahuvadhoo, South Nilande Atoll located in south central region of Maldives. The atoll consists of 56 islands of which 7 are inhabited. Kudahuvadhoo is the capital Dhaalu Atoll and is located at geographic coordinates N 02°40'15"; E 72°53'37" (Figure 1). The total area of Kudahuvadhoo is approximately 171ha including the reclaimed land and the airport. Currently approximately 36% (63 ha) of the total land is inhabited. A large area from the western side has been reclaimed and since 2017, the island hosts a domestic airport referred to as Dhaalu Airport. The resident population of the island was estimated at 2,447 during Census 2014 (NBS, 2015), which has almost doubled to 4,500 as per island council data.

The proposed work will be undertaken on the southeastern corner of the island, where the current IWRMC is located. The land area required for project development was allocated for the purpose and approved by Maldives Land and Survey Authority in 2019, at the time of initial construction of the IWRMC (land area approval document by MLSA is given in Appendix 4). Figure 1 shows the location of Kudahuvadhoo in Dhaalu Atoll and location of the existing IWRMC in the island. The closeup image also shows current waste dumping area just outside the existing IWRMC.



**Figure 1. Location of Kudahuvadhoo in Dhaal Atoll (left,) and location of IWRMC at Kudahuvadhoo (right, top) and closeup of existing IWRMC (right, bottom) (Larger map given in Appendix 5)**

## 4.2 Project components

The existing IWRMC of area 0.22ha was established in 2019 and are being used since then. The proposed project involves upgrading of the waste management center including establishment of an AD composting plant. However, the upgrade would not involve expansion of the existing IWRMC in terms of size as all the civil works required for the proposed AD piloting and other upgrades are planned to be carried out within the boundary of the existing center.

Details of existing infrastructure and new infrastructure to be developed are given in Table 2 and Figure 2 gives a schematic of the layout for proposed IWRMC showing the existing areas and proposed areas. A larger scale drawing is given in Appendix 6 of this report.

**Table 2 Existing and proposed infrastructure to be developed under the project**

<b>Existing Infrastructures</b>	<b>Proposed Infrastructures</b>
<ul style="list-style-type: none"><li>• Machine Room</li><li>• Office / Toilet</li><li>• Septic Tank</li><li>• Wood Waste Area.</li><li>• Unprocessed Inorganic Waste Storage Area</li><li>• Inorganic Waste Processing Area</li><li>• Collection Bays</li><li>• Burner.</li><li>• Boundary Wall and Gate</li><li>• Fire extinguishers (2 nos.)</li></ul>	<ul style="list-style-type: none"><li>• Organic waste processing area</li><li>• Waste unloading and loading area</li><li>• Processed inorganic waste storage area</li><li>• Bulk waste storage area</li><li>• Hazardous waste storage area</li><li>• Installing drains</li><li>• Connecting Water</li><li>• Fire safety equipment</li><li>• Connecting electricity to the new developments</li></ul>

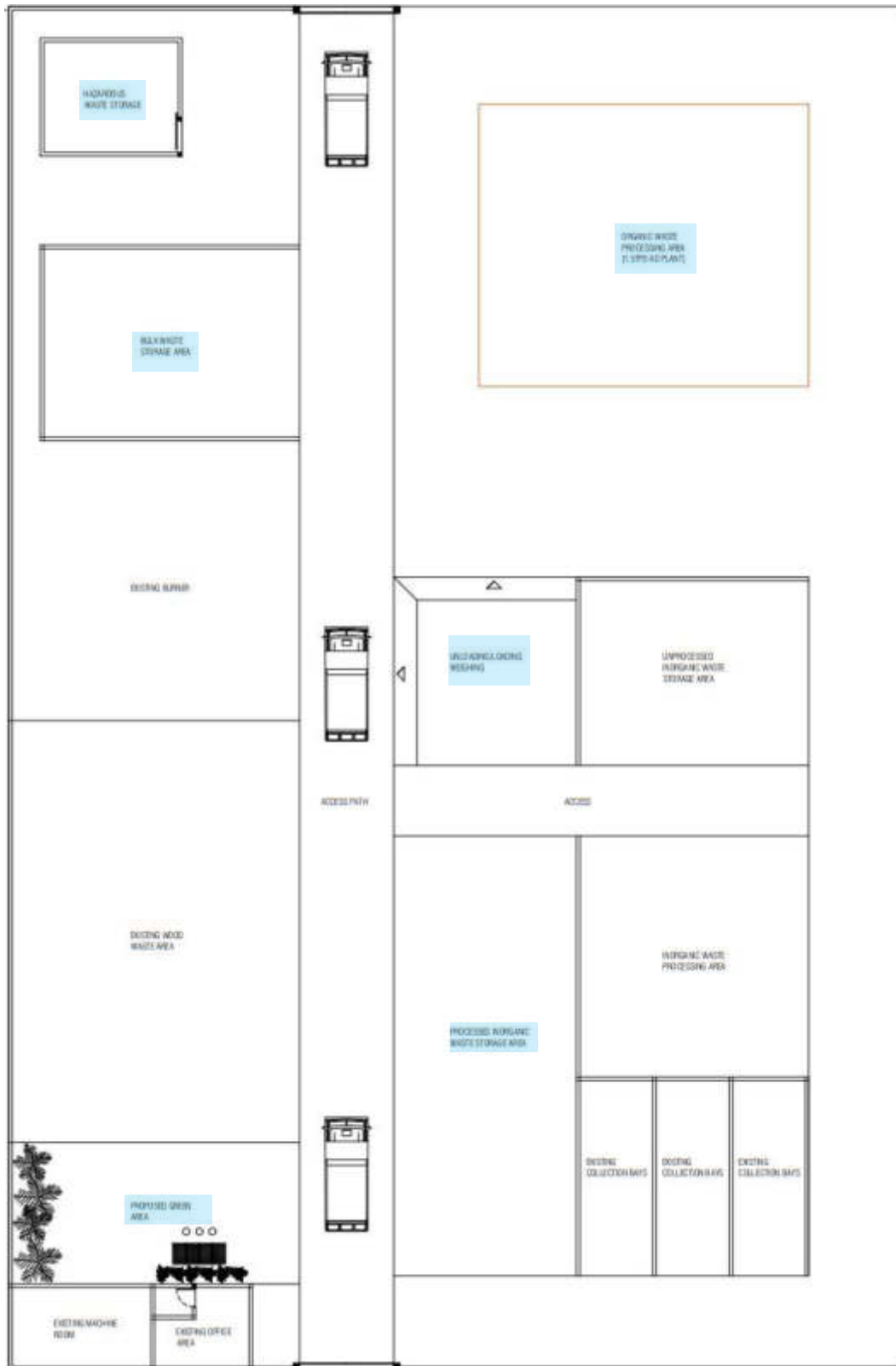


Figure 2. Schematic layout of IWRMC, blue highlights showing the proposed infrastructures (site plan also given in Appendix 6)

## **4.2.1 Anaerobic Digestion (AD) plant**

### **4.2.1.1 Technology**

The proposed technology for treating organic waste in Kudahuvadho is a 1.5 ton capacity Plug Flow Reactor or PFR anaerobic digestion (AD) plant. Its main function is converting organic waste into biogas, while compost and liquid digestate are produced as biproducts. The liquid digestate can be directly used as a fertilizer, while the wet compost can be dried to obtain compost of high nutrient value.

Although the biogas produced can be utilized for cooking or converted to electricity with the addition of a bio-generator or IR biogas stoves with a biogas compressor (2-5Kg/cm<sup>2</sup>) to the system, provisions for such arrangements are not being made via the proposed project due to budgetary limitations. Instead, the biogas generated will be flared.

Around 5-10% of the biodegradable waste fed into the bio-methanation plant comes out as compost in case of food waste/MSW/cow dung and 30-40% of the material comes out undigested organic residue. The residues and leafy material containing lignin which does not get digested completely comes out of the digester at the end of 30 day solids retention time (SRT). This material can be pulled out of the digester and dried to obtain compost of high nutrient value. Anaerobic compost is found to have higher nutrient content when compared to aerobic compost. From 1tpd of biodegradable waste fed into a biogas plant, around 30-40kg of wet compost (6-10kg dry) compost can be achieved. The digester liquid (600- 700L/pd) is also high in nutrients can be used as fertilizer

### **4.2.1.2 Cost**

The cost of the plant excluding civil works is approximately \$25,000 to \$30,000. The cost of the project including civil works is estimated as Rf 2.5 million (USD 162,127).

## **4.3 Construction phase**

### **4.3.1 Construction methods**

The construction contractor for the project has not been identified yet. The contractor will be identified upon approval of ESMP. The contractor shall provide details of materials and methodology for construction subject to approval from the client. Hence, construction work will be carried out as per contract for various components of the project. Machinery and materials to



be used (including sand required for construction) will be bought locally or imported if not available.

Details of construction methods given below are as provided by the proponent (in the absence of a contractor). As per the proponent, normal civil works will be undertaken for the construction of the building. Details of the new infrastructure to be developed at the IWRMC as part of the proposed project are explained below:

**1. Organic waste processing area**

A 1.5-ton anerobic digestion (AD) plat will be instated at a 168sqm area. Details of the technology are provided in section 12.

**2. Waste unloading and loading area**

A roofed area with a floor screed (concrete slab), designated for weighing and sorting of incoming waste to organic and inorganic fractions.

**3. Processed inorganic waste storage area**

An additional area for storage of inorganic waste will be developed adjacent to the left of the existing collection bays and the inorganic waste processing area. It is a roofed area with a floor screed (concrete slab). The additional storage space created will enable storage of processed inorganic waste for a period of 4 – 6 months.

**4. Bulk waste storage area**

A roof area with a floor screed (concrete slab) enclosed by 3 brick walls, where bulk waste such as old furniture, roofing sheets etc. will be stored and sold or given free to the community.

**5. Hazardous waste storage area**

A fully enclosed room with a roof, floor screed (concrete slab), 4 walls and a gate, where the received hazardous waste will be stored prior to its final disposal at a RWMF. Appropriate hazard, flammable liquid and warning signage will be installed.

**6. Drain Installation**

Drains will be installed at the newly constructed waste unloading and loading areas, the waste processing areas and waste storage areas, which will be connected to the existing septic tank of the IWRMC.

**7. Connecting Water**

Water taps will be installed at the waste unloading and loading areas, the waste processing areas, waste storage areas and close to the AD plant.

**8. Connecting electricity to the new developments**

Electricity will be connected to the new developments from the existing electricity distribution board of the IWRMC.

#### **9. Fire safety equipment**

The existing IWRMC has 2 fire extinguishers. Additional fire safety equipment will be supplied and installed as part of the contract and essentially includes:

- 50KG DCP Trolley 2 nos.
- 50LTR Foam Trolley 1 no.
- Wet Chemical 6Ltr with Cabinet for hazardous waste area 1 no.
- Water 9Ltr with Cabinet for Office Area – Outside 1 no.
- CO<sub>2</sub> 2KG with Cabinet for Office Area – Outside 1 no.

### **Construction of Foundation and concrete slab**

The proposed method of foundation construction for the IWRMC is using concrete footing and concrete foundation beams. As detailed designs are not available at present, depth of excavation is unavailable. However, since the structures are single storey structures, it is assumed that depth of excavation will not exceed 600mm. Excavation will be done manually and given the shallow excavation necessary, dewatering will not be required. Ordinary Portland cement will be used for all concrete works.

The Concrete foundation beams will be covered with a concrete slab with varying thickness at different areas of the IWRMC. Thickness of slab at the office area is proposed to be 75mm, while that at hazardous waste storage area and bulk waste storage area will be 100mm. The concrete slab at the rest of the waste processing areas will have a thickness of 150mm.

#### **4.3.2 Location for relocating existing waste**

The temporary waste relocation area proposed during the initial screening stage of the project is located at the eastern side of the island. This site was also used as a waste dumping site prior to the construction of the IWRMC at the existing location. Hence there are few inorganic waste such as rooftiles and iron rods. There are no large trees or coconut palm and the only vegetation found at this location are shrubs (Figure 3). Removing of these shrubs would not have significant impact on the vegetation. However, it is important to note that the site is within close proximity to the coast.

If this location is to be chosen as the temporary location to relocate the waste from the IWRMC and for temporarily disposing of household waste during the construction period the following should be considered. These are also detailed in the mitigation plan in section 8.

- Approve the land purpose from the council
- Demark the boundary area by fence (mesh wire or safety net) to ensure that there dumped waste is not blown away to the sea
- Only remove the shrub at the temporary site.
- Cover the area with a polyurethane bounded tent to avoid any blown way waste



**Figure 3. Vegetation and conditions of the temporary site**

## 4.4 Operational phase

According to the feasibility study carried out for the project, for Kudahuvadhoo it is estimated that, 2,640kg of waste will be generated per day (CITRES and MEECO, 2019). This corresponds to 1,848kg of organic and 792 kg of inorganic waste. The fraction of food is estimated as 1,478.40kg daily. To process this daily food waste an Anaerobic Digester (AD Plant (Plug flow reactor) of 1.5-ton capacity will be installed at the current waste management facility.

### 1. Waste Collection

Each household will be supplied with bins to facilitate segregation of waste at household level. Three motorized vehicles are proposed to be used for household waste collection. Daily collection services will be provided at a cost of MVR 100 per household.

### 2. Sorting

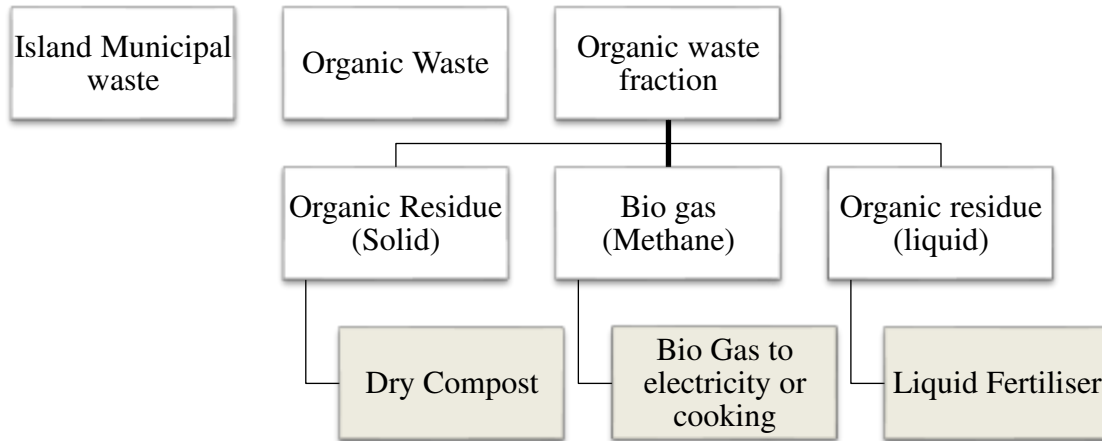
Collected waste will be sorted into organic and inorganic waste at site. After sorting, the inorganic waste will be further segregated into plastic, metal, glass etc., and processed via baling, compaction and crushing. The processed waste will be stored at the area designated for storage within the management facility. This waste will be shipped periodically (once enough bulk material for a ship load is processed) to the nearest regional waste management facility (Thilafushi in Male' atoll is the designated site for Zones 4 & 5). The organic waste will be treated through anaerobic digestion. The facility also has separate storage areas for hazardous waste.

### 3. Processing the organic waste

The organic proportion of waste would be processed through the AD plant, via systematic collection of households at source and transported (motorized vehicles) to the waste management facility. Waste will be sorted at site and the organic (food and easily degradable organic materials) will be processed through anaerobic digestion. The following Figure 4 shows a general schematic flow diagram of the process.

Bi product of the digestion process after approximately 30 days are biogas (predominantly methane, 50% of gaseous composition), liquid bi-product of organic digestion and solid residues.

Biogas can be used for generating electricity or cooking, though this will not be further processed through this project due to financial restrictions. Gas produced from the anaerobic processing of organic waste will be flared (wasted). Liquid residue and solid residues have the potential to be used as organic fertilizers such as liquid fertilizer or compost.



**Figure 4. Schematic of the flow diagram of the organic waste treatment process**

#### **4. Leachate Management**

The proposed method of organic waste disposal through mechanical anaerobic digestion will greatly reduce leachate from waste handling and disposal. Appropriate design with leachate proof flooring associated with the proposed construction aspects, with surface drainage mechanisms at site ensures unmanaged leachate seepage leaked to the ground. The drainage system will be connected to the septic tanks constructed to dispose sewage and other wastewater generated at site.

#### **5. Waste Transport to a Regional Facility**

The inorganic waste processed and hazardous waste stored at storage areas within the management facility. This waste will be shipped periodically (once enough bulk material for a ship load is processed) to the nearest regional waste management facility. The organic waste will be composted through Anaerobic Digestion technology. Thilafushi has been proposed as the regional waste management facility for zone 4 and 5 of strategic waste management policy of Maldives. Thilafushi is currently being developed under financing from the Asian Development Bank.

#### 4.4.1 Anaerobic Digestion Plant Process

The Anaerobic technology which is adopted for the facility is Plug Flow Reactor or PFR technology. The PFRs function like a three-zone fermenter where rapid fermentation occurs within the inlet zone with over production of volatile fatty acids (VFA) making it acidic. During this phase gas bubbles ( $\text{CO}_2$ ) generally nucleate around and adhere to the biomass making them float in the digester liquid. In the second zone after the simple compounds present in the leaf biomass are converted to acids, a balance between the acidogenic and methanogenic bacteria is achieved when the biomass is still in a floating state. The third zone is a region where VFA produced in earlier zones diffuse into it and are converted to biogas. Under normal circumstances when the digesting biomass from the inlet starts to float it tends to gradually dry and form fermentation arrested 'scum'. The PFR system overcomes this issue by retaining the biomass under digester liquid for a sufficiently long period for the acidogenic bacteria to initiate fermentation and digests the easily fermentable fractions of the biomass. As the decomposition rates fall and several slow-growing methanogenic bacteria colonize this biomass in sufficient numbers, the rates of acidogenesis and methanogenesis very quickly become balanced enough to carry out a stable and continuous fermentation of the biomass even when the biomass feedstock is afloat.

The technology allows domestic waste to be fed in a partially segregated manner, wherein inorganic waste like glass and plastic bags (less than 2%) can be fed to the reactor without segregation and can be collected from a passage of the reactor later. Additionally, any type of waste even agro-residues and long banana stems can be fed as it is without pulverization. Thereby, labor charges spent for segregation and preparation can be largely minimized. The technology also does not require the addition of water for pre-treatment or for any other process. The machinery and other moving parts involved in the reactor are less hence reducing the consumption of energy used to produce biogas, of which this technology produces a high volume (up to  $60\text{m}^3/\text{TPD}$ ; 80-85% of the theoretical methane yields). The PFR reduces one ton of bio-waste to less than 100kg in a 30-day retention time.

A schematic of the anaerobic digestion process by the proposed technology is shown in Figure 5.

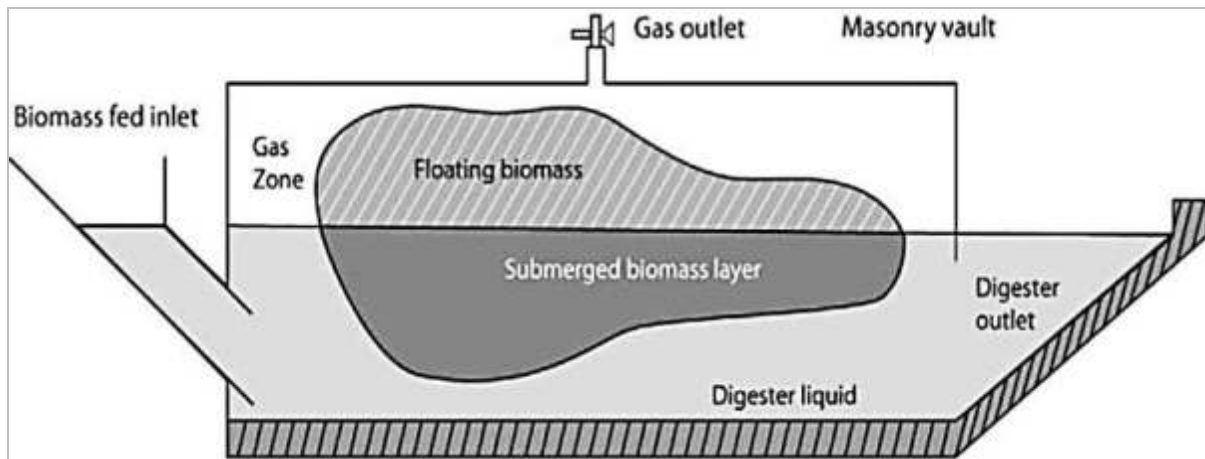


Figure 5. Schematic of the anaerobic digestion process (sourced from BIOEN, n.d.)

#### 4.4.1.1 Input (Feed material)

The proposed feedstock in these bio-methanation plant are food waste, agriculture residues etc. This technology enables material to be fed to the machine as it is without size reduction or pulverization. Hence the material can be added without pre-processing to form slurry-like material with water.

#### 4.4.1.2 Outputs

The main output of the processing is biogas (60m<sup>3</sup>/day, mainly methane) from food waste & agricultural-residues. In addition, the digester will generate solid residues and organic liquids.

Around 5-10% of the biodegradable waste fed into the bio-methanation plant comes out as compost in case of food waste. The leafy material containing lignin does not get digested completely and comes out of the digester at the end of 30d period. This material can be pulled out of the digester and dried to obtain compost of high nutrient value. Anaerobic compost is found to have higher nutrient content when compared to aerobic compost. Approximately 30-40kg of wet compost (~10kg dry) can be achieved from 1ton of biodegradable waste fed into a biogas plant daily. The digester liquid (500liters/day) is also high in nutrients and can be used as fertilizer.

It is proposed that the gas will be flared at site. The liquid which can be considered as a fertilizer and solid residue (compost) will be used locally for agricultural purposes or can be processed and sold to nearby resorts.



The Client informs that the AD plant will be supplied at a later stage after the completion of the civil works required for its installation. As per the current project implementation schedule, the plant is expected to be supplied, installed and commissioned within the final quarter of 2021.



Figure 6. Example of AD plant installed in a resort hotel, Reethiifaru, Baa atoll (source: BIOEN, India)

#### 4.4.2 Schedule for implementation

As per information provided by the Client, all civil works of the project is anticipated to be completed within 6 calendar months. An estimated schedule for construction (as given by Client) is provided in Table 3.

Table 3. Tentative Project Schedule

Activity	Month 1		Month 2	Month 3	Month 4	Month 5	Month 6
<b>Mobilization &amp; Supply of Construction Materials</b>							
<b>Site Preparation: levelling, Earthworks and relocation of existing waste</b>							
<b>Civil Works</b>							
<b>Demobilization</b>							



### **4.4.3 Major inputs and outputs**

#### **4.4.3.1 Inputs**

##### **Access to site, mobilization and material unloading**

Access to site and material unloading will be via existing harbour on the western side of the island. Materials will be transported to the project site and stored at the site.

##### **Workforce requirements, availability and logistics**

Work will be carried out by a Contractor, though contractor for the project has not been assigned as yet. Based on information provided by client, workforce will comprise of approximately 10 personnel inclusive of Site supervisor (1), engineer (1) and laborers (8). Workforce will be accommodated through rental of property from the island. If workforce is to be mobilized during the current COVID-19 health emergency, they will follow all required guidelines by HPA prior to and during their time on the island (inclusive of required tests, quarantine etc.).

##### **Provision for water, electricity and Sewerage services during construction**

Electricity, Water and Sewerage services required for the workers will be arranged via the existing facilities available on the island as the workforce will be accommodated in existing houses and/or guesthouses.

Electricity and non-potable water are available at the proposed site, which the workforce can use during the working hours. The IWRMC site also has a connection from RO plant and water network laid on the island. Mineral water bottles or rainwater will be used for drinking purposes.

##### **Vegetation clearance**

The proposed work will be carried out at an existing IWRMC facility with easy access via one of the main roads which goes along the whole length of the island. Hence no vegetation clearance is necessary for the proposed work.

## **Fire hazard, health and safety**

The existing IWRMC has 2 fire extinguishers. Additional fire safety equipment such as CO<sub>2</sub> and water-based fire extinguishers will be supplied and installed as part of the contract. The safety equipment that will be provided are listed below:

- 50KG DCP Trolley (2 nos.);
- 50LTR Foam Trolley (1 nos.);
- Wet Chemical 6Ltr with Cabinet for hazardous waste area (1 nos.);
- Water 9Ltr with Cabinet for Office Area – Outside (1 nos.); and
- CO<sub>2</sub> 2KG with Cabinet for Office Area – Outside (1 nos.).

The IWRMC will be operated by the Council. During consultations it was identified that training would be required for those involved in the operations, both in operations of the centre and firefighting skills. This is hence involved in the training programme identified in Chapter 10 of this report.

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## **Construction waste and waste oil**

The upgrading of the existing IWRMC would inevitably generate some construction and demolition waste such as parts of demolished walls and roofing materials. However, quantity of such waste generated is anticipated to be insignificant. These materials will be utilized for the construction of the proposed new infrastructures of the IWRMC as much as possible, with any remaining waste temporarily stored in an allocated area within site, before being disposed to Thilafushi. Other construction waste may include materials slightly hazardous in nature such as used thinners and paint cartons which will be properly sealed and stored at the existing hazardous waste storage room of the IWRMC for further treatment and or disposal to Thilafushi.

Existing waste disposal in the island is being carried out at the area immediately adjacent to the IWRMC. However, a considerably small amount of waste was also observed within the centre, at the collection bay area and in jumbo bags. These will also be disposed at the site being used at present.

#### 4.4.3.2 Outputs

The key output of the project is an IWRMC setup with AD plant for processing of organic waste. In the absence of a contractor, Inputs / outputs of the project have been provided after discussion with the PMU of the MCEP. Table 4 gives details of inputs of the project while Table 5 gives details of outputs of the project.

**Table 4. Inputs of the project**

	<b>Input resource</b>	<b>Type and amount</b>	<b>Means of obtaining the resource</b>
Construction phase	Workforce	Site supervisor – 1 Site engineer - 1 Workers - 8	Contractor hired for the project
	Water for Construction	Ground water (150 litres per day)	Groundwater well at the site
	Construction Materials	Concrete, cement, sand, masonry blocks, flood lights, G.I. pipes, metal sliding doors, aluminium doors and windows, emulsion paint, Lysaght Roofing Sheet, 3 phase power sockets, ceiling fan and Timber	Imported or purchased where available locally. Contractor will make arrangements to import or purchase these materials and transport to the island
	Construction Machinery	Compactor (for ground leveling), pickups or trucks (for land transport of construction material), Concrete mixing machine and concrete supply pump and pipe	Responsibility of the contractor. Local resources such as pickups for hire will be utilized as much as possible. If not available locally the contractor will import these machineries.
	Fuel	Diesel	Local suppliers
	Firefighting	Portable fire extinguisher	Responsibility of the contractor. Imported or purchased locally and to be brought to the site during mobilization.
Operational phase	Equipment	1.5-ton capacity Plug Flow Reactor or PFR anerobic digestion (AD) plant	Purchased locally or imported. Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.
	Water	Groundwater (non-potable use)	Groundwater well within the IWRMC
	Power	3-phase power for operation of waste management equipment.	From local powerhouse. A 25mm, 4 core power supply cable will be laid from nearest distribution box to waste yard distribution board (approximately 300m)).

			Total estimated power requirement for operations of the centre is 3KW.
	Labour	About 3 workers to manage waste in the IWRMC and 3 workers to provide collection services to the community.	To be sourced ideally from within the community, or if not available, other locals or expatriate workers. Responsibility of the Island Council. The Council of the outsourced third party will make accommodation arrangements within local houses or guest houses if expatriate workers are hired.
	Fuel	Diesel	Local suppliers
	Firefighting equipment	CO <sub>2</sub> and water-based fire extinguishers	Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.
	Waste	Waste generated within the island - approximately 2286 kilograms per day.	Waste will be collected from households and businesses within the island

**Table 5. Project outputs**

	<b>Input resource</b>	<b>Type and amount</b>	<b>Means of obtaining the resource</b>
Construction phase	General Construction Waste	Moderate amount of Solid Waste	General construction waste will be reused as much as possible. Any remaining waste will be transferred to the nearest regional facility by the contractor/operator.
	Municipal Waste	Small quantity	Removed to the disposal site designated by the council.
	Soil	Excavation for substructure	Product at site, will be used for backfilling during construction.
	Dust	Moderate amount during cement mixing and excavation	Product at site
	Waste oil and diesel	Small quantity	By-product at site
	Greenhouse Gas Emissions	Small quantity. Emissions from construction material transporting vehicles and construction machinery.	By-product at site .
Operational phase	Biogas, liquid fertilizer and compost	AD plant	Produced at site, biogas flared and liquid fertilizer and compost used locally for agricultural purposes or sold to nearby resorts.

	Inorganic Waste	Crushed glass, compacted metal, shredded plastic	Produced at site and reused within community as much as possible. Remaining waste to be stored in their respective area within the IWRMC and transferred to a regional facility every 4 to 6 months.
	Greenhouse Gas Emissions	Electricity usage (Minute quantity) Methane (Biogas) that will be flared	N/A

## **5 Existing environment**

### **5.1 Current waste management practices**

The waste management issue is one of the significant environmental concern for the island and communities. The island council have undertaken all the necessary preparatory work in order to facilitate the implementation of the IWRMC at the island. These include clearance of the access road facilities and preparation of lighting poles for the access road and most importantly designating land area for waste management.

The island has invested in more than 2.5 million MVR to establish the service on the island. The council employs its own staff including foreign labour to ensure the island receives the service. Waste is managed at a rate of MVR 150 per month per household.

A waste management plan exists in Kudahuvadhoo. Waste is separated at the households and they are collected from the households to be transferred to the waste site. This includes plastic, wood, glass, metal and food waste. They are stored in separate bays at the waste center and perishable waste were burnt at the waste management site.

However, it has been a few years since the incinerator brokedown. Waste is now open-burned at the site and waste are piling up at the center. Since the site has started filling up, any sorting or segregation is not practiced at the waste center now. Due to the limited financial and human resources it has been difficult to remove the residue and better manage the site. Therefore, the center is almost full and waste is also dumped outside the center.

The normal working hours for burning practice is usually afternoon. According to the council, they burn waste after reviewing the direction of wind to ensure that communities are less effected due to smoke.

#### **5.1.1 Island Waste Stream**

As mentioned above, waste is not segregated at IWRMC currently. However bulky waste and few other in organic types of waste were placed in their respective bays. A visual assessment was undertaken at the site to estimate current waste stream of the island (see Figure 8). Table 6 shows the waste estimation for the island.

**Table 6. Waste stream estimation for Dh. Kudahuvadhoo**

Type of Waste	Method of Management	Amount / tons
Scrap metal	Transfer to Thilafushi.	200
Cans	Transfer to Thilafushi	5
Crushed Glass	Transfer to Thilafushi	20
Plastics	Transfer to Thilafushi	3
Mix and ash	Open burning	Un estimated
Kitchen waste	Disposed to the sea	Un estimated
Other bulky waste	Transfer to Thilafushi	Un estimated

## 5.2 Unassigned Waste Dumping

Since the island has managed waste collection system despite the financial losses to the council, there is no other unassigned waste dumping on the island. All the waste from the household are taken by the council and collected at the IWRMC.

## 5.3 Project Site

The project site is same as the existing IWMRC and is located south east of the island (see Figure 1 for location). It has an area approximately 0.22 ha. The entire perimeter of the IWMRC has 10 feet plastered walls and access to the site is through the one gate. The existing facilities in the IWRMC includes:

- **Machine Room:** Fully enclosed lockable room where equipment can be stored after daily operations.
- **Office / Toilet**
- **Septic Tank:** A septic tank is present adjacent to the office area which is connected to the sewer network of the island. The drains at the toilet are connected to the septic tank.
- **Wood Waste Area:** An open area where wood chipping is being carried out.
- **Unprocessed Inorganic Waste Storage Area:** A roofed area with a floor screed (concrete slab), where inorganic waste are being kept just after unloaded prior to processing.
- **Inorganic Waste Processing Area:** A roofed area with a floor screed (concrete slab), where metal can baling, glass crushing, plastic shredding etc. area being carried out.

- **Collection Bays:** Enclosed roofed areas with floor screed (concrete slab) where processed inorganic waste are supposed to be stored. However currently it is used to store equipment's required waste management activities for the island including bins, jumbo bags, spades (see Figure 8).
- **Burner:** An enclosed burner with a chimney is present in the IWRMC which was previously used for burning waste, but is currently damaged and inoperable.
- **Boundary Wall and Gate:** A boundary wall is present surrounding the IWRMC. A gate is present north of the IWRMC, towards the main road of the island (Boduthakurufaanumagu). The center is closed from 20:00hrs everyday.
- **Equipment:** A can compactor, metal crusher, plastic and a metal shredder do exist, but currently all of them are malfunctioning due mechanical failures. The IWRMC also has 2 fire extinguishers.

Figure 7 shows an aerial view of the site while Figure 8 shows the location of the site with important landmarks to show the proximity.



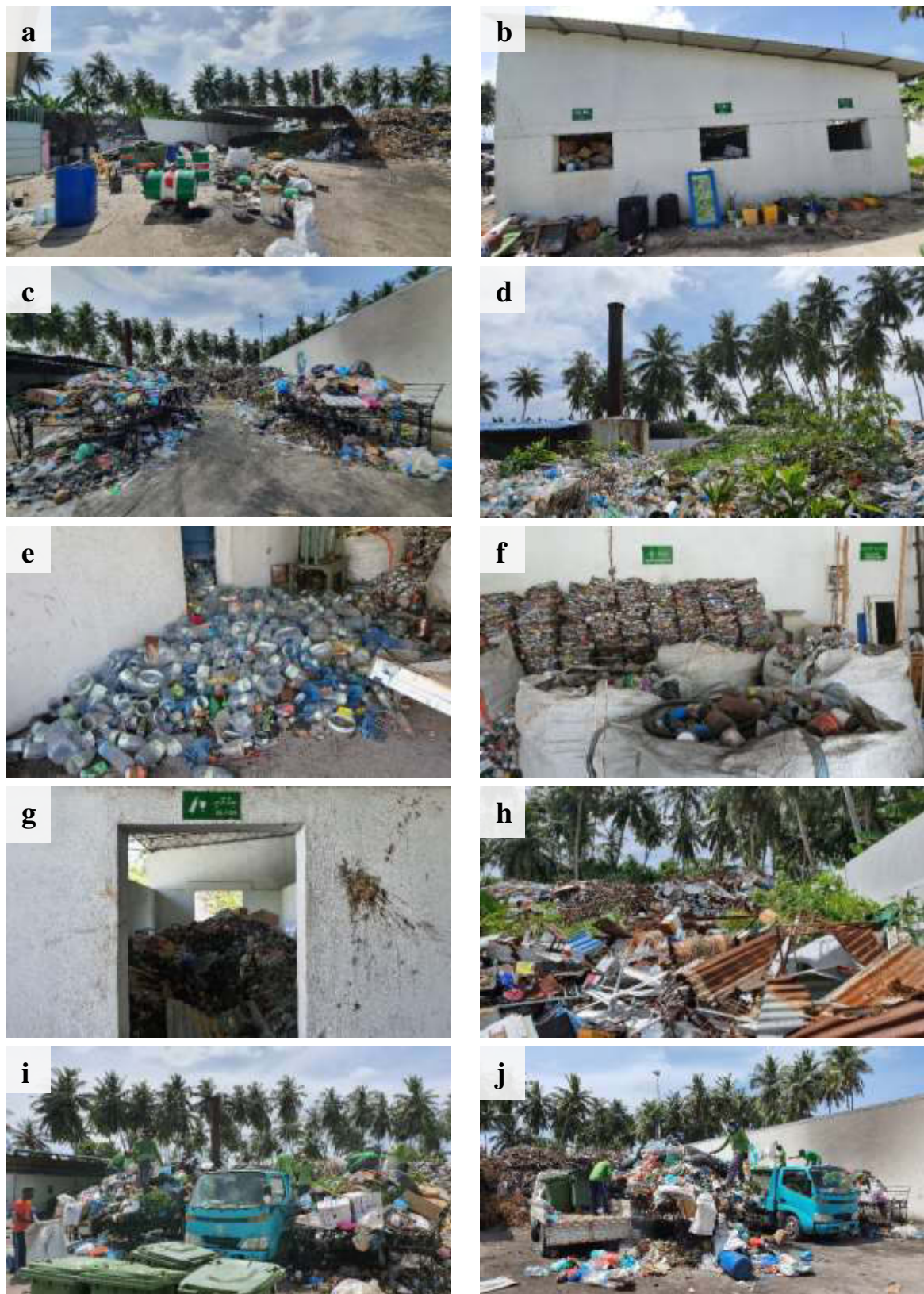


**Figure 7. IWRMC site location in Dh. Kudahuvadhoo**





Figure 8. Location of the project site and important landmarks.



**Figure 9. Waste Management Practices at Dh. Kudahuavdhoo IWRMC. (a) oil waste, (b) separation bays, (c) open burning stations, (d) broken down incinerator, (e) plastic bottles in the bay, (f) metal can pallets, (g) glass in the bay, (h) bulky waste in the mixed area, (i) and (j) loading the burning stations with waste.**



### 5.3.1 Soil Condition

With exceptionally poor management and due to pilling up waste, ground is contaminated with waste oil and leachate from waste (see Figure 10).



Figure 10. Ground of IWRMC is contaminated with waste oil and leachate from waste.

### 5.3.2 Proximity to residential areas

The nearest residential area is located approximately within a 50 m radius to the northwest of IWRMC. Power distribution boxes are also found within a radius of 50 m which is in the nearest residential block and the site is provided with three phase electricity for 24 hours provided by FENAKA. The island does have and RO water network established and a water connection is available at the site. A gravity type sewerage network is established on the island.

## 5.4 Land ownership

The allocated land for IWRMC is designated by the council and approved by Maldives Land and Survey Authority (Appendix 4). The Land Use Plan of the island also indicated that the proposed location would be used as the waste management area.

## 5.5 Coastal Environment

Approximately a 65ha land was reclaimed around the south part of the island in 2013. The main purpose of this reclamation was construction of the Dhaalu Airport. A 1,650 m revetment was done on the reclamation area (420 m towards end of the runway, 670 m towards the terminal and start of runway, and 560 m on the northern side of the reclamation). The unarmoured reclaimed area is under erosion. Nevertheless, these erosion scrapes are not significant. The most significant erosion scarps are observed on northern tip of the island (see Figure 10). This area is almost on the opposite side of the island from the IWRMC. Hence the proposed waste site is not expected to be affected due to erosion.



**Figure 11. Coastal erosion side of the island.**

## **5.6 Accessibility to the waste site**

Waste site is accessible by road and are easily accessible. Main roads connecting to the site is depicted in Figure 7.

## **5.7 Vegetation**

The current waste management area does not have any vegetation. There is approximately 15 coconut palms tree surrounding the IWRMC fence. However, the larger vegetation type recorded at these sites are planted Banana trees (*Keyo gas*). A proper vegetation assessment of three 30 meter transects was done. The main features of the vegetation transects are discussed below. Figure 11 shows vegetation transects and abundance of types of vegetation at the transect.



**Figure 12. Types of major vegetation near Dh. Kudahuvadhoo IWRMC**

## **5.7.1 Vegetation Transects**

### **5.7.1.1 Salient Features of Transect 1**

Three types of plants are found in this transect. The total number of plants that were observed in the transect were 12. Figure 14, shows the average height of the plants along the transect. Table 7, shows the type of plants that were observed at the transect. It is estimated that transect represents Keyo gas (67%), Dhivehi Ruh (25%), and 8% of Muranga gas (See Figure 13 (a)).

### **5.7.1.2 Salient Features of Transect 2**

Two types of plants are found in this transect. The total number of plants that were observed in the transect were 31. Figure 15, shows the average height of the plants along the transect. Table 7, shows the type of plants that were observed at the transect. It is estimated that transect represents Keyo gas (90%), and 10% of Boa Kashikeyo (See Figure 13 (b)).

### **5.7.1.3 Salient Features of Transect 3**

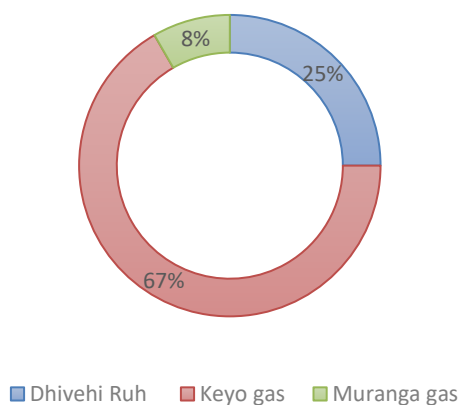
Two types of plants are found in this transect. The total number of plants that were observed in the transect were 8. Figure 16, shows the average height of the plants along the transect. Table 7,

shows the type of plants that were observed at the transect. It is estimated that transect represents Dhivehi Ruh (50%), and Boa Kashikeyo (38%) and Ahi gas (12%) (See Figure 13 (c)).

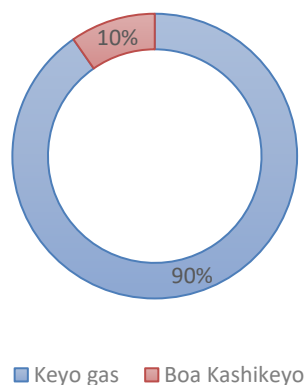
**Table 7. Types and frequency of plants observed in vegetation transects**

Transect	Local Name	Common Name	Scientific Name	Quantity	Observed average height /m
1	Muranga gas	Drumstick tree	Moringa oleifera Lam.	1	7
	Keyogas	Banana	Musaceae	8	3 – 7
	Dhivehi Ruh	Coconut Palm	Cocos nucifera L.	3	30
2	Boa Kashikeyo	Pandanus, screw pine	Pandanus odoratissimus L.f.	3	15
	Keyogas	Banana	Musaceae	28	7 - 10
3	Dhivehi Ruh	Coconut Palm	Cocos nucifera L.	4	30
	Ahi gas	Indian mulberry	Morinda citrifolia L	1	10
	Boa Kashikeyo	Pandanus, screw pine	Pandanus odoratissimus L.f.	3	15

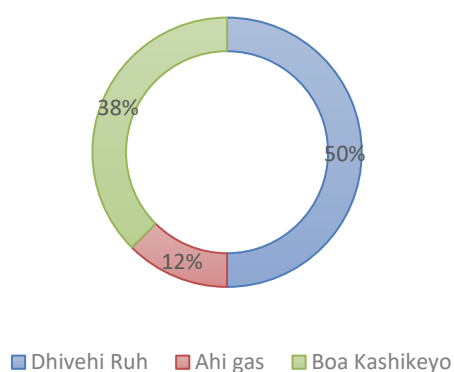
(a)



(b)



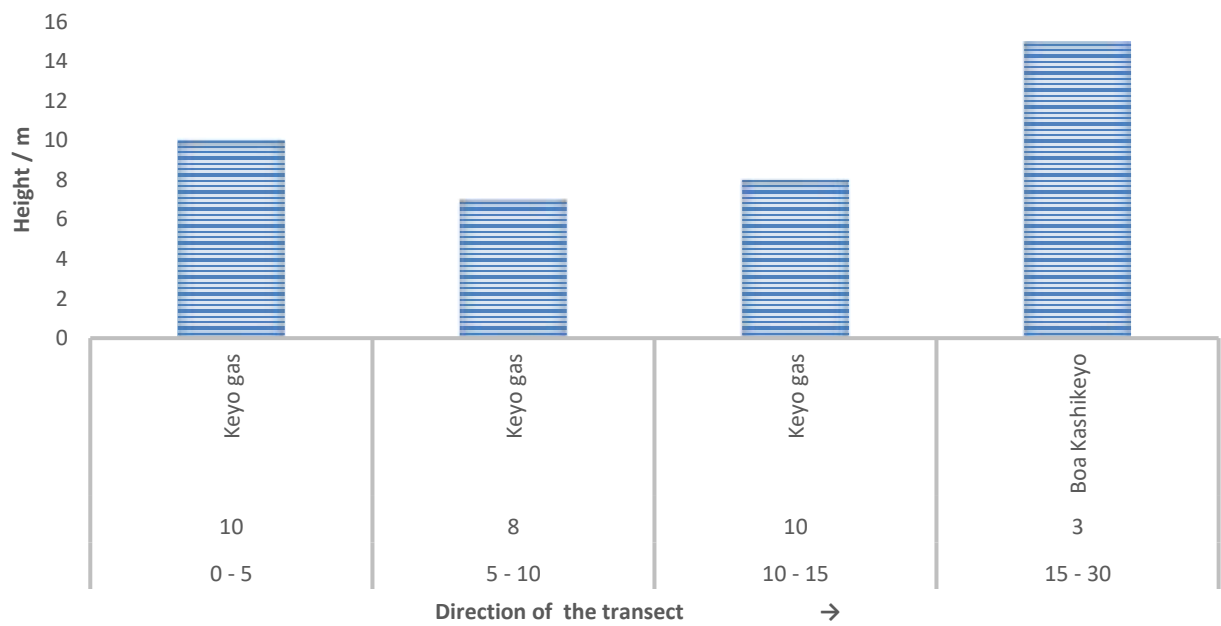
(c)



**Figure 13. Abundance of plants found in vegetation transects. (a): Transect 1, (b): Transect 2, and (c): Transect 3.**

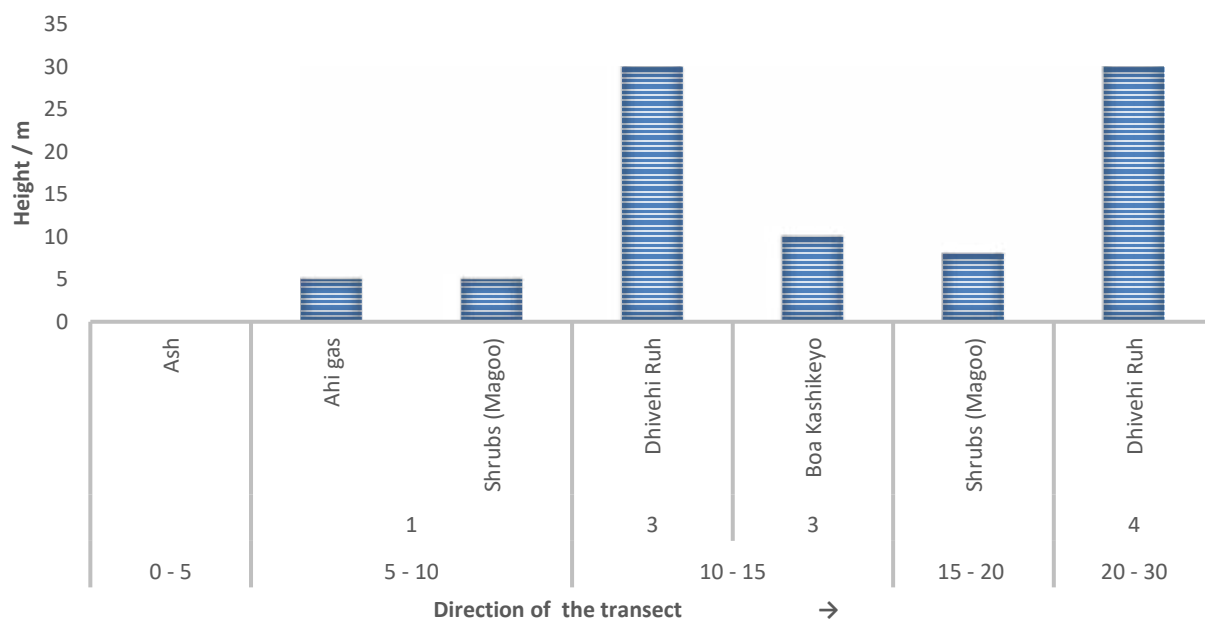


**Figure 14. Height of the plants along the transect 1**



**Figure 15. Height of the plants along the transect 2**





**Figure 16. Height of the plants along the transect 3**



**Figure 17. Types of vegetation observed during the vegetation survey.**

## 5.8 Groundwater Quality

The groundwater samples are taken from two locations (IWRMC and Control Site). Geographic coordinates of groundwater sample sites are:

- Project site: N2°40'04.80"; E 073°29'27.39"
- Control site: N 2°40'12.26"; E 072°53'46.31"

The physical, chemical, and biological parameters in accordance with the ToR was investigated at MWSC laboratory. Table 8 shows the results of the sampling. MWSC laboratory analysis is attached in Appendix 7. Most of the parameters are within the normal range. The conductivity and dissolved solids are higher than the optimal range. This is possibly due to fact that the ground water source is near the coast.

**Table 8. Results of the groundwater**

Parameter	Source or Site	Control	EPA Optimum Range
Physical Appearance	Clear with particles	Clear with particles	
Temperature /°C	24.5	24.5	25-30
pH	7.26	7.57	6.5-8.5
Conductivity / $\mu\text{scm}^{-1}$	5660	395	<1500
Total Dissolved Solids / $\text{mg l}^{-1}$	2830	197	<1000
Nitrate / $\text{mg l}^{-1}$	0.9	0.4	
Total Petroleum Hydrocarbon	<0.036	<0.036	

## 5.9 Air Quality

Air quality was measured at the waste site and a control site. Location of the air quality monitoring zones are shown in Figure 8. Air quality measuring equipment was installed at the site. WolfSense instruments (Figure 18) which measure particulate matter (PM10 and PM2.5) and toxic gases; carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>) and Sulphur dioxide (SO<sub>2</sub>) were used to collect air quality information.



**Figure 18. Air quality measuring instrument.**

Data was collected twice, once during the daytime and another during the night. Data is collected for 1 hour at a sampling rate of every 10 sec. Following describes the results of the air quality.

Table 9 show the air quality analysis summary for both the sites. As expected, during the daytime, the PM10 and PM2.5 levels are higher at the site. On average, PM10 levels of  $3.72 \mu\text{g}/\text{m}^3$  and  $3.79 \mu\text{g}/\text{m}^3$  were observed at the source during the day and night, respectively. At the control site, on average, PM10 levels of  $1.93 \mu\text{g}/\text{m}^3$  and  $2.93 \mu\text{g}/\text{m}^3$  were observed during the day and night, respectively. Similar pattern although with higher levels were observed for PM2.5. Toxic gases also observe similar pattern. Due to time limitations and of COVID restrictions, monitoring was limited during the site visit. Pollution monitoring was done in Thilafushi (Ministry of Environment, 2019), where Villingli a close by island was used a control and results from that assessment is shown in Table 10. However, due to different sampling methods, it is difficult to compare the results.

**Table 9. Summary of air quality at both the sites**

	Source (site)				Control							
	PM10 (µg/m³)		PM2.5 (µg/m³)		PM10 (µg/m³)		PM2.5 (µg/m³)					
	Day	Night	Day	Night	Day	Night	Day	Night				
Max	33.27	49.90	51.17	37.13	22.18	22.18	41.52	35.09				
Min	0.00	0.00	19.88	18.42	0.00	0.00	17.84	19.59				
Average	<u>3.72</u>	<u>3.79</u>	<u>32.48</u>	<u>27.59</u>	<u>1.93</u>	<u>2.93</u>	<u>26.94</u>	<u>27.29</u>				
	Source (site)						Control					
	NO <sub>2</sub> (ppm)		CO (ppm)		SO <sub>2</sub> (ppm)		NO <sub>2</sub> (ppm)		CO (ppm)		SO <sub>2</sub> (ppm)	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Max	0.21	0.24	7.80	2.20	0.00	0.00	0.23	0.23	4.10	2.40	0.00	0.00
Min	0.17	0.22	1.40	1.40	0.00	0.00	0.20	0.21	0.60	1.40	0.00	0.00
Average	<u>0.20</u>	<u>0.24</u>	<u>3.31</u>	<u>1.67</u>	<u>0.00</u>	<u>0.00</u>	<u>0.21</u>	<u>0.23</u>	<u>2.60</u>	<u>1.88</u>	<u>0.00</u>	<u>0.00</u>

**Table 10. Pollution monitoring levels observed at Thilafushi (Ministry of Environment, 2019)**

	Parameters / Results (based on 24 hr average)			
	PM10	PM2.5	SO <sub>2</sub>	NO <sub>2</sub>
	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>
<b>Thilafushi Downwind (AQ-1)</b>				
Minimum	7.0	8.0	5.0	0
Maximum	427.0	384.0	72.0	87.0
<b>Mean</b>	<b>26.5</b>	<b>26.9</b>	<b>25.3</b>	<b>59.5</b>
99th Percentile	147.0	122.0	76.0	78.0
<b>Thilafushi Crosswind (AQ-2)</b>				
Minimum	8.0	5.0	0.0	49.0
Maximum	134	112	18.5	65.0
Mean	<b>19.3</b>	<b>12.1</b>	<b>9.8</b>	<b>56.0</b>
99th Percentile	37.6	24.6	16.5	60.0
<b>Thilafushi Downwind (AQ-3)</b>				
Minimum	4.0	1.0	2.0	53.0
Maximum	690.0	362.0	112.2	81.0
<b>Mean</b>	<b>88.4</b>	<b>42.8</b>	<b>32.4</b>	<b>64.9</b>
99th Percentile	281.0	85.4	40.3	72.1
<b>Vilingili Island (AQ-4)</b>				
Minimum	13.0	22.7	2.0	2.0
Maximum	41.0	41.0	19.0	87.0
<b>Mean</b>	<b>22.7</b>	<b>22.1</b>	<b>7.6</b>	<b>60.6</b>
99th Percentile	32.0	32.0	2.0	70.8
<b>WHO Standard</b>	<b>50.0</b> (24 hr avg)	<b>25.0</b> (24 hr avg)	<b>20.0</b> (24 hr avg)	<b>200.0 (1 hr avg)</b> <b>40.0 (1 yr avg)</b>

## 5.10 Noise

Noise level around project site was measured using noise meter. Sound was measured for 1 minute at the desired location both at the source and control area during day and night. The maximum, minimum and average noise was recorded. Table 11, shows the noise recordings at Dh. Kudahuvadhoo.

Noise measurements have not significantly reduced during day and night at the source. This may be due to the quitter environment. A slight decreased of noise level is observed at night. This might be due to lack of work at the site during night time.

Similar to the source, there is no observable difference during day and night time at control. During day however, the noise level has passed the general standard, as the place is within proximity of pharmacy and hospital. Generally, it can be concluded that noise level is within the permissible level as per the USEPA noise level standards.

**Table 11. Noise levels at source and control locations**

	Noise level at Source		Noise level at Control		USEPA Noise level standards	
Date	14 January, 2021				Day	Night
Time	0820 hrs	2010 hrs	1420 hrs	2220 hrs	50	45
Minimum / dBs	42.7	43.1	46.8	43.4		
Average / dBs	45.7	44.7	58.1	45.9		
Maximum / dBs	51.8	46.2	65.2	54.9		

### 5.11 Protected Areas and Environmentally Sensitive Sites

The island does not have any protected or environmentally sensitive zones.

### 5.12 Areas of Historic and Cultural Significance

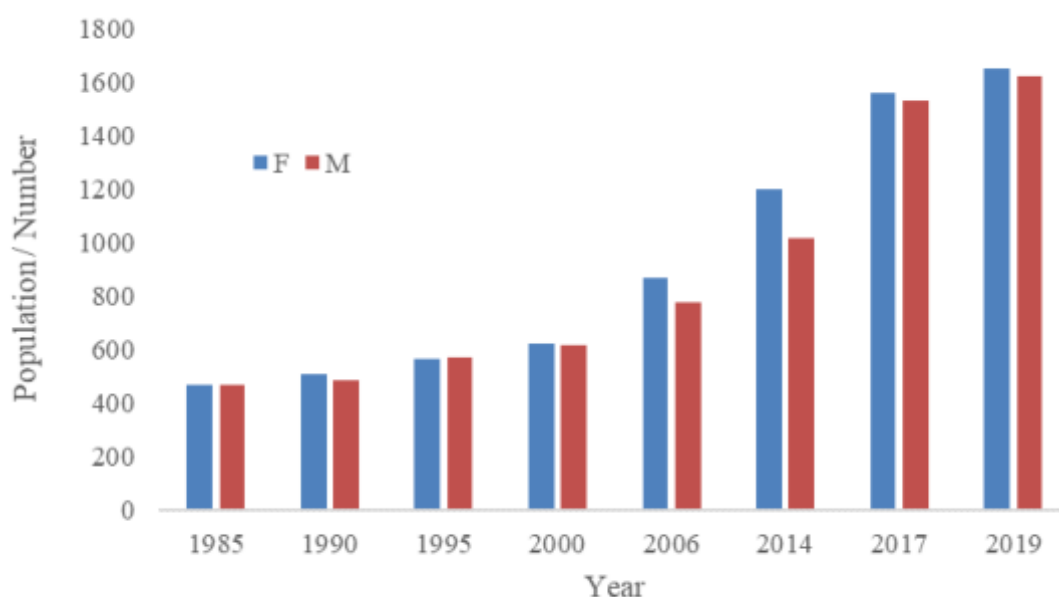
The island does not have any cultural heritage sites.

### 5.13 Socio-Economic Environment

#### 5.13.1 Demography

The current registered population as of January 2021 is 3,363, whereas the resident population is 4,500 people (Kudahuvadhoo Council, 2021). As per the latest Census data of 2014, the resident population of Kudahuvadhoo is 2,213 (1,017 Male and 1,196 Female). Although usually in most islands the resident population is lower than the registered population, in Kudahuvadhoo it is notably higher. Furthermore, the population has doubled since 2014. The reasons could be the availability of better facilities in the island and the in-migration of people who used to live elsewhere like Male' due to the Covid-19 pandemic situation.

Although gender-based population for 2021 is not available, it can be observed from the past data that the Male to Female ratio is almost at 1:1 ratio (see Figure 19).



**Figure 19. Gender disaggregated population of Dh. Kudahuvadhoo 1985 – 2019**

As for existing number of households, a total of 878 plots have been allocated and registered as residential plots in Kudahuvadhoo of which only 58% (515) are occupied (Kudahuvadhoo Council, 2021).

### **5.13.2 Non-governmental Organisations**

The island of Kudahuvadhoo has several Non-governmental organisations, who are active in different areas. The Ministry of Youth, Sports and Community Empowerment report a total of 8 NGOs registered from the island (NGO Portal, n.d.). However, none are of relevance to the project. Furthermore, none are involved in any waste management activities of the island.

### **5.13.3 Economy**

The island is one the developing economies within the region. The largest employment sector of the island is Fisheries including fish processing. With the presence of airport, residents work at Dhaalu airport as well. Civils servants or employment in public sector, construction, carpentry, agriculture, and tourism (employment in tourist resorts) are also reported as areas of employment in Kudahuvadhoo.

### **5.13.4 Infrastructure**

The island has a large harbour which have improved access to the island. The presence of a domestic airport which was built on 2017 has paved way for economic resilience and improved

access to the island significantly. The airport is also the home of Manta Air which is operated by the Universal Enterprises Pvt Ltd.

The island also hosts the Atoll Education Center which offers higher secondary. Moreover, the island also hosts the Dhalu Atoll Regional Hospital which is a tertiary level hospital. The island also has two pharmacies of which one is operated by STO. An atoll branch of Bank of Maldives provides basic banking services.

#### **5.13.5Utility Services**

The island has three phase electricity for 24 hours provided by FENAKA Kudahuvadhoo branch. A sewerage system established on the island provides disposal of sewage to the sea through a proper network, although not treated. Rainwater is used for drinking purposes while groundwater is used for showering and other non-potable uses. Bottled water is also used to some extent.

## 6 Environmental Impacts

Various methods are available to categorize impacts and identify the magnitude and significance of the impact, such as checklists, matrices, expert opinion, modeling etc. Impacts on the environment from various activities of the project construction work (constructional impacts) and post construction (operational impacts) have been identified through interviews with the project management team and field data collection surveys. Data collected during field surveys have been used to predict outcomes of various operational and construction activities on the various related environmental components. This data can also be used as a baseline for future monitoring of the environment. The basis for environmental impact evaluation for this report is based on Rapid Impact Assessment Matrix (RIAM) which allows judgements (both subjective and quantitative assessments) to be made and provide good understanding of these decisions (Pastakia and Jensen, 1998).

### 6.1 Impact analysis methodology

The environmental impacts as a result of this project was analysed using the Rapid Impact Assessment Method (RIAM). The RIAM approach allows us to analyse and present the results of an all-inclusive EIA, which analyses impacts on all environmental components (physical, biological, social, cultural, economic etc.); the approach allows for data from these different components to be analysed against common important criteria within a common matrix, thus providing a rapid, clear assessment of the major impacts (Pastakia and Jensen, 1998).

Methodology description has been sourced from Pastakia and Jensen (1998). The approach is based on standard definition of important assessment criteria and collation of partially quantitative values for each of these criteria so as to achieve an accurate and independent score for each of the environmental conditions being assessed. The assessment criteria fall into two groups A and B as described in Table 12 below.

**Table 12. Assessment criteria used in RIAM approach**

Criteria		Scale	Description
A - Criteria that are of importance to the condition, and which can individually change the score obtained	A1 – importance of condition	4	Important to national/international interests
		3	Important to regional/national interests
		2	Important to areas immediately outside the local condition
		1	Important only to the local condition
		0	No importance
	A2 – Magnitude of change / effect	+3	Major positive benefit
		+2	Significant improvement in status quo
		+1	Improvement in status quo
		0	No change / status quo
		-1	Negative change to status quo



B - Criteria that are of value to the situation, but individually should not be capable of changing the score obtained.	B1 – Permanence	-2	Significant negative disbenefit or change
		-3	Major disbenefit or change
		1	No change / not applicable
	B2 – Reversibility	2	Temporary
		3	Permanent
		1	No change / not applicable
	B3 – Cumulative	2	Reversible
		3	Irreversible
		1	No change / not applicable
		2	Non – cumulative / single
		3	Cumulative / synergistic

The value for each of these criteria is obtained through a series of simple formulae as below:

- $(A1) \times (A2) = AT$
- $(B1) + (B2) + (B3) = BT$
- Environmental score (for any given condition) =  $(AT) \times (BT)$

Multiplication of the values of group A ensures that the weight of each score is expressed, while summation of values of group B ensures that the individual value scores cannot influence the overall score, but that the collective importance of all values group (B) are fully considered.

Environmental components to be assessed are identified through the EIA process and in the RIAM approach, these are divided into four categories as below:

- Physical/Chemical (PC): covers all physical and chemical aspects of the environment
- Biological/Ecological (BE): covers all biological aspects of the environment
- Sociological/Cultural (SC): covers all human aspects of the environment, including cultural aspects.
- Economic/Operational (EO): qualitatively to identify the economic consequences of environmental change, both temporary and permanent.

A matrix is then produced for the different components identified for the project set against the different assessment criteria. Criteria scores are then given to each component and the environmental score for each component calculated using the formulas given above.

The scores obtained are then interpreted based on range bands, as given in Table 13. Each range band describes the level of an expected change (positive or negative) and they also represent the final assessment from the RIAM analysis. Once the ES score is set into a range band, these can be shown individually or grouped according to component type and presented in a graphical or numerical form as preferred.

**Table 13. Range bands used for RIAM approach, with Environmental scores, criteria number and code**

Scoring values (ES)	Range band	Criteria Number	Criteria Colour Band Description
72 to 108	E	5	Major positive change/impact
36 to 71	D	4	Significant positive change/impact
19 to 35	C	3	Moderate positive change/impact
9 to 18	B	2	Positive change/impact
1 to 9	A	1	Minimal positive change/impact
0	N	0	No change/status quo / not applicable
-1 to -9	-A	-1	Slight negative change/impact
-10 to 18	-B	-2	Negative change/impact
-19 to -35	-C	-3	Moderate negative change/impact
-36 to -71	-D	-4	Significant negative change/impact
-72 to -108	-E	-5	Major negative change/impact

Possible impacts arising from the construction and operation works are categorized into physical, biological, socio cultural and economic including operational aspects of the project. Environmental impacts of the project are evaluated against these environmental components. The impacts identified are also described according to their location, extent (magnitude) and characteristics. Positive and negative impacts are categorized by intensity of impacts for identifying best possible remedial (mitigation measures) action to be taken. Below are the impact scale and categories.

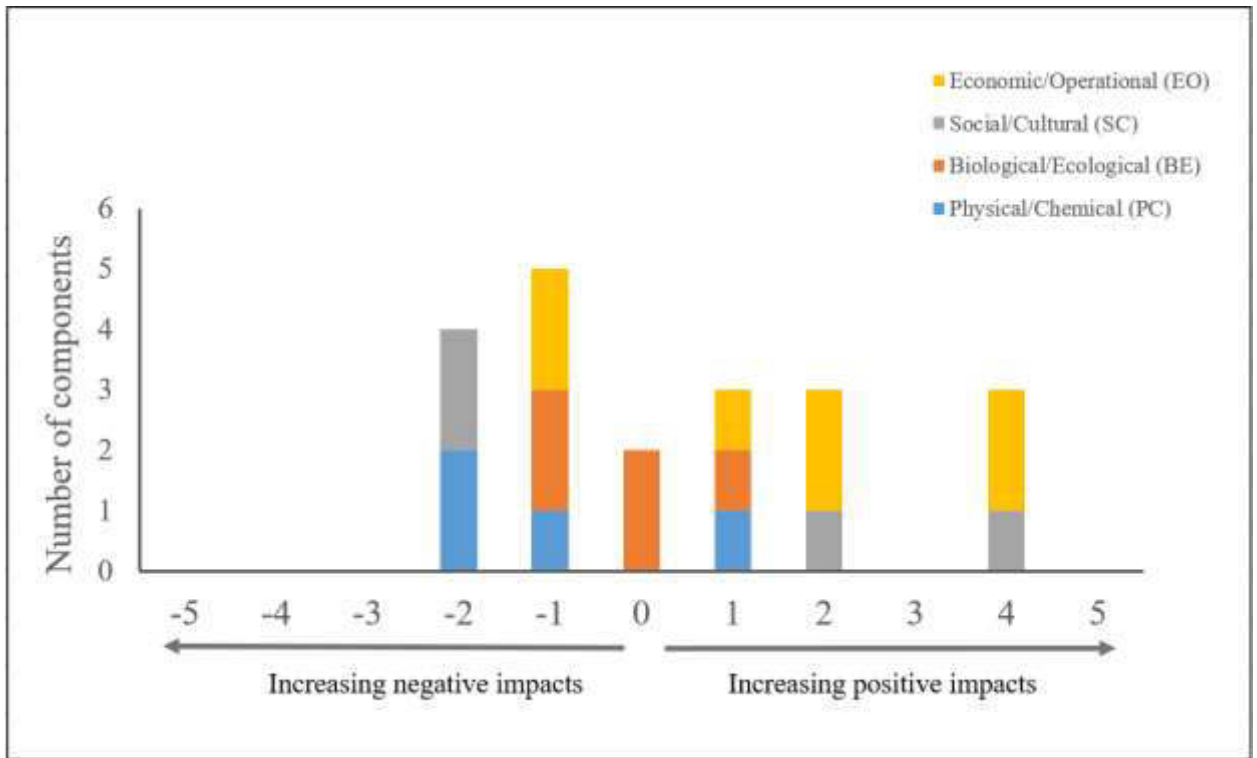
## 6.2 Impact Analysis

The significance of environmental impacts associated with the project (positive and negative) is ranked and colour coded to show the intensity of the impact for each environmental component as listed in Table 13. Impacts are assessed according to probability, significance, magnitude and duration. Tables 14 gives the assessment for the impacts, and these are further discussed in the following sections.

Figure 20 provides a graphic summary of the overall impacts for all the environmental components considered. Negative impacts of the project and their negativity scale was in the low to moderate range (-A to -C) while positive impacts were in the moderate range (B to C). The most significant negative impact was that due to sorting and handling of hazardous waste, while the benefits on the environment and community due to proper waste management was the most significant positive impacts.

**Table 14. Outcome of the environmental impacts with reference to environmental components considered. (PC = Physical/Chemical, BE = Biological/Ecological, SC = Social/Cultural and EO = Economic/Operational. Colour codes refers to intensities of impact each component subjected to assess)**

Code	Description	RIAM Criteria Scores					Environmental Value Score (ES)	Range Value Band (RB)	Criteria number
		A1	A2	B1	B2	B3			
PC 1	Changes to the ambient air quality (smell) due to waste sorting and processing	1	1	3	2	2	7	+A	1
PC 2	Changes to the ambient noise due to waste sorting and processing	1	-1	3	2	2	-7	-A	-1
PC 3	Air pollution at the project site due to emissions associated with construction machinery and vehicles and dust	2	-1	2	2	2	-12	-B	-2
PC 4	Air pollution due to emissions associated with operation of bio-digester and flaring of Methane	2	-1	3	3	2	-16	-B	-2
PC 5	Waste displacement from the temporary site to the coast/ beach (groundwater/ reef health)	1	-1	2	2	3	-7	-A	-1
BE 1	Impact on island environment/soil due to waste handling and processing	1	-1	1	1	1	-3	-A	-1
BE 2	Impact to the groundwater due to use for construction	1	0	1	1	1	0	N	0
BE 3	Impact to the groundwater due to waste handling and processing	1	1	2	2	2	6	+A	1
BE 4	Impact to the flora (vegetation) due to the land clearing required for the project	0	0	1	1	1	0	N	0
BE 5	Impact to the flora and fauna (animals) due to material transfer	1	-1	1	1	1	-3	-A	-1
BE 6	Waste displacement from the temporary site to the coast (marine environment)	1	-1	2	2	3	-7	-A	-1
SC 1	Health and safety risks to the workers due to construction works	2	-1	2	2	2	-12	-B	-2
SC 2	Health and safety risks to the workers due to operation of waste facility	2	1	3	3	3	18	+B	2
SC 3	Impacts of hazardous waste sorting and storage and disposal to the workers	2	-1	2	2	3	-14	-B	-2
SC 4	Benefits associated with improved waste processing and disposal to the community	2	3	3	1	3	42	+D	4
EO1	Changes to the environment due to improved waste processing	2	2	3	3	3	36	+D	4
EO2	Benefits to the community due to improved waste management practice and operation of the facility	2	2	3	3	3	36	+D	4
EO3	Changes to the ambient air quality (smell) due to waste sorting and processing	1	2	3	2	3	16	+B	2
EO4	Changes to the ambient noise due to waste sorting and processing	1	-1	3	2	3	-8	-A	-1
EO5	Risk to IWRMC workers	1	-1	3	3	3	-9	-A	-1
EO6	Impact on island environment/soil due to waste handling and processing	1	2	3	2	3	16	+B	2
EO7	Impact to the groundwater due to waste handling and processing	1	1	3	2	3	8	+A	1



**Figure 20. Graphic summary of RIAM analysis for the upgrading of IWRMC at Dh. Kudahuvadhoo. Y-axis shows the number of components**

Following sections provides a brief explanation of the significant impacts identified in the matrix above.

### 6.2.1 Construction phase

#### Impacts on noise pollution and disturbances (PC and SC)

The project site is at a distance of approximately 65m from the nearest residential. While noise impacts during construction work is an unavoidable impact, the work entailed does not require use of much heavy machinery. However, given the distance between project site and residential area minor level impact is expected from the noise during construction.

#### Impacts on groundwater table and quality due to construction work (PC)

Groundwater quality of the island is considered good based on the test results as most of the parameters are within optimal range. The conductivity and dissolved solids are on the higher side (possibly because the source is near coast) is expected to increase during the construction stage as groundwater will be used for the civil works. However, this is only expected to have a localised impact on the groundwater and will be short term.

### **Impacts on ground vibrations to nearby houses and buildings (PC)**

The nearest residential area is approximately 65m from project site. However, scope of work and construction required is not envisaged to have any disturbances in terms of ground vibrations as no heavy machinery or vehicles will be used.

### **Impacts on air quality (PC)**

The construction work requires civil works, with main machinery used being a cement mixing machine. The construction work is envisaged to have a negative impact on the air quality at the site, due to generation of dust. This will be a short-term impact, which would clear up after construction work is completed.

### **Impacts due to material spillage during transfer of construction materials to the project island (PC and BE)**

Construction material will be carried to site on barges and bigger vessels. There is always the chance of pollution of the marine environment during mobilization and material unloading. However, given that the materials will be packaged with no loose items, this impact is envisaged to be minor to negligible. However, any oil spills during such trips has the potential to have a significant negative impact both on the physical (seawater quality, reef health) and biological aspects (marine fauna and flora) of the marine environment.

### **Impact due to vegetation removal (PC and BE)**

The proposed work does not require any vegetation clearance and hence this is not applicable to current project.

### **Impacts to vegetation and fauna due to improper handling and driving during material transportation (PC and BE)**

Material transportation during construction phase will be from the harbour to the project site, through the access road which has also already been cleared. Hence, while impacts due to transport of material is envisaged to be negligible, that due to handling of materials and potential accidents, if it happens, is envisaged to be minor to moderate, depending on the material being handled. Pollution due to accidental spill of construction materials to be used (due to improper handling), especially oil will have a significant negative impact on the environment at the site (on groundwater resource and fauna).

## **Impacts due to arrival of workforce (SC)**

The proposed work will be carried out by an assigned contractor who have their own workforce. Majority of development projects are carried out in the same manner and arrival of workforce on the island to carry out construction work would not be a new aspect for the island community. The Contractor has the responsibility to ensure that the workforce is comprised of all legal personnel and that their actions while on the island are within accepted social norms. The Contractor also has the responsibility to ensure that the workforce also have the required needs met, such as proper accommodation and daily meals as well as other logistics. This component of the project is not envisaged to have a significant impact on the social environment of the island.

## **Health and safety of workforce (SC)**

The Contractor has the responsibility to ensure the health and safety of the workforce which will be taken to the island. As such the Contractor must ensure that their accommodation and meals while on the island are taken care of regularly. Accommodation in cramped quarters, especially during the COVID 19 pandemic has the potential to have a significant negative impact on the health and safety of the workforce and even the community. First aid kits available on site will ensure that any minor injuries are easily taken care of without delay.

## **Impacts due to road closure (SC)**

Since the IWRMC is located at one end of the island, any road closure (if required) is not envisaged to have an impact on the day-to-day life of the island community.

## **Impact due to loss of land (SC)**

The site proposed for the work is an already allocated land for the waste management centre and is under operation since 2019. The proposed work does not require new land area and hence no additional impact is envisaged in this aspect. Additionally, with reclaimed land on the western side, the island of Kudahuvadhoo has available land area for other purposes.

## **Impact due to waste relocation and disposal at temporary site (PC and BE)**

The site proposed for waste relocation is an empty area near the coastline at eastern side of the island. Since the location is near the coast, the risk of waste being displaced to the sea impacting the marine environment during heavy weather is considered as a minor impact though not well managed could even be a major one.

Furthermore, impact to groundwater due to leachate at temporary site is envisaged to be minor to moderate.

## **6.2.2 Operational phase**

### **Impacts on noise pollution and disturbances (PC and EO)**

The operations of the IWRMC and the technology to be used for composting is not envisaged to have a significant impact in terms of noise pollution. Furthermore, operation of the facility would alleviate existing other disturbances such as that due to open burning currently practiced on the island.

### **Impacts due to litter, odour and vectors (PC, SC and EO)**

The collected waste which is transferred to the IWRMC should be unloaded and stored in the appropriate areas. Improper handling of waste at this stage has the potential to increase the severity of impact due to litter, odour and vectors.

### **Impacts due to material spillage during transfer (PC, BE and EO)**

Waste materials will be collected from households and transferred to the centre by staff hired to the centre. They will undergo all necessary training to ensure that the operations are carried out as per all operation guidelines. However, accidental spills during material transfer to site is a potential impact, with significance of impact dependent on the type of material spilled.

### **Health and safety of the IWRMC operators (SC and EO)**

The workforce hired for IWRMC operations will be given all necessary trainings and provided with all required safety equipment and attire. First aid kits will also be available on site to handle any minor injuries. Impact on health and safety during general operations is envisaged to be minor to moderate (if proper care is not taken), especially since the technology to be used at the site is quite environmentally friendly.

However, in the event whereby hazardous waste is brought to the facility to be stored for transfer to the RWMF, handling of this waste has the potential to be a great risk to the IWRMC workers.

### **Economic impacts due to the IWRMC (SC and EO)**

Upgrade of the IWRMC opens employment opportunities for the island community, to be involved in different stages of implementation of the works in the Island Waste Management Plan. Hence this is a major social benefit due to the functioning of the centre, which would be for the long term. Additionally, the compost generated through the project is a potential source of income through sale of the product. At present, waste collection is carried out by the community themselves at no cost. Once the facility becomes operational again with the upgrade and

functioning machineries, waste collection and disposal will be carried out through the staff of IWRMC at a cost and this will generate some revenue to the council to better manage the waste.

### **Island community health (SC and EO)**

The setup of the IWRMC would enable proper and safe disposal of the waste generated by the island community. This has a multitude of benefits key of which are improved health of the community and improved aesthetics. The operation of the facility would bring a cessation to the practice of open dumping and burning. Hence the project is envisaged to have a major socioeconomic benefit.

### **Impacts associated with proposed technology**

The proposed organic waste treatment technology is quite simple and requires very little manpower. The technology allows domestic waste to be fed in a partially segregated manner, wherein inorganic waste like glass and plastic bags (less than 2%) can be fed to the reactor without segregation and can be collected from a passage of the reactor later. Additionally, any type of waste even agro-residues and long banana stems can be fed as it is without pulverization. The process generates some level of odour, although not of significance. The key outputs of the process, biogas (Methane and CO<sub>2</sub>), liquid fertilizer and compost can be utilized for various purposes. The compost and liquid fertilizer are of high nutrient quality. They can be used for agricultural purposes on the islands or can be packaged and sold to nearby resorts/islands. The, improper handling of the excess liquid fertilizer including the method of disposal however may cause significant negative impacts on the environment, if seeped into the ground, due to high BOD of the product. The Biogas is proposed to be flared, which would produce CO<sub>2</sub> and water vapour. CO<sub>2</sub> is a GHG and will cause an increase in emissions from waste composting thereby degrading the quality of air. However, this impact will be significantly lower than emission of Methane which is found in the biogas.

The AD plant and waste treatment method also addresses the issue of leachate generation, hence minimising the need for construction of additional leachate collection tanks. The design of the area where the AD plant will be housed incorporates drains which will provide the necessary means for removal of any leachate generated.

The existing IWRMC is already connected to the existing power grid of the island which can cater to the additional load. Hence there is no need for setup of a separate power generator at the site. While one impact due to the sourcing of power is the generation of greenhouse gases through burning of fuel, this is an existing impact due to operation of the powerhouse. The additional load due to connection of IWRMC to the power grid is not envisaged to be of significance. Overall, the proposed technology is not envisaged to have significant negative impacts on the environment. Moreover, it is envisaged to have major positive impacts due to proper waste disposal.



## 7 Alternatives

Alternatives for a project are considered for various components of the project, in terms of location, methodology to be implemented etc. Alternatives considered will identify the best practical environmental option for the different components.

Location for the proposed work is at the existing IWRMC of the island. Furthermore, there are no negative impacts on environment with regards to the choice of location, hence an alternative location for the waste management center will not be considered in this plan however temporary site for relocating the existing waste during upgrading works at the existing center are discussed along with the waste treatment method and alternative power sources.

### 7.1 Considered alternatives

#### Waste treatment method / technology

The feasibility report for the project considers different types of waste treatment methods and their advantages and disadvantages (CITRES and MEECO, 2019). The recommended method for organic waste treatment, based on rationales given in the feasibility report is Anaerobic Digestion based on the current waste quantity produced on the island and its projections for 2050. Alternatives considered in this report are:

- Proposed method: Anaerobic digestion
- Alternative 1: In-vessel composting
- Alternative 2: Windrow-based open composting

The environmental, social and economic aspects of Anaerobic Digestion (proposed option) are;

- Very large land area required for setup (environmental)
- Biogas generated can be reused as a potential source of energy (for cooking or converted to electricity). But this would require additional investments (environmental / economic)
- Increased in emissions of CO<sub>2</sub> due to biogas flaring (waste treatment) - environmental
- Higher nutrient content compost and digestate material which can be used as a fertilizer (environmental / economic)
- High energy requirement (environmental)
- Labour requirement for operation of Anaerobic digestion plant is low (social)
- Processing time approximately 1 month (social/ economic)
- Potential for moderate odour generation (social)
- Highly dependent on mechanical equipment (economic)
- Very high capital cost (economic)

- Very high operations and maintenance cost (economic)
- Economic turnover is high (economic)

Appendix 8 gives a matrix of the environmental, economic and social aspects of these three different methods of waste treatment (Table 1 in Appendix 8). The Appendix also gives mitigation measures for each of the alternatives (Table 2 in Appendix 8).

Anaerobic digestion means a higher capital cost, greater land requirement and higher operation and maintenance costs. At the same time, it also means low labour requirement, faster processing time (1 month), high quality bi products which can be used as liquid fertilizer and compost, and high economic turnover. The process is ideal for larger islands, with greater quantity of waste generation and greater land availability. Furthermore, the biogas generated could be utilized through additional investments, which while removing negative impacts associated with emissions, is also a positive impact of the project.

Use of windrows-based composting also means greater land area and higher labour requirement. The piles have to be turned manually every 5 days and usually takes longer to process (2 to 4 months for final product). Additionally, given that this is undertaken in an open area, this will inevitably attract vectors such as flies and rats and other pests.

As for in-vessel composting method, although the capital cost is slightly higher than that for windrow-based composting, all other aspects are positive for the in-vessel composting method (see Appendix 8). Land area requirement being small is a big benefit especially for the smaller islands of Maldives. Low labour requirement is another advantage, in addition to few environmental benefits.

The proposed method of anaerobic digestion as proposed in the feasibility study (CITRES and MEECO, 2019) is considered as the most feasible option for organic waste management in this project for upgrading waste management at Kudahuvadhoo. This has been concluded based on the environmental and economic benefits of the method.

### **Temporary site for relocating the existing waste**

A second component for which an alternative can be considered is the temporary site for relocating the existing waste.

- Proposed Location: Eastern side of the island near the coast
- Alternative: The project site, existing IWRMC

A location from the eastern side beach area has been proposed as a potential area for temporary waste disposal site. This area is close to the existing IWRMC and is vacant with no significant vegetation cover. However, the concerning issue is its proximity to the coast and the disapproval

of island council to have any other site except the IWRMC for waste disposal even if it is for temporarily.

Due to the many grievances regarding the difficulties faced during the development of the waste management center and the difficulties they had to face both logistically and financially in transfer of waste from the island to Thilafushi, the council has reservations to allocate another land for disposal even for a temporary term.

Thus, the alternative as suggested by the island council is to use the existing IWRMC, after clearance of the existing waste pile to Thilafushi, as the temporary waste disposal area even during the construction phase. As per the island council, they can easily manage the daily waste within the center even during the construction phase. Currently there is an extension of the center, with a shaded shed at the eastern side of the center which the council believes can also be used as a waste disposal area temporarily. Most importantly they reiterated that the existing waste piles should be cleared prior to the start of the project and once cleared they will have ample working space within the center. Furthermore, they also noted that, once the project starts and if there is an absolute need to assign an additional space, they can facilitate it.

However, not having a separate location for relocating the existing waste is not a practical option as this may lead to dumping waste into the periphery of the IWRMC as it is practiced to some extent even now due to excess waste within the center. This periphery has a rich vegetation cover. Disposal of waste to the existing center without the necessary upgrades would impact the groundwater and the surrounding vegetation due to leachate other hazardous waste. Furthermore, this will disrupt the proposed works at the IWRMC and will put the workers at risk.

Hence the proposed option of allocating the eastern side for temporary relocation of waste can be considered as the most feasible option as it provides a separate space for the waste, it is not too far from the IWRMC and it does not require any vegetation clearance. The consultant however strongly recommends to follow the mitigation measures proposed in section 8 to prepare the temporary setup to ensure prevention of leachate and waste disbursement during unfavorable weather conditions such as heavy winds, storm surges etc.

Although the alternative suggested by the island council is considered not feasible, mitigation measures for this option are also given in Appendix 8 (Table 3).

### **Power supply and energy source**

A third component for which an alternative can be considered is the energy source to be used for power generation and operation of the IWRMC.

- Proposed method: power connection already made to the IWRMC
- Alternative 1: installation of solar panels

- Alternative 2: Use of bio-generator to convert biogas generated as output of anaerobic digestion to electricity (for use at IWRMC)

The proposed method of sourcing power for the IWRMC is through connection to the existing power grid of the island. Total power requirement for the AD plant is very low, approximately 3kW and the existing capacity of the island power facility is 1MW, with average load of less than 1MW. While use of fuel as energy source at the power facility is a negative impact on the environment, the additional load is not expected to increase the significance of this impact by a great extent. The capital cost is low though, and an operations and maintenance cost will be incurred due to monthly bills. The absence of fuel handling however greatly lowers the risk of environmental pollution due to accidental spills and fire hazards at the centre.

An alternative and more environmentally friendly method is to install solar panels on the roofed areas of the IWRMC to generate the required electricity for operation of the centre. However, this would increase the financial cost of the proposed project, as this would incur a high capital cost, although in the long term has the potential to be financially more feasible, due to minimal operations and maintenance cost. Furthermore, the roof areas of the centre can be used, as there is no open burning or incineration at the centre. Other benefits include the avoidance of pollution of groundwater and other environmental components due to accidental spills, nullification of emissions of greenhouse gases due to fuel burning for IWRMC operations and reduced risk on workforce due to use of flammable liquids.

A second alternative option is to install a bio-generator at the IWRMC, to convert the biogas generated during AD process into electricity which can specifically be used for the centre and its operations. This option would reduce any negative impacts due to bio-gas flaring which is currently proposed, while at the same time providing an environmentally friendly source of power for the IWRMC. However, additional land area would be required for the installation of the bio-generator and set up of a small power facility within the IWRMC. This space, could however be put to better use. Furthermore, addition of a bio-generator would increase the cost of the project, which is a present not financially sustainable.

While the installation of a solar panel to source power is seen to be most environmentally feasible option of the three options considered, this is an unaccounted high capital cost at present, which is not financially feasible. Hence the proposed option using the power which has already been connected to the IWRMC is the most feasible option, as it does not require additional work or incur additional cost. The Consultant however, strongly urges the installation of renewable energy sources at IWRMC, through a separate project. Consultant also recommends the exploration of the option of bio-gas conversion to electricity, to be used at the facility.

Mitigation measures for the alternative energy sources are also given in Appendix 8 (Table 4).

## 8 Mitigation Plan

Environmental impacts that are associated with the project, both during construction and operational phase and which have been identified as significant impacts are discussed in this chapter. These are discussed in the context of various components of the project; evaluation of baseline environmental conditions at the project impact area and vicinity; concerns raised by the stakeholders through consultations and review of the literature of similar projects and experience of the EIA Consultant.

There are a number of actions that can be taken to minimize or avoid impacts altogether. Mitigation measures are selected to reduce or minimise the severity of any predicted adverse environmental effect and improve the overall environmental performance and acceptability (lower environmental damage) of the project from the perspective of construction and operation.

Mitigation measures are discussed for the construction and operational phase of the project with respect to various components and their likely impacts on physical, biological (within the project area), and social and economic environment (health, culture and economy). Impacts due to the project based on the assessment principles followed are foreseen as low to moderately negative to moderately positive. In order to further minimise potential negative impacts, mitigation measures have been discussed below (Table 15). Translation of the proposed ESMP in Dhivehi is given in Appendix 9 of this report.

**Table 15. Mitigation measures proposed for the project (ESMP matrix)**

<b>Project activity</b>	<b>Potential Environmental impacts</b>	<b>Proposed mitigation measures</b>	<b>Institutional responsibility (implementation and supervision)</b>	<b>Estimated quantities required and material specifications recommended</b>	<b>Cost estimates</b>	<b>Comments</b>
Detailed design and Planning Phase	Improper functioning of the waste management facility and associated environmental impacts due to improper design	<ul style="list-style-type: none"> <li>Ensure detailed design takes into account details of the proposed layouts and all designs are as per specifications required, taking into account the environmental components that may be affected.</li> </ul>	Proponent	NA	NA	
	Noise pollution	<ul style="list-style-type: none"> <li>Ensure that the site selection sets a minimum distance of 60m from residential and public areas</li> </ul>	Island council MLSA Proponent	NA	NA	Already approved site
	Coastal erosion due to the proximity of the facility to the shoreline	<ul style="list-style-type: none"> <li>Vegetation buffer of 20m maintained between IWRMC boundary extent and high tideline.</li> </ul>	Island council MLSA Proponent	NA	NA	
Pre-construction Phase	Impact on marine and terrestrial environment during handling and transport of construction materials	<ul style="list-style-type: none"> <li>Material should be sourced from the closest point or should be brought in bulk and transported to the island.</li> <li>Detailed BOQ shall be made and should be followed to reduce the waste and to reduce the number of trips</li> </ul>	Contractor (implementation) Proponent (supervision)	N/A	N/A	

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<p>made to the island to provide the resources</p> <ul style="list-style-type: none"> <li>• Ensure all materials being transferred are packed properly with no loose materials</li> <li>• Monitor oil spills and maintain machinery</li> </ul>				
	Impact on environment due to improper storage	<ul style="list-style-type: none"> <li>• Storage areas for construction materials should have an impermeable surface and should be covered</li> <li>• Materials should be stored in appropriate containers</li> <li>• Area should be regularly monitored for any leaks</li> <li>• Storage facility should be setup within project site to minimise vehicle movements</li> </ul>	Contractor (implementation) Proponent (supervision)	N/A	N/A	
	Impact on flora, fauna and groundwater due to handling of construction related materials and equipment	<ul style="list-style-type: none"> <li>• Ensure workforce are trained and supervised to handle materials during transfer, and unloading so as to minimize accidental spills, littering etc.</li> <li>• Ensure materials are properly packed and any oil/fuel is</li> </ul>	Contractor (implementation) Proponent (supervision)	N/A	N/A	Pre-construction – site preparation phase

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		properly stored in containers used for that purpose				
	Sociocultural impact due to arrival of workforce	<ul style="list-style-type: none"> <li>Recruit local companies and Maldivians for the work (priority given to locals)</li> <li>Workforce should be sensitized to the social norms and acceptable behaviour of the Maldivian culture.</li> <li>Workforce should be fully aware of the Do's and Don'ts of the Maldivian culture.</li> <li>Develop Contractor's Code of Conduct (sample Code of Conduct provided by the World Bank given in Appendix 10, which the contractor can adopt by customizing it to the local context.</li> <li>Establish Grievance Redress mechanism given in the report. Information displaying contact details of the focal points (Tier 1 and Tier 2) should be displayed on the project board, council notice</li> </ul>	Contractor (implementation) Proponent (supervision)	Grievance Redress Mechanism given Section 9.4 to be enforced.		Council / MCEP PMU staff to be assigned as focal points hence no additional cost for implementation of GRM



Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		board and via posters displayed in public areas. QR code for downloading the forms and information on GRM should be given in each of the media used.				
Construction Phase	Noise pollution	<ul style="list-style-type: none"> <li>Operate machinery during day time hours (6am to 6pm)</li> </ul>	Contractor (implementation) Proponent (supervision)	N/A	N/A	
	Air pollution / Dust	<ul style="list-style-type: none"> <li>Regularly maintain machinery so as to reduce emissions.</li> <li>Provide workers with masks and other required gear</li> <li>Regular watering of site to minimize dust (after work everyday)</li> </ul>	Contractor (implementation) Proponent (supervision)	As per operational manual of machinery	N/A	Should be included in the construction contract
	Impact on groundwater table and groundwater quality	<ul style="list-style-type: none"> <li>Extract only quantity of water required for the civil works.</li> </ul>	Contractor (implementation) Proponent (supervision)	N/A	N/A	
	Impact on health and safety of workforce	Occupational Health and Safety measures <ul style="list-style-type: none"> <li>Ensure workers are well briefed on the health and safety measures to be followed during the project</li> </ul>	Contractor / Island Council (implementation) Proponent (supervision)	Contractor to provide Health and Safety Plan	N/A	Should be included in the construction contract

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> <li>• Ensure work force are given all the appropriate safety equipment and gear required for the work (safety hats, boots, glasses, masks and gloves)</li> <li>• Display PPE requirement board at site which should the PPE required by the workers when carrying out different tasks of the construction work</li> <li>• Minimal use of manual lifting must be practiced.</li> <li>• Ensure set up of easy access toilets, wash basins at the site. either through rental from nearby area or installation of a portable toilet.</li> <li>• Provision of regular meal breaks and an onsite resting area for the workers, where they can rest during the breaks</li> <li>• Ensure provision of first aid kit on site ensure readily available transfer in instances of emergency use</li> </ul>				

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> <li>• Ensure workforce are accommodated in appropriate quarters where they are not cramped.</li> <li>• All staff handling hazardous waste should be given the proper protective gear (protective eye gear, protective gloves )</li> </ul> <p>COVID 19 related preventative measures</p> <ul style="list-style-type: none"> <li>• Ensure that there is set number of workers in each room so as to allow social distancing</li> <li>• Ensure that workforce follows all HPA guidelines at all times, with respect to COVID 19 pandemic.</li> <li>• Measures should be in place to undertake daily temperature checks of workforce and enable social distancing at the accommodation facilities and work site.</li> </ul>				

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
	Impact on public health and safety	<ul style="list-style-type: none"> <li>Clearly demarcate project area through metal sheet fencing</li> <li>Ensure public does not have access to the project site and appropriate signs are put up at the required areas</li> </ul> <p>Establish Grievance Redress mechanism given in the report. Information displaying contact details of the focal points (Tier 1 and Tier 2) should be displayed on the project board, council notice board and via posters displayed in public areas. QR code for downloading the forms and information on GRM should be given in each of the media used.</p>	Contractor (implementation) Island Council	N/A	N/A	Should be included in the project cost
	Fire safety	<ul style="list-style-type: none"> <li>Ensure connections to power facility are established by trained and competent personnel</li> <li>Ensure construction workforce are trained in</li> </ul>	Contractor (implementation) Island Council	Firefighting equipment should be included as part of equipment inventory of IWRMC	Should be included in the project cost	

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		firefighting so as to address any fire hazards promptly <ul style="list-style-type: none"> <li>• A portable fire extinguisher should be used at the site.</li> <li>• Installation of a fire hydrant / water point at site</li> </ul>				
	Waste Management During Construction Phase	<ul style="list-style-type: none"> <li>• Clear the area from all the existing waste, relocate it to Thilafushi as much as possible and relocate the remaining to the temporary relocation site</li> <li>• Construction waste produced should be reused for the construction of the IWRMC as much as possible. The remaining reusable materials such as (metal bars and roofing sheets) should be given to the island community or the island council free of cost.</li> <li>• Since no vegetation clearance is required. Any potential green waste generated during the set up of the temporary</li> </ul>	Contractor / Island Council (implementation) Proponent (supervision)	N/A	N/A	Should be included in the project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<p>waste translocation site to be sun-dried.</p> <ul style="list-style-type: none"> <li>Any remaining construction waste shall be temporarily stored and taken out of the island to a RWMF at the time of demobilizing.</li> <li>Hazardous waste generated should be collected and stored in sealed containers</li> <li>Area where hazardous waste is stored should have an impermeable surface (such as concrete layer, metal sheet) and should be clearly marked with warning signs</li> </ul>				
	Impact on marine environment and groundwater due to waste relocation/disposal to the temporary site	<ul style="list-style-type: none"> <li>The temporary area should be clearly demarcated with a fenced boundary and ensure it is aesthetically acceptable as the location is near the public beach area.</li> <li>Cover the ground of the site with an impermeable surface (such as concrete layer, metal sheet) to prevent leachate</li> </ul>	Contractor / Island Council (implementation) Proponent (supervision)	N/A	N/A	Should be included in the project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> <li>Cover the area with a polyurethane bounded tent to avoid any displacement of waste</li> <li>Clear the area after the completion of IWRMC</li> </ul>				
Operation and maintenance phase	Impacts due to waste spillage during transfer of waste from households to the centre	<ul style="list-style-type: none"> <li>Identify correct way in which waste should be left for collection (properly closed bags with no leakage)</li> <li>Ensure transport vessel carrying the waste carries only a set load</li> <li>Vessels should be enclosed on all sides to prevent spills</li> <li>Setup of appropriate bins at identified locations</li> <li>Provision of proper and complete training to IWRMC operators (in all aspects of operations)</li> <li>Provision of all required PPE to the staff of IWRMC</li> <li>Protective clothing, gloves, respiratory face masks and slip-resistant shoes are</li> </ul>	Waste Facility Operator Island Council	Operational plan should be prepared and IWRMC should be registered and licensed by EPA as per Waste Management Regulation.	N/A	Should be included in the project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<p>recommended for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet.</p> <ul style="list-style-type: none"> <li>Noise protection gear such as ear muffs should be provided to all workers operating or working within vicinity of loud equipment</li> <li>Provision of hard hats for workers operating or working within vicinity of heavy mobile equipment, and at the discharge location for collection trucks, include provision of hard hats</li> </ul>				
	Impacts due to installation and operation of AD plant	<ul style="list-style-type: none"> <li>Design and construct an appropriate sized area for machine installation, with an impermeable layer, drainage mechanism and leachate collection tank for leachate management</li> <li>Ensure Carbon: Nitrogen (C:N) ratio is between 20:30.1 optimum methane production.</li> </ul>	Waste Facility Operator Island Council	N/A	N/A	Should be included in project cost



Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<p>If ratios is higher than this, nitrogen availability will limit the process and consequentially decrease gas production and digestate produced will be less in nutrient quality (Environment Agency, 2013)</p> <ul style="list-style-type: none"> <li>• Ensure that the AD plant is operated at the correct operational temperature for the specific plant being used (Environment Agency, 2013)</li> <li>• Operate an anaerobic digester under thermophilic digestion conditions, in order to increase the pathogen destruction, biogas production rate (hence higher energy recovery) and the retention time (World Bank Group, 2007)</li> <li>• Ensure pH inside the AD plant is maintained between 6.5 to 8 which is the wider range for optimum growth rate of methane producing</li> </ul>				

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<p>organisms (Environment Agency, 2013).</p> <ul style="list-style-type: none"> <li>Recycle wastewater to the reactor to the greatest extent possible</li> <li>Explore the potential use of biogas (Methane) such as use for cooking or generating electricity</li> </ul>				
	Potential increase in air pollution due to flaring of methane	<ul style="list-style-type: none"> <li>Warming potential of CH<sub>4</sub> is higher than CO<sub>2</sub>. Therefore, flaring of CH<sub>4</sub> will reduce the warming potential by conversion to water vapour and CO<sub>2</sub>.</li> <li>Care should be taken to maintain the flaring vent and the flame so as to have controlled burning (to prevent CH<sub>4</sub> emissions).</li> </ul>	Waste Facility Operator Island Council	N/A	N/A	
	Impacts due to AD plant malfunction	<ul style="list-style-type: none"> <li>Provision of proper and complete training to IWRMC operators (in all aspects of operations and AD plant maintenance)</li> </ul>	Waste Facility Operator Island Council	N/A	N/A	Should be included in project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> <li>Undertake routine maintenance of machinery as per the manual</li> <li>1 year stock of spare parts that might be required for the routine functioning of the AD plant should always be maintained.</li> </ul>				
	Impacts of hazardous waste sorting and storage and disposal to the workers	<ul style="list-style-type: none"> <li>Specific times should be allocated to receive hazardous waste in the facility.</li> <li>Dedicated area should be marked for collection and storing of hazardous waste.</li> <li>The floor should be concrete to minimize seepage into ground should there be a spill or an accident.</li> <li>Chemicals and other hazardous material should be placed in closed containers with proper signage.</li> <li>Fire extinguishers should be available in close proximity.</li> </ul>	Waste Facility Operator Island Council	N/A	N/A	Should be included in project cost
	Impact on groundwater resource due to	<ul style="list-style-type: none"> <li>Ensure drains are cleaned regularly to prevent clogs</li> </ul>	Waste Facility Operator Island Council	Associated with operation	Associated with operation	

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
	leachate and wastewater processing	<ul style="list-style-type: none"> <li>Organic waste brought to the IWRMC must be prepared for anaerobic digestion according to a scheduled plan</li> </ul>				
	Litter, odour and vectors	<ul style="list-style-type: none"> <li>Sort waste brought to IWRMC and carry out organic waste processing in the AD plant according to a scheduled plan</li> <li>Store inorganic waste and other bulk waste in their allocated storage areas</li> <li>Undertake volume reduction via glass crushing, metal can baling, plastic shredding, wood chipping etc.</li> <li>Arrange regular disposal of inorganic waste through transportation to the RWMF</li> </ul>	Waste Facility Operator Island Council		N/A	Should be included in project cost
	Socio-cultural conflicts	<ul style="list-style-type: none"> <li>Hiring of locals (especially from within the island community) to operate and manage the IWRMC and implement the Island Waste Management Plan</li> <li>Establish the Grievance Redress Mechanism given in</li> </ul>	Waste Facility Operator Island Council	Costs associated with the contract	Not known	Should be included in project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		this report. Information displaying contact details of the focal points (Tier 1 and Tier 2) should be displayed on the project board, council notice board and via posters displayed in public areas. QR code for downloading the forms and information on GRM should be given in each of the media used.				
	Workplace safety	<ul style="list-style-type: none"> <li>• Set up of all required sign boards as per the Waste Management regulation</li> <li>• Ensure all firefighting equipment required for the facility are in place and in good condition</li> </ul>	Waste Facility Operator Island Council	Fire safety equipment to be supplied and installed as part of the contract: <ul style="list-style-type: none"> <li>• 50KG DCP Trolley (2)</li> <li>• 50LTR Foam Trolley (1)</li> <li>• Wet Chemical 6Ltr with Cabinet for hazardous waste area (1)</li> <li>• Water 9Ltr with Cabinet for Office Area – Outside (1)</li> </ul>	N?A	Should be include in project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
				<ul style="list-style-type: none"> <li>CO2 2KG with Cabinet for Office Area – Outside (1)</li> </ul>		
	Impact on resources	<ul style="list-style-type: none"> <li>Prepare a plan to switch on the compactors and shredders depending on the incoming waste stream to conserve electricity.</li> <li>Ensure that all equipment is serviced and kept clean daily, to reduce the amount of water required for cleaning.</li> <li>Work shall be planned to be carried out during day times.</li> <li>Use solar lights in the premises.</li> </ul>	Waste Facility Operator Island Council	N/A	N/A	Should be included in project cost

## 9 Environmental Management and Monitoring Plan

Monitoring is the systematic collection of information over a long period of time. It involves the measuring and recording of environmental variables associated with the development impacts. Monitoring is needed to:-

- Compare predicted and actual impacts;
- Test the efficiency of mitigation measures;
- Obtain information about responses of receptors to impacts;
- Enforce conditions and standards associated with approvals;
- Prevent environmental problems resulting from inaccurate predictions;
- Minimize errors in future assessments and impact predictions;
- Make future assessments more efficient;
- Provide ongoing management information; and
- Improve EIA and monitoring process.

Impact and mitigation monitoring are carried out to compare predicted and actual impacts occurring from project activities to determine the efficiency of mitigation measures. This type of monitoring is targeted at assessing human impacts on the natural environment. Impact monitoring is supported by an expectation that at some level anthropogenic impacts become unacceptable and action will be taken to either prevent further impacts or re-mediate affected systems.

Table 16 shows the monitoring work to be carried out for the construction and operational phase of the project. Commitment to carrying out and financing the mitigation and monitoring work is given in the proponent's declaration at the beginning of the report.

**Table 16. Monitoring programme for the project**

<b>Proposed mitigation measure</b>	<b>Parameters to be monitored</b>	<b>Location</b>	<b>Measurements</b>	<b>Frequency of monitoring</b>	<b>Responsibility</b>	<b>Cost (MRF)</b>
<b>Pre-construction phase</b>						
Monitor oil spills	Spill events	Sea/land	Logs of spill events	After every event	Contractor	N/A
<b>Construction phase</b>						
<b>Groundwater quality</b>	Temperature, Conductivity, pH, Total Dissolved Solids and Nitrate, TPH	Project site and control site	Water samples tested in-situ using probe or sent to competent laboratory if necessary	Once every 2 months during construction phase	Contractor	7,500.00 (total)
<b>Workforce health and safety</b>	Daily temperature checks  General health and wellbeing of workforce	Project site	Logs of any illness amongst workforce	Daily	Contractor	Part of the contract
<b>Monitor spills during the waste collection and disposal process at the temporary site</b>	Spill assessments during collection, transfer, within the temporary site and transfer from IMWRM to site and vice versa  Littering around the island	Temporary site and transport route  Around the island	Logs of spills and type  Logs of littering incidents (date, location and type of waste)	Spill logs after every incident  Littering monitoring every 3 months	Contractor IWRMC operator / Island Council	Part of contract
<b>Monitor quality of outlet flows of the anaerobic digester</b>	Total Organic Carbon (TOC), Chemical Oxygen Demand (COD),	AD plant at IWRMC	Sample collected from outlet flow of AD plant sent to competent laboratory	Once after installation of AD plant and priming of unit (test run)	AD plant installation contractor/Proponent	2,500.00



	Nitrogen (N), Phosphorus (P) and Chlorine (Cl)					
<b>Grievance redress mechanism</b>	Monitor grievances by the community or other personnel	Whole island	Log of grievances filed and how these were handled	Continuous process	Island Council / MCEP	Part of the contract
<b>Operational phase</b>						
<b>Monitor spills during the waste collection and disposal process</b>	Spill assessments during collection, transfer, with IWRMC and transfer to RWMF	IWRMC site and transport route	Logs of spills and type	Spill logs after every incident	IWRMC operator / Island Council	Part of operational cost
	Littering around the island	Around the island	Logs of littering incidents (date, location and type of waste)	Littering monitoring every 3 months		
<b>Monitor IWRMC operations</b>	Waste generated and disposed quantities	IWRMC	Daily logs of waste generated  Composting logs with details of input/output quantities  Logs of disposal of inorganic waste	Daily / for every incidence of disposal of inorganic waste	IWRMC operator / Island Council	Part of operational cost
<b>Groundwater quality</b>	Temperature, Conductivity, pH, Total Dissolved Solids and Nitrate	Project site and control site	Water samples tested in-situ using probe or sent to competent laboratory if necessary	Once every 6 months	IWRMC operator / Island Council	4,000.00 (per year)
<b>Grievance redress mechanism</b>	Monitor grievances by the community or other personnel	Whole island	Log of grievances filed and how these were handled	Continuous process	Island Council / MCEP	Included in operational cost

## 9.1 Reporting Procedures and Implementation Schedule

The reporting procedures and schedule for the various monitoring components are given in Table 17 below.

**Table 17. Reporting schedule for the monitoring programme**

<b>Phase</b>	<b>Deliverables</b>	<b>Responsibility</b>	<b>Accountability</b>
<b>Construction phase</b>	Monitoring report (as per format provide by MCEP Safeguards Specialist) submitted every 3 months or earlier based on date of invoice submission by the Contractor which should include the following: <ul style="list-style-type: none"><li>• Log of spill events during material transfer</li><li>• Groundwater quality monitoring reports</li></ul>	Contractor	MCEP
<b>Operational phase</b>	Monitoring report submitted once a year (as per format provide by MCEP Safeguards Specialist) which should include the following: <ul style="list-style-type: none"><li>• Logs of spill / littering assessments</li><li>• Waste quantification logs</li><li>• Compost quantification logs</li><li>• Groundwater quality monitoring reports</li><li>• Outcomes of grievances filed</li></ul>	IWMRC Operator / Island Council	MCEP

## 9.2 Cost Estimates and Sources of Funds

The cost estimates for the different mitigation measures and monitoring work are given in Tables 15 and 16 respectively. The Tables also identify the personnel responsible for the implementation of these measures, who will also be responsible for funding these components.

## 9.3 Contract Clauses

Contractual clauses have been identified to ensure that the full implementation of the ESMP which is a requirement of both the World Bank and EPA is carried out during the construction phase of the project. Operation of the facility will be handed over to the Island Council. The Consultant recommends incorporation of the following clauses into the agreement signed with the construction contractor for the project:

1. Contractor should submit a report inclusive of photographic evidence of implementation of mitigation measures such as set up of sign boards, provision of safety gear to workforce at the start of construction

2. Payment invoices must be accompanied with progress reports, which give the following details:
  - Work completed to date of invoice
  - Delays faced and reasons for delay
  - Mitigation measures implemented during the time period
  - Environmental impacts observed during the work period and measures taken to correct these impacts
3. Monitoring reports should be submitted in the format required by MCEP, as per the schedule identified in this ESMP. Employer has the right to withhold payment if reports are not submitted as per schedule and in required format
4. The Employer or the Contractor have the right to terminate the contract, if either party is in violation of any part of the contract. Termination in such instances will be effective immediately from the date of termination.

## **9.4 Grievance redress mechanism**

The Maldives Clean Environment Project has formulated a Grievance Redress Mechanism (GRM) for these projects, which would facilitate the receiving and addressing of any grievances which may arise during both the construction and operational phase of the project. The mechanism has two tiers, whereby Tier 1 will be facilitated by the Island Council and Tier 2 by the MCEP.

The Island Council were briefed about the mechanism during the stakeholder consultation meeting held with them regarding the project and operations of the IWRMC. The Council have also been requested to identify a focal point for managing the GRM at Tier 1. Details of focal point identified by the Council are:

- Name: Ahmed Ibrahim
  - Designation: Senior Municipal Officer
  - Contact number: 9666446

Tier 2 will be managed by the MCEP, with the Environmental and Social Safeguards Specialist as the focal point.

Table 18 below gives the details of the GRM formulated by MCEP.

**Table 18. Grievance Redress Mechanism for the project, formulated by the PMU**

<b>Tiers of Grievance Mechanism</b>	<b>Nodal Person for Contact</b>	<b>Contact Communication and other facilitation by the project</b>	<b>Timeframe to address grievance</b>
First Tier: Island Council	<p>Island Council will be the first point of contact for any grievances.</p> <p>The staff designated as the waste management focal point by the island council will manage grievances on behalf of the council.</p>	<p>GRM should be publicly displayed in the construction site as well as the council office. GRM should also be outlined in official website and/or social media pages of Council, ME (and/or the project), including contact details of the nodal person in each tier.</p> <p>Grievances can be addressed informally by contacting the council through email / telephone / in person.</p> <p>If the grievance cannot be resolved informally, an aggrieved party must submit a complaint on the Tier I Complaint Form. A copy of the form (with the council seal) should be provided to the aggrieved party as evidence of receipt.</p> <p>Electronic version of the complaint form should be available from the websites and/or social media pages of ME and the council. Physical copies of the form should be available from the council front office.</p> <p>Council will provide assistance to fill the form for those who cannot write.</p> <p>The council should keep separate registries for informal and formal complaints and maintain records of all complaints received.</p> <p>The council will discuss the matter with all relevant stakeholders (Farmers, Fishermen, School, Health Center, Women's group etc.), where deemed necessary and attain views of them. If such meetings are arranged, the date, time, location or venue, list of participants (with contact details) and a summary of the main outcome of the consultation must</p>	15 working days

		<p>be annexed to the written decision issued by the council.</p> <p>If the complaint is resolved within 15 working days, the council must communicate the decision to the aggrieved party in writing. The aggrieved party must acknowledge the receipt of decision and submit their agreement or disagreement with the decision within 10 working days. If no acknowledgement is submitted from the aggrieved party within this period, then the decision will be considered as accepted. If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and the aggrieved party must consent and sign-off the request for the extension to take effect. An extension can be made to an additional 15 working days. The staff designated as the waste management focal point by the island council will manage and provide feedback for grievances submitted to the council.</p>	
Second Tier: Ministry of Environment (ME)	Environmental and Social Safeguards officer at the Project Management Unit (PMU)	<p>If the grievance cannot be resolved through Tier 1 to the satisfaction of the aggrieved party or if the issue is outside the jurisdiction of the council (issues related to RWMF), an aggrieved party may submit a complaint on the Tier 2 Complaint Form.</p> <p>A copy of the form (with ME seal) should be provided to the aggrieved party as evidence of receipt. Electronic version of the complaint form should be available from the websites and/or social media pages of ME and the council. Physical copies of the form should be available from the council and ME front office.</p> <p>A copy of the Tier 1 Complaint Form should be submitted with the Tier 2 Complaint Form.</p>	15 working days

		<p>ME will forward the grievance to PMU.</p> <p>PMU screens the grievance and determine if its related to MCEP. If it is unrelated, the aggrieved party must be notified in writing and the way forward must be outlined to them including the necessary government institutions to follow up.</p> <p>Environment and Social Safeguards Officer at the PMU will be the contact person in processing a grievance through the Second Tier.</p> <p>PMU will discuss the matter with EPA and other relevant institutions, where deemed necessary and attains views of them. PMU will also arrange site visits and hold onsite discussions and meetings if necessary.</p> <p>The PMU will be responsible to ensure that there is no cost imposed on the aggrieved person, due to the grievance mechanism at the second tier.</p> <p>If the complaint is resolved within 15 working days, the PMU must communicate the decision to the aggrieved party in writing. The aggrieved party must acknowledge the receipt of decision and submit their agreement or disagreement with the decision within 10 working days. If no acknowledgement is submitted from the aggrieved party, then the decision will be considered as accepted.</p> <p>If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and the aggrieved party must consent and sign-off the request for the extension to take effect. An extension can be made to an additional 15 working days.</p>	
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<p>Third Tier: Judiciary Power / Assistance to Vulnerable Persons beyond the Project's Grievance Redress Mechanism</p>	<p>Judiciary system is an option for an aggrieved person and/or community in case that the other tiers have not been effective</p>	<p>The legal system is accessible to all aggrieved persons.</p> <p>Assistance from the PMU of MCEP is available only for vulnerable person(s)* as per this grievance mechanism.</p> <p>In cases where vulnerable person(s) are unable to access the legal system, the Attorney General's office will provide legal support to the vulnerable person(s). The PMU must assist the vulnerable person(s) in getting this support from Attorney General's Office. PMU must also ensure that there is no cost imposed on the aggrieved person if the person belongs to the vulnerable groups. The list of vulnerable groups is as defined in the footnote but may be further defined by MEE.</p> <p>The verdict of the Courts will be final.</p>	<p>As per established Judicial Procedure</p>

\*Vulnerable person(s): A vulnerable person(s) for the purpose of this project is a person who is poor, physically or mentally disabled/handicapped, destitute, disadvantaged for ethnic or social reasons, an orphan, a widow, a person above sixty years of age, or a woman heading a household.

## 10 Training recommendations

During consultations meetings with the Island Council, it was identified that operations of the IWRMC can only be effectively and fully implemented with training of the staff involved in the operations. As a result of this, the ESMP identifies areas where training is required and who the training is targeted for and this is given in Table 19. Consultant would like to note that given that training needs for most of these IWRMC projects would be very similar, some details of the training programme have been sourced from ESMP carried out for upgrading of IWMC in N. Holhudhoo (Zuhair, 2019).

**Table 19. Training requirements for the implementation of the ESMP**

<b>Training activity</b>	<b>Participants</b>	<b>Type of training and content</b>	<b>Responsibility</b>	<b>Scheduling</b>	<b>Cost estimates</b>
Strengthening the capacity of the contractor on ESMP implementation and reporting.	PMU personnel and Contractor	Brief of the ESMP and monitoring requirements  Data to be collected and how to be presented (Format of monitoring report)	PMU / Environmental and Social Safeguards Specialist	Kick off meeting	N/A
Strengthening PMU's capacity on compliance monitoring	All PMU staff involved in the work	Familiarisation with monitoring requirements and monitoring report template	Environmental and Social Safeguards Specialist	Construction phase	N/A
General awareness on health, safety and environment	Construction workforce	Introduction to the health and safety precautionary measures to be implemented (site safety rules / PPE / emergency response)  Training in environmentally friendly ways of carrying out construction work with minimal littering	Site Supervisor / Contractor	Pre-construction phase  Construction phase	N/A



		Training in following COVID 19 guidelines at workplace and accommodation.			
Community Mobilization	Waste Management Committee	<p>Introduction (Refresher) to the Waste Management Regulation, Policy and Guidelines</p> <p>Introduction (Refresher) to the Island Waste Management Plan and Waste Management Committee</p> <p>Training in ways to segregate waste at household level</p> <p>Training in marketing of compost product</p>	Communication Specialist of MCEP	Pre-construction phase	<p>Travel cost of facilitators</p> <p>Designing and printing of training materials and workshop costs</p>
Operation and Maintenance training of the anaerobic digestion plant	IWMRC staff	<p>Introduction to compost preparation using organic waste</p> <p>Step by step guidance on anaerobic digestion and preparation of compost</p> <p>Step by step guidance to use and maintenance of the AD plant installed on the island</p>	<p>Zone-5 Project Coordinator of MCEP</p> <p>WMPCD</p> <p>Island Council</p> <p>Communications Specialist of MCEP</p>	Prior to commencement of operations	<p>Travel cost of trainer</p> <p>Developing and printing of Training Manual</p>

Fire safety training and fire drills.	IWRMC staff	<p>Introduction to potential hazard scenarios and fire safety</p> <p>Training in use of fire safety equipment on the site</p> <p>Emergency response and evacuation plan and drill</p>	<p>PMU/ MCEP</p> <p>MNDF</p>	Prior to commencement of operations	<p>Travel cost of trainer</p> <p>Developing and printing of Training Manual</p>
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## **11 Contingency plans**

The following contingency plan is proposed in case that the project planning, construction and operation as scheduled have not been met due to unforeseen circumstances such as failure to meet specific performance criteria established by law or necessary for the project to meet its commitments in the ESMP and including responses to natural and other risks identified and mitigated in the ESMP. The project related risks and mitigation measures addressed in the report are mainly environmental and socio economic. The significance of environmental and other impacts identified through RIAM are low negative and failure to or deviation from the proposed mitigation measure will not significantly affect the outcome of the project from impact on natural environment and in the worst-case scenario the island waste management system defaults to current status quo. Nevertheless, the following sections highlights proposed measures in the event the upgraded facility and its operations are interrupted.

### **11.1 Natural Disasters**

Natural disaster such as earthquakes are rare in the Maldives. However, the risk of flooding associated with extreme weather such as storm surges and heavy rain is notable. Climate change risks such as sea level rise is projected as long term and such future risks are high with respect to the low elevation of islands in the Maldives.

This ESMP has not addressed potential risks to the project with respect to project design. It appears, from the limited information made available with regard to architectural design of the layout of the facility from the proponent, that the design has not included project sea level risk mitigation factor into the design, somewhat considered for critical infrastructures as general policy (legally not required by law or regulation as yet). That been said, it is challenging to identify what becomes a critical infrastructure or not as any infrastructure (public or private) are equally vulnerable to flooding.

Locally applicable regulation such as EIA regulation requires for all development project to ensure that a minimum 20m vegetation buffer be maintained. The location of this project conforms to that requirement. Additionally, it may be important to review the design of the facility to assess whether the design has considered climate proofing (e.g. flooding risks) as part of the design. If not, identify potential costs involved for such design so that future projects of similar nature consider such cost if they are feasible or important as part of national sustainable development strategy.

## **11.2 Disruptions to operation of the facility**

Few aspects may be associated with potential destruction to the operation of the facility. These include;

- Breakdown of the machinery
- Components required for optimal processing of organic waste not available
- Staff not appropriately trained to operate the machinery

Breakdown of the machinery is often associated with lack of routine maintenance services that are required for any machinery. Hence the facility operator should ensure that adequate supply of materials are stocked at site so that any minor breakdown or disruption to the operation of the machinery is immediately or quickly addressed. Required routine services to the machinery or other equipment or vehicle should be followed according to the operation manuals and guidelines. The facility or operation supervisor shall ensure such protocols are maintained through proper logs and documentations.

Interruption to the operations of vehicles and machinery is also associated with lack of or inadequate training provided to the machinery operators. Adequate training provided to the operators of the machinery or equipment is thus essential. Hired staff shall be based on optimal technical qualifications. If technical qualification are not available due to local human resources capacity that project shall include training to the staff hired prior to the facility become operational.

In case of interruption to the operation of the facility, place for storage of the unprocessed waste at the site should be established by an agreed SOPs established as part of the operation of the facility, between stakeholders of the project. Such shall be agreed by;

- Formulation of agreements with the facility operator, island council and ME to agree on a procedure to handle waste in case of emergency
- Transport the waste to nearby island where such facility is operational until operational issues are rectified
- Ensure appropriate and secured finance is made available in the operational budget.

## 12 Stakeholder consultation

Stakeholder consultations with relevant personnel, as identified in the TOR for the ESMP, was carried out as online meetings, telephone conversations and through a short survey of households. Key stakeholders identified in the TOR are:

- Island Council of Dh. Kudahuvadhoo
- Environmental Protection Agency
- FENAKA Corporation Limited
- Health Protection Agency
- Ministry of National Planning, Housing and Infrastructure and Maldives Land and Survey Authority (MLSA)
- Maldives National Defense Force
- Women's Development Committee of the island
- Community Consultation or Household Survey on their perception of the project
- Ministry of Environment / MCEP

Table 20 gives details of the discussion points of the different stakeholder consultation meetings. Details of personnel consulted with are given in Appendix 11.

**Table 20. Outcomes of the consultation meetings**

Meeting details	Discussion points and feedback (in italics)
<p>Consultation with the Island Council</p> <p>Date: 10<sup>th</sup> January 2021</p> <p>Meeting held at the Office of the Secretariat of Dhaalu Kudahuvadhoo Island Council</p>	<p>The objective of this meeting was to inform and undertake consultation on the current waste management practices on the islands and identify concerns of the council with regards to installation of Anaerobic Digester.</p> <p>General Waste Management Issues in the island</p> <ul style="list-style-type: none"> <li>▪ <i>The have identified waste management as an environmental problem and have built waste management system. The island manage the organic waste at their site through open burning. On the other hand, inorganic waste including bulky waste are removed from the island.</i></li> <li>▪ <i>The island have invested in more than 2.5 million MVR to establish the service on the island. The council employs its own staff including foreign labour to ensure the island receives the service. All the waste from the household are managed at a rate of 150 MVR per Month.</i></li> <li>▪ <i>Since all the equipment including the inclinator is not working, the waste open burning is practiced. The waste sites does not employ any sorting or segregation. Furthermore, due to lack of</i></li> </ul>

	<p><i>an effective waste management at the site, the IWMRC is almost filled. Hence residues or ash left after the open burning is dumped next to the site.</i></p> <ul style="list-style-type: none"> <li>▪ <i>The normal working hours for burning practice is usually afternoon. According to the council, they burn waste after reviewing the direction of wind to ensure that communities are less effected due to smoke.</i></li> </ul> <p><b>GRM at Council Level</b></p> <ul style="list-style-type: none"> <li>▪ <i>The island does have an EPA endorsed waste management plan. All grievance matters related to waste management issue is handled by the site supervisor at the IWRMC. Locals are aware of the focal point.</i></li> </ul> <p><b>Removal of vegetation from the site</b></p> <ul style="list-style-type: none"> <li>▪ <i>The IWRMC site does not have any trees or palms to be removed. If an expansion is required the council only intends to expand the site towards the beach side. At the possible extension side, there are only few coconut palms and of Banana trees.</i></li> <li>▪ <i>The access roads are cleared. There is no large vegetation such as trees or coconut palms.</i></li> <li>▪ <i>The council indicated that they would be facilitating the compensation to trees if required, however Ministry of Environment shall make the payment to the council.</i></li> <li>▪ <i>With regard to the replantation process, the council indicated that the large trees and coconut palms cannot be replanted. The council indicated that all these trees including palms would not be auctioned for its timber.</i></li> <li>▪ <i>Council indicated that they have plans to undertake replanting 2 tree for every tree removed at the site.</i></li> </ul> <p><b>Proposed AD technology.</b></p> <ul style="list-style-type: none"> <li>▪ <i>The council does not believe in the AD-composting technology and they are skeptic over its successful implementation on the island.</i></li> <li>▪ <i>The main reason associated with this thinking is due to the mistrust that is established within the council and the Ministry of Environment.</i></li> <li>▪ <i>The council is uncertain about realization of the technology in islands due to many unfulfilled promises made by Ministries over the time. Furthermore, they indicated that a staff needs to be trained to operate the new technology and the council would</i></li> </ul>
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	<p><i>recommend their staff to be trained during the handover process.</i></p> <p>Temporary Site during the construction phase</p> <ul style="list-style-type: none"> <li><i>The council indicated the only choice would be to use the existing waste management area. The council would not be able to provide another land from the island. Furthermore, the council suggests the project contractor to remove all the waste from the island.</i></li> </ul>
<p>Consultation with Women's Development Committee</p> <p>Date: 10<sup>th</sup> January 2021</p> <p>Meeting held at the Office of the Secretariat of Dhaalu Kudahuvadhoo Island Council</p>	<p>The objective of this meeting was to inform and undertake consultation on the current waste management practices on the islands and identify concerns of the Women's Development Committee (WDC) with regards to installation of Anaerobic Digester.</p> <p>Institutional capacity and role of WDC</p> <ul style="list-style-type: none"> <li><i>The WDC does not have any active management roles in waste management issues of the island.</i></li> <li><i>All the decision are made by the council.</i></li> </ul> <p>Proposed AD technology.</p> <ul style="list-style-type: none"> <li><i>WDC believes it would be beneficial for farmers on the island with composting. Furthermore, WDC supports its practical nature of making the compost. They also welcome the technology of producing the compost as that would reduce environmental damage and improves quality of the product.</i></li> <li><i>The WDC have shown its dissatisfaction particularly on the level of awareness around the island on waste management issues.</i></li> </ul>
<p>Consultation with the FENAKA</p> <p>Date: 10<sup>th</sup> January 2021</p> <p>Meeting held at the Office of the Secretariat of Dhaalu Kudahuvadhoo Island Council</p>	<p>The objective of this meeting was to inform and undertake consultations on the current electricity demand and understand FENKA capacity to provide electricity for operation of the IWRMC including the Anerobic Digestor.</p> <p>Current Electricity demand</p> <ul style="list-style-type: none"> <li><i>The island has installed capacity of approximately 1MW, that is generated by 3 sets of generators (500kv, 400kv, 250kv). All the generators are synchronized and the island is provided with 3 phase electricity for 24 hours.</i></li> <li><i>For electricity production approximately 1400 – 1900 liters of oil is used per day.</i></li> </ul> <p>Provision of electricity for operation of IWRMC</p> <ul style="list-style-type: none"> <li><i>FENAKA has the capacity to provide electricity requirements to the IWRMC including the power requirements of the proposed digestor. Furthermore, FENAKA would be able to</i></li> </ul>

	<i>provide electricity requirements to contractors who will undertake civil works</i>
<p>Consultation with the Environmental Protection Agency</p> <p>Date: 12<sup>h</sup> January 2021</p> <p>Meeting held via Googlemeet</p>	<p>EIA Consultant enquired about the licensing requirements for operating island waste management centers:</p> <ul style="list-style-type: none"> <li>• <i>Operation License needs to be acquired for the vehicles and vessels used for transport of waste from one place to another.</i></li> <li>• <i>Operation Permits are given to operate the waste management center upon submission of waste management plans.</i></li> <li>• <i>All waste management practices should be in accordance with the guidelines provided in the waste management regulation</i></li> </ul> <p>EIA Consultant enquired about the duration of the operation permits issued:</p> <ul style="list-style-type: none"> <li>• <i>The duration depends on the method of waste management planned for that island. It may be 5 years, 2 years or even 1 year. The duration is determined after reviewing the waste management plan.</i></li> <li>• <i>The permits can also be renewed with completion of terms.</i></li> </ul> <p>EIA consultant enquired if there would be any inspection carried out by the EPA before renewing operating permits of the centers.</p> <ul style="list-style-type: none"> <li>• <i>EPA will carry out an inspection and decide on renewal of permit.</i></li> </ul> <p>EIA Consultant enquired if EPA has any comments on the design of the waste management centers</p> <ul style="list-style-type: none"> <li>• <i>There are no specific design requirements yet from EPA. The participant noted that the drawings shared were not very clear and to send clear drawings for them to review.</i></li> </ul> <p>Meeting was ended with no further comments. It was agreed to share the drawings for their review.</p>
<p>Consultation with the MNPHI / MLSA</p> <p>Date: 11<sup>h</sup> January 2021</p> <p>Meeting held via Googlemeet</p>	<p>Meeting was held with participant from Land use planning department. EIA Consultant briefed the participant about the project and enquired whether they had any issues with respect to the area allocated for the project site. EIA Consultant also informed that the Client had already received letters from MLSA, approving the locations (for at least majority of the islands) and agreed to send a list of islands for which letters had been received.</p> <ul style="list-style-type: none"> <li>• <i>Participant of the meeting stated that if approval had already been given, then they had not further comments or issues. They further stated that once the list is shared with them, they will also discuss with MLSA and communicate their comments to the consultant in writing.</i></li> </ul>
<p>Consultation with MNDF</p> <p>Date: 28<sup>th</sup> January 2021</p> <p>Meeting held via Googlemeet</p>	<p>Meeting was held with personnel from the fire safety and training departments of MNDF. EIA Consultant briefed the participant about the project and stated that main points of discussion for the meeting was with respect to fire safety and willingness of MNDF to assist in training the IWRMC operators on firefighting.</p> <p>EIA Consultant enquired whether they had any concerns about the project from a fire safety / hazards aspect.</p>



	<ul style="list-style-type: none"> <li>• <i>Since there is no fuel storage on site or use of fuel for any purpose on the site, they had no major concerns</i></li> <li>• <i>Some drawings for these centres have been shared with MNDF. Request to send all drawings, inclusive of fire safety measures to them for their approval.</i></li> <li>• <i>Recommend to formulate a firefighting and fire safety plan prior to project commencement, so that in the instance of a fire incidence, personnel are well aware of how to handle the situation.</i></li> <li>• <i>The plan should include details of firefighting team, leading staff, equipment details, assembly points and emergency contact numbers. The plan should be approved by MNDF fire department.</i></li> <li>• <i>Fire hydrant or water point to be established on site and a water pump should be added to the list of firefighting equipment to be sourced for the site. This will be used for handling of any major fire events.</i></li> </ul> <p>EIA Consultant enquired about the willingness of MNDF personnel to give the required training for the workforce of the IWRMC</p> <ul style="list-style-type: none"> <li>• <i>The MNDF regional branch at L. Kahdhoo, F. Nilandhoo and Dh. Kudahuvadhoo can undertake the trainings for the IWRMC staff of Faafu, Dhaalu, Thaa and Laamu atoll as required by the proponent. Ministry should send a formal request to MNDF to this effect and the public affairs department of MNDF will arrange the trainings.</i></li> </ul> <p>Meeting adjourned with no further questions or queries on either sides.</p>
Ministry of Environment / MCEP	<p>A formal consultation/meeting with the project PMU was held at the Inception stage.</p> <p>Regular communications have also been carried out via phone or email throughout the report formulation process, which also includes communications regarding project progress, delays, request for information.</p>

*Note: Meeting request has been made to Health Protection Agency with numerous followups, though a meeting has not been scheduled to date (copies of email communications given in Appendix 12). Consultation with Maldives Energy Authority has not been carried out, as the PMU have later informed that this is not required, since installation of bio-generator is not within the scope of this project.*

## 12.1 Results of the Household survey

A household survey was undertaken to assess the perception of the community with regards to the current waste management practice and their willingness to pay for a proper waste management system. Survey forms were sent to the Island Council so as to enable the household survey data collection (copy of survey form is given in Appendix 13). Questions were asked about their waste segregation methods, waste disposal methods for both biodegradable and non-biodegradable waste and their perception on the location and size of proposed IWRMC. A total of 37 households took part in the survey, which is approximately 7% of households on the islands. Key findings of the survey include:

- On average, all households produce more non-biodegradable waste than biodegradable waste.
- All respondents reported having their waste collected by the Council appointed waste management staff and taken to the IWRMC for disposal.
- Waste segregation at household level was reported by approximately 73% of the respondents
- When enquired about the fee being taken by the Council for waste management (MRF 150 per household), 70% felt that the fee was acceptable, while 24% felt that the fee was not suitable and should be between MRF 100 to MRF 200 per month. Remaining 6% did not answer the question.
- 73% of respondents felt that the location of the IWRMC is suitable, while the remaining felt that it was too close to the residential area and hence residents living in nearest areas feel the impacts due to waste management (such as impacts due to smoke as a result of open burning and odour impacts). In terms of views regarding the size of the centre, 70% felt that the centre was too small, while 27% felt that current size was appropriate. The remaining felt that the centre was too big.
- When enquired about impacts faced by the island community, due to the current location of the IWRMC, 78% stated that impacts due to smoke and odour from the centre were the most prominently felt, especially by those living close to the centre. 16% stated that the present location would not have an impact on the residential area due to the project work (construction and operational)
- When enquired about the best mitigation measures to minimize impacts due to the IWRMC and associated work, the following was reported:
  - Regular disposal of waste from the centre (76%)
  - Creation of a vegetation buffer between the site and residential area (16%)
  - Complete cessation of burning of waste at the centre (19%)
  - Increase height of perimeter wall (19%)
  - Installation of firefighting equipment at the IWRMC (21%)
  - Proper storage of waste which cannot be regularly disposed (5%)

- Additional measures proposed include, increasing number of incinerators to undertake all waste burning through the use of incinerators, and regular disposal of waste to Thilafushi, similar to Male’.

## **13 Gender Empowerment / Preparation of Gender Action Plan**

Traditionally cleaning the roads, houses and waste collection and disposal are carried out mostly by women. With establishment of waste management centres with machinery and facilities in some islands, the activities related to waste management are not only a responsibility of women but men are also actively involved in the process. In most islands with waste management systems in place, women are mostly involved at household level; in cleaning and waste segregation, whereas men are involved in collecting waste from the households and managing the waste at the waste management centres.

As per Census 2014 resident population, in Dh. Kudahuvadhoo 46% of the population are women and 54% are men (NBS, 2014). The island has a Women's Development committee, though they are not involved in waste management system of the island as the Island Council has a dedicated a waste management unit who carry out the work.

During the consultations carried out to discuss the proposed upgrading of the waste management centre project in Dh. Kudahuvadhoo, the WDC raised their concerns on the lack of awareness on waste management among the community. They also noted that they do not have any active management role in waste management of the island and all decisions are made by the island council. Although cleaning of households, waste segregation at household level, cleaning of island roads and public areas, were still carried out mostly by women, these are not thought as part of the waste management system as they are not formally involved in the process. They were in favor of the proposed organic waste composting mechanism.

The Environmental and Social Assessment and Management Framework and Resettlement Policy Framework for the MCEP consists of a Gender Development Plan which identifies Gender Issues, Strategies and Proposed activities relevant to the project (MEE, 2016). As this is the basis for the formulation of a Gender Action Plan for the components under the MCEP and hence is of significant relevance to the proposed project, the Gender Development Plan has been directly sourced from MEE (2016, p70) and is given in Table 21 below.

As highlighted in the Gender Development Plan, currently women feel they are excluded from the opportunities of being part of the waste management system, and they have suggestions that would help in management of waste at the island. This was also reflected in the consultations carried out with the women development committee of Dh. Kudahuvadhoo. Based on the findings listed in the Gender Development Plan and the findings from the consultations, a Gender Action Plan is proposed as given in Table 22.

**Table 21. Gender Development Plan as in the ESMF for the MCEP (MEE, 2016)**

<b>Gender issues</b>	<b>Strategy</b>	<b>Proposed Activities</b>
Lack of awareness	Awareness campaign about the project for the community focusing on the vulnerable group including women.	Formation of women groups around specific project areas.  Share information about the project benefits with local community.
Low Level of literacy	Support functional literacy campaign and develop extension programs to take the benefits from the project as per the needs of illiterates.	Undertake literacy programs as built- in activities coordinated with literacy programs.  Develop the implementing strategies to communicate real time information specifically for economically weaker section.  Develop audio-visual aids and documentary for training programs about the project for illiterate women groups.
Excluded from opportunities because of social boundaries as a result low level of participation in decision making process	Rapport building with Women Development Office at District or local level involving them in Program.  Gender sensitization to all stakeholders including project entities.  Ensure Women's participation during meetings, project implementation and monitoring.	Carry out meetings and interaction program with and orientation to women in the community.  Conduct leadership training for women members of commodity groups.
Lack of knowledge / access to technical knowhow	Promote need based technical awareness and support services.	Organize training on technologies.  Provide opportunities of exposure or study visit to women's group to develop their leadership capacity.
Disparity in Wages	Accord Priority Employment to women in project generated construction activities.  Promote equal wages for equal work.	Inform women groups regarding proposed construction works.  Identify women interested to Work; assess their skills and involve them as per their capabilities.  Monitor women wage rate and do the needful to ensure wage equality for similar type of construction works.  Inclusion of the above elements in the contractors' document

**Table 22. Gender Action Plan for the project**

<b>Gender Activity/Action Plan</b>	<b>Performance Indicators / Targets</b>	<b>Responsibility</b>	<b>Timeline</b>
Outcome: Dh Kudahuvadhoo IWRMC is upgraded with the required environmental and social safeguards as per the existing laws and regulations of the Maldives and the World Bank's Safeguard Policies			
Output 1: Promote gender equality in employment and income			
1.1 Ensure both genders gain employment and economic benefit during the construction and implementation phase of the project.  This may include, but not be limited to architects, quantity surveyors, human resource managers, procurement experts, waste management experts and engineer, fire and safety personnel, heavy duty vehicle drivers, operators and machines.	1.1.1 Include a minimum of 30% female staff in the construction of the project (2021 baseline: 0)  1.1.2 Include a minimum of 50% female staff in the implementation of the project (2021 baseline: 0)	Island council  Island council	2021  2021
Output 2: Promote gender equality in capacity building and training			
2.1 Ensure trainings conducted for the staff of the waste management center including training for operation of various vehicles and machines, will be conducted for both male and female staff.	2.1.1 Include participation from both genders with a minimum of 30% females in all trainings conducted as part of the project (2021 baseline: 0)	Ministry of Environment	2021 – 2022

Output 3: Ensure safety and protection from sexual harassment for all staff			
3.1 Ensure safety of both male and female workers as per the health and safety measures and policies in place	3.1.1. Ensure strict policies are in place in order to prevent acts of sexual harassment among the workers and/or by any member of the workers towards someone in the community (2021 baseline: 0)	Ministry of Environment	2021 – 2022
	3.1.2 Ensure strict actions are taken against those who violate such health and safety regulations and policies	Ministry of Environment Island council	2021 - continuous
Output 4: Gender equal participation in decision making			
<p>4.1 Ensure gender equality in decision making level including but may not be limited to architects, quantity surveyors, human resource management experts, waste management experts and engineers, fire and safety personnel, heavy duty vehicle drivers operators and machinery.</p> <p>4.2 Ensure equal representation of men and women in public consultations with regards to the project.</p> <p>This will ensure key decisions regarding the project are made in consultation with both genders.</p>	4.1.1 Include a minimum of 30% females at decision making level (2021 baseline: 0).	Ministry of environment Island council	2021 – continuous
	4.1.2 Include 50% of women in any public consultations held with regards to waste management in the island (2021 baseline: 0).	Ministry of environment Island council	2021 - continuous

## 14 Conclusion

The findings of this assessment for the formulation of an Environmental and Social Management Plan for the proposed project by the Ministry of Environment through the Maldives Clean Environment Project to establish a full-fledged IWRMC and facilitate piloting of Anaerobic Digestion for organic waste treatment in Kudahuvadhoo shows that the project has low to moderate negative impacts on the environment. The process followed to identify environmental impacts associated with project was Rapid Impact Assessment Matrix (RIAM) which is based on standard definition of importance assessment criteria, with semi quantitative values for each of these criteria, to provide an accurate and independent score (environmental value) for each condition.

The environmental score for the project is of positive and negative. Positive changes that are of importance (highest positive environmental score) are;

1. Benefits to the island community (both social and economic) due to improved waste management practices and operation of the facility
2. Changes to the environment due to improved waste processing methods

Negative changes or impacts that are of significance (highest negative environmental score) are;

1. Impacts due to sorting and storage of hazardous waste
2. Impacts due improper waste management at the temporary waste relocation/disposal site
3. Health and safety risks to the workers during construction and operational work
4. Air pollution due to emissions associated with construction machinery
5. Groundwater pollution due to potential disposal of excess digester liquid

Lesser negative impacts from the project includes impacts on the environment due to accidental spills during transfers and material handling. The proximity of the project site from the residential area aids to minimize a lot of impacts due to the project, such as that due to noise and air pollution and other disturbances. The project will be undertaken at the existing IWRMC. Hence vegetation clearance and loss of land is also not an impact of this project.

The proposed method of organic waste treatment, which will be done inside the plant itself is predicted to have minimal negative impacts as it greatly overcomes the issues faced by other methods of composting such as windrow-composting. Additionally, it has several benefits, some of which that have been reported are:



- Input source can be fed into the plant with partial segregation and without the need for pulverization
- Low labour requirement
- Plant composed of minimal parts, hence energy requirement is low
- High nutrient quality end products (compost and digester liquid)
- Biogas generated can be utilized for cooking or converted to electricity
- Comparatively shorter processing times ensures high economic return
- Beneficial to the environment;
- Minimises the problems of odour, leachate generation and ground water contamination associated with traditional methods of waste disposal

Stakeholder consultations carried out as part of the project showed support for the project overall, especially the women development committee. The island council however have reservations and grievances because of past experiences.

A household survey was undertaken to assess the perception of the community with regards to the current waste management practice and their willingness to pay for a proper waste management system. Results of the show that the current waste management system being implemented by the Council is effective and majority of respondents were happy about the system and the fees being charged. While majority felt that the current location was suitable, about a quarter of the respondents felt that it was not suitable, quoting proximity to residential areas as the reason for this. They further stated that this proximity results in residents feeling the impacts due to open burning and odour, which would be more significant depending on wind direction. In terms of size of the IWRMC, majority felt that the current size was too small to properly cater to the waste management needs of the island.

Mitigation measures considered for the various impacts predicted for the project include:

- Proper set up of the temporary waste relocation/disposal site to prevent all associated negative impacts
- Provision of adequate training in proper method of handling of machinery and materials during both construction and operational phase
- Provision of adequate training in proper method of handling of waste during collection and disposal during operational phase
- Provision of all protective gear to workers during both construction and operations
- Implementation of the Grievance Redress Mechanism which has been formulated by the proponent, both during construction and operations
- Care should be taken to maintain the flaring vent and the flame to have controlled burning and not to allow CH<sub>4</sub> to escape.

Mitigation measures have also been discussed for the alternative methods discussed in the report. However, should the proponent decide at a later stage to choose one of the alternative methods, rather than the selection option in this report, the Consultant stresses the importance of getting environmental clearance for the change in design and scope through a separate document, as the process would require consultations with the Council amongst other additional information.

Monitoring programme identified in the report will enable the proponent to assess whether the mitigation measures which have been identified in the report are effective. Early identification of negative impacts will enable the proponent to rectify the course of activities.

In order to further minimise and manage environmental and social impact associated with the project the following are recommended:

1. Adherence to all relevant legislations, regulations, guidelines and standards during construction and operation of the IWRMC;
2. Establish environmental and occupational health and safety procedures for all relevant components;
3. Installation of renewable energy sources at IWRMC, such as solar panels to source power for operations;
4. Utilise the biogas produced to generate electricity which can be used to power the IWRMC operations
5. Ensure that measures are in place to address the issue of excessive digester liquid, so as to enable its utilization or disposal in an environmentally friendly manner
6. Carryout awareness raising campaigns to increase awareness of the general public regarding proposed work
7. Ensure all trainings identified under the Training programme of this report are properly implemented so as to ensure proper implementation of the project at all phases.
8. Encourage greater participation of women, especially during operational stage
9. Ensure proper supervision and inspection of the temporary waste disposal site during construction and the IWRMC at regular intervals

In the context of the above conclusions and recommendations, with due consideration to the environmental components identified above and the extent of the project activities and their likely and predicted impacts identified, with proposed mitigation measures and monitoring followed, it is concluded that the project is feasible and justified. Furthermore, the positive benefits due to the project, both to the environment and island community outweigh the negative effects on the environment during the project.

## **Acknowledgements**

The consultant acknowledges the contribution provided by the team members in this report for the valuable contribution to the report and especially at the field. The consultant also acknowledges the assistance provided by the PMU of MCEP. Appreciation also to the Island Council of Kudahuvadhoo, especially the focal point for the project, Ahmed Ibrahim for their continuous assistance during the project report formulation and survey work.

CVs of team members are given below.

## Curriculum Vitae

<b>Position</b>	Environmental Consultant
<b>Name</b>	Shahaama Abdul Sattar
<b>Address</b>	G. Helengeli, Lily Magu Male', Rep. of Maldives
<b>Contact</b>	Mobile: +9607904985 Email: <a href="mailto:shahaama.abdulsattar@lamer.com.mv">shahaama.abdulsattar@lamer.com.mv</a> <a href="mailto:shahaama.sattar@gmail.com">shahaama.sattar@gmail.com</a>
<b>Date of Birth</b>	30 September 1980
<b>Nationality</b>	Maldivian
<b>Education</b>	<b>Master of Science (MSc)</b> in Fisheries Biology and Fisheries Management, University of Bergen. Bergen, Norway, 2004 - 2006  <b>Bachelor of Science (BSc.)</b> , The Flinders University of South Australia, Adelaide, South Australia, 1999 - 2001
<b>Membership of Professional Associations</b>	Small Island Research Group (SIRG) Maldives, Vice President
<b>Countries of Work Experience</b>	Maldives
<b>Languages</b>	<b>Dhivehi</b> Mother tongue <b>English</b> Fluent

### Employment Record

#### **From: 2008 - 2011**

Employer: Marine Research Centre, Ministry of Fisheries and Agriculture, Male', Maldives.  
Position: Fisheries Biologist

#### **From: 2006 to 2008**

Employer: Marine Research Centre, Ministry of Fisheries Agriculture and Marine Resources, Male', Maldives.  
Position: Senior Research Officer

#### **From: 2002 – 2004**

Employer: Marine Research Centre, Ministry of Fisheries Agriculture and Marine Resources, Male', Maldives.  
Position: Research Officer

#### **Line of work at MRC included:**

Assessment of the reef and grouper fisheries of Maldives, with surveys to monitor fisheries and fish species behavior. Compilation and analysis of data, for regular reviews and reporting and formation of management recommendations. Key role in the formulation of the Grouper Fisheries Management Plan / Grouper Fisheries and Export Regulation

Focal point for the IUCN funded project on identification of reef fish spawning aggregations in the Maldives through fishermen interviews (2007)

Secretariat and key organizer – Indian Ocean Cetacean Symposium 2009

Project Partner for Maldives for the Darwin Initiative Coral Reef Fish Project, Maldives

MRC Focal Point for the Atoll Ecosystem Conservation Programme, Ministry of Housing and Environment (2009 – 2011)

Participated in the Biodiversity Valuation survey of Baa Atoll Maldives carried out by AEC project and IUCN

**From: May 2011 – Dec 2012**

Employer: Darwin Reef Fish Project / Marine Research Centre (Maldives) and Marine Conservation Society (UK)

Position: Consultant, Darwin Reef Fish Project (4 year joint collaboration between MRC and MCS, UK)

Assess the various reef fisheries (grouper, aquarium and food fisheries) of the Maldives and aims to establish management plans for these fisheries. Provision of technical support and assistance to the project staff and MRC in implementing the project and formulation of the management plans.

**From: July 2011 – Dec 2011**

Employer: Bay of Bengal Large Marine Ecosystem Project

Position: BOBLME Sharks Working Group Coordinator

Coordinator for the Sharks WG of BOBLME project, and work with the focal points in the member countries, to assist in the formulation and implementation of their National Plans of Action for Sharks.

**From: June 2011 to Present**

Employer: Land and Marine Environmental Resource Group Pvt Ltd

Position: Environmental Consultant

**Workshops/Seminars Participated**

15-21 March 2003 - Training Workshop on the Implementation of Multilateral Agreements in the Conservation of Biodiversity with special focus on Marine Biodiversity. Kushiro, Japan

14-16 November 2006 – Sixth William R. and Lenore Mote International Symposium – Life history in Fisheries Ecology and Management. Sarasota, Florida

03-05 March 2008 – Olhugiri and Dhigalihaa Protected Areas Management Planning Workshop. Eydhafushi, Maldives

11 March 2008 – Applying the Ecosystem Approach to managing Atoll Ecosystems in the Maldives. Hulhule Island Hotel, Maldives

24-26 March 2008 – Regional Consultation on Preparation of Management Plans for Shark Fisheries. Beruwela, Sri Lanka

17-19 June 2008 – Workshop on Assessment and Management of the Offshore Resources of

South and Southeast Asia. Bangkok, Thailand

22-23 March 2009 – BOBP-IGO National Workshop on Monitoring, Control and Surveillance in Marine Fisheries. Male', Maldives

18 – 20 July 2009 – Indian Ocean Cetacean Symposium 2009. Paradise Island Resort and Spa, Maldives.

09-11 August 2009 – Second Regional Consultation on Preparation of Management Plans for Shark Fisheries. Kulhudhuffushi, Maldives

24-25 February 2010 – BOBLME Project – National Inception Workshop, Male', Maldives

2-3 June 2010 – BOBP-IGO Technical Advisory Committee – 5<sup>th</sup> Meeting, Male', Maldives

13-14 September 2010 – BOBLME Fisheries Assessment Working Group – 1<sup>st</sup> Meeting, Bangkok, Thailand

14-16 December 2010 – EWS-WWF 2<sup>nd</sup> Marine Conservation Forum for the Gulf Region In partnership with the Pew Environment Group – Local Actions for Global Challenges, Abu Dhabi, United Arab Emirates

18-19 January 2011 – Bay of Bengal Large Marine Ecosystem Project – Workshop on the Status of Marine Managed Areas in the Bay of Bengal, Penang, Malaysia

5-7 July 2011 – Bay of Bengal Large Marine Ecosystem Project – First meeting of the BOBLME Sharks Working Group, Male', Maldives

7-8 September 2011 – Workshop to formulate the Grouper Fisheries Management Plan, DRFP/MRC, Male', Maldives

15-17 September 2011 – SEAFDEC Special Meeting on Sharks Information Collection in Southeast Asia, Bangkok, Thailand

10 April 2014 - Stakeholder Consultation to present the National Plan of Action on the Conservation and Management of Sharks (NPOA-Sharks), Male', Maldives

## **Publications**

Sattar, S. A., Najeeb, A., Islam, F., Afzal, M. S. and Wood, E. (2012) Management of the grouper fishery of the Maldives, *Proceedings of the 12<sup>th</sup> International Coral Reef Symposium, Cairns, Australia, 9-13 July 2012, Session 13E* (in press)

Ushan, M., Wood, E., Saleem, M. and Sattar, S. A (2012) Maldives Sharkwatch Report for 2009 - 2010, *Proceedings of the 12<sup>th</sup> International Coral Reef Symposium, Cairns, Australia, 9-13 July 2012, Session 13D* (in press)

Sattar, S. A., Andréfouët, S., Ahsan, M., Adam, M. S., Anderson, C. R. and Scott, L (2012) Status of the Coral Reef Fishery in an Atoll under tourism development: the case of Central Maldives, *Atoll Research Bulletin* 590: 163-186

Sattar, S. A., Amir, H. and Adam, M. S. (2012) Reef fish tagging programme – Baa Atoll Pilot project, *Atoll Research Bulletin* 590: 187-200

BOBLME (2011) Report of the BOBLME Sharks Working Group, 5-7 July 2011, Male' Maldives,

*Prepared for the Bay of Bengal Large Marine Ecosystem Project by Sattar, S. A. and Anderson, R. C. Saleem, M., Sattar, S. A. (2009) Study on post-tsunami restoration and conservation projects in Maldives, Prepared for the International Union for Conservation of Nature.*

Tamelander, J., Sattar, S., Campbell, S., Hoon, V., Arthur, R., Patterson E. J.K., Satapoomin, U., Chandi, M., Rajasuriya, A. and Samoilys, M. (2009) Reef fish spawning aggregation in the Bay of Bengal: Awareness and Occurrence, *Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008, Session 22*

Sattar, S. A., Jørgensen, C., Fiksen, Ø. (2008) Fisheries Induced Evolution of Energy and Sex Allocation. *Bulletin of Marine Science*, 83(1): 235-250

Sattar, S. A. (2008) Review of the Reef fishery of the Maldives, Marine Research Centre, Male', Maldives. 62 pp

Sattar, S. A. and M. S. Adam (2005) Review of the Grouper fishery of the Maldives with additional notes on the Faafu Atoll fishery. Marine Research Centre, Male', Maldives. 54 pp

### **Environmental Impact Assessments Reports and other studies**

The following are a selected list of the projects I have been involved in as an environmental consultant at LaMer Group Pvt Ltd.

<b>Name of assignment or project</b>	EIA for development of domestic airport facility at Funadhoo, Shaviyani Atoll
<b>Year</b>	2018
<b>Location</b>	Funadhoo, Shaviyani Atoll, Maldives
<b>Client</b>	Regional Airports, Ministry of Tourism
<b>Project features</b>	Development of domestic airport facility at Funadhoo
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA for agricultural development project at Hulhidhoo, Vaavu Atoll
<b>Year</b>	2017
<b>Location</b>	Hulhidhoo, Vaavu Atoll, Maldives
<b>Client</b>	Aarah Investments Pvt Ltd
<b>Project features</b>	Development of Hulhidhoo as a mix-use island with an agricultural (hydroponics) and tourism component
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA for development of 100 bed hospital at Addu City
<b>Year</b>	2017
<b>Location</b>	Addu City, Maldives
<b>Client</b>	Ministry of Housing and Infrastructure
<b>Project features</b>	Redevelopment of Equatorial Convention Centre as a 100 bed tertiary level hospital
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA for relocation of sewer outfalls at IGMH and Westpark area, Male'
<b>Year</b>	2017
<b>Location</b>	Male', Maldives
<b>Client</b>	MWSC Pvt Ltd
<b>Project features</b>	Relocation of sewer outfalls at IGMH and Westpark area to industrial village area of Male'
<b>Positions held</b>	EIA team member

<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA for resort development at Islands I and E of Emboodhoofalhu Finolhu Development project
<b>Year</b>	2017
<b>Location</b>	Emboodhoofalhu Finolhu, Maldives
<b>Client</b>	Dream Islands Development Project
<b>Project features</b>	Development of reclaimed islands I and E of Emboodhoofalhu Finolhu as tourist resorts
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	Environmental Impact Assessment Report for aquatic animal quarantine facility at Hulhumale'
<b>Year</b>	2016
<b>Location</b>	Hulhule, Maldives
<b>Client</b>	Ministry of Fisheries and Agriculture
<b>Project features</b>	Setting up an animal quarantine facility within plant quarantine service area in Hulhule
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	Environmental Impact Assessment report for relocation of Male' Submarine cable landing
<b>Year</b>	2016
<b>Location</b>	Male', Maldives
<b>Client</b>	Dhiraagu
<b>Project features</b>	EIA related to relocation of the submarine cable from existing location to a new location
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	Socioeconomic Situation analysis of selected fishing communities as part of formulation of Master Plan for Sustainable Fisheries (MASPLAN)
<b>Year</b>	2015
<b>Location</b>	ADh. Mahibadhoo, F. Bilehdhoo, GA. Villingili, HA. Ihavandhoo, L. Gan, L. Maamendhoo, Lh. Naifaru, S. Maradhoo, Maldives, Maldives
<b>Client</b>	Ministry of Fisheries and Agriculture
<b>Project features</b>	Socioeconomic survey of selected islands, to undertake a situational analysis of the island communities
<b>Positions held</b>	Fisheries Management Consultant
<b>Responsibilities</b>	Carryout socioeconomic surveys in forms of group discussions and household surveys. Data collection and analysis and report formulation (trip reports and overall situational analysis).
<b>Name of assignment or project</b>	Development of Training material for project staff on mainstreaming and increasing awareness on climate change adaptation and mitigation measures in tourism operation
<b>Year</b>	2015
<b>Location</b>	Male', Maldives
<b>Client</b>	Ministry of Tourism
<b>Project features</b>	Mainstreaming and increasing awareness on climate change adaptation and mitigation measures in tourism operation
<b>Positions held</b>	Team member
<b>Responsibilities</b>	Material development and presentation
<b>Name of assignment or project</b>	Development of water supply and a sewerage system at Fuvahmulah
<b>Year</b>	2015
<b>Location</b>	Fuvahmulah, Gnaviyani atoll. Maldives
<b>Client</b>	Ministry of Environment and Energy
<b>Project features</b>	Setting up a water supply and a sewerage facility
<b>Positions held</b>	EIA team member



<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	Environmental Impact Assessment for soft coastal protection works at GDh. Thinadhoo
<b>Year</b>	2014
<b>Location</b>	GDh. Thinadhoo, Maldives
<b>Client</b>	Ministry of Environment and Energy
<b>Project features</b>	Beach Nourishment and Coastal protection
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	Beach Nourishment and Coastal Protection works at a private land at Praslin, Seychelles
<b>Year</b>	2014
<b>Location</b>	Praslin, Seychelles
<b>Client</b>	Ahmed Didi
<b>Project features</b>	Beach Nourishment and Coastal protection at Praslin, Seychelles
<b>Positions held</b>	Environmental assessment team member
<b>Responsibilities</b>	Preparation of the report submitted to the client
<b>Name of assignment or project</b>	1500 Housing Unit construction Project Maldives
<b>Year</b>	2014
<b>Location</b>	Fuvahmulah, Gadhdhoo, Hoadedhdhoo, Hithadhoo, Holhudhoo, Madaveli, Thinadhoo, Maldives
<b>Client</b>	Ministry of Housing and Infrastructure
<b>Project features</b>	Construction of Housing Units at the specified Islands
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Coastal modification at Robinson Club Maldives
<b>Year</b>	2013
<b>Location</b>	Ga. Funamaudua, Maldives
<b>Client</b>	Robinson Club Maldives, Maldives
<b>Project features</b>	Coastal modification at the NW side of the island, construction of geo-bag revetment and harbor basin maintenance dredging works
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for construction of gravity type waste water collection system at ADh Omadhoo
<b>Year</b>	2013
<b>Location</b>	ADh Omadhoo, Maldives
<b>Client</b>	ADh Omadhoo Island Council Office
<b>Project features</b>	Construction of gravity type waste water collection system and sea outfall pumping system
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for upgrading of Maldivian Gas Pvt Ltd Gas jetty
<b>Year</b>	2013
<b>Location</b>	Thilafushi, Maldives
<b>Client</b>	Maldivian Gas Pvt Ltd
<b>Project features</b>	Reconstruction of existing gas jetty head and expansion of jetty head
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Resort development at GDh Havvoodaa
<b>Year</b>	2013
<b>Location</b>	GDh Havvoodaa, Maldives
<b>Client</b>	Crystal Plaza Pvt Ltd, Maldives
<b>Project features</b>	Construction of a resort hotel and all the related amenities
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report

<b>Name of assignment or project</b>	EIA report for Coastal protection, coastal modification, beach nourishment, coral nursery setup and entrance channel maintenance dredging work
<b>Year</b>	2013
<b>Location</b>	Gili Lankanfushi, Maldives
<b>Client</b>	Gili Lankanfushi, Maldives
<b>Project features</b>	Coastal protection, coastal modification, beach nourishment, coral nursery setup and entrance channel maintenance dredging work
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Harbor development project at Dh. Maaenboodhoo
<b>Year</b>	2013
<b>Location</b>	Dh. Maaenboodhoo, Maldives
<b>Client</b>	Ministry of Housing and Infrastructure
<b>Project features</b>	Development of harbor facility (dredging of harbor basin, construction of wharfs and breakwater)
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Flood mitigation and reclamation work at Faresmaathoda
<b>Year</b>	2013
<b>Location</b>	GDh. Faresmaathodaa, Maldives
<b>Client</b>	United Nations Office for Project Services (UNOPS)
<b>Project features</b>	Construction of breakwater and reclamation of land
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Development of Domestic Airport Facility
<b>Year</b>	2012
<b>Location</b>	Th. Thimarafushi, Maldives
<b>Client</b>	Maldives Airports Company Limited
<b>Project features</b>	Construction of runway apron
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Wharf reconstruction and upgrading of existing berthing facility and slipway
<b>Year</b>	2012
<b>Location</b>	Thilafushi, Maldives
<b>Client</b>	Fuel Supply Maldives Pvt Ltd, Maldives
<b>Project features</b>	Reconstruction of wharf and upgrading of existing berthing facility and slipway
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Resort development at B. Kanifinolhu
<b>Year</b>	2012
<b>Location</b>	B. Kanifushi, Maldives
<b>Client</b>	Coastline Hotels and Resorts Pvt Ltd, Maldives
<b>Project features</b>	Construction of a resort hotel and all the related amenities
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for Borehole construction at Cyprea Mrine Food Fish Factory
<b>Year</b>	2012
<b>Location</b>	K. Himmafushi, Maldives
<b>Client</b>	Cyprea Marine Food Pvt Ltd, Maldives
<b>Project features</b>	Construction of a 8 inch borehole at factory premise
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report

<b>Name of assignment or project</b>	EIA report for resort development at K. Kudavilligili, Maldives
<b>Year</b>	2011
<b>Location</b>	K. Kudavillingili, Maldives
<b>Client</b>	Yacht Tours Pvt Ltd, Maldives
<b>Project features</b>	Construction of resort hotels and all the related amenities. In addition a large reclamation of the shoreline as additional land as part of the resort development is also part of the project
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report
<b>Name of assignment or project</b>	EIA report for development of city hotel, hospitality institute and resort development at Gasfinolhu and Bodufinolhu, L. Atoll
<b>Year</b>	2011
<b>Location</b>	L. Gan, Bodufinolhu and Gasfinolhu, Maldives
<b>Client</b>	Premier Equities Pvt Ltd, Maldives
<b>Project features</b>	Construction of a resort hotel and required amenities including a training hotel for hospitality industry
<b>Positions held</b>	EIA team member
<b>Responsibilities</b>	Preparation of the EIA report

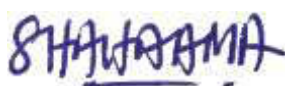
## Referees

Dr. Mohamed Shiham Adam, PhD  
Marine Research Centre  
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Email: [msadam@mrc.gov.mv](mailto:msadam@mrc.gov.mv)

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[charles.anderson11@btinternet.com](mailto:charles.anderson11@btinternet.com)

## Certification

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



Shahaama A. Sattar

Date: October 2018

## CURRICULUM VITAE

1. **POSITION:** Environment Analyst
2. **NAME OF FIRM:** LaMER Group Pvt.Ltd
3. **NAME:** Azim Musthag
4. **DATE OF BIRTH:** 13<sup>th</sup> December 1985
5. **NATIONALITY:** Maldivian
6. **PERSONAL ADDRESS:** M. Anthias, Fulooniya Magu, Malé, Maldives
7. **EDUCATION**  
Bachelor of Marine Science (Majoring in Marine Ecology),  
Griffith University, Queensland, Australia.  
  
DELFI (Diplôme d'études en langue française) Level A1 and  
Level A2
8. **MEMBERSHIP OF PROFESSIONAL SOCIETIES:** Master Instructor with the Scuba Schools  
International (SSI).
9. **OTHER TRAINING:**  
Fish Watch Training Workshop conducted by Darwin Reef Fish  
Project initiated by the Marine Research Centre of Maldives in  
collaboration with Marine Conservation Society (UK) in 2009.  
  
IUCN Manta Ray Workshop in 2013.  
  
National Coral Reef Monitoring Framework monitoring protocols  
training in 2014 conducted by IUCN Maldives.
10. **COUNTRIES OF WORK EXPERIENCE:** Maldives and Australia
11. **LANGUAGE AND DEGREE OF PROFICIENCY:**  
English - Native or bilingual proficiency  
Dhivehi - Native or bilingual proficiency  
French - Limited working proficiency
12. **EMPLOYMENT RECORD:**  
2005 - 2011  
Dive Instructor,  
Maldivers Diving Centre, Malé.  
  
2012 – 2014  
Dive Instructor,  
Diveoceanus Dive Centre at Paradise Island Resort  
  
2017 - 2017  
Research Assistant  
Griffith University, Gold Coast, Australia.  
  
2018 (Present)  
Environmental Analyst  
Lamer Pvt Ltd
13. **DETAILED TASKS ASSIGNED:** **WORK UNDERTAKEN THAT BEST ILLUSTRATES  
CAPABILITY TO HANDLE TASKS:**  
  
**Project:** Ecological surveys for the proposed, potential UNESCO  
biosphere reserves.  
**Year:** 2018

**Location:** Maldives

**Client:** IUCN Maldives

**Main project features:** Surveying of 5 reefs and 3 islands.

**Position:** Consultant.

**Activities performed:**

Conducted ecological (marine and terrestrial) surveys at the proposed sites

Data compilation and analysis

Assisted in the final report development.

**Project:** Environmental Monitoring Report for resort development

**Year:** 2018

**Location:** Maldives

**Client:** Pearl Atoll Pvt Ltd

**Main project features:** Survey for the Environmental Monitoring Report

**Position:** Environmental Analyst

**Activities performed:**

Conducted the marine component of the survey. The seawater quality analysis, sedimentation analysis, reef benthic surveys, and fish surveys.

**Project:** Environmental Impact Assessment Report for resort development

**Year:** 2018

**Location:** Bodufushi, Raa Atoll.

**Client:** Alibey Maldives Pvt Ltd

**Main project features:** EIA Survey for an addendum

**Position:** Environmental Analyst

**Activities performed:**

Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

**Project:** Environmental Impact Assessment for Coastal Protection and Entrance Clearance.

**Year:** 2018

**Location:** Bandos Island Resort, Kaafu Atoll.

**Client:** Bandos Island Resort.

**Main project features:** EIA Survey

**Position:** Environmental Analyst

**Activities performed:**

Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

**Project:** Third Addendum to the Environmental Impact Assessment Report

**Year:** 2018

**Location:** Enboodhoo Finolhu Lagoon

**Client:** Dream Islands Development Pvt Ltd

**Main project features:** Reclamation of Islands for Resort Development at Enboodhoo Finolhu Falhu, South Malé Atoll

**Position:** Environmental Analyst

**Activities performed:**

Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

**14. Certification:**

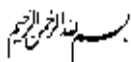
I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.



\_\_\_\_\_  
*[Signature of staff member or authorized representative of the staff]*

Date: 05<sup>th</sup> August 2018  
*Day/Month/Year*

Full name of staff member: Azim Musthag



## CURRICULUM VITAE (CV)

1. **Full Name/ Address:** Aishath Abdulla
2. **Date of Birth:** 10/09/1986                      **Nationality:** Maldivian
3. **Education:** 2012 Masters in Environment & Development, University of Melbourne, Australia  
2010 BA (Hons) in Urban and Regional Planning, International Islamic University  
Malaysia, Malaysia
4. **Membership of Professional Associations/Non-Governmental Organisations:** - Secretary of  
Small Island Research Group NGO
5. **Other Training:** Attended the Expert Group Meeting (EGM) on: Urbanization in Small Island  
Developing States as an Urban Planner from the Maldives; at the United Nations in New York (June  
2016)
6. **Countries of Work Experience:** Maldives, Malaysia
7. **Languages:** Dhivehi-Good, English-Good
8. **Experience/ Employment Record (General)**

February 2013- Present	Senior Planner: Work in environmental and planning consultancies, including preparation of plans, studies and EIA reports etc LAMER Group Pte Ltd Male' Maldives
November 2010 – January 2011	Urban Planner/ Acting- Business Development Manager: Work in handling and managing bidding processes, HR, project proposals, Marketing. Planning related projects Riyan Pte.Ltd Male' Maldives
May 2009 - July 2009	Urban Planner-Trainee ANZ PLANNERS SDN. BHD Selangor Malaysia

## **9. Specific Experience/ Employment Record (as per TOR requirements)**

### **Maldives Housing Market Needs and Assessment Study; Maldives Urban Development and Resilience Project (MUDRP)**

Year: September 2020-Ongoing

Client: Ministry of National Planning, Housing and Infrastructure

Position Held: Qualitative Analyst

Duties Rendered: Design, conduct and reporting of Consumer Research; mapping of existing regulatory and institutional frameworks related to housing and land in Maldives; provide input to the recommendations to develop national housing policy and housing strategy.

### **Developing International Port Facilities in the North or South of Maldives; Stage 2 Reports – Transshipment Hub in Ihavandhippolhu Atoll**

Year: July 2020

Location: Upper North Atoll, Maldives

Client: Ministry of Economic Development

Positions Held: Social Impact Assessment Consultant

Duties Rendered: Assessment of socio-economic setting and impacts, stakeholder consultations, public perception survey, social impact analysis and report writing.

### **Preparation of an Integrated Urban Development Master Plan for Addu City**

Year: October 2019-Onhold

Client: Addu City Council

Position Held: **Urban** Planner and Project Manager

Duties Rendered: Carry out consultations and assessments, preparation of plans, overall management of the project

### **Preparation of B. Hithaadhoo Land Use Plan**

Year: August 2019 to October 2019

Client: Hithaadhoo Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

### **Preparation of Ga. Kondey Land Use Plan**

Year: March 2019 to July 2019

Client: Kondey Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

### **Maldives Building Regulatory Capacity Assessment (BRCA), Building Regulation for Resilience Program**

Year: January 2018- October 2019

Location: Male', Maldives

Client: Ministry of National Planning and Infrastructure, Maldives

Positions Held: Urban Planner,

Duties Rendered: Technical contribution to BRCA Component 1 and 3 assessment for Maldives, and associated recommendation development. Material and technical support to 2. Participation and



facilitation of kick-off workshop in Maldives. Facilitation and logistical support for the Action-Planning Workshop in Maldives

**Environmental and Social Impact Assessment for the proposed North Upgrading of Infrastructure at North Regional Waste Management Facility Zone 2, Raa Vandhoo**

Year: December 2018 – January 2019

Location: Raa atoll Vandhoo, Maldives

Client: Ministry of Environment, Maldives

Positions Held: Urban Planner, Social Impact Assessment Consultant

Duties Rendered: Assessment of possible environmental and social impacts of the proposed upgrade at the WMC. Community consultations, social impact analysis and report writing

**Assessment of Climate Sensitive Natural Resources in Laamu Atoll and Preparation of Resources Maps**

Year: July 2016- July 2018

Client: UNDP

Position Held: Project Coordinator

Duties Rendered: Overall coordination of the project which includes project planning, keeping PMU updated on the progress of the project, facilitate the project team in addressing the issues, delays etc during the project.

**Preparation of R. Inguraidhoo Land Use Plan**

Year: March 2018 to May 2018

Client: Inguraidhoo Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

**Development of Training Modules, Materials and Field Training; Organic Farming and Handicraft, Climate Change Adaptation Project (CCAP), Livelihood support program for wetland management**

Year: June 2017 to February 2018

Client: Ministry of Environment and Energy

Position Held: Project Leader

Duties Rendered: Development of training materials, project Coordination and Reporting

**Formulation of Coastal Protection Regulation, ICCRRIP Project**

Year: September 2014 to January 2015

Client: Ministry of Environment & Energy

Position Held: Project Coordinator

Duties Rendered: Consultations, Input in formulation of Regulation and reporting

**Developing a Handbook to Enhance the Capacity of Trainers to Increase the Resilience of People with Disabilities to DRR and CCA**

Year: 2016

Client: National Disaster Management Center

Position Held: Consultant

Duties Rendered: Review and analyze existing; provide input in relevant stakeholder consultations;

**Preparation of the handbook Preparation of AA. Feridhoo Land use plan**

Year: 2016

Client: Feridhoo Island Council  
Position Held: Planner  
Duties Rendered: Community Consultations, land use planning and reporting

**Preparation of K. Himmafushi Land use plan**

Year: February 2016 to March 2016  
Client: Himmafushi Island Council  
Position Held: Planner  
Duties Rendered: Community Consultations, land use planning and reporting

**Tool Kit and Training Materials for Increasing Awareness on Climate Change Adaptation & Mitigation Measures in Tourism Sector (Kaaf, Alif Alif, Alif Dhaal, Baa & Lhaviyani Atoll)**

Year: May 2015 to August 2015  
Client: Ministry of Tourism  
Position Held: Project manager  
Duties Rendered: Preparation of Materials, Conducting workshops

**Tool Kit and Training Materials for Increasing Awareness on Climate Change Adaptation & Mitigation Measures in Tourism Sector (For Tourism Staff)**

Year: December 2015 to February 2016  
Client: Ministry of Tourism  
Position Held: Project manager  
Duties Rendered: Preparation of Materials, Conducting workshops

**Situation Analysis for the formulation of Master Plan for Sustainable fisheries (MASPLAN)**

Year: February 2015 to March 2015  
Client: JICA  
Position Held: Consultant  
Duties Rendered: Community Consultations, Analysis and reporting

**Preparation of AA. Bodufolhudhoo Land use plan**

Year: May 2015 to June 2015  
Client: Bodufolhudhoo Island Council  
Position Held: Planner  
Duties Rendered: Community Consultations, land use planning and reporting

**Preparation of AA. Mathiveri Land Use Plan**

Year: June 2014 to July 2014  
Client: Mathiveri Island Council  
Position Held: Planner  
Duties Rendered: Community Consultations, land use planning and reporting

**Development of a National Framework/Plan on managing IDP's (internally displaced) persons/population caused by crises, emergencies and climate change**

Year: May 2014 –Dec 2014  
Client: UNDP/NDMC  
Position Held: Team Leader  
Duties Rendered: Overall project coordination and delivery

**Preparation of Disaster Management Plan for a Guest House**

Year: 2014

Client: Sea Side Lodge Guesthouse Manager, Hulhumale'

Position Held: Planner

Duties Rendered: Preparation of the disaster management plan according to the guidelines set by

**Perceptions and understandings of climate change and migration survey (K.Guraidhoo and R.Dhuvaafaru) carried out by a Norwegian Research Institute**

Year: August 2013 September 2013

Client: CICERO - Center for Climate and Environmental Research – Oslo; Norwegian Academic Institution

Position Held: Local Consultant

Duties Rendered: Assisted (CICERO to carry out the household survey, focus group discussions and the key informant interviews

**Review and Update the Detailed Island Risk Assessment in the Maldives prepared for HDh. Kulhudhuffushi and GDh. Thinadhoo**

Year: March 2013 to September 2013

Client: Ministry of Environment and Energy

Position Held: Social Planner/Project Coordinator

Duties Rendered: Review all relevant documents related to DIRAM study, study the social aspects impacting the risks of the islands and overall management of the project.

**Integration of Climate Change Risk Resilience into Land Use Planning**

Year: February 2011 to April 2011

Client: Ministry of Housing and Environment

Position Held: Planner/Project Coordinator

Duties Rendered: Provide input in planning perspective and also over all coordination of the project inclusive of conducting a workshop to present the findings

**Preparation of Heritage Action Plan and Preliminary Inventory**

Year: September 2011 to November 2011

Client: Department of National Heritage

Position Held: Team Leader

Duties Rendered: Proposed action plan for the protection and safeguarding of national heritage. Prepared a preliminary inventory of the existing tangible and intangible heritage of Maldives

**Preparation of Atoll and Island Development Plans for AA. Atoll**

Year: September 2011 to December 2011

Client: Secretariat of AA Atoll council

Position Held: Planner/ Project Manager

Duties: Manage and prepare the development plans

**Reviewing the Third Tourism Master Plan 2005-2011**

Year: December 2010 to October 2011

Client: Ministry of Tourism Arts and Culture

Position Held: Planner/Project Coordinator

Duties Rendered: Provide input in planning perspective and also over all coordination of the project inclusive of conducting a workshop to present the findings

**Preparation of a detailed Layout Plan for Tourism Zone (Asseyri Project)**

Year: December 2010 to February 2011

Client: Ministry of Tourism Arts and Culture

Position Held: Planner/Project Coordinator

Duties Rendered: Provide input in planning perspective through preparing the layout plan and also over all coordination of the project inclusive of conducting a workshop to present the findings

### **Appraisal of Hithadhoo Regional Hospital Development**

**Location:** S. Hithadhoo, Maldives

Year : November 2010

Client: OPEC Fund for International Development (OFID)

Position Held: Socio Assessment Specialist/Project Coordinator

Duties Rendered: Overall Coordination of the project and carry out social Impact assessment study.

### **Mapping study of infrastructure and resources for Youth**

**Location:**

Year : January 2010 to April 2010

Client: UNDP

Position Held: Assistant project coordinator

Duties Rendered: Assisting in overall coordination of the project

## **Professional Referees**

**Name:** Najfa Shaheem Raazee

**Position:** Project Manager of ICCRRIP Project, Ministry of Environment and Energy

**Email Address:** najfa.raazee@environment.gov.mv

**Name:** Hamdhaan Zuhair

**Position:** Environmental and Social Safeguards Officer (CCAP), Ministry of Environment and Energy

**Email Address:** [hamdhaan.zuhair@environment.gov.mv](mailto:hamdhaan.zuhair@environment.gov.mv)

**Name:** Ismail Abid

**Position:** Managing Director, Land and Marine Environmental Resource Group Pvt Ltd.

**Email Address:** [ismail.abid@lamer.com.mv](mailto:ismail.abid@lamer.com.mv)

## References

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- CITRES and MEECO, 2019. *Feasibility Study for a Regional Solid Waste Management System in Zone IV and V, Maldives - REPORT PHASE 2 – DRAFT 1 FINAL VERSION*. Prepared for Maldives Clean Environment Project - Ministry of Environment
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- Ministry of Youth, Sports and Community Empowerment, n.d. Maldives NGO Portal [online] Available at [Maldives NGO Portal - The Maldives NGO Directory](#) (accessed on 9<sup>th</sup> February 2021)
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- Zuhair, A. H., 2019. *Environmental Management plan for the upgrading of Island Waste Management Centre in N. Holhudhoo*. Prepared for Ministry of Environment
- Zuhair, A. H., 2021. *Environmental and Social Management plan for the proposed establishment of Island Waste and Resource Management Centre in Th. Madifushi*. Prepared for Ministry of Environment

## Appendices

## **Appendix 1 List of abbreviations**

AD	-	Anaerobic Digestion
EIA	-	Environmental Impact Assessment
EPA	-	Environmental Protection Agency
ESMP	-	Environmental and Social Management Plan
GoM	-	Government of Maldives
IWRMC	-	Island Waste Resource Management Centre
IWMP	-	Island Waste Management Plan
MCEP	-	Maldives Clean Environment Project
ME	-	Ministry of Environment
MSL	-	Mean Sea Level
RIAM	-	Rapid Impact Assessment Matrix
RWMF	-	Regional Waste Management Facility
SOP	-	Standard Operating Procedures
TOR	-	Terms of Reference
WMPCD	-	Waste Management and Pollution Control Department

## **Appendix 2 Island Waste Management Plan Dh. Kudahuvadhoo**





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Environmental Protection Agency

203-WMPP/381/2017/6 : ސަރުކާރު

ދިވެހިރާއްޖޭގެ ބިންދު ދިވެހިސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި ގޮތުގައި  
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ދިވެހިރާއްޖޭގެ ބިންދު ދިވެހިސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި ގޮތުގައި

22 ޖަނުއަރީ 2017

12 ޖަނުއަރީ 2017

ދިވެހިރާއްޖޭގެ ބިންދު ދިވެހިސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި ގޮތުގައި  
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ދިވެހިރާއްޖޭގެ ބިންދު ދިވެހިސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި ގޮތުގައި  
ދިވެހިރާއްޖޭގެ ބިންދު ދިވެހިސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި ގޮތުގައި

1 of 1

2016

13	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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موندونې نوم	د شمولي / د شمولي	شمار	#
موندونې نوم	موندونې	موندونې	1
موندونې نوم	موندونې	موندونې	2
موندونې نوم	موندونې	موندونې	3
موندونې نوم	موندونې	موندونې	4
BML	موندونې	موندونې	5
موندونې نوم	موندونې	موندونې	6
موندونې نوم	موندونې	موندونې	7
MNDF	موندونې	موندونې	8
موندونې نوم	موندونې	موندونې	9
موندونې نوم	موندونې	موندونې	10
موندونې نوم	موندونې	موندونې	11
موندونې نوم	موندونې	موندونې	12
موندونې نوم	موندونې	موندونې	13
موندونې نوم	موندونې	موندونې	14
موندونې نوم	موندونې	موندونې	15
موندونې نوم	موندونې	موندونې	16
موندونې نوم	موندونې	موندونې	17
موندونې نوم	موندونې	موندونې	18
موندونې نوم	موندونې	موندونې	19







شماره	توضیحات
13	د ټولنیزو اړیکو وزارت
8	د ټولنیزو اړیکو وزارت
21	د ټولنیزو اړیکو وزارت
795	د ټولنیزو اړیکو وزارت
8	د ټولنیزو اړیکو وزارت
14	د ټولنیزو اړیکو وزارت
25	د ټولنیزو اړیکو وزارت
7	د ټولنیزو اړیکو وزارت
1	د ټولنیزو اړیکو وزارت
40	د ټولنیزو اړیکو وزارت
6	د ټولنیزو اړیکو وزارت
1	د ټولنیزو اړیکو وزارت
21	د ټولنیزو اړیکو وزارت
3	د ټولنیزو اړیکو وزارت
22	د ټولنیزو اړیکو وزارت
1	د ټولنیزو اړیکو وزارت









0-9000

مردم شماری و سرشماری	مردم شماری و سرشماری	مردم شماری و سرشماری	مردم شماری و سرشماری	مردم شماری و سرشماری
864000	72000	150	480	مردم شماری و سرشماری
39000	3250	250	13	مردم شماری و سرشماری
9600	800	200	4	مردم شماری و سرشماری
14400	1200	300	4	مردم شماری و سرشماری
120000	10000	10000	مردم شماری و سرشماری	مردم شماری و سرشماری
300000	25000	25000	مردم شماری و سرشماری	مردم شماری و سرشماری
36000	3000	750	مردم شماری و سرشماری	مردم شماری و سرشماری
120000	10000	10000	مردم شماری و سرشماری	مردم شماری و سرشماری
120000	10000	10000	مردم شماری و سرشماری	مردم شماری و سرشماری
1623000	135250		مردم شماری و سرشماری	مردم شماری و سرشماری





دیس کی سطح پر مقررہ کی گئی ہے۔

نمبر	مقام / شرح
3	نمبر 3
20	نمبر 20
100	نمبر 100
3000	نمبر 3000
200	نمبر 200
12	نمبر 12
5	نمبر 5
5000	نمبر 5000
1	نمبر 1
1	نمبر 1
1	نمبر 1
1	نمبر 1
1	نمبر 1
3	نمبر 3
5	نمبر 5
5	نمبر 5
6	نمبر 6
6	نمبر 6
10	نمبر 10
2	نمبر 2
1	نمبر 1
12	نمبر 12
12	نمبر 12
12	نمبر 12









2. قۇرۇلۇش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى							
مەبلەغ	تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى						
خىزمەت ئىسپاتى	ئىسپات ئىسپاتى 5-2 خىزمەت ئىسپاتى ئىسپاتى ئىسپاتى ئىسپاتى						
تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى	خىزمەت ئىسپاتى 30% تەكشۈرۈش						
تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى	تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى						
تەكشۈرۈش ئىسپاتى	تەكشۈرۈش ئىسپاتى	تەكشۈرۈش ئىسپاتى	تەكشۈرۈش ئىسپاتى	تەكشۈرۈش ئىسپاتى	تەكشۈرۈش ئىسپاتى	تەكشۈرۈش ئىسپاتى	تەكشۈرۈش ئىسپاتى
350000	500000	2021-2017	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	1. تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى
350000	890000	2021-2017	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	2. تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى
350000	-	2021-2017	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	3. تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى
		2021-2017	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	تەكشۈرۈش ئىسپاتى / ئىسپاتى	4. تەكشۈرۈش ئىسپاتى ۋە تەكشۈرۈش خىزمەتلىرى













7. قۇتۇلۇش دىئەتلىرىگە سېتىش ئۆلچىمى ئۆزگەرتىش						
مەبلەغ	بىرلىك	مەبلەغ	بىرلىك	مەبلەغ	بىرلىك	مەبلەغ
160000	250000	2021-2017	مەبلەغ	بىرلىك	مەبلەغ	بىرلىك
60000	389000	2017	مەبلەغ	بىرلىك	مەبلەغ	بىرلىك
60000	130000	2021-2017	مەبلەغ	بىرلىك	مەبلەغ	بىرلىك
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3





















بسم الله الرحمن الرحيم  
الحمد لله رب العالمين

مبلغ	مبلغ	مبلغ
259056/-	21588/-	7 قروش و 70 پيس ( دسويست و نه سويست و نه سويست )
252000/-	21000/-	3 قروش و 30 پيس
60000/-	5000/-	4 قروش و 40 پيس ( دسويست و نه سويست و نه سويست )
120000/-	10000/-	دسويست و نه سويست و نه سويست و نه سويست
36000/-	3000/-	3 قروش و 30 پيس
24000/-	2000/-	2 قروش و 20 پيس
60000/-	5000/-	4 قروش و 40 پيس ( دسويست و نه سويست و نه سويست )
48000/-	4000/-	10 قروش و 100 پيس ( دسويست و نه سويست و نه سويست )
96000/-	8000/-	10 قروش و 100 پيس ( دسويست و نه سويست و نه سويست )
955056/-	79588/-	7 قروش و 70 پيس



## **Appendix 3 Terms of Reference issued by World Bank**

## ANNEX 1: TECHNICAL TOR A

ESMP or ESIA for the establishment or upgrading of IWRMC with  
Anaerobic Digestion (AD) Technology

# Technical Terms of Reference A: ESMP for the establishment or upgrading of IWRMC with Anaerobic Digestion (AD) Technology

## Objective and Scope of Preparation of ESMP or EISA

In order to ensure short and long term environmental and social impacts that would arise due to the proposed development are adequately mitigated and monitored, following the screening decision from EPA and the World Bank, an ESMP or an ESIA will need to be developed as per the scope presented below and in accordance with the ESAMF of the Project and the Environmental Impact Assessment Regulations (2012). The project IWMPs should be reviewed and used as the basis for baseline information. Field level verification should be conducted prior to the preparation of the ESMP or the ESIA.

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

Following should be the key components/assessment outline of the ESMP/ESIA:

1. **Executive Summary:** An executive summary of the significant findings of the report shall be prepared both in Dhivehi and English language. The executive summary shall include summaries of project description and how significant environmental and social issues will be resolved. The conclusion of the study must be stated.
2. **Introduction:** Briefly describe the major components of the proposed project. Provide a brief history and justification of the project and describe how the proposed development will improve on the current arrangements for waste management in the project area. Provide details of the proponent, and institutional arrangements for implementation and operations of the proposed development, and environmental and social issues of similar projects. Include desktop studies and review of similar ESMPs and ESIAs.

Major components of the Island Waste Management Regulation and the Island Waste Management Plan (IWMP) should be described (fee structure, consultations undertaken for plan preparation etc.), indicating the status of approval (prepared, under review or approved by EPA) and highlighting any

challenges faced by the council in plan preparation and approval (if any). The report also should indicate whether a study or public consultation has been (or should be) undertaken to assess willingness / ability to pay.

**3. Legislative and Regulatory Considerations:** This chapter should cover the legal aspects related to the project. Outline the project's consistency with the existing national, state, regional and local planning that apply to the project include reference to relevant statutory and non-statutory plans, planning policies, guidelines, strategies and agreements as appropriate. Outline the pertinent policies, regulations and standards governing project location, land use, environmental quality, and public health and safety. This should cover information on legal requirements specific to the project, such as permits to be taken under the Environmental Impact Regulations (2012) and the land allocation process followed with MLSA and other relevant institutions. There should be a brief description on the process (and law) pertaining to the allocation of land to development projects, in general, and to the IWRMC, in particular. Issues related to land acquisition and resettlement should be addressed, stating no impact or minimal impact.

If the gas generated from the AD plant is intended to be used to produce electricity using a bio-generator, approval from Maldives Energy Authority (MEA) should be acquired and included in the report.

**4. Study Area:** Submit an A3 scaled plan with indications of all the proposed land infrastructures. Specify the boundaries of the study area for the ESMP or the ESIA highlighting the location and size of the proposed construction. The study area should include nearby environmentally and socially sensitive areas (EPAs / ESAs, houses, mosques, schools, playgrounds etc.), nearest 3 phase distribution box, water connection point (if water network system is present at the island), sewer connection point (if sewer network system is present at the island). Justification for site selection shall be provided. Relevant developments in the area must also be addressed including residential areas and all economic ventures and cultural sites.

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

#### General Construction and Operations

- Provide a clearly labelled concept design and scaled site plan of the project boundary. If the project involves upgrading of an existing IWRMC, the infrastructure already present and

those that will be introduced as part of the upgrading works should be clearly distinguished in the concept design presented.

- Submit a detailed description of the components of the project and how the project activities will be undertaken.
- Describe the construction phase components of the project including but not limited to site clearance, collection bay area, AD plant room, equipment room, groundwater well, toilet, septic tank, leachate collection tank, resting area and perimeter walls and fences. If the project involves upgrading of an existing IWRMC, provide information on the existing structures of the IWRMC and how these structures will be incorporated into the design for upgrading.
- If the project involves upgrading of an existing IWRMC, suggest ideal locations for temporarily relocating the waste currently present at the existing IWRMC (if any). Propose adequate mitigation measures to prepare the temporary storage site with particular emphasis given to leachate prevention.
- Describe the operational phase components of the project including but not limited to waste collection services, method of storing, AD plant operations, bio-generator operations (if applicable), leachate management, arrangements for the removal of inorganic waste from the IWRMC and clean-up of existing small open dump sites.
- Details, types and numbers of labor/workers required during construction/establishment and during operation
- Include a project schedule.
- A matrix of inputs and outputs related to the project activities shall be included and described separately for construction and operational phase.

#### Design of AD plant and associated components

- Concept design of the AD plant and process flow diagram with all its components including the proposed method for gas storage and its subsequent use (conversion to electricity).
- Description of the AD plant and associated bio-generator (if the intended use is for generating electricity for the energy requirements of the IWRMC). Details of the materials that will be used for the construction of the plant should be given (fiber reinforced plastic, stainless steel etc.)
- Corresponding sizes and daily processing capacities of the AD plant and the associated bio-generator (if applicable) should be given.
- Type and amount of waste that it can treat (food waste, green waste, paper etc. in mixed form or separated) and details of any products required for activation (such as water and bacterial inoculum) including its corresponding quantities to operate for a period of 1 year.

- Type and quantity of gas generated (methane, CO2 etc.), method of gas collection and storage, process for conversion to electricity (or any other use) and how to deal with any excessive gas must be clearly mentioned.
- Solid and liquid bi-products and output of the process (wet / dry compost) including the method of their potential use and/or disposal.
- If a bio-generator is to be installed, the following should be addressed:
  - Noise ammunition measures
  - Cooling water system including cooling pipe location (if any) and justification.
  - Emergency power supply plan.
  - Lower energy consumption ventures and awareness.
  - Chimney height and justification on how the height was determined based on relevant local and international standards.

#### Fuel Management (if applicable – in case additional fuel is required to operate the bio-generator)

- Volume required for plant operation
- Rate of waste lube oil generation, its collection, storage and disposal.
- Fuel storage tank details (size, location, method of transportation from harbor to storage plant).
- Fuel transportation, pipeline drawing and specification especially leakage proofing.
- Measures of fuel containment
- Method of fuel transport from harbor to storage
- Fuel handling and management plan during operations
- Mitigation in case of fuel spillage

#### Fire hazard, health and safety

- Vulnerability analysis of the system to fire, electrical and explosion hazard.
- Provision to fire safety, including details of firefighting equipment that will be established, signage, alarm system etc.
- Firefighting capacity of IWRMC operators. If not found to be adequate, recommend a fire safety training program to the IWRMC operators which should be completed prior to operationalization of the center. Indicate the availability of fire wardens in the island and their capability to assist in such a program.

#### Construction waste and waste oil

- Waste fuel and oil management details.
- Construction waste management and disposal.



6. **Existing Environment:** The existing environment study will require data collection and survey analysis techniques given the nature of the project and the proposed technology. A vegetation survey of the site must be presented since a large number of vegetation are subject for clearance. The vegetation analysis should be supplemented by drone imagery and / or photographs. The following information should also be provided based on field observations and consultations with the island council and the community. Photographic evidence should be provided where appropriate.

- a) Current Waste Management Practices: Describe how waste is managed at present. This should include information about waste collection method and times, means of disposal (both organic and inorganic), staffs managing waste etc. Information about existing open dump sites (if any) and method of disposal should also be provided. Provide a map indicating the locations and dimensions of the open dump sites. Describe the waste composition and estimated volumes of each open dump site with photographic references.
- b) Unassigned Waste Dumping: Describe the overall cleanliness of the island and whether unassigned waste dumping is observed. This should include an assessment of the status of contamination of the site as well via visual observation.
- c) Project Site and Access Road: Describe the condition of the ground and soil of the project site (visual analysis). Provide an estimate of the amount and composition of waste present at the existing IWRMC and existing environments of temporary relocation sites (only applicable if an upgrading project). Provide information related to distances between residential areas, commonly used public places (mosques, schools, parks etc.), nearest 3 phase electricity distribution box, water connection point (if water network system is present at the island), groundwater wells and sewer connection point (if sewer network system is present at the island). Additionally, information related to the access road and route to waste unloading area shall be provided.
- d) Land ownership and usage: Describe the legal boundaries of the site, and identified current usage of the land in terms of squatters, land encroachments, fixed and movable structures, trees and wells, etc. Describe land allocation/ownership details of the project area and any need for land taking causing resettlement impacts.
- e) Coastal Modification / Erosion: Provide information related to any coastal modifications undertaken in the island in recent history and the side of the island subjected to coastal

erosion. Indicate whether any coastal erosion is noticed from the shoreline closest to the proposed development.

- f) Vegetation present at the site: Describe the number and type of vegetation present at the project site and access road including scientific and local names. The amount of vegetation that require compensation and estimated cost must be indicated (separate for project site and access road, as the proponent of the access road is the island council). An explanation on how the rate of compensation is set by the Council and the process undertaken for the payment of compensation for loss of coconut palms and other trees should be given. Vegetation cover maps shall be included where appropriate (identifying the areas subjected for vegetation removal and translocation). Emphasis must be given to translocate trees (within the source islands or out of the island in instances where space scarcity is an issue) as much as possible. Methods of vegetation removal and translocation must be described, which should yield the preferred method for the project site and access road. Locations for compensatory 2:1 replantation must be identified and indicated on a map. *(Note: If development of an access road is found to be an associated project to which the island council will be the proponent, commitment letter from the island council stating their full responsibility to implement mitigation measures and assume monitoring responsibilities for the associated project must be included in the ESMP or ESIA).*
- g) Groundwater Quality: Temperature, pH, conductivity, total dissolved solid (TDS), Nitrate and total petroleum hydrocarbon (from the proposed location of AD plant).
- h) Air Quality: Particulate matter (PM10 and PM2.5), carbon monoxide (CO), nitrogen oxide (NO) and Sulphur dioxide (SO2).
- i) Noise: outside within 1m radius and within the nearest residential area.
- j) Protected Areas and Environmentally Sensitive Sites: Provide information on the environmentally protected and sensitive areas that exists close to the proposed development. Indicate distances from the project sites and if the protected area is in the project impact zone and if there are any observed potential impacts. Proximity of the site to surface water bodies or sensitive habitats (e.g. coasts, mangroves, wetlands) should also be identified.

k) Areas of Historic and Cultural Significance: Provide information on areas of historic and cultural significance that exist close to the proposed development. Indicate distance from the selected project site.

l) Socio-Economic Environment: Describe the socio-economic environment of the island.

- Demography: total population segregated by gender, density, growth and pressure on land and marine resources.
- Details of vulnerable/marginalized groups (households headed by females, households' special needs, households below poverty line etc.) and community-based organizations (i.e. women's/youth groups etc.) & their activities.
- Economic activities and livelihood patterns: Major economic activities of the community including but not limited to local tourisms (no. of operational guesthouses), businesses (no. of wholesale and retail shops), cafés / restaurants, fishing vessels etc.
- Status of access to market, health facilities, banking, communication, etc.
- Electricity: Describe how electricity is provided at the islands and the capacity of the generators installed.
- Water Resources and Sewerage: Source of portable and non-portable water supply. If through RO indicate the type and capacity of the plant and water storage tanks. Describe how sewerage is treated at the island (i.e. through septic tanks or sewer network system).

7. **Impact Identification**: The ESMP or EISA should identify all the impacts, direct and indirect, during and after construction, as well as for the operations of the IWRMC and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

a) Physical / Chemical: describe impacts on groundwater, soil, noise, air and waste.

- Impacts on noise pollution and disturbances (both in construction and operations)
- Impacts on groundwater table and quality due to construction, operations (leachate / stormwater runoff) and accidental fuel spillage (if fuel tanks are included within project scope).
- Impacts on ground vibrations to nearby houses and buildings.
- Impacts on air quality.
- Marine water pollution due to spillage during material transfer.

b) Biological: describe impacts on vegetation and fauna.

- Impact due to vegetation removal.
  - Impacts to vegetation and fauna due to improper handling and driving during material transportation.
  - Impacts due to material spillage during transfer of construction materials to the project island.
- c) Any resettlement impact - such as loss of land, livelihoods, assets etc. due to land taking/acquisition and/or other project interventions.
- Verify the legal status of the land required; document existing structures, land plots, and other physical assets at the project site to establish a cut-off date for entitlements in accordance with the policies given in ESMF.
  - Identify the persons and their families likely to be affected by the project including those who are vulnerable. This should cover information pertaining to members of families who are residing, practicing any trade, occupation or vocation in the project affected area, including those who may potentially lose income due to loss of coconut palms having a moderate economic value.
  - Project Affected Families are those who are likely to lose their house, homestead, commercial establishment, agricultural land, employment or are alienated wholly or substantially from the main source of their trade, occupation or vocation, or who will lose any other immovable property or their source of livelihood. Including people losing access to private property or common property resources.
- d) Sociological / Cultural: describe impacts of road closure, nearby sensitive areas (mosques, schools etc.), health and safety of surrounding community / contracted labor and sociocultural conflict.
- Sociocultural conflict due to arrival of expatriate workers and recruitment of expatriate IWRMC operators.
  - Impacts due to illegal immigrants being potentially recruited by the contractor.
  - Contractors code of conduct and communication.
  - Loss of source of sand for local public use due to sand mining from the area of the lagoon permitted for local public sand mining (which is prohibited under law).
  - Health and safety of the construction workers and the IWRMC operators.
  - COVID19 restrictions and special considerations for the contractor (potential mitigation measures may include daily temperature checks, cleaning procedures, shift roaster, arrangement for social distancing in labor camps, establishment of handwashing facilities at work site and labor camp etc.).
  - Fire hazard due to improper handling of fuel (if fuel storage is included with the project scope) and waste.

- e) Economic / Enhancement Plans: describe any potential benefits or losses to the economy.
- Employment opportunities.
  - Impacts to the local economy due to purchasing of locally available construction materials.
  - Impacts to the public due to high user fees.
  - Cost saving in IWRMC operations due to electricity being generated from waste.
  - Some of these opportunities can be further developed to draw environmental and social benefits to the local area. The ESMP should identify such opportunities and develop a plan to systematically harness any such benefit
- f) Specific Impacts Associated with the Proposed Technology: The Consultant should assess the following aspects in line with the proposed technology.
- **Odor Management:** Assess if the technology has an inbuilt odor management system and managed odors automatically.
  - **Fluid and Discharges:** Will there be any fluid discharges from the proposed technology, will the machines require any extra piping space or water discharge systems or expansion of the existing leachate management system provided via the design, the consultants should propose suitable design requirements if so in the ESMP.
  - **Waste Inputs:** Assess if the technology requires additional segregation of pre management of the incoming organic waste. Indicate specifically under the section on operational aspects of the ESMP what steps need to be taken specifically by the IWRMC operators in handling in coming waste to ensure it can be efficiently used in line with the proposed technology.
  - **Energy Requirements and Efficiency:** The energy requirement to run the machinery and the status of energy efficiency of the machinery proposed should be assessed, i.e. the consultants should assess the energy requirements for operating the technology and propose the most efficient means of managing. Can a connection be made to the existing Island Grid, if so, will the capacity suffice, can a solar and battery generator be used as an energy source and if diesel generators are to be used which is the least alternative, the amount of fuel required etc. should be asses as part of the project alternatives analysis. For all energy sources impacts in terms of emissions, noise, safety risks etc. should be assessed and mitigatory measures suggested in the ESMP accordingly.
  - **Sludge and Residuals:** The nature and amount of all residual material produced, solid and liquid should be assessed and recommend means by which it can be re-

used and/or managed in the ESMP. If reuse is recommended the consultant should also recommend the requirements for routine monitoring of quality of the digestate and liquid residue for instance if it is recommended to be used in agricultural processes.

- **Safety features on the machinery:** such as presence of emergency stop buttons, emergency lights and/or alarms for emergency use are equipped to ensure the best level of safety should be present and the consultants should assess if the proposed technology, especially machinery include these in addition to proposing other safety features in the ESMP.

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

8. **Project Alternatives:** Describe alternatives including the “no project option” should be presented. Alternative examined for the project should include alternative locations, design and technology options, and alternative energy sources which shall be evaluated in environmental, social and economic terms. Alternative technology options for the treatment of organic waste may include manual composting and the use of compost machines. Depending on the source of energy proposed to operate the IWRMC, alternative energy sources evaluated shall include connection from existing power grid, solar, battery and diesel generators. For all energy sources impacts in terms of emissions, noise, safety risks etc. should be assessed and mitigatory measures suggested accordingly. All alternatives must be compared according to commonly accepted standards and norms and international standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options shall be specified for each component of the proposed project.

9. **Mitigation and management of negative impacts:** Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures. Mitigation measures to avoid or compensate habitat destruction caused by land clearance will have to be considered. Mitigation measures should be provided for COVID19 related aspects such as daily temperature checks, cleaning procedures, shift roaster, arrangement for social distancing in labor camps, establishment of handwashing facilities at work site and labor camp etc. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those

measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. An Environmental and Social Management Plan (ESMP) for the proposed project, identifying responsible persons, their duties and commitments shall also be given. The environmental and social management plan should be presented in matrix format, clearly indicating the responsible person, cost, equipment and resources required for each proposed action. In cases where impacts are unavoidable arrangements to compensate for the environmental and / or social effect shall be given.

On islands where large volumes of residual legacy waste are identified at the IWRMC site, the consultant will present a recommended course of action for island clean up, need for waste segregation and management options, including onsite and offsite, resource recovery, recycling and/or final disposal in the form of mitigatory actions defined for the context of each Island.

Mitigation measures should be presented as a matrix consistent to the format provided below.

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g. secondary impacts)
<b>Detailed design and planning Phase</b>						
<b>Pre-Construction Phase -Site Preparation</b>						
<b>Construction Phase</b>						
<b>Operation and Maintenance Phase</b>						

The proposed ESMP matrix shall be translated to Dhivehi language and provided as an Annex to the report.

## 10. Development of monitoring and reporting plan:

10.1. Monitoring Program: Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for vegetation clearance, soil, groundwater, noise and air quality, spillage assessment and grievance redress mechanism. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

The monitoring program should give details of the following;

- Monitoring indicators to be measured for evaluating the performance of each mitigatory measure (for example national standards, engineering structures, extent of area replanted, etc.).
- Monitoring mechanisms and methodologies
- Monitoring frequency
- Monitoring locations
- Cost of monitoring
- Responsible party

The recommended format for presenting the monitoring program is given below.

Proposed Mitigation Measure	Parameters to be monitored	Location	Measurements (Incl. methods & equipment)	Frequency of Measurement	Responsibilities (Incl. review and reporting)	Cost (equipment & Individuals)
<b>Detailed design and planning Phase</b>						
<b>Pre-Construction Phase</b>						
<b>Construction Phase</b>						
<b>Operation and Maintenance Phase</b>						

**10.2. Reporting Procedures and Implementation Schedule:** The consultant should propose adequate reporting mechanisms with frequencies for the implementation of the ESMP and the proposed monitoring program.

**10.3. Cost Estimates and Sources of Funds:** Implementation of mitigatory measures mentioned in the ESMP will involve an initial investment cost as well as recurrent costs. The ESMP should include costs estimates for each measure and also identify sources of funding, which is to be covered under section 9. In addition to this, estimated costs shall be provided (separate for construction and operational phase activities) for specific items and materials that the contractor and the operators would require to implement the ESMP effectively. Such items may include the cost of purchasing PPEs, fire extinguisher, signages, trainings etc. This would essentially enable the contractor to reflect accurate costs in the bid documents. Potential sources of funding for the operational phase should be reflected.



**10.4. Contract Clauses:** This is an important section of the ESMP that would ensure recommendations carried in the ESMP will be translated into action on the ground. Contract documents will need to be incorporated with clauses directly linked to the implementation of mitigatory measures. Mechanisms such as linking the payment schedules to implementation of the said clauses could be explored and implemented, as appropriate.

## **11. Management of Other On- or Off-Site Environmental Pollution Control and Infrastructure**

This section should address management of critical elements of pollution control and infrastructure that are not otherwise included in the mitigation plan because they were considered an essential part of the proposed project.

## **12. Summary of all Training Recommendations**

This section should include programs targeted to increase the capacity of the contractor and the operator in the implementation of the ESMP. A capacity needs assessment for the operations of the IWRMC should be undertaken, highlighting gaps and training recommendations for a fully functional system. Special consideration must be given to cover operational training requirements of the proposed AD plant and associated bio-generator (if included with the project scope).

The training recommendations are likely to include the following:

- Strengthening the capacity of the contractor on ESMP implementation and reporting.
- Strengthening PMU's capacity on compliance monitoring.
- General awareness on health and safety.
- Contractor's code of conduct.
- Community Mobilization: Based on the assessment, the consultant should describe key messages for communication/awareness and recommend methods/tools. Also, recommend approaches to mobilize communities, enhance community participation (including that of women's groups) and create ownership/interest around waste management.
- Operation and Maintenance training of the AD plant and bio-generator.
- Fuel handling (if applicable).
- Fire safety training and fire drills.

Institutional Strengthening Activity	Position(s)	Scheduling	Responsibility(is)	Cost Estimates	

Training Activity	Participants	Types of Training	Content (modules, Etc.)	Scheduling	Cost Estimates

### 13. Contingency Plans

Contingency plans shall be prepared and described to address: a) failure to meet specific performance criteria established by law or necessary for the project to meet its commitments in the ESMP and b) respond to natural and other risks previously identified and mitigated in the ESMP in the event reasonable and feasible mitigation measures to address the risks are inadequate.

- Performance-related Contingency Plans, indicating the steps that will be taken should monitoring indicate that:
  - Environmental standards are not being met
  - Impacts are greater than predicted
  - Mitigation measures and/or rehabilitation are not performing as predicted
- Natural Disaster Risk Response Plan (assumes that risk identification and risk reduction have been addressed in other parts of the EA)
- Other Risks Response Plans (assumes that risk identification and risk reduction have been addressed in other parts of the EA)
- Contingency plans for maintaining service or reducing downtime in the event of accidents or natural catastrophes that disrupt project operation

**14. Grievance Redress Mechanism (GRM):** Describe the proposed grievance redress mechanism of the project developed by the PMU and offer suggested improvements including naming the responsible person in each tier.

**15. Stakeholder consultation:** Identify appropriate mechanisms for providing information on the development project and the GRM to relevant stakeholders. Consultations must be undertaken with all key stakeholders – including communities, government officials etc. During consultations the project activities should be introduced, and stakeholders given opportunity to ask questions/clarifications, raise their objections/concerns and the consultant should provide relevant feedback – this discussion should be documented in the form of a table noting the points discussed/issues raised and feedback provided. The report shall include a brief description of the Council’s plan for GRM execution at tier 1. The report should include a list of people/groups consulted, their contact details and summary of the major outcomes. The following people or institutions should be consulted.

- Island Council (on GRM, Island Waste Management Plan, fee collection system, plan for 2:1 replantation, and the overall project in general)
- EPA (on the overall design of the IWRMC, AD component and operation licensing requirements).
- Maldives Energy Authority (on the operations and the bio generator to produce electricity for the IWRMC operations).
- FENAKA (on the capacity of the island power plant to cater for the energy requirements of the IWRMC).
- Health Protection Agency (on COVID19 health and safety requirements).
- Ministry of Planning and Infrastructure and Maldives Land and Survey Authority (regarding land use plan).
- Maldives National Defense Force (on handling of fuel, fire safety and willingness to assist in training the IWRMC operators on firefighting).
- Waste Management Committee (on their role of waste management at the island).
- Women's Development Committee (on their involvement and perspectives on how waste management can be improved in the Island)
- Community Consultation or Household Survey (randomly selected with emphasis given to those residing at a close proximity to the project site: on the adequacy of the proposed site, feasibility of overall design of the IWRMC and the proposed technology, health and safety considerations, proposed fee collection structure, willingness to pay and waste management plan of the council).
- Ministry of Environment / MCEP (on the overall project as the proponent and GRM at tier 2)

The consultant should take into consideration COVID19 safety measure during consultations, follow WHO/WB & GoM guidelines when conducting consultations and explore remote/online options when conducting consultation.

## **16. Gender Empowerment / Preparation of Gender Action Plan**

The consultants will carry out Gender analysis as an integral part of the social assessment. The project designs should be gender responsive based on the gender analysis. The findings and recommendations from the gender analysis during project planning and feedback from beneficiaries during implementation must be discussed thoroughly to determine the need for further action. Listed below are the key action points:

- Identify key gender and women's participation issues.
- Conduct gender analysis as part of overall Social Assessment.

- Examine gender differences in knowledge, attitudes, practices, roles, status, wellbeing, constraints, needs, and priorities, and the factors that affect those differences.
- Assess men's and women's capacity to participate and the factors affecting that capacity.
- Assess the potential gender-differentiated impact of the project and options to maximize benefits and minimize adverse effects.
- Identify government agencies and nongovernmental organizations (NGOs), community-based organizations (CBOs), and women's groups that can be used during project implementation and assess their capacity. The possibility of utilizing such ground to execute 2:1 replantation and if so the requirement to provide financial assistance with estimates must be provided.
- List out major gender actions.
- Develop gender-disaggregated indicators and monitoring plan.

## 17. Validation and Disclosure

The draft executive summary and the ESMP (matrix table in mitigation chapter) in local language should be disclosed in all major affected settlements and at island level in printed format and disseminated as appropriate or made available via online means for public commenting. This should be completed prior to or at the time of submitting the report to the EPA and the World Bank for clearance, so the period for public commenting can be sequenced in parallel to the review process. The consultant will assist the project in disclosure documents in all major affected settlements and at island and national level. The final cleared version of the report will be disclosed in major project websites and social media platforms with a summary of major findings through the disclosure process reflected as an annex.

## 18. Conclusion

This section shall specify the environmental acceptability of the project, taking into account the impacts and measures identified during the assessment process. It shall also identify any other conditions or external requirements for ensuring the success of the project.

**Presentation-** The ESMP or ESIA report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The ESMP or EISA report will be organized according to the final TOR, in accordance to, but not necessarily limited by, the outline the Environmental Impact Assessment Regulations (2012) and the ESAMF. The report shall include Dhivehi translations of the executive summary and the ESMP matrix. All raw data collected, including maps and surveys should be submitted in Raw form to the client in digital format.

## **Appendix 4 Approval letter from MLSA**



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Secretariat of the Kudahuvadhoo Council, South Nilandheatholhu

Dh.Kudahuvadhoo

Republic of Maldives

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ahmedkaleel@live.com ދިވެހިރާއްޖޭގެ ދަރިވަރުންނަށް

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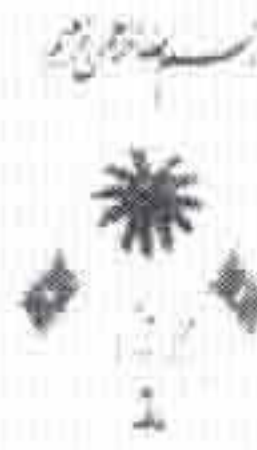
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**Maldives Land and Survey Authority**  
Ministry of National Planning and Infrastructure  
Male', Republic of Maldives.

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ސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި 431-LIS/381/2019/5

ދިވެހިސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި ސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި  
މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ

މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ 381-B/431/2019/01 (08 ސެޕްޓެމްބަރު 2019) ސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި

މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ 39000 ސަވަރުގައި ބަޔާންކުރި ސަރުކާރުގެ ގެޒެޓްގައި ބަޔާންކުރި  
މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ 24 ސެޕްޓެމްބަރު 2019

27 ސެޕްޓެމްބަރު 2019

24 ސެޕްޓެމްބަރު 2019

މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ  
މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ

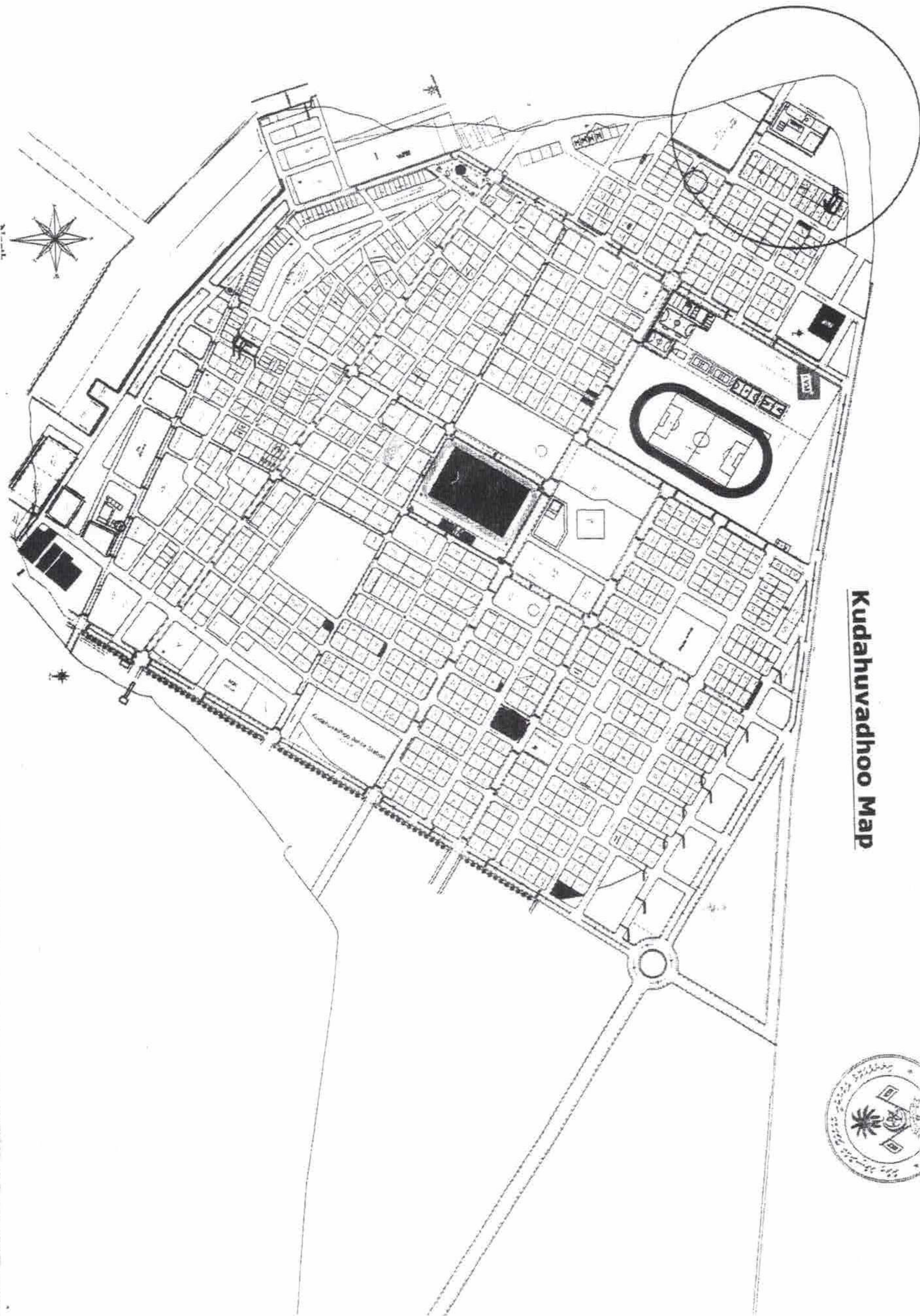
B 3136

11.12 2019  
މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ

މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ  
މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ

މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލާނިންގ އަންދު އިންފްރާސޯޓްރިއާކްޗަރ





**Kudahuvadhoo Map**







# Waste Management Centre 25000.00sqft

Boduthakuru Raanumagu

Wood waste area

Inclinator

Composting area

Burning area

Glass

Plastic

Iron / Aluminium

Machine House

Iron wastes

Hazardous wastes

60960 [200']

38100 [125']

2192 [40']

kalthuthumayyaage

848

safe  
heave  
849

Light  
will  
850

Re

Gaadi

BYU













Secretariat of the Kudahuvadhoo Council, South Nilandheatholhu

٣٠٠ ٢٠٠ ١٠٠

مرفوعاً

نار بر سوختی سر بر سر

381(N)2019/03-83 : ستر ستر ستر

تاریخ: 2019	03	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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[illegible]

دَاسُو زَیْرُودِ قُتْمَقِ دَیْسَیوَرُو سَیْمَیوَرُو اَیْرَیجِ (نَاسَیوَرُو دَیْرَیجِ)

[illegible]

<p>مَدِينَةُ الْمَدِينَةِ: مَدِينَةُ الْمَدِينَةِ</p>	<p>مَدِينَةُ الْمَدِينَةِ: مَدِينَةُ الْمَدِينَةِ</p>
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[illegible]

جیٹ میٹر سرسبز قریب 21 مئی 2019 09:00 بجے  
جیٹ میٹر 56 مئی 2019 09:00 بجے

[illegible]

*[Handwritten signature]*



*0005525*



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



*(Handwritten signature)*

Secretariat of the Kudahuvadhoo Council, South Nilandheatholhu

Dh.Kudahuvadhoo

قر. ۳۴/۴/۳۳

Republic of Maldives

٤٥٤  
حرف و رسم و فتح

مستند نمبر: 08/2018/ 438 /B-381/No:

[illegible]

میر و بریلوئی سرحد 438-WMPC/381/2018/09 ( 26 جولائی 2018 ) کی سیدھی

[illegible]

1439 سحر 29

2018 12 12

۵۵۵

Ques

*Handwritten signature*

لا ابرئ مني ولا ابرئ مني

[illegible]









ސަރުކާރުގެ ނަންބަރު: 203-WST/381/2019/12

ސަރުކާރުގެ ނަންބަރު: 3676  
ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާގެ ނަންބަރު: 3676

މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާގެ ނަންބަރު: 3676  
ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާގެ ނަންބަރު: 3676  
ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާގެ ނަންބަރު: 3676  
ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

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15 ނަންބަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

12 ނަންބަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ



ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ  
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މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ	މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ	މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ	މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ
15.59	31/12/19		

Environmental Protection Agency

Green Building, 3rd Floor, HandhuvaareeHingun

Male, Rep. of Maldives, 20392

Tel: (+960) 333 5949 (+960) 333 5951

Fax: (+960) 333 5953

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މިއަހަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

ދިވެހިރާއްޖޭގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

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20392 ނަންބަރުގެ ބަނޑުޖަރުކުރާ ޖަމިއްޔާ

Email: secretariat@epa.gov.mv

Website: www.epa.gov.mv



ಸರ್ಕಾರ



ವಿರೋಧಿ ಸಂಸ್ಥೆ

Environmental Protection Agency



ನಂ. 58/2013/ರ-58

# License for Waste Management

ಇದು 2013/ರ-58 ನಿಯಂತ್ರಣದ ಅಡಿಯಲ್ಲಿ ಈ ಲೈಸೆನ್ಸ್ ನೀಡಲಾಗಿದೆ.

This license is issued to the licensee contingent upon acceptance of the conditions attached to this license, pursuant for the Waste Management Regulation (2013/R-58).

ನಾಮದ ಲೈಸೆನ್ಸಿ  
Dh. Kudahuvadhoo Council  
Name of the licensee

ನಿರಂತರ ವಿಳಾಸ  
Niranthe Atholhu Dhekunuburi  
Kudahuvadhoo Council Idhaara  
Permanent Address

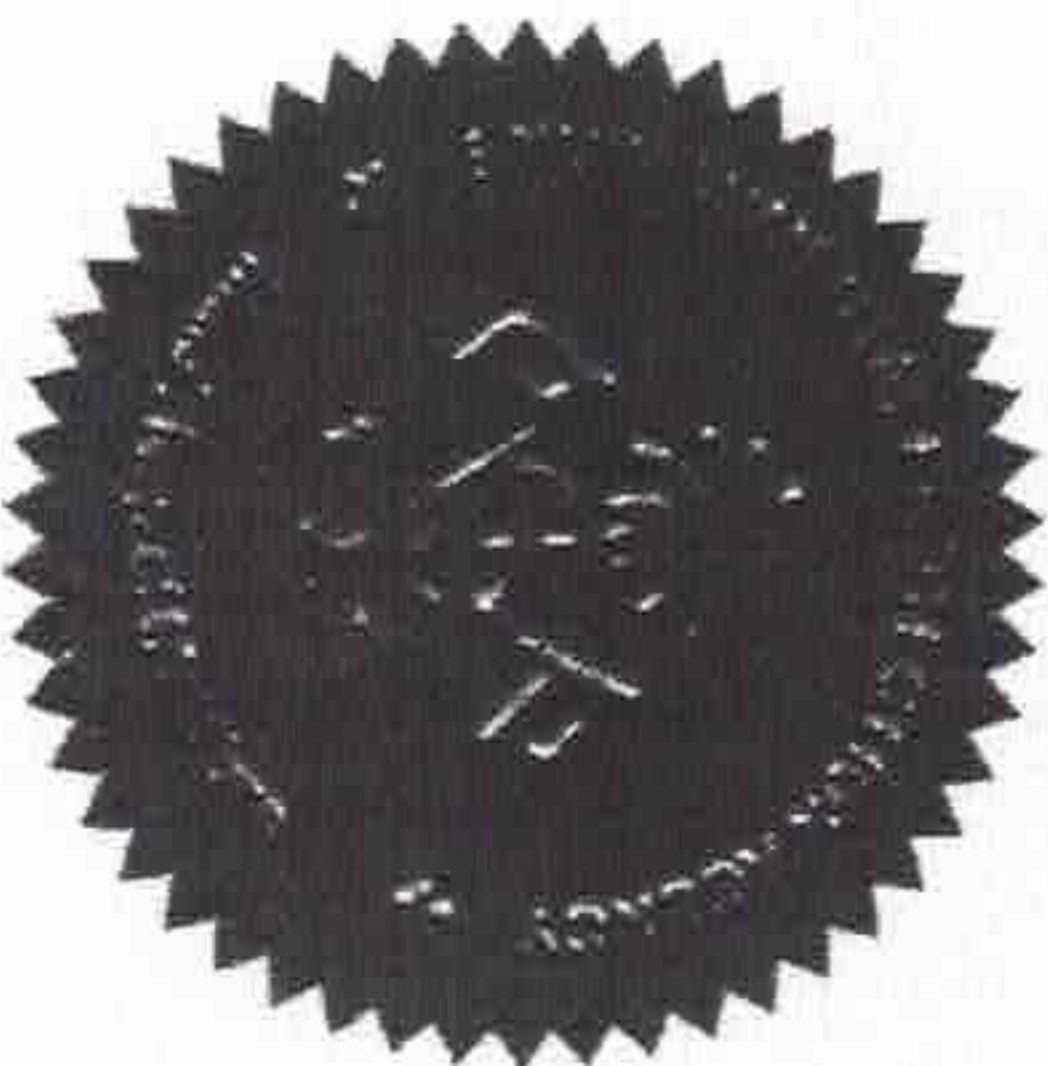
ನಿರಂತರ ವಿಳಾಸ  
Dh. Kudahuvadhoo  
Area of License permitted  
Waste transfer site

ನಿರಂತರ ವಿಳಾಸ  
Management of  
Waste Center  
Permitted Waste Management Category

ನಿರಂತರ ವಿಳಾಸ  
Handling  
Special Waste  
Waste Storage  
Composting

2019  
12 December 2019  
Permitted Date

2022  
12 December 2022  
Expire date



ನಿರಂತರ ವಿಳಾಸ  
Director General



17A-WMA/2019/04



[illegible]

This is to certify that WASTE MANAGEMENT CENTER OF DH KIDAH VADHOQ is registered under

Waste Management Regulation (2013/R-58)

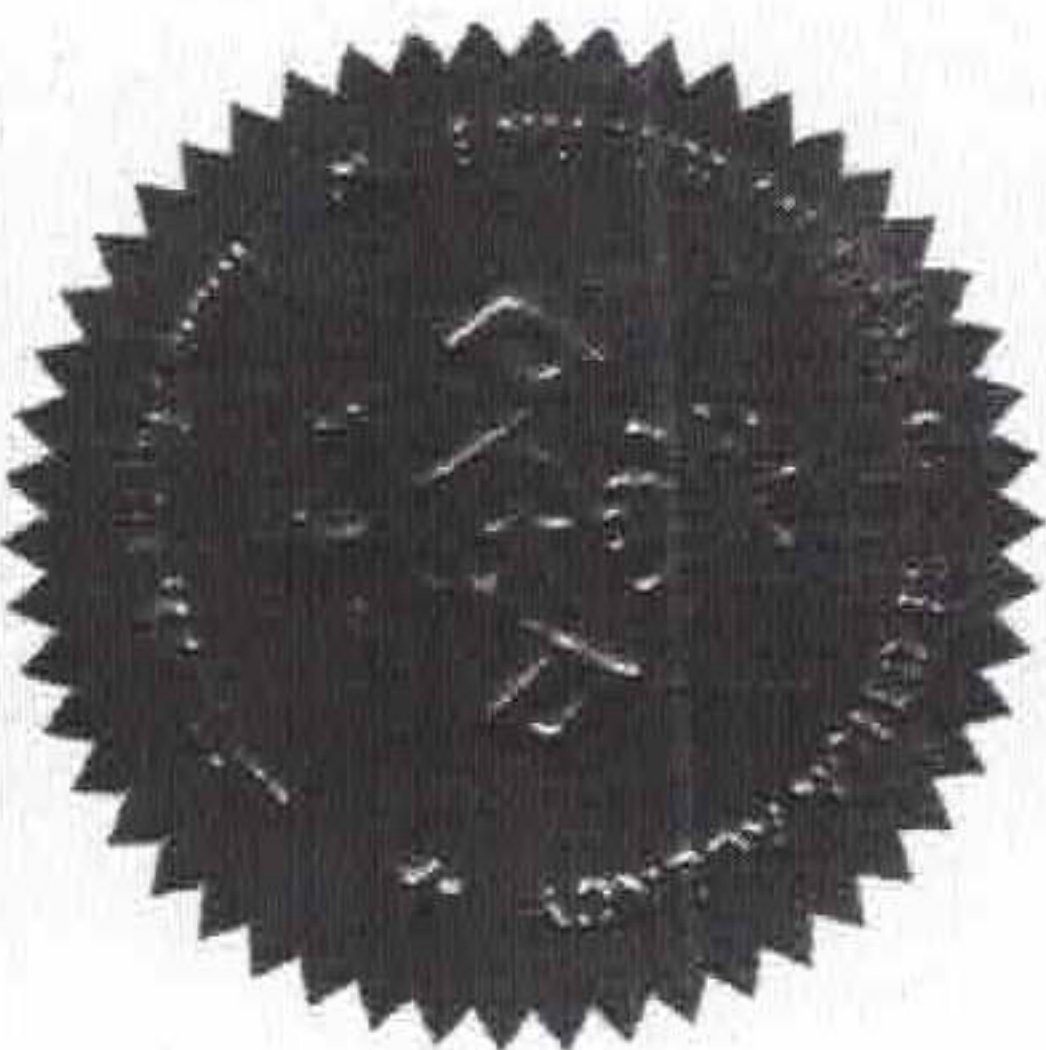
12-12-2022

Size of the Waste Management Center

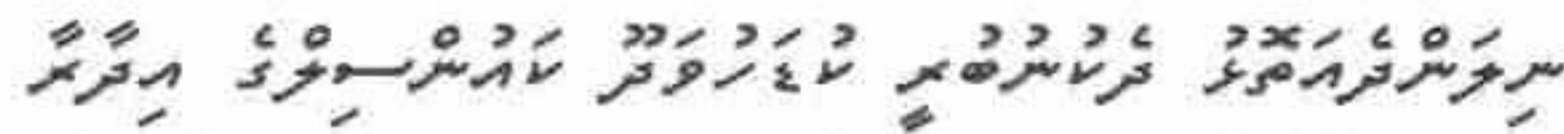
Effective Date

**Expiry Date**

Director General







٢٢ / ٢ / ٢  
٢٢ / ٢ / ٢

٤٥٨

نمبر ۱۵۴۵ ۱۵۴۶ ۱۵۴۷ ۱۵۴۸ ۱۵۴۹

مَدْرَسَةُ

[illegible]

حَدَّثَنَا

[illegible][illegible]

د شتمنډ مورانه لارو پر وړاندې د زوت ناسته پورته کول. د لار په پیل کې د مورانه لارو پر وړاندې د شتمنډ مورانه لارو پر وړاندې د زوت ناسته پورته کول.

$\frac{0}{\text{سر}} : \frac{\text{دو سر}}{\text{مردم و مردان}} , \frac{\text{سه سر}}{\text{تیرا مردم و تیرا مردان}} , \frac{\text{چهار سر}}{\text{چاره مردم و چاره مردان}} , \frac{\text{پنج سر}}{\text{پنجه مردم و پنجه مردان}}$

[illegible]

6760522: کوئٹہ سڑک نمبر:

٥٧٤ ٤٥٥٤٢٥  
عزیز علی صاحب

[illegible]



# ١٠٠

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- 12 ..... ١٠٠
- 13 ..... ١٠٠
- 13 ..... ١٠٠
- 14 ..... ١٠٠











دَسَوَ اَمُو تَاغُو دَسَرَتَرِ مَوُو نَسِي سَهَّو حِرُّو خُجُو اَنَدُو وَاوَرِ مَزِي سَكْرَا قِي سَرِ اِهَرِ مَوُو سَرُو  
مَكْرَا مَزِي وَرِي لَوُو مَوُو رَارُو.

اَللّٰهُمَّ صَلِّ وَسَلِّمْ عَلٰى سَيِّدِنَا مُحَمَّدٍ وَصَلِّ وَسَلِّمْ عَلٰى اٰلِهِ

[illegible]

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[illegible]

٥٠٠٠٠٠ ٥٠٠٠٠٠

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خبر فتح صاعی و بر سر صاعی و بر سر صاعی و بر سر صاعی

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25 26 -

[illegible]

1-  $\frac{d}{dt} \left( \frac{1}{r^2} \right) = -\frac{2}{r^3} \frac{dr}{dt}$



- [illegible]

- 146 سَعْدُ 6



-8- شرح مرقیہ مرقیہ

9- عَمَّ يَتَسَاءَلُونَ

10- زمرہ

11- حَرْقُومَر

12- ایشو سہ ماہی

[illegible][illegible]

1- قرض مساع

2- كَسْبُ الْمَرْمِيَّةِ

[illegible]

لَا تُرْجَوُوهُ وَيَسْأَلُكُمْ فِيهِ الْغَافِلُونَ

[illegible]

داسر دکر دکر دکر دکر

۱.  $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$  ۲.  $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$  ۳.  $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$  ۴.  $\frac{1}{8} \times \frac{1}{9} = \frac{1}{72}$  ۵.  $\frac{1}{10} \times \frac{1}{11} = \frac{1}{110}$   
 ۶.  $\frac{1}{12} \times \frac{1}{13} = \frac{1}{156}$  ۷.  $\frac{1}{14} \times \frac{1}{15} = \frac{1}{210}$  ۸.  $\frac{1}{16} \times \frac{1}{17} = \frac{1}{272}$  ۹.  $\frac{1}{18} \times \frac{1}{19} = \frac{1}{342}$  ۱۰.  $\frac{1}{20} \times \frac{1}{21} = \frac{1}{420}$   
 ۱۱.  $\frac{1}{22} \times \frac{1}{23} = \frac{1}{506}$  ۱۲.  $\frac{1}{24} \times \frac{1}{25} = \frac{1}{600}$  ۱۳.  $\frac{1}{26} \times \frac{1}{27} = \frac{1}{702}$  ۱۴.  $\frac{1}{28} \times \frac{1}{29} = \frac{1}{812}$  ۱۵.  $\frac{1}{30} \times \frac{1}{31} = \frac{1}{930}$   
 ۱۶.  $\frac{1}{32} \times \frac{1}{33} = \frac{1}{1056}$  ۱۷.  $\frac{1}{34} \times \frac{1}{35} = \frac{1}{1190}$  ۱۸.  $\frac{1}{36} \times \frac{1}{37} = \frac{1}{1332}$  ۱۹.  $\frac{1}{38} \times \frac{1}{39} = \frac{1}{1482}$  ۲۰.  $\frac{1}{40} \times \frac{1}{41} = \frac{1}{1640}$   
 ۲۱.  $\frac{1}{42} \times \frac{1}{43} = \frac{1}{1806}$  ۲۲.  $\frac{1}{44} \times \frac{1}{45} = \frac{1}{1980}$  ۲۳.  $\frac{1}{46} \times \frac{1}{47} = \frac{1}{2162}$  ۲۴.  $\frac{1}{48} \times \frac{1}{49} = \frac{1}{2352}$  ۲۵.  $\frac{1}{50} \times \frac{1}{51} = \frac{1}{2550}$   
 ۲۶.  $\frac{1}{52} \times \frac{1}{53} = \frac{1}{2756}$  ۲۷.  $\frac{1}{54} \times \frac{1}{55} = \frac{1}{2970}$  ۲۸.  $\frac{1}{56} \times \frac{1}{57} = \frac{1}{3192}$  ۲۹.  $\frac{1}{58} \times \frac{1}{59} = \frac{1}{3422}$  ۳۰.  $\frac{1}{60} \times \frac{1}{61} = \frac{1}{3660}$   
 ۳۱.  $\frac{1}{62} \times \frac{1}{63} = \frac{1}{3906}$  ۳۲.  $\frac{1}{64} \times \frac{1}{65} = \frac{1}{4160}$  ۳۳.  $\frac{1}{66} \times \frac{1}{67} = \frac{1}{4422}$  ۳۴.  $\frac{1}{68} \times \frac{1}{69} = \frac{1}{4692}$  ۳۵.  $\frac{1}{70} \times \frac{1}{71} = \frac{1}{4970}$   
 ۳۶.  $\frac{1}{72} \times \frac{1}{73} = \frac{1}{5256}$  ۳۷.  $\frac{1}{74} \times \frac{1}{75} = \frac{1}{5550}$  ۳۸.  $\frac{1}{76} \times \frac{1}{77} = \frac{1}{5852}$  ۳۹.  $\frac{1}{78} \times \frac{1}{79} = \frac{1}{6162}$  ۴۰.  $\frac{1}{80} \times \frac{1}{81} = \frac{1}{6480}$   
 ۴۱.  $\frac{1}{82} \times \frac{1}{83} = \frac{1}{6806}$  ۴۲.  $\frac{1}{84} \times \frac{1}{85} = \frac{1}{7140}$  ۴۳.  $\frac{1}{86} \times \frac{1}{87} = \frac{1}{7482}$  ۴۴.  $\frac{1}{88} \times \frac{1}{89} = \frac{1}{7840}$  ۴۵.  $\frac{1}{90} \times \frac{1}{91} = \frac{1}{8190}$   
 ۴۶.  $\frac{1}{92} \times \frac{1}{93} = \frac{1}{8556}$  ۴۷.  $\frac{1}{94} \times \frac{1}{95} = \frac{1}{8930}$  ۴۸.  $\frac{1}{96} \times \frac{1}{97} = \frac{1}{9312}$  ۴۹.  $\frac{1}{98} \times \frac{1}{99} = \frac{1}{9702}$  ۵۰.  $\frac{1}{100} \times \frac{1}{101} = \frac{1}{10100}$

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2.  $\frac{1}{2} \frac{d}{dt} \left( \frac{1}{2} m v^2 \right) = \frac{1}{2} m v \frac{dv}{dt}$   
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## ארבעה עשר חלקים ושלשה חלקים

בזה ספר מביא מנהגים ודרכים אשר נהגו ונהגות בזה העולם  
 ומהם אשר הם נכונים ומהם אשר הם שגוים ומהם אשר הם  
 נכונים ומהם אשר הם שגוים ומהם אשר הם נכונים ומהם אשר הם שגוים

בזה ספר מביא מנהגים ודרכים אשר נהגו ונהגות בזה העולם  
 ומהם אשר הם נכונים ומהם אשר הם שגוים ומהם אשר הם נכונים ומהם אשר הם שגוים

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 ומהם אשר הם נכונים ומהם אשר הם שגוים ומהם אשר הם נכונים ומהם אשר הם שגוים

## חלקים ושלשה חלקים

בזה ספר מביא מנהגים ודרכים אשר נהגו ונהגות בזה העולם  
 ומהם אשר הם נכונים ומהם אשר הם שגוים ומהם אשר הם נכונים ומהם אשר הם שגוים

בזה ספר מביא מנהגים ודרכים אשר נהגו ונהגות בזה העולם  
 ומהם אשר הם נכונים ומהם אשר הם שגוים ומהם אשר הם נכונים ומהם אשר הם שגוים

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- 16- חלקים ושלשה חלקים





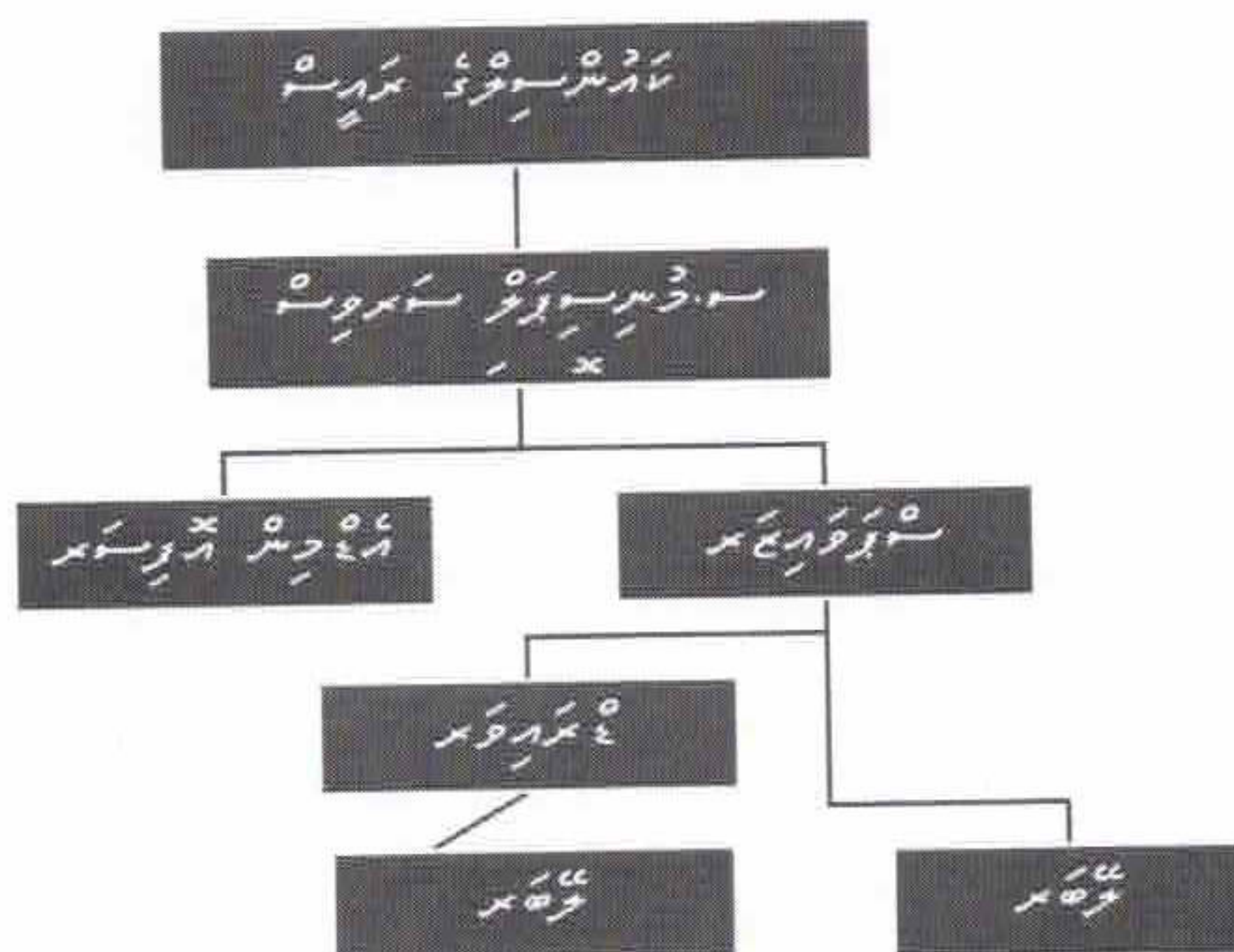


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دَ شَعْرَتِ رِسْوَتِ عَزِيزِ دَمِيذِ وَ شَرَحَ دَرَجِ سَعْدِ نَكَبَتِ اَرَاكِ مَوْتِ. دَرَجَتِ دَ شَعْرَتِ  
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- 06- 1. 2. 3. 4. 5. 6. 7. 8. 9.
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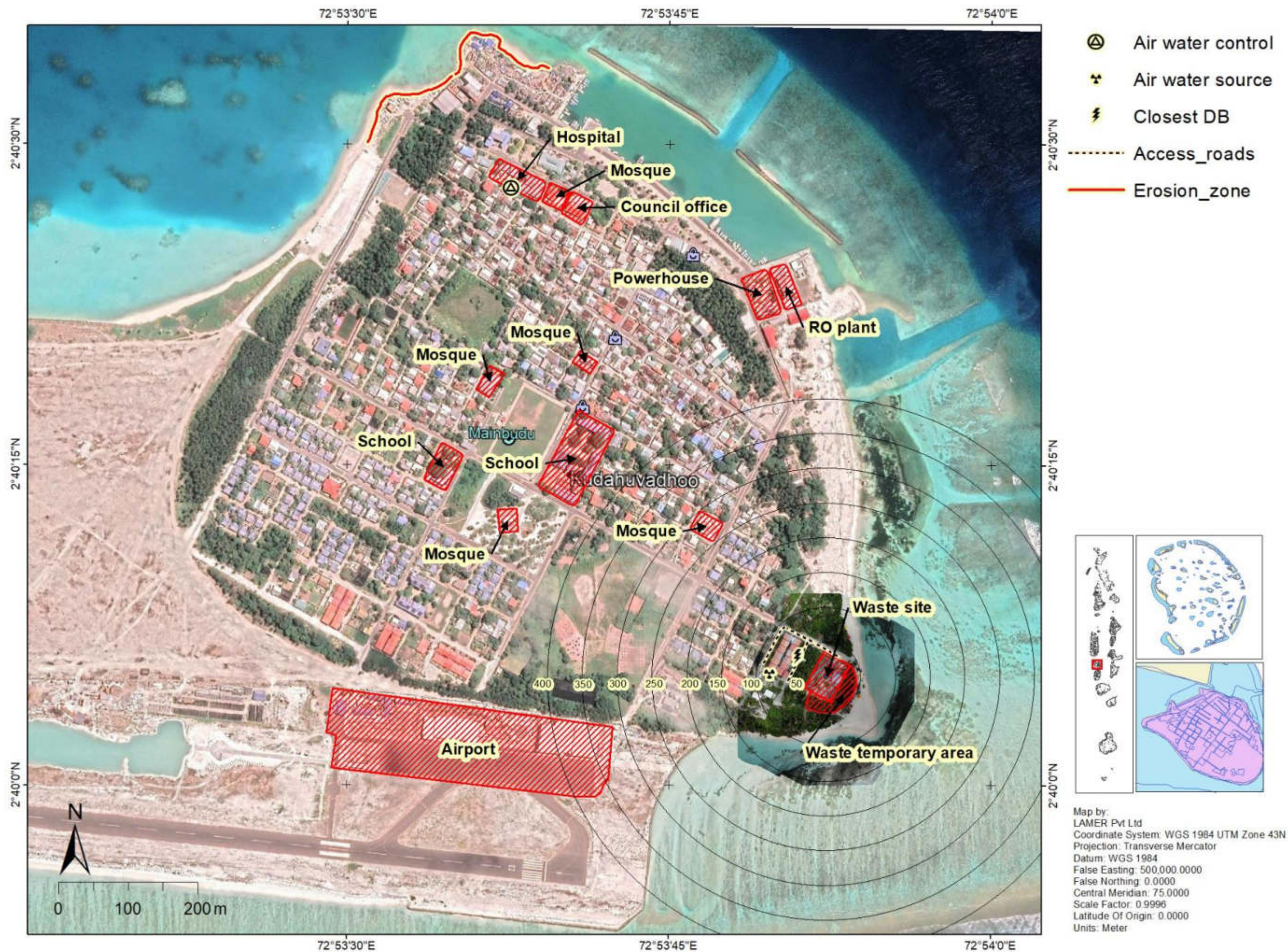
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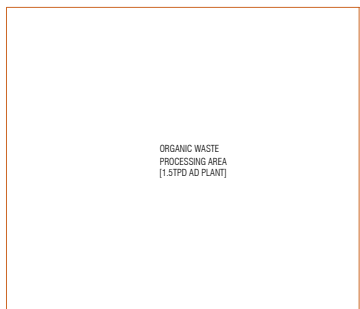
## **Appendix 5 Map of study area**







## **Appendix 6 Site plan**



**MCEP**  
**MINISTRY OF ENVIRONMENT**  
GREEN BUILDING, HANDHUVAREE HIGUN,  
MAAFANNU, MALE\* (20392), REPUBLIC OF MALDIVES,  
TEL: +960-3018431, +960-3018300, FAX: +960-328301

## **Appendix 7 Water test results reports from MWSC**



**Male' Water & Sewerage Company Pvt Ltd****Water Quality Assurance Laboratory**

Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives  
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv



**WATER QUALITY TEST REPORT**  
Report No: 500185945

**Customer Information:**

Land &amp; Marine Environment Resources

H.Azum

Ameeneemagu

Male' MALE

Report date: 24/01/2021

Test Requisition Form No: 900191049

Sample(s) Received Date: 19/01/2021

Date of Analysis: 19/01/2021 - 19/01/2021

Sample Description ~	Gan Site	Gan Control	Kudahuvadhoo Control	TEST METHOD	UNIT
Sample Type ~	Ground Water	Ground Water	Ground Water		
Sample No	83216056	83216057	83216058		
Sampled Date ~	17/01/2021 09:00	17/01/2021 09:00	17/01/2021 09:00		
PARAMETER	ANALYSIS RESULT				
Physical Appearance	Pale yellow with particles	Clear with particles	Clear with particles		
Conductivity *	984	751	395	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	µS/cm
pH *	7.40	7.56	7.57	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-
Temperature	24.1	24.4	24.5	Electrometry	°C
Total Dissolved Solids	492	375	197	Electrometry	mg/L
Nitrate *	0.6	1.4	0.4	HACH Method 8171	mg/L
Total Petroleum Hydrocarbon (TPH)	<0.036 (LoQ 0.036 mg/L )	<0.036 (LoQ 0.036 mg/L )	<0.036 (LoQ 0.036 mg/L )	UV Fluorescence	mg/L

**Keys:** µS/cm : Micro Seimen per Centimeter, °C : Degree Celcius, mg/L : Milligram Per Liter

Checked by

Aminath Sofa  
Laboratory Executive

Approved by

Mohamed Eyman  
Manager, Quality

**Notes: Sampling Authority:** Sampling was not done by MWSC Laboratory

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

This test report is ONLY FOR THE SAMPLES TESTED.

~ Information provided by the customer

\*Parameters accredited by EIAC under ISO/IEC 17025:2017

**Male' Water & Sewerage Company Pvt Ltd****Water Quality Assurance Laboratory**

Quality Assurance Building, 1st Floor, Male' Hingun, Vilimala', Male' City, Maldives  
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

**WATER QUALITY TEST REPORT**  
Report No: 500185945**Customer Information:**

Land & Marine Environment Resources  
H.Azum  
Ameeneemagu  
Male' MALE

Report date: **24/01/2021**  
Test Requisition Form No: **900191049**  
Sample(s) Received Date: **19/01/2021**  
Date of Analysis: **19/01/2021 - 19/01/2021**

Sample Description ~	Kudahuvadhoo Site	TEST METHOD	UNIT
Sample Type ~	Ground Water		
Sample No	83216059		
Sampled Date ~	17/01/2021 09:00		
PARAMETER	ANALYSIS RESULT		
Physical Appearance	Clear with particles		
Conductivity *	5660	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	µS/cm
pH *	7.26	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-
Temperature	24.5	Electrometry	°C
Total Dissolved Solids	2830	Electrometry	mg/L
Nitrate *	0.9	HACH Method 8171	mg/L
Total Petroleum Hydrocarbon (TPH)	<0.036 (LoQ 0.036 mg/L )	UV Fluorescence	mg/L

Keys: µS/cm : Micro Seimen per Centimeter, °C : Degree Celcius, mg/L : Milligram Per Liter

**Checked by**

Aminath Sofa  
Laboratory Executive

**Approved by**

Mohamed Eyman  
Manager, Quality

**Notes: Sampling Authority:** Sampling was not done by MWSC Laboratory

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This test report is ONLY FOR THE SAMPLES TESTED.

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\*Parameters accredited by EIAC under ISO/IEC 17025:2017

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

## Appendix 8 Alternatives proposed and respective mitigation measures

This section provides comparative description of organic waste composting technologies considered in the ESMP prepared for managing organic waste at Kudahuvadhoo. Anaerobic digestion is the preferred technology where windrow-based open composting and in-vessel composting has been compared with preferred option. The following matrix provides a comparative assessment of the three options considered for the project from environmental, social and economic perspective (Table 1).

**Table 1. Comparison of organic waste treatment option selected with alternatives considered**

	<b>Environmental aspects</b>	<b>Social aspects</b>	<b>Economic aspects</b>
<b>Anaerobic Digestion (preferred option)</b>	<ul style="list-style-type: none"> <li>• Relatively large land area required for set up</li> <li>• Biogas generated can be reused as a potential source of energy (for cooking or converted to electricity).</li> <li>• Organic nutrient content (liquid residue and undigested biproduct) can be used as a liquid fertilizer and compost.</li> <li>• High energy requirement</li> </ul>	<ul style="list-style-type: none"> <li>• Labour requirement for operation of Anaerobic digestion composting machine is low.</li> <li>• Processing time approximately 1 month</li> <li>• Low to moderate odour due to waste processing</li> </ul>	<ul style="list-style-type: none"> <li>• Highly dependent on mechanical equipment</li> <li>• Very high capital cost</li> <li>• High operation and maintenance cost</li> <li>• Economic turnover is high (shorter time than windrow-composting and high value product)</li> <li>• Potential to use bi products for economic use</li> </ul>
<b>In-vessel composting</b>	<ul style="list-style-type: none"> <li>• Small land area required for setup</li> <li>• Overcomes the problem of leachate generation</li> <li>• Burning of waste is not required</li> <li>• The system is only slightly affected by environmental conditions, as work will be carried out indoors (sheltered area)</li> <li>• Moderate energy is required for operation</li> </ul>	<ul style="list-style-type: none"> <li>• Labour requirement is low (2 to 3 persons can carry out operations)</li> <li>• Compost can be prepared in a short time frame (15-to-30-minute cycles in OWC machine and 10 to 12 days for curing)</li> <li>• Minimal odour associated with processing of waste</li> </ul>	<ul style="list-style-type: none"> <li>• Highly dependent on mechanical equipment</li> <li>• High capital cost</li> <li>• Moderate operations and maintenance cost</li> <li>• Economic turnover is very high due to fast process</li> </ul>
<b>Windrow-based open composting</b>	<ul style="list-style-type: none"> <li>• Large land area required for setup</li> </ul>	<ul style="list-style-type: none"> <li>• Labour requirement is high as it involves strenuous work. The pile needs to be</li> </ul>	<ul style="list-style-type: none"> <li>• Minimally dependent on mechanical equipment</li> <li>• Low capital cost</li> </ul>

	<ul style="list-style-type: none"> <li>• High leachate generation with potential for groundwater contamination</li> <li>• The system is only highly affected by environmental conditions, as it is carried out in the open</li> <li>• Attracts flies, rodents and other pests</li> <li>• Low energy requirement</li> </ul>	<ul style="list-style-type: none"> <li>turned every 5 days or so to ensure even composting.</li> <li>• The whole process is time consuming and may require months to complete the process.</li> <li>• Strong odour associated with the processing, especially when the pile is being turned.</li> <li>• Attracts flies, rodents and other pests</li> </ul>	<ul style="list-style-type: none"> <li>• Low operations and maintenance cost</li> <li>• Economic turnover low due to the long time taken for composting</li> </ul>
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The following table provides environmental and social impact mitigation measures proposed for the alternative technologies compared (Table 2).

**Table 2. Mitigation measures proposed for the alternative waste treatment methods**

<b>Method</b>	<b>Mitigation measures proposed</b>
<b>Anaerobic Digestion (AD) (proposed method)</b>	<ul style="list-style-type: none"> <li>• Mitigation measures for the process as reported in ESMP matrix given in this report (Chapter 8, Table 15)</li> </ul>
<b>In-vessel composting</b>	<ul style="list-style-type: none"> <li>• Design and construct an appropriate sized area for machine installation, with curing racks. The area should have an impermeable layer with drains installed to drain any leachate generated</li> <li>• Ensure Bioculum is added at the correct rate to enhance the natural aerobic process</li> <li>• Ensure moisture level while in the machine is kept at required levels for that specific machine</li> <li>• Ensure moisture level of compost while of curing racks is maintained through installation of automatic fogging devices</li> <li>• Undertake routine maintenance of machinery as per the manual</li> <li>• 1 year stock of bioculum and spare parts that might be required for the routine functioning of the OWC machine should always be maintained.</li> <li>• Provide protective gears to the workers (gloves, water proof footwear, protective eye wear, masks)</li> <li>• Provide appropriate training to workforce with regard to waste handling, processing and management</li> <li>• Ensure provision of a first aid kit on site so as to attend to any medical emergencies immediately. Cover open wounds to prevent contact with the incoming loads</li> </ul>
<b>Windrow-based open composting</b>	<ul style="list-style-type: none"> <li>• Design and construct an appropriate sized compost slab with an impermeable layer, drainage mechanism with leachate collection tank established</li> <li>• Design of composting area should be at least partially shaded to enable composting during rainy season</li> </ul>



	<ul style="list-style-type: none"> <li>• Ensure compost material are appropriately segregated to avoid potential vermin infestation. Open compost is most suitable for garden waste (branches, twigs, and leaves), vegetable waste and fruit waste</li> <li>• Maintain adequate aeration, temperature and retention time in biological treatment systems to achieve pathogen destruction (World Bank Group, 2007)</li> <li>• Maintain Carbon: Nitrogen (C:N) ratio between 30:1, moisture content between 40-60%, temperature between 30-50°C and pH between 6 and 8 (CITRES and MEECO 2019)</li> <li>• Ensure that the windrow is high enough to retain the heat and maintain the temperature, but still small enough to let air diffuse to the centre.</li> <li>• Ensure that the compost pile is regularly turned to allow for air diffusion into the material and mixing of the material in order to move larger particles into the core to undergo composting.</li> <li>• As per IFC EHS Guidelines “avoid conditions that can lead to spontaneous combustion (e.g., moisture between 25 – 45 percent and temperatures above about 93°C. This can be achieved for example by keeping windrows less than about 3m high and turning them when the temperature exceeds 60°C)” (World Bank Group, 2007)</li> <li>• Water the compost pile depending on the moisture content in the waste</li> <li>• Isolate workers from spore dispersing components of the composting process such as turning, by opting to mechanical turning (e.g., by using tractors).</li> <li>• Provide protective gears to the workers (gloves, water proof footwear, protective eye wear, masks)</li> <li>• Provide appropriate training to workforce with regard to waste handling, processing and management</li> <li>• Ensure provision and use of dust masks or respirators under dry and dusty conditions (e.g., when compost is being turned)</li> <li>• Ensure provision of a first aid kit on site so as to attend to any medical emergencies immediately. Cover open wounds to prevent contact with the incoming loads</li> </ul>
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**Table 3. Mitigation measures proposed for the alternative temporary waste relocation/disposal area**

<b>Method</b>	<b>Mitigation measures proposed</b>
Assigning the vacant area at the eastern side of the island near the coast	<ul style="list-style-type: none"> <li>• Mitigation measures for the location as reported in ESMP matrix given in this report (Chapter 8, Table 15)</li> </ul>
Assigning the existing IWRMC as the temporary waste relocation/disposal during construction	<ul style="list-style-type: none"> <li>• Clear the existing stock pile and transfer it to RWMF.</li> <li>• Cover the ground of the site with an impermeable surface (such as concrete layer, metal sheet) to prevent leachate</li> </ul>

Alternative sources of electricity for the operation of preferred waste management technology also have been considered. The following table provides options considered for using electricity and their potential impact mitigation measures (Table 4).

**Table 4. Mitigation measures proposed for the alternative energy sources**

<b>Method</b>	<b>Mitigation measures proposed</b>
Electricity already connected to the IWRMC	Mitigation measures for the process as reported in ESMP matrix given in this report (Chapter 8, Table 15)
Installation of solar panels	<ul style="list-style-type: none"> <li>• Roof structure is appropriately designed and constructed to ensure that the solar panels and substructure load can be sustained</li> <li>• Enough roof area made available to ensure that the energy requirement can be tapped from photo voltaic structures (PV) installed</li> <li>• Establish a way to provide the excess energy produced to the island electric grid</li> </ul>
Installation of a bio-generator in the IWRMC to convert biogas to electricity	<ul style="list-style-type: none"> <li>• Ensure required approvals and permits are obtained prior to construction of area for installation of bio-generator (design should meet all required criteria by relevant authorities)</li> <li>• Ensure that the generator set installed is sufficient to cater to the needs of the IWRMC</li> <li>• Ensure that all fire and explosion prevention measures are in place</li> <li>• Ensure wall-mounted sensors that are capable of detecting hazardous gases (Carbon monoxide, Hydrogen Sulphide, Ammonia, Carbon Dioxide and Methane) are installed</li> <li>• Ensure use of proper confined space entry procedures (providing proper ventilation, ensuring a second person is present outside any occupied confined space, and using safety harnesses.</li> <li>• Ensure use of a handheld multi-gas detector to determine if hazardous levels of biogas are present prior to entry into any confined space.</li> <li>• Enclosed transformers should always remain permanently sealed and locked.</li> <li>• Only a licensed electrician should perform any transformer maintenance.</li> <li>• Operators should ensure that proper cover plates are present and intact on panels and outlets.</li> <li>• Ensure use of utility-grade fire resistant clothing when working with electricity.</li> <li>• Ensure area where bio-generator is installed in properly ventilated</li> <li>• Clear warnings must be placed on the respective parts of the plant and the operating personnel must be trained.</li> <li>• Ensure proper operation of equipment like stirrers, pumps, feeding equipment to avoid fatal electric shocks.</li> <li>• Ensure that the power facility is soundproof.</li> <li>• Restrict operations to daytime hours</li> <li>• Ensure all the required sign boards are in place</li> </ul>

	<ul style="list-style-type: none"> <li>• Ensure power facility operators are provided with all the required protective gear</li> <li>• Ensure that there is sufficient and relevant fire prevention and firefighting equipment at the facility</li> <li>• Ensure that power facility operators are properly trained in all aspects of the operations and maintenance of the facility</li> <li>• Ensure that the generator set is regularly maintained and that the whole facility is kept in clean conditions</li> <li>• Ensure there are sufficient stock parts for a period of 1 year at any given time</li> </ul>
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## **Appendix 9 Translation of ESMP**



[illegible]













[illegible]







				ماڊىل سىستېمىنىڭ مەبلەغ سەۋىيەسىنىڭ ئۆزگىرىشى مەبلەغ ئۆزگىرىشىنىڭ نەتىجىسى سىستېمىنىڭ ئۆزگىرىشىنىڭ نەتىجىسى	
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## **Appendix 10 Sample Contractor's Code of Conduct provided by PMU**

## CODES OF CONDUCT

<b>Codes of Conduct .....</b>	<b>1</b>
<i>Company Code of Conduct.....</i>	<i>2</i>
<i>Manager's Code of Conduct.....</i>	<i>5</i>
<i>Individual Code of Conduct.....</i>	<i>8</i>

### Codes of Conduct

Three Codes of Conduct are presented below:

- i. **Company Code of Conduct:** Commits the company to addressing ESHS, OHS and GBV issues;
- ii. **Manager's Code of Conduct:** Commits managers to implementing the Company Code of Conduct, as well as those signed by individuals; and,
- iii. **Individual Code of Conduct:** Code of Conduct for everyone working on the project, including managers.

## **Company Code of Conduct** **Implementing ESHS and OHS Standards** **Preventing Gender Based Violence**

The company is committed to ensuring that the project is implemented in such a way which minimizes any negative impacts on the local environment, communities, and its workers. This will be done by respecting the environmental, social, health and safety (ESHS) standards, and ensuring appropriate occupational health and safety (OHS) standards are met. The company is also committed to creating and maintaining an environment where children under the age of 18 will be protected, and where Sexual Exploitation and Abuse (SEA) and sexual harassment have no place. Improper actions towards children, SEA and sexual harassment are acts of Gender Based Violence (GBV) and as such will not be tolerated by any employee, sub-contractors, supplier, associate, or representative of the company.

Therefore, to ensure that all those engaged in the project are aware of this commitment, the company commits to the following core principles and minimum standards of behavior that will apply to all company employees, associates, and representatives, including sub-contractors and suppliers, without exception:

### **General**

1. The company—and therefore all employees, associates, representatives, sub-contractors and suppliers—commits to complying with all relevant national laws, rules and regulations.
2. The company commits to full implementing its ‘Contractors Environmental and Social Management Plan’ (C-ESMP) as approved by the client.
3. The company commits to treating women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status. Acts of GBV are in violation of this commitment.
4. The company shall ensure that interactions with local community members are done with respect and non-discrimination.
5. Demeaning, threatening, harassing, abusive, culturally inappropriate, or sexually provocative language and behavior are prohibited among all company employees, associates, and its representatives, including sub-contractors and suppliers.
6. The company will follow all reasonable work instructions (including regarding environmental and social norms).
7. The company will protect and ensure proper use of property (for example, to prohibit theft, carelessness or waste).

### **Health and Safety**

8. The company will ensure that the project’s OHS Management Plan is effectively implemented by company’s staff, as well as sub-contractors and suppliers.
9. The company will ensure that all persons on-site wear prescribed and appropriate personal protective equipment, preventing avoidable accidents, and reporting conditions or practices that pose a safety hazard or threaten the environment.
10. The company will:
  - i. prohibit the use of alcohol during work activities.
  - ii. prohibit the use of narcotics or other substances which can impair faculties at all times.
11. The company will ensure that adequate sanitation facilities are available on site and at any worker accommodations provided to those working on the project.

12. The company will not hire children under the age of 18 for construction work, or allow them on the work site, due to the hazardous nature of construction sites.

### **Gender Based Violence**

13. Acts of GBV constitute gross misconduct and are therefore grounds for sanctions, which may include penalties and/or termination of employment and, if appropriate, referral to the Police for further action.
14. All forms of GBV, are unacceptable, regardless of whether they take place on the work site, the work site surroundings, at worker's camps or within the local community.
15. Sexual harassment of work personnel and staff (e.g. making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature) are acts of GBV and are prohibited.
16. Sexual favors (e.g. making promises of favorable treatment such as promotions, threats of unfavorable treatment such as losing a job, payments in kind or in cash dependent on sexual acts) and any form of humiliating, degrading or exploitative behavior are prohibited.
17. The use of prostitution in any form at any time is strictly prohibited.
18. Sexual contact or activity with children under 18—including through digital media—is prohibited. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.
19. Unless there is full consent<sup>1</sup> by all parties involved in the sexual act, sexual interactions between the company's employees (at any level) and members of the communities surrounding the work place are prohibited. This includes relationships involving the withholding/promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex (including prostitution). Such sexual activity is considered "non-consensual" within the scope of this Code.
20. In addition to company sanctions, legal prosecution of those who commit acts of GBV will be pursued if appropriate.
21. All employees, including volunteers and sub-contractors are highly encouraged to report suspected or actual acts of GBV by a fellow worker, whether in the same company or not. Reports must be made in accordance with project's GBV Allegation Procedures.
22. Managers are required to report and act to address suspected or actual acts of GBV as they have a responsibility to uphold company commitments and hold their direct reports responsible.

### **Implementation**

To ensure that the above principles are implemented effectively the company commits to:

23. Ensuring that all managers sign the project's 'Manager's Code of Conduct' detailing their responsibilities for implementing the company's commitments and enforcing the responsibilities in the 'Individual Code of Conduct'.

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<sup>1</sup> **Consent:** refers to when an adult makes an informed choice to agree freely and voluntarily to do something. There is **no** consent when agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, manipulation, deception, or misrepresentation; the use of a threat to withhold a benefit to which the person is already entitled, or; a promise made to the person to provide a benefit. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that consent cannot be given by children under the age of 18, even if national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.



24. Ensuring that all employees sign the project's 'Individual Code of Conduct' confirming their agreement to comply with ESHS and OHS standards, and not to engage in activities resulting in GBV, child endangerment or abuse, or sexual harassment.
25. Displaying the Company and Individual Codes of Conduct prominently and in clear view at workers' camps, offices, and in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas and health clinics.
26. Ensuring that posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
27. Ensuring that an appropriate person is nominated as the company's 'Focal Point' for addressing GBV issues, including representing the company on the GBV Complaints Team (GCT) which is comprised of representatives from the client, contractor(s), the supervision consultant, and local GBV Service Provider.
28. Ensuring that an effective GBV Action Plan is developed in consultation with the GCT which includes as a minimum:
  - i. **GBV Allegation Procedure** to report GBV issues through the project Grievance Redress Mechanism (Section 4.3 Action Plan);
  - ii. **Accountability Measures** to protect confidentiality of all involved (Section 4.4 Action Plan); and,
  - iii. **Response Protocol** applicable to GBV survivors and perpetrators (Section 4.7 Action Plan).
29. Ensuring that the company effectively implements the agreed final GBV Action Plan, providing feedback to the GCT for improvements and updates as appropriate.
30. Ensuring that all employees attend an induction training course prior to commencing work on site to ensure they are familiar with the company's commitments to ESHS and OHS standards, and the project's GBV Codes of Conduct.
31. Ensuring that all employees attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the project's ESHS and OHS standards and the GBV Code of Conduct.

*I do hereby acknowledge that I have read the foregoing Company Code of Conduct, and on behalf of the company agree to comply with the standards contained therein. I understand my role and responsibilities to support the project's OHS and ESHS standards, and to prevent and respond to GBV. I understand that any action inconsistent with this Company Code of Conduct or failure to act mandated by this Company Code of Conduct may result in disciplinary action.*

Company name: \_\_\_\_\_

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

## Manager's Code of Conduct Implementing ESHS and OHS Standards Preventing Gender Based Violence

The company is committed to ensuring that the project is implemented in such a way which minimizes any negative impacts on the local environment, communities, and its workers. This will be done by respecting the environmental, social, health and safety (ESHS) standards, and ensuring appropriate occupational health and safety (OHS) standards are met. The company is also committed to creating and maintaining an environment where children under the age of 18 will be protected, and where Sexual Exploitation and Abuse (SEA) and sexual harassment have no place. Improper actions towards children, SEA and sexual harassment are acts of Gender Based Violence (GBV) and as such will not be tolerated by any employee, sub-contractors, supplier, associate, or representative of the company.

Managers at all levels have a responsibility to uphold the company's commitment. Managers need to support and promote the implementation of the Company Code of Conduct. To that end, managers must adhere to this Manager's Code of Conduct and also to sign the Individual Code of Conduct. This commits them to supporting the implementation of the Contractor's Environmental and Social Management Plan (C-ESMP), the OHS Management Plan, and developing systems that facilitate the implementation of the GBV Action Plan.

Managers need to maintain a safe workplace, as well as a GBV-free environment at the workplace and in the local community. Their responsibilities to achieve this include but are not limited to:

### **Implementation**

1. To ensure maximum effectiveness of the Company and Individual Codes of Conduct:
  - i. Prominently displaying the Company and Individual Codes of Conduct in clear view at workers' camps, offices, and in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas and health clinics.
  - ii. Ensuring all posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
2. Verbally and in writing explain the Company and Individual Codes of Conduct to all staff.
3. Ensure that:
  - i. All direct reports sign the 'Individual Code of Conduct', including acknowledgment that they have read and agree with the Code of Conduct.
  - ii. Staff lists and signed copies of the Individual Code of Conduct are provided to the OHS Manager, the GBV Complaints Team (GCT), and the client.
  - iii. Participate in training and ensure that staff also participate as outlined below.
  - iv. Put in place a mechanism for staff to:
    - (a) report concerns on ESHS or OHS compliance; and,
    - (b) confidentially report GBV incidents through the Grievance Redress Mechanism (GRM)
  - v. Staff are encouraged to report suspected or actual ESHS, OHS, GBV issues, emphasizing the staff's responsibility to the Company and the country hosting their employment, and emphasizing the respect for confidentiality.
4. In compliance with applicable laws and to the best of your abilities, prevent perpetrators of sexual

- exploitation and abuse from being hired, re-hired or deployed. Use background and criminal reference checks for all employees nor ordinarily resident in the country where the works are taking place.
5. Ensure that when engaging in partnership, sub-contractor, supplier or similar agreements, these agreements:
    - i. Incorporate the ESHS, OHS, GBV Codes of Conduct as an attachment.
    - ii. Include the appropriate language requiring such contracting entities and individuals, and their employees and volunteers, to comply with the Individual Codes of Conduct.
    - iii. Expressly state that the failure of those entities or individuals, as appropriate, to ensure compliance with the ESHS and OHS standards, take preventive measures against GBV, to investigate allegations thereof, or to take corrective actions when GBV has occurred, shall not only constitute grounds for sanctions and penalties in accordance with the Individual Codes of Conduct but also termination of agreements to work on or supply the project.
  6. Provide support and resources to the GCT to create and disseminate internal sensitization initiatives through the awareness-raising strategy under the GBV Action Plan.
  7. Ensure that any GBV complaint warranting Police action is reported to the Police, the client and the World Bank immediately.
  8. Report and act in accordance with the agreed response protocol any suspected or actual acts of GBV.
  9. Ensure that any major ESHS or OHS incidents are reported to the client and the supervision engineer immediately, non-major issues in accordance with the agreed reporting protocol.
  10. Ensure that children under the age of 18 are not present at the construction site, or engaged in any hazardous activities.

## **Training**

11. The managers are responsible to:
  - i. Ensure that the OHS Management Plan is implemented, with suitable training required for all staff, including sub-contractors and suppliers; and,
  - ii. Ensure that staff have a suitable understanding of the C-ESMP and are trained as appropriate to implement the C-ESMP requirements.
12. All managers are required to attend an induction manager training course prior to commencing work on site to ensure that they are familiar with their roles and responsibilities in upholding the GBV elements of these Codes of Conduct. This training will be separate from the induction training course required of all employees and will provide managers with the necessary understanding and technical support needed to begin to develop the GBV Action Plan for addressing GBV issues.
13. Managers are required to attend and assist with the project facilitated monthly training courses for all employees. Managers will be required to introduce the trainings and announce the self-evaluations, including collecting satisfaction surveys to evaluate training experiences and provide advice on improving the effectiveness of training.
14. Ensure that time is provided during work hours and that staff prior to commencing work on site attend the mandatory project facilitated induction training on:
  - i. OHS and ESHS; and,
  - ii. GBV required of all employees.
15. During civil works, ensure that staff attend ongoing OHS and ESHS training, as well as the monthly mandatory refresher training course required of all employees to on GBV.

## **Response**

16. Managers will be required to take appropriate actions to address any ESHS or OHS incidents.
17. Regarding GBV:
  - i. Provide input to the GBV Allegation Procedures and Response Protocol developed by the GCT as part of the final cleared GBV Action Plan.

- ii. Once adopted by the Company, managers will uphold the Accountability Measures set forth in the GBV Action Plan to maintain the confidentiality of all employees who report or (allegedly) perpetrate incidences of GBV (unless a breach of confidentiality is required to protect persons or property from serious harm or where required by law).
  - iii. If a manager develops concerns or suspicions regarding any form of GBV by one of his/her direct reports, or by an employee working for another contractor on the same work site, s/he is required to report the case using the GRM.
  - iv. Once a sanction has been determined, the relevant manager(s) is/are expected to be personally responsible for ensuring that the measure is effectively enforced, within a maximum timeframe of **14 days** from the date on which the decision to sanction was made by the GCT.
  - v. If a Manager has a conflict of interest due to personal or familial relationships with the survivor and/or perpetrator, he/she must notify the Company and the GCT. The Company will be required to appoint another manager without a conflict of interest to respond to complaints.
  - vi. Ensure that any GBV issue warranting Police action is reported to the Police, the client and the World Bank immediately
18. Managers failing address ESHS or OHS incidents, or failing to report or comply with the GBV provisions may be subject to disciplinary measures, to be determined and enacted by the cCompany's CEO, Managing Director or equivalent highest-ranking manager. Those measures may include:
- i. Informal warning.
  - ii. Formal warning.
  - iii. Additional Training.
  - iv. Loss of up to one week's salary.
  - v. Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.
  - vi. Termination of employment.
19. Ultimately, failure to effectively respond to ESHS, OHS, and GBV cases on the work site by the company's managers or CEO may provide grounds for legal actions by authorities.

*I do hereby acknowledge that I have read the foregoing Manager's Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to ESHS, OHS, and GBV requirements. I understand that any action inconsistent with this Manager's Code of Conduct or failure to act mandated by this Manager's Code of Conduct may result in disciplinary action.*

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

## Individual Code of Conduct Implementing ESHS and OHS Standards Preventing Gender Based Violence

I, \_\_\_\_\_, acknowledge that adhering to environmental, social, health and safety (ESHS) standards, following the project's occupational health and safety (OHS) requirements, and preventing Gender Based Violence (GBV) is important.

The Company considers that failure to follow ESHS and OHS standards, or to partake in activities constituting GBV—be it on the work site, the work site surroundings, at workers' camps, or the surrounding communities—constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of employment. Prosecution by the Police of those who commit GBV may be pursued if appropriate.

I agree that while working on the project I will:

1. Consent to Police background check.
2. Attend and actively partake in training courses related to ESHS, OHS, and GBV as requested by my employer.
3. Will wear my personal protective equipment (PPE) at all times when at the work site or engaged in project related activities.
4. Take all practical steps to implement the contractor's environmental and social management plan (C-ESMP).
5. Implement the OHS Management Plan.
6. Adhere to a zero-alcohol policy during work activities, and refrain from the use of narcotics or other substances which can impair faculties at all times.
7. Treat women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.
8. Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
9. Not sexually exploit or abuse project beneficiaries and members of the surrounding communities.
10. Not engage in sexual harassment of work personnel and staff—for instance, making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature is prohibited. E.g. looking somebody up and down; kissing, howling or smacking sounds; hanging around somebody; whistling and catcalls; in some instances, giving personal gifts.
11. Not engage in sexual favors—for instance, making promises of favorable treatment (e.g. promotion), threats of unfavorable treatment (e.g. loss of job) or payments in kind or in cash, dependent on sexual acts—or other forms of humiliating, degrading or exploitative behavior.
12. Not use prostitution in any form at any time.
13. Not participate in sexual contact or activity with children under the age of 18—including grooming, or contact through digital media. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.
14. Unless there is the full consent<sup>1</sup> by all parties involved, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or

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<sup>1</sup> **Consent** is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained using threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that



promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex (including prostitution). Such sexual activity is considered “non-consensual” within the scope of this Code.

15. Consider reporting through the GRM or to my manager any suspected or actual GBV by a fellow worker, whether employed by my company or not, or any breaches of this Code of Conduct.

With regard to children under the age of 18:

16. Bring to the attention of my manager the presence of any children on the construction site or engaged in hazardous activities.
17. Wherever possible, ensure that another adult is present when working in the proximity of children.
18. Not invite unaccompanied children unrelated to my family into my home, unless they are at immediate risk of injury or in physical danger.
19. Not use any computers, mobile phones, video and digital cameras or any other medium to exploit or harass children or to access child pornography (see also “Use of children's images for work related purposes” below).
20. Refrain from physical punishment or discipline of children.
21. Refrain from hiring children for domestic or other labor below the minimum age of 14 unless national law specifies a higher age, or which places them at significant risk of injury.
22. Comply with all relevant local legislation, including labor laws in relation to child labor and World Bank’s safeguard policies on child labor and minimum age.
23. Take appropriate caution when photographing or filming children (See Annex 2 for details).

#### **Use of children's images for work related purposes**

When photographing or filming a child for work related purposes, I must:

24. Before photographing or filming a child, assess and endeavor to comply with local traditions or restrictions for reproducing personal images.
25. Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this I must explain how the photograph or film will be used.
26. Ensure photographs, films, videos and DVDs present children in a dignified and respectful manner and not in a vulnerable or submissive manner. Children should be adequately clothed and not in poses that could be seen as sexually suggestive.
27. Ensure images are honest representations of the context and the facts.
28. Ensure file labels do not reveal identifying information about a child when sending images electronically.

#### **Sanctions**

I understand that if I breach this Individual Code of Conduct, my employer will take disciplinary action which could include:

1. Informal warning.
2. Formal warning.
3. Additional Training.
4. Loss of up to one week’s salary.

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consent cannot be given by children under the age of 18, even if national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

5. Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.
6. Termination of employment.
7. Report to the Police if warranted.

*I understand that it is my responsibility to ensure that the environmental, social, health and safety standards are met. That I will adhere to the occupational health and safety management plan. That I will avoid actions or behaviors that could be construed as GBV. Any such actions will be a breach this Individual Code of Conduct. I do hereby acknowledge that I have read the foregoing Individual Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to ESHS, OHS, GBV issues. I understand that any action inconsistent with this Individual Code of Conduct or failure to act mandated by this Individual Code of Conduct may result in disciplinary action and may affect my ongoing employment.*

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix 11 List of stakeholders consulted

Institution	Name	Designation	Contact
Kudahuvadhoo Council	Ahmed Sham	Council President	
	Ali Saud	Vice President	
	Ahmed Mauroof	Council Member	
	Ahmed Shain	Council Member	-
	Abdulla Jameel	Council Member	-
	Ahmed Ibrahim	Director	9666446
EPA	Inaya Abdul Raheem	Civil & Structural Engineer	inaya.abdulraheem@epa.gov.mv
MNPHI/ Landuse planning dept)	Nihaaza Anees		nihaaza.anees@planning.gov.mv
MLSA	Fathimath Shanna	Director / Land department	<a href="mailto:fathimath.shanna@mlsa.gov.mv">fathimath.shanna@mlsa.gov.mv</a>
Womens' Development Committee	Zuhudha Abdul Satar	WDC Members	
	Samiya Abdul Azeez		
	Hafeeza Yaugoob		
	Sharmeela Mohamed		
	Aminth Rasheedha		
FENAKA Corporation Ltd	Ismail Rasheed	Manager, Kudahuvadhoo FENAKA branch	
MNDF	Warrant Officer Grade 1	Ahmed Hassan	7795838
	Warrant Officer Grade 1	Farooq Ismail	9884399
	Staff Sergeant	Mohamed Ashraf	7776098

## **Appendix 12 Copies of emails sent to HPA regarding consultation meeting**



Shahaama Abdul Sattar <[shahaama.abdulsattar@lamer.com.mv](mailto:shahaama.abdulsattar@lamer.com.mv)>

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## Formulation of ESMP for establishment or upgrading of IWRMC in Zone 4 and 5

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Shahaama Abdul Sattar <[shahaama.abdulsattar@lamer.com.mv](mailto:shahaama.abdulsattar@lamer.com.mv)>

Wed, Jan 20, 2021 at 10:17 AM

To: [shiyana@health.gov.mv](mailto:shiyana@health.gov.mv)

Dear Shiyana,

Please find below, mail sent on 9th Jan, requesting for a consultation meeting regarding the formulation of the Environmental and Social Management Plan for the establishment or upgrading of Island Waste Management and Resource Management centres in Zone IV (Meemu, Faafu Dhaalu) and Zone V (Thaa, Laamu). Would appreciate it if a consultation could be arranged at the earliest.

Thank you

**Best Wishes,**

Shahaama Abdul Sattar

Environmental Consultant



LAMER Group Pvt. Ltd.

Azum(4th Floor), Ameenee Magu, Henveiru, Male' 20054, Maldives

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W [www.lamer.com.mv](http://www.lamer.com.mv)

----- Forwarded message -----

From: **Shahaama Abdul Sattar** <[shahaama.abdulsattar@lamer.com.mv](mailto:shahaama.abdulsattar@lamer.com.mv)>

Date: Sat, Jan 9, 2021 at 5:38 PM

Subject: Formulation of ESMP for establishment or upgrading of IWRMC in Zone 4 and 5

To: <[hpa@health.gov.mv](mailto:hpa@health.gov.mv)>

Cc: Ismail Abid <[ismail.abid@lamer.com.mv](mailto:ismail.abid@lamer.com.mv)>, Hussein Zahir <[hussain.zahir@lamer.com.mv](mailto:hussain.zahir@lamer.com.mv)>, Aisha Abdulla <[aishath.abdulla@lamer.com.mv](mailto:aishath.abdulla@lamer.com.mv)>

Dear Sir / Madam

LaMer has been awarded the work to carry out environmental and social assessments for the establishment or upgrading of Island Waste Management and Resource Management centres in Zone IV (Meemu, Faafu Dhaalu) and Zone V (Thaa, Laamu) by the Ministry of Environment (Letter from ME attached for your information).

As a part of the formulation of the Environmental and Social Management Plans for these projects, we would like to consult with you regarding the three components as below (with specific emphasis on on COVID19 health and safety requirements):

1. Piloting Anaerobic Digestion (AD) and Upgrading of the Existing IWRMC of L. Fonadhoo, Dh. Kudahuvadhoo, M. Muli and F. Nilandhoo
2. Upgrading of IWRMC at Th. Vandhoo with Aerobic Technology using Composting Machine
3. Construction of an Island Waste Management Centre with Aerobic Technology using Composting Machine at six islands (Dh. Maaenboodhoo, L. Dhanbidhoo, L. Gan, M. Kolhufushi, Th. Hirilandhoo, Th. Guraidhoo).



I have attached the project briefs and site plans for the three components. for your information. Would appreciate it if you could inform us of a time for an online consultation regarding this project.

Looking forward to an early reply.

**Best Wishes,**

Shahaama Abdul Sattar

Environmental Consultant



LAMER Group Pvt. Ltd.

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W [www.lamer.com.mv](http://www.lamer.com.mv)

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#### 4 attachments



**Project brief - Piloting Anaerobic digestion and upgrade of 4 existing IWRMC.pdf**  
1551K



**Project brief - Aerobic digestion and mechanical composting in Th. Vandhoo IWRMC.pdf**  
1357K



**Project brief - Aerobic digestion and mechanical composting new IWRMC.pdf**  
2394K



**Letter of Award from ME.pdf**  
54K

## **Appendix 13 Copy of Household survey form**

[illegible]

د شومېر د رسرې مړه:

[illegible]

1. ۵۵ سطر:

2.  $\frac{1}{2} \frac{d}{dt} \left( \frac{1}{2} m v^2 \right) = \frac{1}{2} m v \frac{dv}{dt}$

- اَرْمَدِي ۛ خَرْمَدِي
- خَرْمَدِي ۛ خَرْمَدِي
- اَرْمَدِي ۛ خَرْمَدِي
- اَرْمَدِي ۛ خَرْمَدِي

3. کجھڑ کر تیرہ گڈس، نو گڈی "و" سو اتر سر سو مو و دسر؟

— —

[illegible]

(دستور: دستور: 21 / 1 دستور: دستور: دستور: دستور)

- **تشریح کریں:** \_\_\_\_\_
- **تشریح کریں:** \_\_\_\_\_

5. אֶתְחַבֵּר לַסָּמִיטָה וְאֶתְחַבֵּר לַסָּמִיטָה וְאֶתְחַבֵּר לַסָּמִיטָה





- **تیسرے معجزے کی تائید:**
- **تیسرے معجزے کی تائید:**

6.  $\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$  ?

- رَسْمٌ

• سُرُور (سَمَوَاتِ 8 رِسْر)

[illegible]

- 
- 
- 
- 

8. נאמר שכל שאלה היא שאלה של זיהוי. האם זה נכון?

• נכון

• לא נכון

9. נאמר שכל שאלה היא שאלה של זיהוי. האם זה נכון?

• נכון

• לא נכון

• לא נכון

10. נאמר שכל שאלה היא שאלה של זיהוי. האם זה נכון?

• נכון

• לא נכון

11. נאמר שכל שאלה היא שאלה של זיהוי. האם זה נכון?

• נכון

• לא נכון

• לא נכון

12. נאמר שכל שאלה היא שאלה של זיהוי. האם זה נכון?

• נכון

13. נאמר שכל שאלה היא שאלה של זיהוי. האם זה נכון?

• נכון

• לא נכון

• לא נכון

• לא נכון

• לא נכון

• לא נכון

• לא נכון

14. נאמר שכל שאלה היא שאלה של זיהוי. האם זה נכון?

• נכון

• לא נכון

• לא נכון