Initial Environmental Examination

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MLD: Greater Malé Environmental Improvement and Waste Management Project

Outer Island Waste Management Improvements: Thinadhoo, Vaavu Atoll

Prepared by the Ministry of Environment, Climate Change and Technology of the Republic of Maldives for the Asian Development Bank.

CURRENCY EQUIVALENTS
(as of 1 February 2021)

Currency unit	–	Rufiyaa (Rf)
Rf1.00	=	$0.06
$1.00	=	Rf 15.4

ABBREVIATIONS

ADB	-	Asian Development Bank
AHs	-	affected households
BPEO	-	best practicable environmental option
CDW	-	construction and demolition waste
dB L_{eq}	-	continuous noise equivalent level, expressed in decibels
DMS	-	detailed measurement survey
EA	-	executing agency
EMP	-	Environmental Management Plan
EPA	-	Environmental Protection Agency
EPPA	-	Environmental Protection and Preservation Act of 1993
ES	-	environment specialist
GMEIWMP		Greater Malé Environmental Improvement and Waste Management Project
GOM	-	Government of the Republic of Maldives
GRC	-	grievance redress mechanism
HHs	-	households
IA	-	implementing agency
IEE	-	initial environmental examination
IMO	-	independent monitoring organization
IRC	-	Inter-Ministerial Resettlement Committee
IWMC	-	Island Waste Management Centre
MECCT.	-	Ministry of Environment, Climate Change and Technology
MF		Ministry of Finance
MMS		Maldives Meteorological Service
MNPHI		Ministry of National Planning, Housing and Infrastructure
NBS		National Bureau of Statistic
MPW/100ml	-	most probable number (of bacteria) per 100 millilitres of water
NAPA	-	National Action Programme of Action (for climate change)
O&M	-	operation and maintenance
PMDSC	-	Project Management, Design and Supervision Consultants
PMU	-	project management unit
STELCO		State Electric Company
SWM		solid waste management
RWMF	-	regional waste management facility
WAMCO	-	Waste Management Corporation

NOTE

In this report, "$" refers to US dollars

Contents

1. Executive Summary

A. Introduction

1 The Greater Malé Environmental Improvement and Waste Management Project (GMEIWMP) will establish an integrated solid waste management system in Greater Malé and support Island Waste Management Centers (IWMCs) on 32 further inhabited islands in zone 3 which comprises the atolls of Alifu Alifu, Alifu Dhaalu, Kaafu, and Vaavu. Areas in which improvements will be introduced include collection, transfer, treatment using advanced waste-to-energy technology, disposal, recycling, dumpsite closure and remediation, and public awareness in reduce-reuse-recycle (3R); as well as institutional capacities for service delivery and environmental monitoring. The project will further improve climate change resilience and disaster risk management and contribute to reduced emissions into the environment.

2 The report discusses the findings of an Environmental and Social Management Plan (ESMP) undertaken by Water Solutions Pvt. Ltd. in order to fulfil obligatory requirements of the National Environment Protection and Preservation Act, Law No. 4/93 for the proposed development of Island Solid Waste Management Center (ISWMC) in V. Thinadhoo. The project will be implemented by Ministry of Environment, Climate Change and Technology. The aim of the project is to develop a modern island waste management center in Thinadhoo island. This is under the project of Integrated Solid Waste Management Project for Zone III that includes Greater Male', North and South Male' Atoll, North and South Ari Atoll and Vaavu Atoll.

B. Existing Conditions of Rakeedhoo Waste Management

3 In Thinadhoo waste is managed by means of open burning. At the waste dumpsite, there are no fences or any other structures. No fees are being collected to dump the waste, however it is noted that island guesthouses help to manage the waste. The only way of managing the waste in the island is through open burning to which Island Council get lot of complaints from the residents of the island. Thinadhoo island has lot of guesthouses and Island Council informed that when the waste is burnt, tourists complain about smoke and smell. The current waste management practices in the island are not appropriate. Therefore, Ministry of Environment, Climate Change and Technology proposes to build an ISWMC on the island to adopt more environment friendly and socially acceptable waste management practices on the island that would facilitate collection of waste from the households and business, manage the waste at the center and final transfer the residual waste to Thilafushi for final treatment and disposal.

C. Description of the subproject

4 The project involves constructing a new Island Solid Waste Management Center in Thinadhoo. The location proposed for the ISWMC is located on western side of the island near the football field. There is no fence or structures in the location. The proposed ISWMC is 25m x 15m. It will provide provision for storing different types of waste such as plastic, glass and metal. A concrete flooring will be made to handle waste and the leachate collected on the floor will be collected by a trench, treated in an oil trap and disposed into a septic tank. Small office building and water tank will be also built as part of the project. As part of the project waste collection bins and equipment will be provided to the island to improve waste collection and transport to the ISWMC.

D. Impacts and Mitigation Measures

5 The report outlines environmental impacts of the proposed project that have been examined through a number of processes. These include consultations with the project development team, field surveys, observations and assessment, and field experience gained from similar projects implemented throughout the country. Potential positive and negative impacts on the environment have been considered. The assessment indicates environmental impacts, both during the construction and operation stage. Most of the environmental impacts of the project have been identified as resulting mainly from vegetation removal and potential air and water pollution. During the operational stage, impacts may arise during the transport of the waste to regional facility. Also, if the waste is not regularly transferred the smell and visual impacts may be felt by the community. Most of the negative impacts can be minimized by adopting best practices outlined in the mitigation measures of this report. The positive impacts include introduction of proper waste management system in the island. Proposed ISWMC will bring new employment opportunities as well and will benefit indirectly to the local tourism by making the island environment cleaner.

E. Categorization

6 ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB Safeguard Policy Statement (SPS), 2009. This IEE has been undertaken, which assesses in more detail the likely environmental impacts of the subproject and provides an environmental management plan (EMP) specifying the required mitigation and monitoring measures to ensure that these impacts are managed to acceptable levels. This IEE also emphasizes the need to incorporate pollution prevention and control technologies during the design, construction, and operation of the subproject and adhere to internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines.

F. Implementation Arrangement

7 The executing agency is the Ministry of Finance and Treasury. The implementing agency is the ministry of Environment, Climate Change and Technology, which will establish a PMU who will oversee overall project management with assistance from the PMDSC to implement the EMP.

8 For civil works, the Contractor will be required to (i) obtain all statutory clearances prior to commencement of civil works; (ii) establish an operational system for managing environmental impacts (iii) prepare a CEMP based on the EMP of this IEE, and submit to PMDSC for approval; (iv) carry out all of the monitoring and mitigation measures set forth in the approved CEMP; and (v) implement any corrective or preventative actions set out in safeguards monitoring reports that the executing agency or implementing agency will prepare from time to time to monitor implementation of this IEE, EMP, and CEMP. The Contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

9 The island council will be responsible for the operation of the IWMC.

G. Environmental Monitoring

10 EMP compliance monitoring will be undertaken by the PMDSC with the help of the contractor and island council. Effects will be monitored by means of community feedback and laboratory testing.

11 A detailed environmental monitoring report is required to be compiled and submitted to the EPA based on the data collected for the monitoring the parameters included in the monitoring plan given in the EMP. the Contractor will submit weekly and monthly reports on the EMP implementation to the PMSDC/ PMU. The PMU with the support of PMDSC shall prepare semi-annual environmental monitoring reports to be submitted to ADB

H. Conclusion

12 Overall, the project will benefit island of Thinadhoo in the long term and will bring significant amount of environmental and socio-economic benefits, as it is conceived and designed to address environmental issues associated with existing practices of poor waste disposal including open burning of waste. The subproject will not have significant adverse environmental impacts and the impacts associated with the construction phase can be mitigated through effective implementation of the EMP.

1 Introduction

13 The Greater Malé Environmental Improvement and Waste Management Project (GMEIWMP) will establish an integrated solid waste management system in Greater Malé and support Island Waste Management Centers (IWMCs) on 32 further inhabited islands in zone 3 which comprises the atolls of Alifu Alifu, Alifu Dhaalu, Kaafu, and Vaavu. Areas in which improvements will be introduced include collection, transfer, treatment using advanced waste-to-energy technology, disposal, recycling, dumpsite closure and remediation, and public awareness in reduce-reuse-recycle (3R); as well as institutional capacities for service delivery and environmental monitoring. The project will further improve climate change resilience and disaster risk management and contribute to reduced emissions into the environment.

14 The GMEIWMP will be implemented as two projects. Project 1 will comprise (i) improvements to the harbour and waste processing facilities on Thilafushi Island, including a construction and demolition waste (CDW) plant, recycling yard and end-of-life vehicle (ELV) dismantling workshop, (ii) an improved waste collection system (iii) improvements to transfer stations in Malé and Villingilli and Hulhumale, (iv) improvements to outer island waste management centres, (v) services for project management, design and supervision, (vi) services for awareness building and community outreach and (vi) a capacity building technical assistance (CDTA) for the environmental protection agency (EPA). Project 2 will comprise the construction of a new regional waste management facility (RWMF) including a waste to energy (WTE) plant and ash landfill, dumpsite rehabilitation and remediation, and project management and supervision support.

15 This Environmental and Social Management Plan (ESMP) is prepared for the proposed waste management improvement project on the island of Thinadhoo. This EMP is undertaken in order to fulfil obligatory requirements of the National Environment Protection and Preservation Act, Law No. 4/93 and the EIA Regulations (pursuant to the act) of 2007 for the proposed development of Island Solid Waste Management Center (ISWMC) in V. Thinadhoo. This report has also been prepared to meet the IEE requirements according to the ADB's Safeguard Policy Statement (2009). The ESMP is based on design undertaken by Kocks Ingenuiere (Germany) in association with Water Solutions Ltd (Maldives), consultant to the Ministry of Environment, Climate Change and Technology (MECCT). No works will commence until approval of this report by EPA and ADB.

2 Description of the Project

2.1 Project Proponent

16 This project is proposed by the Government of the Maldives where the Ministry of Environment, Climate Change and Technology (MECCT) is the implementing agency. Within the Ministry, the Waste Management Department will be overall managing the project. ADB is financing the development of this project.

17 The Maldivian Government remains committed in solving the issues of solid waste management that are inherent in the greater Male' region. The Environmental Protection Agency (EPA) will oversee the enforcement of environmental standards during the development and operational phase of the project components.

2.2 Location and Study Area

18 Thinadhoo Island is geographically located at 3°29'16.63"N, 73°32'18.36"E in the eastern rim of Vaavu Atoll as shown in the following figure. The nearest inhabited island is Felidhoo just 1695m south of Thinadhoo and nearest uninhabited island is Hulhidhoo just 697m to north-east of Thinadhoo. Census 2014 data shows that the island of Thinadhoo had 132 residents in that year. According to island council the current registered population is 213.

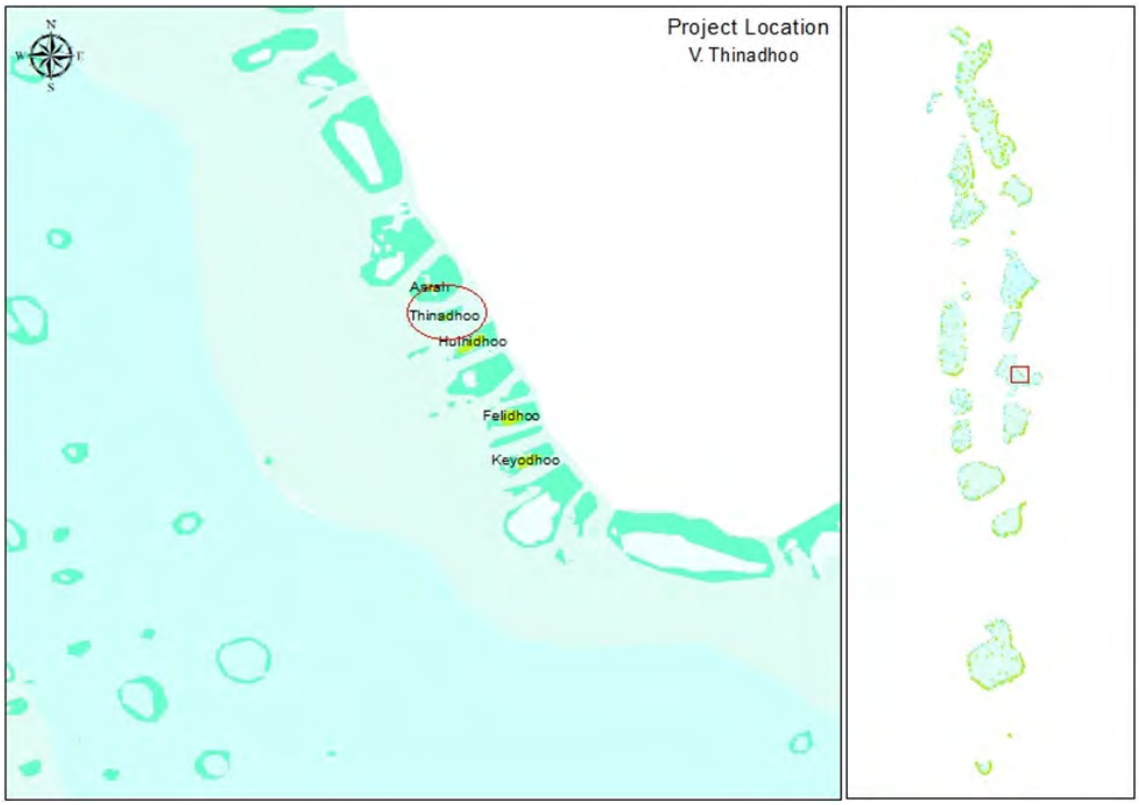


Figure 1: Location of Thinadhoo in Vaavu Atoll

2.3 Need and justification for the project

19 Maldives has been facing serious issue of improper disposal of solid waste recent years due to, but not limited to, population increase, changing lifestyle, dependance on importation coupled with environmental challenges brought by the growing of economic industries such as tourism (Musthafa, 2019). The greater Male' area and its outer islands suffer from serious environmental pollution because of the inadequate collection and disposal of solid waste (ADB, 2018). Issue of improper waste management has deteriorated the livability in the islands of Maldives. Zone

3 (Figure 2), where the project focuses, encompasses 35 inhabited islands including capital Male', Kaafu atoll, Vaavu atoll, Alifu Alifu and Alifu Dhaalu atoll.

20 The island does not have island waste management centre (IWMC). Waste is managed by means of open burning at the waste dumpsite, island council. The island doesn't provide any waste collection services, wastes are being dumped to waste collection area by households and guesthouses. However, bins are being placed at different areas of the island to dump day to day wastes like water bottles etc. No fees are being collected to dump the waste, however it is noted that island guesthouses help to manage the waste. Furthermore, kitchen wastes are dumped into the ocean.

Figure 2: Photos from Thinadhoo. (a) bins at a public place, (b) open burning at waste dump site

2.4 Current waste management practices

21 Thinadhoo island does not have an island waste management center. Waste is managed by open burning, in the southern side of the island. As per island council, wastes are being dumped from 47 households, 1 restaurant, 13 shops, health center, 5 guesthouses and one hotel. However, other infrastructure like Island council, Magistrate court and powerhouse also has some input.

22 Waste is managed by means of open burning at the waste dumpsite, island council. The island doesn't provide any waste collection services, wastes are being dumped to waste collection area by households and guesthouses. However, bins are being placed at different areas of the island to dump day to day wastes like water bottles etc. the size of the bibs are 120 L. No fees are being collected to dumped the waste, however it is noted that island guesthouses help the to manage the waste. Furthermore, kitchen wastes are dumped into the ocean.

23 According to island council managing waste management service is quite difficult due to limited number of machineries. The only way to manage is by open burning. The island is famous for local tourism, island council receive a lot of complaints from guest because of the open burning practice.

Figure 3: Existing waste dumping area

2.5 Proposed project

24 The current waste management practices in the island are not appropriate. The council have identified a new site for a new IWMC on western side of the island. The Ministry of Environment, Climate Change and Technology proposes to build an IWMC on the land proposed by the Island Council, to adopt more environment friendly and socially acceptable waste management practices on the island that would facilitate collection of waste from the households and business, manage the waste at the center and final transfer the residual waste to Thilafushi for final treatment and disposal. The proposed location is 15m x 25m. Figures below shows the location of the site.

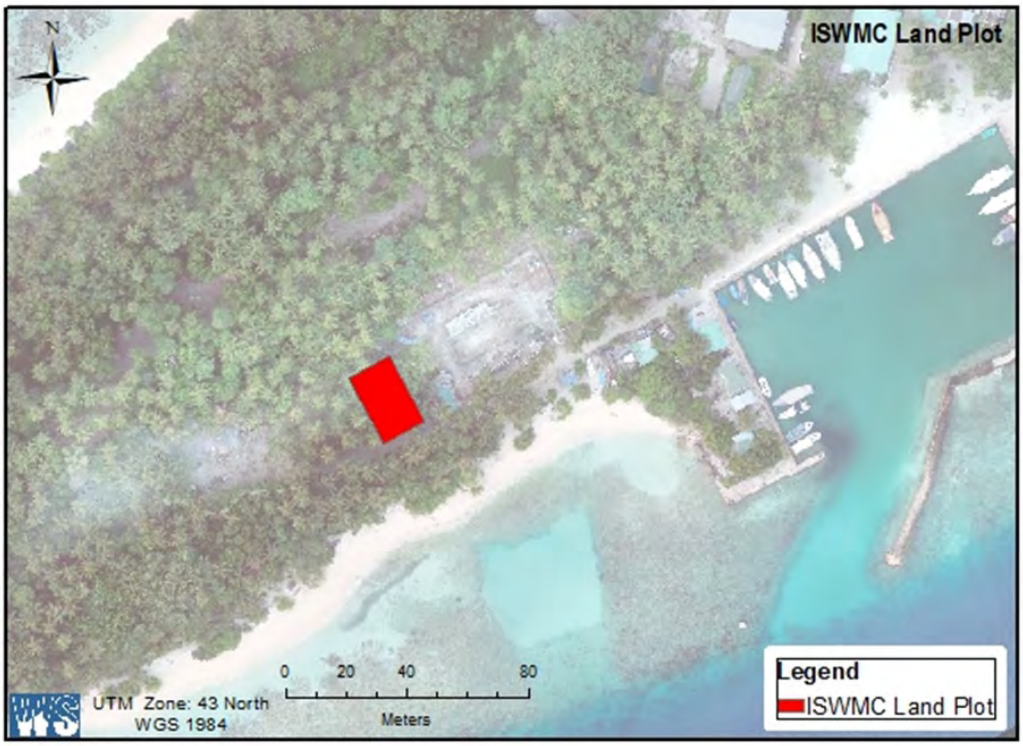


Figure 4: Proposed location of ISWMC

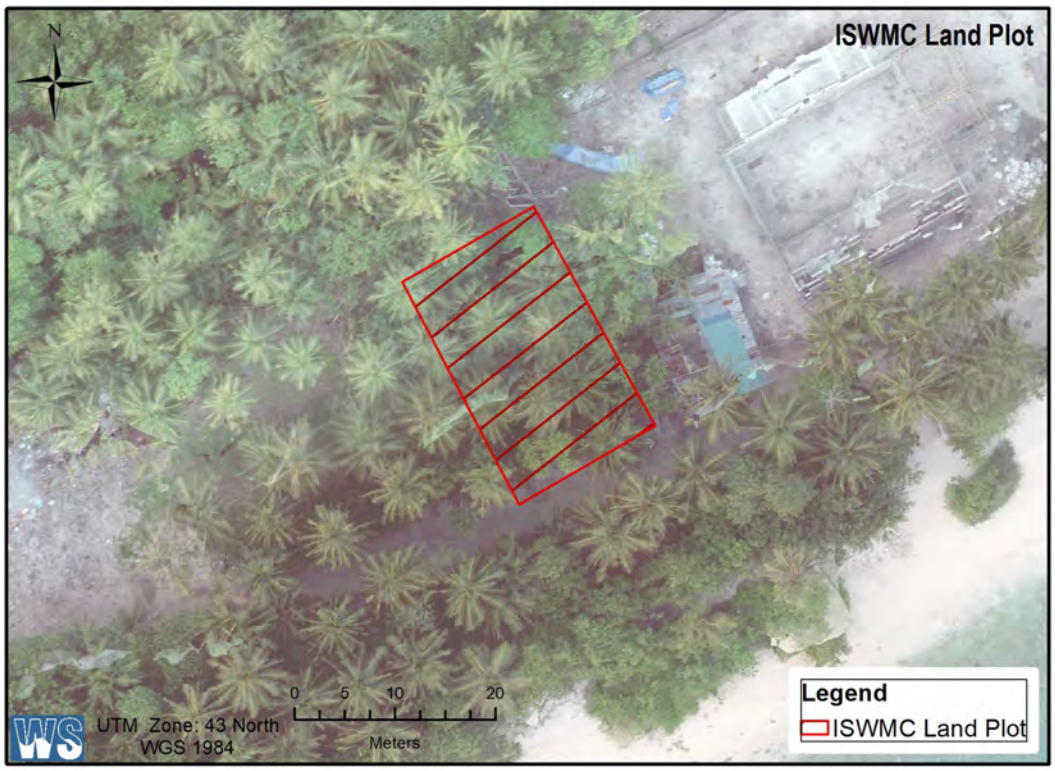


Figure 5: Closeup of site boundary overlaid over a drone photo taken on 20th January 2021.

25 The proposed IWMC has a total area of 379.8 m^2. It is estimated that in the outer islands, household waste generated amounts to 0.6kg/inhabitant/day (Kocks and Water Solutions, 2020). The projected population of Thinadhoo for the current year of 2021 is 302, with a projected 18% increase over the following 10 years (National Bureau of Statistics, 2014). The current IWMC design considers storage of an excess of expected waste for 1-2 weeks, with transport expected to happen once a week. Along with the area allocated for future expansion, the IWMC size will be able to provide appropriate storage of generated waste, with space in excess in case normal functioning faces interruption, and for further waste management activities to take place.

26 As the population data is a projection based on the 2014 Census, some figures may be inaccurate to the current day and has been considered in the ISWMC design.

Table 1: Estimated population and waste generation data

Island Name	Plot Area (m^2)	Population 2021	Population 2031	Estimated Waste 2021 (kg/day)	Estimated Waste 2041 (kg/day)
V. Thinadhoo	379.8	302	358	181.2	214.8

27 Calculations for determining sizes are included below.

Table 2: Thinadhoo ISWMC calculations

Residual waste (without recyclable): 26% + impurities from wrong segregation = 43% of total waste generated	0.20 t/d
Volume of one storage bin at ISWMC (240 l)	0.24 m^3
Needed storage bins/day at ISWMC:	4 bins
Surface area need for 1 bin:	0.43 m^2
Surface area need/day:	1.79 m^2
Surface area foreseen for waste collection bins:	14 m^2
Theoretical storage capacity on the Island for Thinadhoo:	8 days

28 **Transfer and Disposal of Solid Wastes from IWMC**. Waste collected and segregated at the IWMC site will be transported to the Regional Waste Management Center (RWMC) in Thilafushi Island, where the approved Greater Male Waste-to-Energy Project (Phase 2) will be put in place. Initially, the segregated wastes will be transported by small dump trucks from the IWMC to the nearby port where solid waste transfer vessels are stationed. The wastes will then be loaded to these vessels and eventually brought to the RWMC.

29 As part of the overall solid waste management plan under the ongoing Greater Male Environmental Improvement and Waste Management Project (GMEIWMP) (Phase 1), a separate package has been approved to cater to the procurement of transfer vessels that will be used by the different IWMCs for the transport of waste to the RWMC. This package will be tendered for international competitive bidding through Package No. G/04 under the GMEIWMP's Procurement Plan. Currently, preparation for the tendering of this package is underway, and the final procurement is expected to coincide with the completion of the IWMCs, including the Rakeedhoo IWMC. Nevertheless, in order to ensure efficient functioning of the system, the IWMC shall not operate until the transport scheme, including procurement of transfer vessels, as planned under the project is fully put in place.

30 Once the IWMC is completed and the transfer vessels are procured, the transport of segregated wastes from the IWMC to Thilafushi will be done once a week. [1] Vessels will have closed containers which will be loaded with the segregated wastes from the IWMC. The RWMC in Thilafushi is designed to have a dedicated landing ports for these transfer vessels from the different IWMCs, so that no disruption on the other normal daily activities of various locators in the island occurs. The transport of waste from IWMCs to Thilafushi will be a responsibility of WAMCO.

31 **Other waste streams**. Inert construction waste will be treated in a C&D plant and sold or re-used for development projects. Healthcare waste will be fully segregated from collection up to disposal.

32 **Management of Biodegradable Wastes**. All solid wastes sent to the IWMC will be segregated whenever possible according to the type of waste. Home composting bins will be provided to the households on the island to manage bio-degradable wastes. The produced compost can be used within the island or can be transported to the IWMC and Thilafushi for final disposal. The Island Council will be provided with training under the project on how to operationalize the composting component of the IWMC.

2.6 Components of the proposed project

33 The project proposes to construct a new Integrated Solid Waste Management Centre (ISWMC) in Thinadhoo Island. This centre will be used to manage the waste produced in the island before it is being transferred to regional waste management centre at Thilafushi. According to the Feasibility Report of the project, ISWMC is planned in such a way to present an additional value to the community in terms of living condition, working opportunities, business opportunities and environmental improvement (Kasdarli et al., 2018).

34 The ISWMC proposed for Thinadhoo will have the following components.

- Office for administration of the ISWMC
- Concrete platform for handling waste
- Dedicated areas for the conditioning of recyclables (plastics, cans, P&C): Baler facilities
- Dedicated areas to keep glass crusher
- Dedicated area for temporary storage of residual waste and storage of bin
- Dedicated area for household hazardous waste
- Paved area for maneuvering vehicles
- Water tank for storage of rainwater/water from the island
- Utility provision: water supply/storage/handwashing, sewerage (soak pit), electricity (light
- poles, electrical plugs)

35 Following figure shows the main components of the proposed ISWMC in Thinadhoo.

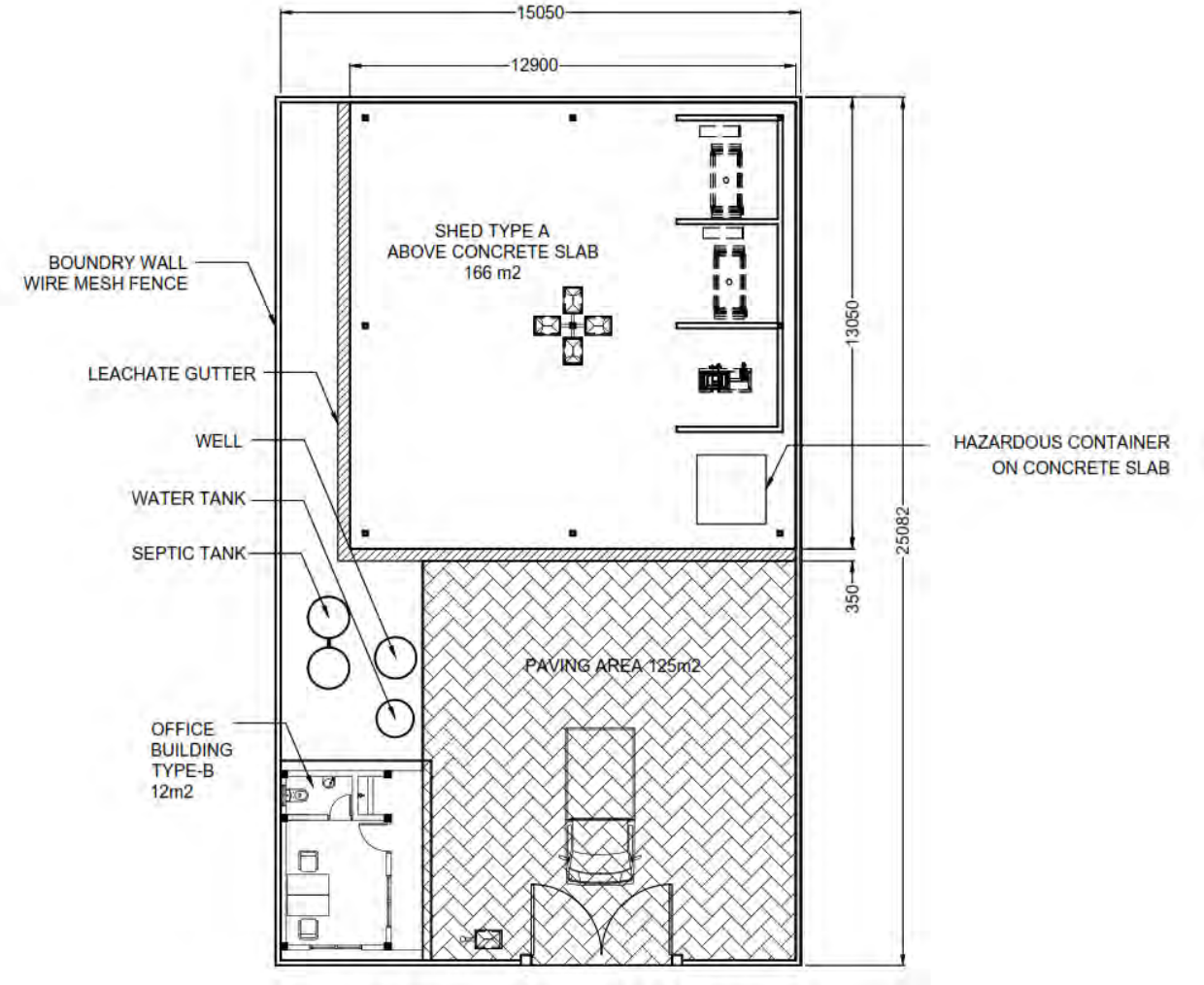


Figure 6: ISWMC concept of Thinadhoo island

36 The proposed ISWMC has 2 main areas as described below.

37 Pavement area: This area will be paved using interlocking concrete blocks and mainly used for maneuvering of vehicles and parking. Total size of the area will be of 125m2. Waste will not be handled or kept in the floor of this area as leachate can seep into ground in case of rain. Bins can be placed in this area for individual waste disposal services.

38 Concrete platform: In addition to the pavement area a concrete platform of the size of 166m2 will be constructed. This area has a roof and is protected from rain. Major waste handling will be undertaken in this area. Waste will be segregated in this area and compacted/crushed using bailers and crushers. This area has 3 separate provisions of 7.5m2 each, for inorganic wastes. Waste such as plastic, metal and glass will be stored separately in the allocated area. Concrete platform is also allocated to store organic waste or to practice composting. Concrete platform is levelled so that water from the platform used for cleaning or other purposes will be collected in the perimeter trench of the platform. This will mainly be of leachate. Leachate will be managed using a septic tank.

39 Hazardous waste storage area: Hazardous waste container of the size 4m2.

40 Office building: For the staff small office of approximately 12m2 will be constructed. This building will have 1 office rooms, a rest room and 1 toilet. A well, water tank and septic tank will also be built under the project.

2.7 ISWM Strategy

2.7.1 Bio-degradable waste

41 As sufficient space is not available in the IWMC for bio-degradable waste treatment, home composting bins will be provided to households. With the exception of cooked or meat/fish food leftovers, organic waste from households can be composted in these bins, with compost from the bin being removed after about 6 to 8 weeks.

42 Ideally, the material to be composted is layered with structural materials (chipped tree trimmings, leaves etc.) which will enhance composting thus reducing the composting period and the formation of unpleasant odours. The compost from the bin can be used as a fertiliser at the home, excess could be given out or taken to ISWMC where it could be stored and transported to Thilafushi for final disposal.

43 Organic waste which cannot be composted will be transported with other streams of waste to the WTE plant, including excess compost which cannot be sold or used on the island. Until the WTE facility is operational this waste will be baled.

44 The system will have no impact on its surrounding. However a capacity building program will be carried out to aid in home composting and raising awareness of the benefits of home composting.

Figure 7: Home composting bin to be used in households.

45 Calculation note:

- Average HH size : 6 people/HH,
- Daily biodegradable waste generation for home composting : 1,7 kg/day
- Daily biodegradable waste generation for home composting : 4,9 l/day
- Home composter volume : 274 l/(8 weeks) => 300 l Home composter

2.7.2 Transport and storage

46 Waste will be collected in the form of small bins, which would then be transported to the IWMC in an open dump truck. Household waste and construction waste will be collected from collection points, while guesthouse and hotel waste will be collected door to door. Waste other than typical household streams such as equipment like TVs or fridges can be collected through special pick-up services or brought to the IWMC by the resident themselves.

47 Design considers storage of waste for 1-2 weeks before being transferred to Regional Waste Management Facility (RWMF). Projects aims to have regular waste collection from outer islands at least once a week.

48 The island waste management centre has been proposed as such that the facility will be able to manage and operate solid waste treatment at island level, even if the scheduled waste transfer is hindered due to the weather or other factors. The island waste management centre

has been designed with some elements of redundancy. The facility would have backup bins and equipment, if one set of equipment is damaged as the centre would be able to treat and manage waste at island level, till the broken machinery is repaired. If in such a situation, the scheduled facility waste transfer vessel is unable to arrive the island to collect the waste due to bad weather or other technical reason, the island waste management facility would be able to store the treated waste at the island waste management centre for a period of 4 to 6 weeks, till it could be collected and transferred to the Thilafushi. The Island Council, who will be operating the island waste management centre, will ensure that these wastes are removed from the island at a reasonable time.

49 The waste at the IWMC stored in 240 l bins and recyclables in bales will be transported on the collection truck from the IWMC to the harbour area, where it will be loaded onto the waste collection vessel. The vessel will then transport the waste to Thilafushi.

50 Further details including the route taken by the waste collection vessel can be found in Annex 16.

2.7.3 Final treatment and disposal

51 Waste Transfer Vessel would transport the waste containers collected from the outer islands to the Regional Waste Management Center for Zone III (RWMC) in Thilafushi Island. At Thilafushi, when WTE facility at RWMC – Zone III becomes operational, the waste collected from the outer islands would managed as follows:

- Residual waste – treated at the Waste to Energy facility at Thilafushi
- Excess compost - temporarily stored at Thilafushi, make it available to agriculture sector and disposed if no interest to take it from Thilafushi.
- Bailed plastic – temporally stored at Thilafushi and provided to recyclers like Parley or others who export for recycling, residues after sorting at Parley sorting plant will be incinerated
- Metals (aluminium, tin cans) – to be handed over to scrap dealers based on Thilafushi
- Hazardous wastes – will be stored temporarily at Thilafushi for export according to Basel Convention or later incineration in the WtE if the waste management regulation provides for their incineration
- Crushed glass – will be processed with C&D waste in the C&D waste plant at Thilafushi and provided to construction industry for making aggregates for non-structural concrete applications or using it as base layer material.
- Non-marketable mineral residues from the C&D waste plant will be used as cover material for the residue landfill of the WtE plant

2.7.4 Management of waste during the transit period

52 Before the commissioning of the ISWMC at the islands, the Island Councils will ensure the wastes generated at the islands are brought to the future waste management area source segregated into recyclable plastic materials and residual waste to comply with the waste management regulation. The waste will be stockpiled in the area as different streams. Since for organic waste no treatment option is yet available, bio-waste will be commingled with residual waste. For the recyclables (mainly rigid plastics), Parley will be provided with balers to be used on the island during the transition phase. Once the ISWMCs are operational, the balers will be incorporated into the ISWMCs.

53 During the transit period before the delivery of the Outer Island Waste Collection Vessel, Ministry of Environment, Climate Change and Technology will provide collection of the waste from the outer islands in Zone III periodically using the WAMCO's waste collection vessels. The Ministry's plan is to undertake the collection of waste from the islands on a route as described in Annex 16.

54 At Thilafushi, before the RWMC – Zone III becomes operational, the treated waste from the islands would be further treated and disposed as follows:

- Residual waste – The waste stream will be brought to Thilafushi in containers that are available at Thilafushi. The waste will be, if necessary, shredded and be baled and stored at Thilafushi for later incineration in the WTE plant, when it becomes operational.
- Baled plastic – temporally stored at Thilafushi and provide it to recyclers like Parley or others who export for recycling, residues from sorting will be baled.
- Excess compost – temporarily stored at Thilafushi, make it available to agriculture sector, bailed and temporarily stored, if no interest to take it from Thilafushi.
- Bailed plastic – temporally stored at Thilafushi and provide it to recyclers like Parley or others who export for recycling
- Crushed glass – temporarily stored at Thilafushi and provided to construction industry for making bricks and blocks of construction
- Mineral fraction will be used for interim dumping at the dump site

2.7.5 Machinery and Equipment

55 To operate the ISWMC machineries will be required that will be used to transport, handle, process and store waste at the ISWMC. Below is the list of the machineries that will be required for the operation of the ISWMCs. This equipment will be provided as part of the project. Training to use this equipment must be undertaken before the start of the operation phase.

a. Trucks
b. Bins
c. Containers
d. Glass crusher
e. Composting units
f. Hazardous waste containers
g. Balers
h. Siever
i. Shredder
j. Weighing device

2.7.6 Design of the IWMC

56 The IWMC's design has its elevation 50cm above ground level, and has a lined, vegetative bund on its sea side as protective measures. To avoid leachate all waste is handled under a shed, with all waste handled in closed bins or containers so any impact had by heavy rain would be minimized. Leachate from organic waste platform is washed out and collected through rainwater drainage system and the sceptic tank in combination with waste water from site cleaning (low polluted water) and treated through a two-chamber sceptic tank with sand filter. The septic tank is dimensioned and located in the IWMC such that it will be able to withstand flooding on the island and would be able to continue to treat water from the IWMC site. There is a 30m buffer between the site and the coast.

2.8 Access Road

57 Regular transferring waste to the regional waste management center in Thilafushi is major part of this project. This part of the project will utilize heavy machineries and trucks to transfer waste from ISWMC to the harbour area of the island. Therefore, the main access road used for this purpose is identified in the diagram below. This road is away from the main residential area of

the island.

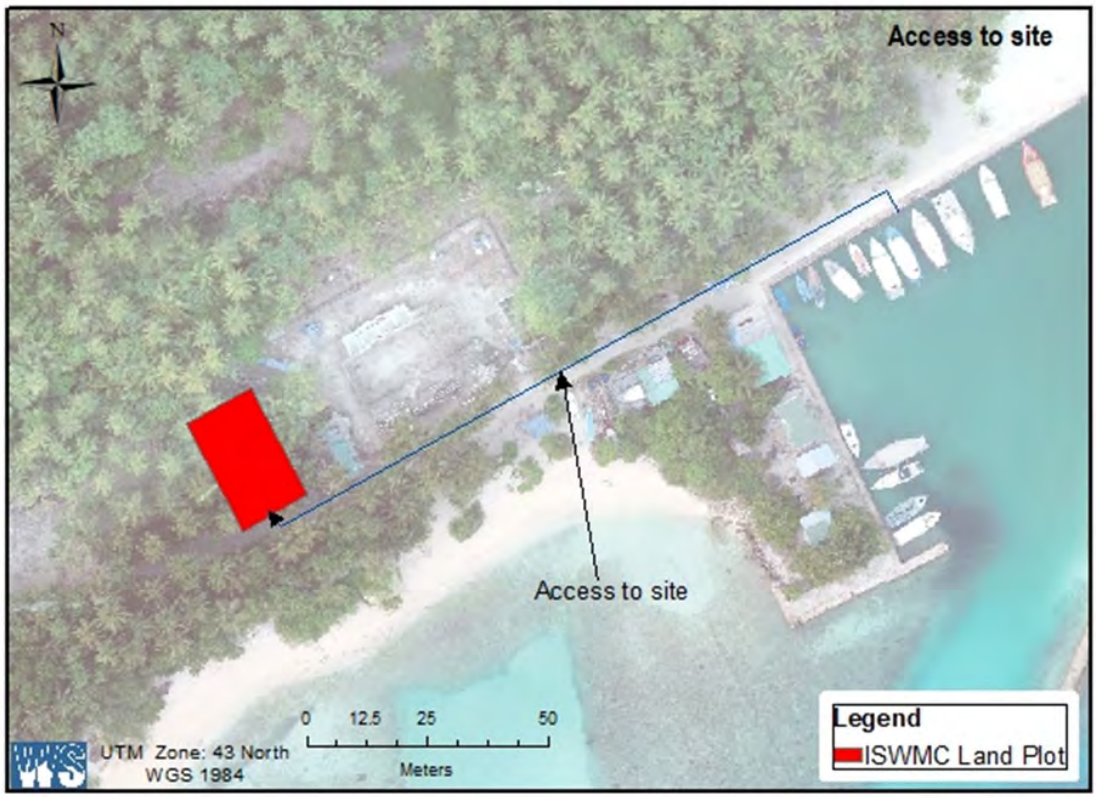


Figure 8: Proposed road to be used to transport waste from ISWMC to harbour area

2.9 Temporary site setup location

58 The proposed project is a very small-scale construction project. Hence this project does not require an additional large area to set up the temporary site. Materials used for this project can be managed inside the proposed site. As for accommodation, workforce can be managed in rent houses in the island as the number of workforces is very minimum.

2.10 Clean up of the existing waste pile

59 The proposed site for the construction of ISWMC is part of the area currently used by the island community to dispose waste. Therefore, clearing existing waste pile in the site will be the first step after mobilization. Currently island community does not segregate at any level and hence the pile consists of mixed waste.

60 It is recommended to remove the waste pile using an excavator and a dump truck and transfer it to Thilafushi for treatment and disposal. After the fully operation of the ISWMC and Zone III waste management project, waste should not be dumped to open areas or burned. All the waste generated in the island will be collected at ISMWC and eventually transferred to regional center to disposal.

2.11 Utility

61 Thinadhoo does not have sewerage and water network in the island. The leachate collected from the concrete floor, where the waste will be handled, will be collected in a trench, and treated in a septic tank. Leachate will be treated by mean of settlement tank and anerobic filter as shown in the figure below.

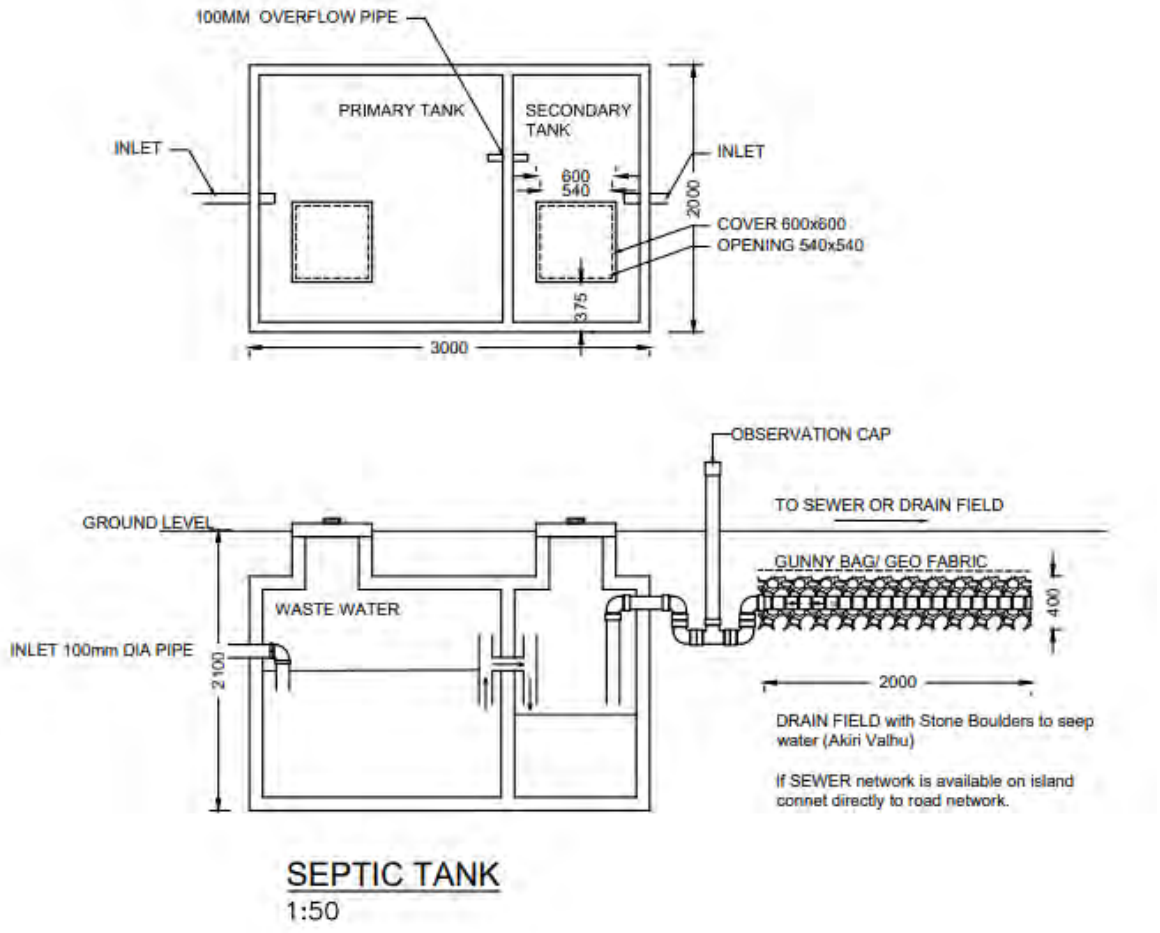


Figure 9: Septic tank proposed in the ISWMC

2.12 Assessment of compliance with selection criteria

62 The table below shows an assessment of compliance with the selection criteria.

Table 3: Assessment of compliance

Criteria	Remarks	Comments
Pre-requisites		
(i) No subproject scope will include features that appear on schedule D of the EIA regulations (2007, updated 2012) (List of Development Proposals Requiring an Environmental Impact Assessment Study)	Development proposals on Schedule D of the EIA regulations related to solid waste management are landfills, incinerators and large-scale waste storage and separation facilities.	No subproject scope will features that appear in schedule D.
(ii) A IEE and EMP must be prepared for each subproject, which must	PMU to seek clearance from ADB on project siting if the	EMP has been prepared in accordance with guidelines

	comply with EHS Guidelines on Waste Management Facilities	criterion cannot be met due to space constraints.	
(iii)	Sites must not have any land acquisition or significant involuntary resettlement and social safeguard issues.	Verify land ownership records.	Land ownership has been verified with island council and no land acquisition is necessary
(iv)	Any new facility must not be sited in an environmentally sensitive area, including all areas within 30m of the shoreline, or within 30m of areas such as thickly vegetated areas that are known to be habitats for bird species of conservation value	The 30m distance should be exceeded where possible. The restriction may be reviewed depending on site availability and stakeholder consultation, and provision of design measures to prevent release of leachate into the sea or onto the vegetated area in the event of the capacity of the leachate collection tank being exceeded.	The proposed site is approximately 30m from the nearest shoreline.
(v)	No new facility to be sited within 500m of areas of cultural significance, such as ancient religious artifacts	Verification, through consulting island councils and the Ministry of Education , that no physical cultural heritage sites are situated within 500m of the IWMC site. The restriction may be reviewed on the basis of site availability and consultation with stakeholders. PMU to seek clearance from ADB on project siting if the criterion cannot be met due to space constraints. Provide for use of “chance find” procedures in the EMP, such that any artifacts are preserved for future generations	The site is not located within 500m of areas of cultural significance.
(vi)	Sites must have sufficient capacity to contain or handle volumes of waste projected to be generated over at least a 20 year planning horizon	To be assessed based on projections on growth in waste generation for each island	Based on population projections 10 years from now the proposed site will have a capacity well in excess of projected waste amounts, with capacity for further growth of the island.
(vii)	Sites must be at least 100m from residences, schools, clinics or mosques	The distance restriction may be reviewed depending on site availability and stakeholder consultation. PMU to seek clearance from ADB on project siting if the criterion cannot be	The proposed site is approximately 100m from the nearest residences.

	met due to space constraints.	
(viii) Sites must be least 100m from groundwater wells	The 100m limit is precautionary, however attention must be given in detailed design to ensure that the leachate collection tank is protected to exclude flood waters, including during storm situations, to ensure that leachate does not enter the groundwater lens. PMU to seek clearance from ADB on project siting if the criterion cannot be met due to space constraints.	As no other plots are available in the islands Land Use Plan, the proposed site is approximately 100m from the nearest groundwater well.
(ix) Sites must not intersect with power lines, water supply pipelines or sewer lines	Where these lie across proposed sites, they must be re- aligned to avoid the site	Site does not intersect with power, water, or sewer supply lines.
(x) For initiatives that require the use of machinery such as shredders and presses, there must be established access to technical expertise for servicing and spare parts must be regularly available in-country		The proposed machinery are simple and can be fixed and serviced by mechanics, and spare parts can be sourced from local service providers.
xi) Consensus from island communities on proposed improvements.	Records of consultations, issues raised, and measures taken to address them to be summarized in IEEs.	Meetings were held with all stakeholders
(xii) No other work, including road, pipeline, or power line improvements are planned at or near the proposed site	Island council to confirm. If such sites are planned, details must be taken account of in design to ensure adequate separation of the infrastructure	No other works are planned at or near the proposed site
(xiii) World Bank Group's Environmental, Health and Safety (EHS) Guidelines requires IWMCs to consider standard design of 110% volume and bunded for impermeable storage to avoid contaminated runoff	Final detailed design to confirm capacity is 110% and bunded	The site is designed in such a way that no waste would be stored at the facility for long, as the waste will be removed from the island to the Regional Waste Facility. All waste handling areas will have impermeable flooring and the water collected on this

entering the surface or groundwater.		platform will be collected in a trench and treated in a septic tank.
Preferable		
(i) Where IWMCs exist, any improvements should be to the existing infrastructure, rather than replacement on new sites.	New sites may be necessary if existing site has become unsuitable due to new developments around it or there is objection from communities to rehabilitate the existing IWMCs.	No existing IWMC exists on the island, and the proposed site is next to the location of the currently used waste dumpsite on the island where waste is openly burnt.
(ii) Removal of trees to be avoided where possible.	When mature trees (of diameter at breast height of 40cm or greater) must be removed, new trees must be planted of a number and species agreed with the island community	27 trees will be relocated elsewhere on the island. As all non-vegetated land on the island has been developed,
(iii) Where composting facilities are to be introduced or expanded, a high level of commitment from the community should be evident to ensure both cooperation in ensuring that waste to be composed is not contaminated and that compost will be purchased or used.	Evidence of commitment from the island community should be obtained.	The IWMC itself will not carry out composting. Instead home composting bins will be provided to the community and the island council has been informed of this plan

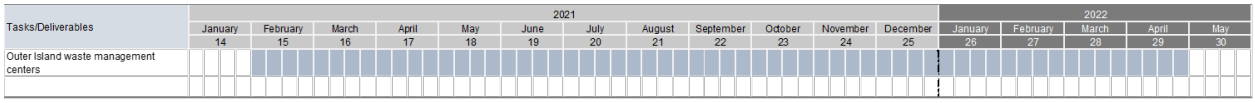
2.13 Project management

63 The project will be managed by Ministry of Environment, Climate Change and Technology by contracting the civil works to a contractor. The contractor will provide a daily work schedule for the project and will be responsible from hiring laborer's, material, and civil works.

2.13.1 Project schedule

64 Total duration of the project is approximately 12 months. Construction of outer island waste management centers in the islands of Zone 3 will be carry out in parallel. Below is the construction schedule for the construction of ISWMC of Zone 3 islands. Master schedule for the whole project is attached as an Annex.

Table 4: Tentative Schedule



2.13.2 Emergency plan in case of spills (diesel, grease, and oil)

65 The project site will have contact numbers for the project manager to contact in case of any emergency. Everyone working on this project will have access to the project managers through mobile phones. To avoid any serious spillage, all fueling activities should be undertaken on land. This would totally avoid any oil spillages to the marine environment. In case of a serious oil spill from a machinery due to a damage, all work will be immediately stopped, and everyone will be directed to focus their attention and effort to get the leaking stop, either through mechanically or by any temporary means. The focus will then be to move the machinery to land if it happens on the sea.

2.13.3 Fuel management

66 All fuel used in the site should be acquired locally to avoid long term storage of fuel on the site. Short term fuel storage on site should be done in an impervious flooring surface or in a leak proof container.

2.13.4 Site safety and safety equipment

67 General precautionary site safety methods will be applied. All workers will be given instructions about health and safety at site. Safety shoes and hats will be provided to all workers. Gloves and boiler suits will be provided for workers when necessary. Earmuffs will be provided to labourers working in noisy environment. Site Supervisors will give a brief on daily basis before the work starts to all workers and all proper health and safety precautions will be implemented on site. Construction safety sign boards must be erected on site.

Figure 10: Sample sign board that can be used on the site.

68 If workers are traveling from an island with a community outbreak of COVID-19, they should be quarantined for 10 days. After 10 days. They should be tested for COVID-19 and their samples need to be sent for testing. If their tests were negative, they would be allowed to leave the premises. HPA guideline for “Travel related quarantine (furabandhu) guideline for groups of 10 or more people staying in shared accommodation” is attached as an annex.

2.13.5 Waste management

69 Waste generated during the construction stage will require adequate disposal, it is contractor’s responsibility for the disposal of wastes. However, with approval from the council, the waste can be managed in the island itself.

2.13.6 Communication

70 The project will be managed by Ministry of Environment, Climate Change and Technology. The contractor will submit weekly and monthly updates about construction work.

1.1 Project inputs and outputs

71 The project has inputs in terms of human resources, natural resources, and machinery. The main output of the project is ISWMC that would bring direct and indirect benefits to the local communities in terms of environmental, social, and economic development. The inputs and outputs are summarized in the following tables.

Table 5: Matrix of major inputs of the project

	Input Resource(s)	Amount / Type	How to obtain resource(s)
Construction period	Sit supervisor / engineer	1	Site supervisor should ideally be local. He/she should be present at the construction site during the construction period. He/she should regularly communicate with island council. It is important that the supervisor has a good understanding of local context, social and cultural norms.
	Construction workers	10 Maldivians and foreign (locals will be given preference)	Open bidding by advertising in local papers/other sources. Since minimal number of workers is used for the project, accommodation can be provided in rent houses/rooms.
	Water supply	100L per day	From the existing water network system of the island. Well water is also available from the football field near the project site.
	Electricity/Energy	Diesel-based electricity from island mains	Existing island grid.
	Construction materials	Cement, sand, gravel, pipes, bars, paint, roofing, electrical equipment etc.	Incorporated in the contract document and contractor to obtain it from local sources. Some of these materials will be available from the island as well.
	Construction machinery	Pickups, small trucks, wheelbarrows, and other general construction machinery.	Responsibility of the contractor to obtain the required machinery.
	Telecommunications	Mobile Phones	Already this service is available in the island
	Transport (sea)	-	Materials to be transported in supply vessels. Contractor to arrange.
	Food (during construction period)	Obtained from the island	Local purchase by the contractor
	Fuel	Diesel, Petrol, Lubricants	Local purchase by the contractor
Operation period	Equipment	Glass crusher, woodchipper, metal can baler, waste collection vehicle, plastic shredder	Provided under this project.
	Water	Desalinated water	Island already has an established water network.
	Power	-	Diesel-based electricity from island mains.
	Staff	Approximately 5	Staff includes drivers, workers, and a supervisor.

	Waste	Approximately 960 kg per day	Waste will be collected from households and businesses and transferred to regional waste management center.

Major types and anticipated quantities of project outputs is presented below.

Table 6: Matrix of major outputs of environmental significance during the project implementation

	Products and waste materials	**Anticipated quantities**	**Method of disposal**
Construction period	Construction waste	Moderate amount of construction waste. Existing waste pile on the site.	Construction waste must be reused as much as possible; rest can be transferred to Thilafushi. Existing waste pile on the site could be transferred to Thilafushi as part of the site preparation process.
	Noise	Only localised to the project environment.	Unavoidable during the construction stage but will be minimal.
	Air pollution	Limited quantities of dust in the construction area. Small quantities of air pollution from transportation of construction materials.	Mainly arising as, a result of dust emission from the construction work such as cement mixing, moving machinery and other processes. Only localised.
	Soil	Small quantity	Will be reused in the backfilling of the excavated areas.
	Waste oil	Small quantity	Barrelled and transferred to the regional waste management center at the end of the construction period.
Operational period	Inorganic waste	Crushed glasses, shredded plastic, compacted metal	Transferred to regional waste management centre (Thilafushi). Weekly transfer is planned to avoid open burning.
	Compost	Moderate amount	Used locally for agricultural purpose and can be sold to nearby resorts/islands. Transferred to IWMC and Thilafushi for disposal if cannot be used.

3 Policy Legal and Administrative Framework

3.1 Republic of Maldives Legislation for Environmental Management

72 The law governing the protection of the environment is the Environmental Protection and Preservation Act (EPPA) of 1993 (Act No 4/93). The law is brief, and sets out the principles for sustaining and extending the benefits of the environment of the Maldives for the people and coming generations. The EPPA confers powers on the MECCT to issue regulations and formulate policies for environmental protection and preservation. Such regulations include the EIA regulations of 2007, updated in 2012 (Regulation No. 2012/R-27).

73 Responsibilities and procedures for conducting environmental assessments, together with the requirements for environmental monitoring of projects, are set out in the EIA Regulations of 2012. All projects that may have an impact on the environment are referred to the Minister of Environment and Energy (EPPA 5(a).

74 The EIA Regulations assign primary responsibility for undertaking environmental assessment of projects to the project proponent and set out procedures, rights and responsibilities for the preparation and approval of EIAs. The Ministry of Environment, Climate Change and Technology (MECCT) undertakes review and approval of environmental assessment reports.

75 Project proponents are defined in the EIA regulations as a person, department or agency who is seeking to carry out or proposes to carry out a development proposal or is the owner or person having charge, management or control of a development proposal. EIA work must be carried out by registered consultants, and the procedures and requirements for registration are set out in Part V of the regulations.

76 The EIA regulations include a schedule (Schedule D) of investment project types that require an EIA. These include landfills, waste incinerators and large scale waste storage projects. For project types not included schedule D, a screening form is submitted in a specified format on the basis of which the MECCT decides whether an Environmental Management Plan is required or if further information is required, in which case an Initial Environmental Examination (IEE) will be carried out. The IEE is completed according to a specified format. If the IEE finds that the project may cause a significant environmental impact, a full EIA is required

77 For schedule D projects and those identified by the IEE as requiring an EIA, a scoping meeting is convened by the MECCT to determine the specific Terms of Reference for the EIA. On completion of investigations and reporting, the EIA report is subject to review by MECCT, which invites comments from other relevant ministries and the public following which an environmental decision is made.

78 On submission of the screening application to EPA, EPA screened this project to prepare an Environmental Management Plan. The Environmental and Social Management Plan for the proposed island waste management center at Thinadhoo has been prepared on a specified format and reviewed for compliance by EPA.

79 The table below shows the relevant polices and regulations to the proposed project. Small brief about the policy/regulation is also provided.

#	**Relevant laws, regulations, policies, and guidelines**	**Description**
1	Environmental Protection and Preservation Act	The project conforms to the requirements of the Environmental Protection and Preservation Act of the Maldives, Law no. 4/93. The EMP has been undertaken in accordance with the EIA Regulation 2012 of the Maldives by registered consultants. The construction and operation phase of the proposed project will fully abide to the Environmental Preservation and Protection Act.
2	Protected Areas and Sensitive Areas	Under Article 4 of the Environment Protection and Preservation Act, the Ministry of Environment, Climate

		Change and Technology is vested with the responsibility of identifying and registering protected areas and natural reserves and drawing up of rules and regulations for their protection and preservation. The proposed project does not have any declared protected or sensitive area within the project boundary.
3	Environmental Impact Assessment Regulation 2012	The Ministry of Environment, Climate Change and Technology has issued EIA regulation on May 2012, which guides the process of undertaking the Environmental Impact Assessment in the Maldives – This guideline also provides a comprehensive outline of the EIA/EMP process, including the roles and responsibilities of the consultants and the proponents. Schedule D of the regulation underlines the projects/practices that require EIAs. Since the ISWMC does not fall within this list, a screening process was followed. Screening decision for this project is to prepare an EMP for this project. This EMP has been prepared in accordance with the guideline provided in the regulation.
4	National Waste Management Policy 2015	The key objective of the waste management policy would be the formulation and implementation of guidelines and means for solid waste management to maintain a healthy environment. The establishment of ISWMC is in line with this policy and is an important part of the Integrated Waste Management System.
5	Waste Management Regulation	WMR contains four main sections: (i) Waste management standards: Defines standards for waste collection, transfer, treatment, storage, waste site management, landfills and managing hazardous waste. (ii) Waste management Permits: Defines approval procedures for waste sites, (iii) Waste transfer: Standards and permits required for waste transport on land and sea, including transboundary movements, (iv) Reporting requirements: Defines reporting and monitoring requirements and procedures, (v) Enforcement: Defines procedures to implement WMR and penalties for non-compliance. The ISWMC proposed under this project was designed to conform the Waste Management Regulation.
6	Land Use Planning	The Land Use Planning Regulations and Guidelines (2005) include land use instruments such as inclusionary zoning and quotas. Land Use Plans (LUP) are prepared in consultation with the Ministry of National Planning, Housing, and Infrastructure, which does have allocations for residential areas as well as for different infrastructure and social needs.
7	Health and Safety in Construction Industry	Construction law was published in 2017 highlighting the rules regarding general construction industry in Maldives. This law includes the building code, permits, involvement of Maldivians in construction industry, inspecting quality of construction, quality of materials used in construction projects and payment regulations for workers. The proposed project should adhere to this law and should follow it throughout the construction stage.
8	Immigration Act	The Maldives Immigration Act (1/2007) establishes rules for the departure and entry of Maldivian nationals,

		and entry, departure, and deportation of foreign nationals. The 15th article of the act establishes work visa permit, which allows for foreign nationals to remain in the Maldives for the purpose of working for a permitted period. Foreign labourers of this project should have valid working visa for the whole duration of the project.
9	Employment Act	Employment Act (2/2008) determines the fundamental principles relating to employment in the Maldives, the rights and obligations of employers and employees, establishes a Labour Relations Authority and an Employment Tribunal to protect such rights, and makes provision for all other matters related to employment. Below is the list of points applicable to the project. • Worker shall not be forced to work for more than 48 hours per week. • Workers shall not be made to work for more than 6days a week consecutively without providing 24 hours for rest. • Workers shall not be made to work continuously for more than 5 hours without providing a break for at least 30 minutes. • Salary should be paid to all permanent contract workers once a month. • Minimum 03 meals shall be provided to construction staff per day or appropriate meal break time shall be provided.
10	Decentralization Act	The Decentralization Act establishes the local councils as highest authority in the locality and who shall have executive powers to be exercised in accordance with this Act. The Act establishes Atoll Councils, Island Councils and City Councils. This project will be monitored and overlooked by the Island Council. The project was also formulated together with the input from the Island Council.
11	Coral and Sand Mining	Coral mining from house reef and atoll rim has been banned through a directive from President's Office dated 26 September 1990. Sand should not be mined from any part of the existing Island, beach, or the newly reclaimed island beach.

3.2 ADB Environmental Safeguard Requirements

80 ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all ADB investments.

81 **Screening and categorization**. The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

(i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.

(ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

(iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

(iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

82 **Environmental management plan**. The SPS further requires the development of an environmental management plan (EMP) specifying the required mitigation and monitoring and who is responsible for implementation.

83 **Public disclosure**. ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

(i) for environmental category A projects, draft EIA report at least 120 days before Board consideration.
(ii) final or updated EIA and/or IEE upon receipt; and
(iii) environmental monitoring reports submitted by the Project Management Office (PMO) during project implementation upon receipt.

84 **Pollution Prevention and Control Technologies**. During the design, construction, and operation of the project the PMDCSC will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects.

Table 7: Applicable WHO Ambient Air Quality Guidelines

Table 1.1.1: WHO Ambient Air Quality Guidelines[7],[8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 8: World Bank Group's Noise Level Guidelines

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

85 **Requirements for the Project**. All statutory clearances will be obtained prior to commencement of civil works. IEEs will be prepared for each package involving civil works and EMP to be attached in the bid and contract documents. IEE will be submitted to ADB for review and approval prior to issuance of bid documents. Monitoring of EMP implementation by the EA is reported to ADB.

3.3 Applicable International Environmental Agreements

86 In addition to national laws, rules and regulations, the government of Maldives is also a signatory to various applicable international conventions. Those applicable to the project as a waste facility in a coastal area, are those relating to environmental pollution and biosafety, as follows:

(i) International Convention for the Prevention of Pollution of the Sea by Oil (1982),
(ii) Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (1989),
(iii) Convention on Biological Diversity (1992),
(iv) United Nations Framework Convention on Climate Change (1992),
(v) Washington Declaration on Protection of the Marine Environment from Land Based Activities,
(vi) Kyoto Protocol to the United Nations Framework Convention on Climate Change (1998),
(vii) Cartagena Protocol on Biosafety (Maldives acceded on 2 September 2002),

4 Description of the Environment

4.1 Physical Resources

4.1.1 Geology, Topography and Soils

87 In common with all islands in the Maldives, Thinadhoo is a reef island that has formed mainly at the periphery of Vaavu Atoll by a process of deposition of shallow-water carbonates and successive coral deposits at the tidal level which gradually rose to reach the present day level of the island. The underlying rock is variable in consistency, reflecting the growth patterns of the coral, which forms dense colonies (coral heads) and large voids between the heads. The unconsolidated sand and gravel on top of the rock layer is subject to seasonal conditions, particularly monsoons as well as wave action, and the beaches in their natural state are dynamic subject to continual erosion and accretion, making infrastructure around the island's coast vulnerable to erosion.

88 The island's soils are mainly sandy in texture, with a significant silt component formed as sand grains have ground against each other. Much of the inland part of the island has topsoil with an organic matter content, supporting thick vegetation in places as well as homes and gardens. The soils are free draining when uncompacted, have poor nutrient status and are alkaline. Surface relief is extremely low and below 2m above sea level.

1.2 General environment of the island

89 Thinadhoo Island is geographically located at 3°29'16.63"N, 73°32'18.36"E in the eastern rim of Vaavu Atoll. The nearest inhabited island is Felidhoo just 1695m south of Thinadhoo and nearest uninhabited island is Hulhidhoo just 697m to north-east of Thinadhoo.

90 The following is the summary of the general environment:

- A harbor is located on southern side of the island,
- The existing harbor has been damaged over the years and overtopping from the breakwater was also been observed,
- Beaches are observed on north-east, north west side of the island
- Erosion has been observed on western, and south east side of the island,
- A seawall has been created on eastern side of the island due to heavy erosion,
- Almost all of the houses were constructed on eastern side of the island,

Figure 11: Aerial photo of the island

4.1.2 Climate

91 The Climate is tropical maritime, featuring two monsoon seasons, originating over the Indian Ocean to the southwest between May and September (Halhangu), and the Bay of Bengal to the drier northeast between December and February (Iruvai). The southwest monsoon is the stronger and monthly rainfall typically exceeds 200mm towards the end of the southwest monsoon period, and is lowest in February. Cyclones can occur, with the higher risk period being between October and January. The island can also experience"edge effects" of larger more distant cyclones. The United Nations (2007)1 estimate that there is a 10% probability of a level one storm on the Saffir-Simpson scale occurring over Kaafu Atoll in a 10 year period. Storms in the level one category are described as being "very dangerous" with wind speeds likely in the range of 119 – 153 kph, and pressures below 100hPa, but not lower than 980 hPa.

92 Temperatures are relatively constant and range between 25oC and 30oC, with the hottest period occurring in March/April and the coolest, December/January. Monthly rainfall fluctuates between around 20mm in February to over 300mm in May, and is over 200mm for most of the year.

93 The prevailing winds are predominantly westerly for much of the year, with easterly winds rare and south easterly winds almost non-existent. Winds are influenced by the monsoon patterns and west-south-westerly and westerly winds are the strongest over the year.

94 The tidal regime is semi-diurnal – two high and two low tides a day. The range for spring tides is approximately 1m and for neap tides, 0.3m while the extreme range between highest high water and lowest low water is 1.32m at the tidal gauge for the Malé area, on Hulhulé Island. Table 9 below gives the average tide levels at Hulhulé.

Table 9: Average tide levels at Hulhulé[2]

Tidal level	**Water level from mean sea level (m)**
Highest High Water (HHW)	0.62
Mean Highest High Water (MHHW)	0.34
Mean High Water (MHW)	0.33
Mean Low Water (MLW)	-0.36
Mean Lowest Low Water (MLLW)	-0.37
Lowest Low Water (LLW)	-0.72

95 Wave heights are also influenced by variations in atmospheric pressure and strong winds. Atmospheric pressure at sea level around Kaafu Atoll typically varies between 1011 and 1017 hPa, and an increase in air pressure of 1 hPa typically lowers the water level by 1cm. Lower pressures can occur in storm events, and may drop below 1000 hPa, entailing an increase of around 10cm or more, adding to effective storm wave heights.

96 Surface currents reflect tides and wind, and generally follow the monsoon pattern, with westward currents dominant from January to March, and the reverse between April and December.

4.1.3 Freshwater Resources

97 Natural freshwater sources on the island comprise rainwater collected from roofs and groundwater that accumulates through infiltration of rainwater into a freshwater lens that forms in underlying strata of the island, though the integrity of the lens and the quality of its water are threatened by the level of extraction and by pollution from human waste where proper sanitation facilities are not used. To get the baseline groundwater quality of the island, samples were taken from 3 locations: from the nearest well to the proposed IWMC site and from a control site.

[1] United Nations Office for the Coordination of Humanitarian Affairs - Regional Office for Asia and the Pacific (OCHA ROAP) (2007) Maldives: Composite Hazard Map.
[2] Source: University of Hawaii Sea Level Center Database, quoted in the Second National Communication of the Maldives to the United Nations Framework Convention on Climate Change. Ministry of Environment, Climate Change and Technology and Energy, 2016.

Figure 12: Groundwater sample locations

Table 10: Groundwater test results

	GW1	GW2	Unit
Conductivity	4350	1753	µS/cm
pH	7.34	7.27	-
Salinity	2.31	0.89	$^{0}/_{00}$
Temperature	23.9	23.5	oC
Nitrogen Ammonia	1.13	0.09	Mg/L
Total Petroleum Hydrocarbon	0.067	0.060	Mg/L

4.1.4 Marine Resources

98 Significant fishing recreational diving and other water supports such as snorkelling, water sports take place in the water around Thinadhoo. Vaavu atoll is considered to be a diving destination for tourists. The water quality is influenced by illegal dumping of solid waste (including from neighbouring islands and passing vessels).

4.1.5 Marine Sediment

99 Pollutants from waste, particularly hazardous waste, can accumulate in the sediment on the lagoon or sea floor on a small scale, due to illegal solid waste dumping.

4.1.6 Air Quality

100 Air pollution sources include vehicle emissions, emissions of other plant and machinery including diesel power generators, and construction activity, as well as industrial activity, all of which are limited on Thinadhoo. Levels of ambient air quality studied on the more populated islands of Greater Malé at the south of the atoll by AECOM in 2010 on Malé, Hulhulé and Hulhumale[3] and compared with World Health Organization (WHO) standards for ambient air, finding that the pollutants of potential concern did not exceed WHO guideline levels in terms of the average 24hr mean.

[3] AECOM in association with Water Solutions (2011). Expansion and Modernization of Malé International Airport: Social and Environmental Impact Assessment, prepared for GMR Malé International Airport Private Limited.

4.1.7 Noise

101 Sources of noise pollution are similar to those for air quality, again very limited on Thinadhoo while wind and waves can contribute significantly to ambient noise levels.

4.2 Ecological Resources

4.2.1 Marine Ecosystems

102 Coral ecosystems have significant ecological significance and occur within lagoon waters and on the periphery of the islands. The corals are vulnerable to pollutants in the water, changes in radiation, changes in turbidity and in nutrient levels. Corals are adapted to low nutrient levels, and in areas where sewage, grey water and food waste is released, which usually have relatively high phosphate and nitrate levels, algal growth will often flourish and suppress coral growth. Thinadhoo has a low population (69 residents), there is therefore little immediate threat to coral colonies around the island from these sources. Coral health can be gauged by established survey methods, such as the reef check protocol supported by the international NGO Reef Check[4] which provide standards to assess the coverage of coral and other substrates on the sea bed.

103 Pelagic fish form an important part of the local economy, both through commercial fishing activities and game fishing. Fishing activity focuses on areas known to be abundant and these occur throughout the Maldives waters, usually distant to the coast.

4.2.2 Avifauna

104 The Maldives has a diverse range of birds, including a significant seasonal population of migratory birds. The islands are important wintering grounds for a large number of migratory species that follow the Central Asian Flyway, a flyway covering a large continental area of Eurasia between the Arctic Ocean and the Indian Ocean, and comprising several important migration routes, extending from the northernmost breeding grounds in Siberia to the southernmost non-breeding wintering grounds in West and South Asia and the Indian Ocean Territory including the Maldives. Floating waste is a known hazard to birdlife on the atoll particularly when toxic waste is ingested or when articles such as plastic bags and string can cause birds to be debilitated or where they cause damage to the digestive system, or when it damages a natural habitat. These can travel considerable distances and therefore such waste released from more populated islands or from vessels can reach islands such as Thinadhoo and cause damage. The habitat of the white-breasted waterhen (*Amaurornis phoenicurus*) is known to be threatened by floating, uncollected solid waste[5].

4.2.3 Terrestrial Ecosystems

105 The present day vegetation cover on the islands is substantially influenced by human habitation and has little biodiversity conservation significance. Vegetation is dominated by pan-tropical species such as coconut (*Cocos nucifera*), Goats foot creeper (*Ipomea pes-caprae*), hibiscus (*Hibiscus tiliaceus*) and beach colophyllum (*Calophyllum inophyllum*).

4.2.4 Protected Areas

106 There are 42 protected areas in the Maldives designated under the EPPA and covering around 24,500ha, or 0.2% of national territory totalling more than 24,494 hectares (0.2% of the national territory) designated under the Environment Protection and Preservation Act 4/93 (EPPA 4/93) to prevent over exploitation, and improve conservation and preservation, including banning of export of important baitfish as aquarium fish, protection of threatened marine species such as sharks, sea turtles, giant clams and black coral and also to enhance and sustain dive tourism.

[4] Hodgson, G., W. Kiene, J. Mihaly, J. Liebeler, C. Shuman, L. Maun and J. Hill (2006). Reef Check Instruction Manual: A Guide to Reef Check Coral Reef Monitoring Published by Reef Check, Institute of the Environment, University of California at Los Angeles.
[5] Common Birds of the Maldives. Live & Learn Environmental Education. www.livelearn.org

107 Only one protected area occur in the vicinity of Thinadhoo. The IUCN has not set a category for any of the sites.

Table 11: Protected areas in the vicinity of Thinadhoo

Name	Type	Area	Notes	Location relative to Thinadhoo Island
Miyaru Kandu, also known as Dhevana Kandu (designated 1st October 1995)	Reef/ channel	1391.9 ha	According to EPA protected areas of Maldives list, Miyaru kandu is: "The reef top starts at about 60m and slopes gently down in a series of ledges to a sandy plateau at 35m. This area of the reef and ledges are packed with life, and there are many shallow caves. On the edge of the reef are great schools of fishes such as red snappers, surgeonfish. Myliobatoidei (Stingrays) and Triaenodon obesus (Whitetip Sharks)."	Approximately 10.9 km to the north west of Thinadhoo

108 To assess the protected areas near the project site, the Integrated Biodiversity Assessment Tool (IBAT) was used to screen the protected areas and critical habitats that may exist around the project area (default area analysis of 50km radius). Results of the initial screening is attached as an Annex of this document.

4.3 Socio-Economic Factors

4.3.1 Population Levels

109 The population of Thinadhoo according to the 2014 census is 69 predicted in the feasibility study for of an integrated Solid Waste Management System for Zone 3 to have reached around 67 at present day levels and to fall to 52 by 2035. However, the island has a greater number of people living for job purposes.

4.3.2 Economy

110 Thinadhoo's economic activity is dominated by the tourism guesthouse. The island has some tourism, primarily a collection of guesthouses and it is also the nearest inhabited island to some resorts in the area. However, the island does not have access to education, primary school has been closed since 2007, due to few number of students.

4.3.3 Public Health

111 Thinadhoo in general have very minimal health care, only one doctor is residence within the island with few health care facilities. Most of the people travel to Felidhoo or Male' for health care. Due to advances made in the sector over recent decades, which feature a rapid decline in maternal mortality rate, and eradication or heavy reduction of the incidence of a number of infectious diseases including leprosy, measles and lymphatic filariasis. However existing waste management practices, particularly regular burning of household waste including plastics, poses a mild risk to people living on the vicinity who regularly breath air that contains smoke from the burning waste.

1.3 Project site and access road condition

112 ISWMC is located on western side of the island, west of new STECLCO building, which is under construction. The diagram below shows the proposed ISWMC area.

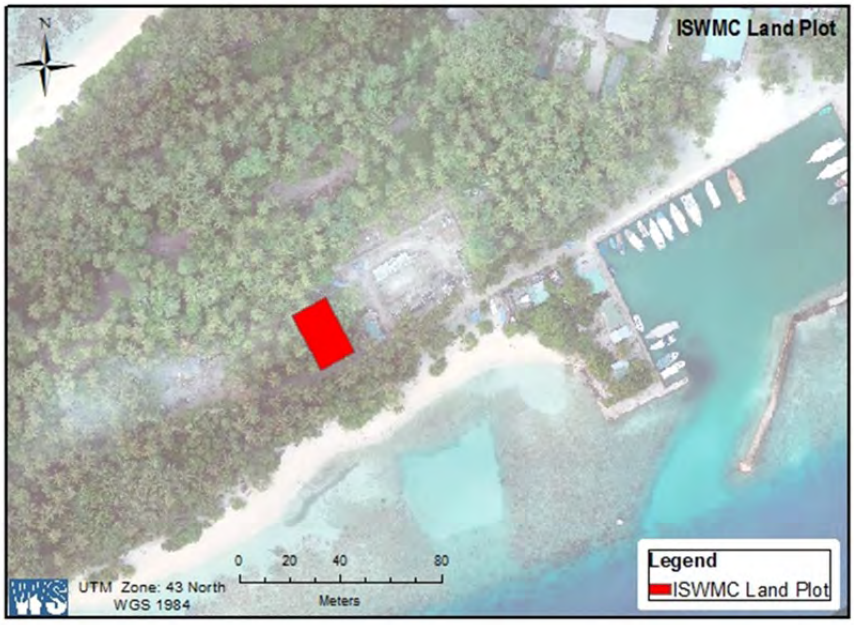


Figure 13: Proposed location for ISWMC

113 The project site can be accessed from southern side road. Southern side road is connected to the existing harbor. The diagram below shows how the site can be accessed from harbor. The diagram below shows how the site can be accessed from harbor.

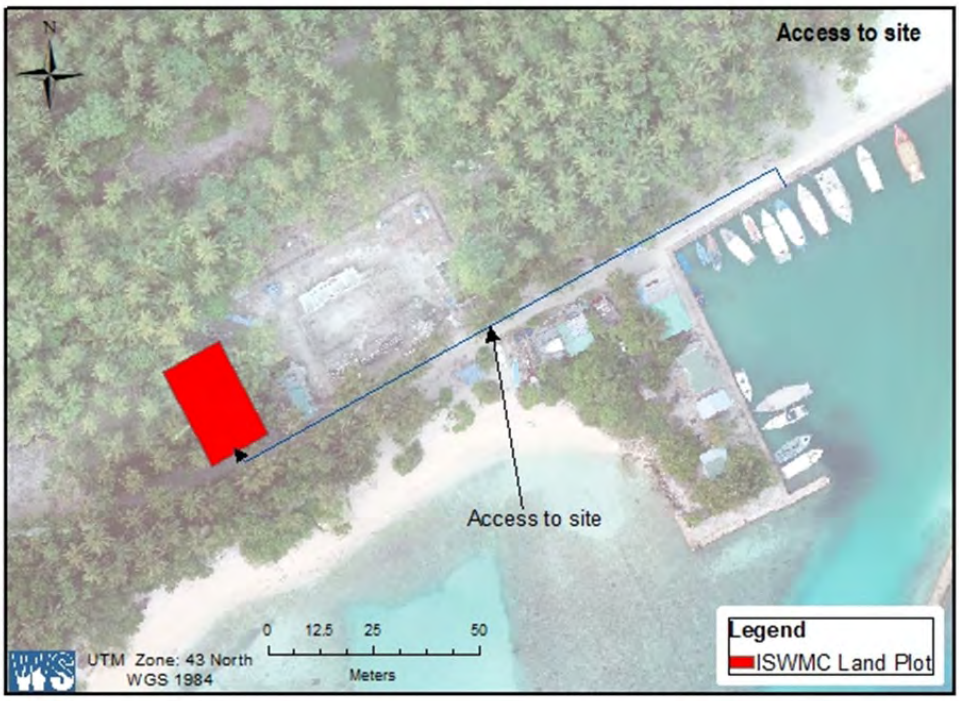


Figure 14: Access road from harbour

Figure 15: Access road condition

5 Anticipated Environmental Impacts and Mitigation Measures

5.1 Impact Identification

114 The potential impacts and mitigation measures have been identified through a site visit, interviews with stakeholders and review of designs for the IWMC and associated facilities.

115 In addition to the stakeholder consultation and primary and secondary data collected for this project, following reports has been reviewed to determine the possible impacts.

- ESMP for the Proposed Construction and Operation of an Island Waste Management Centre in Dhonfanu, Baa Atoll (CDE, 2019)
- EMP for the Proposed Development of Island Waste Management Centerin Th. Vandhoo (Zuhair, 2017)
- EMP for the Proposed Island Waste Management Centre in Bodufulhadhoo, Alifu Alifu Atoll (Musthafa, 2019)
- ESMP for the Upgrading of Island Waste Management Center in R. Maakurathu (Zuhair, 2019)

116 The proposed ISWMC construction project at Thinadhoo Island is expected to have limited impacts on the existing terrestrial environment of the island. These include the vegetation, soil, and the groundwater of the island. The project is also expected to impact the livelihood of the beneficiaries and impact the existing society in many ways. Impact identification has been focused on the environment and socio-economic aspects. Impacts have also been identified for short and long term as well. It is only though identifying the likely impacts; the mitigation measures can be identified and implemented.

5.2 Method of Assessment

117 For detail impact analysis, environmental impact identification was made by a combination of matrices along with expert opinions and experiences from similar projects in the past. The environmental impacts were examined using an adaptation of the Leopold matrix method. The Leopold matrix (Leopold, 1971) implements a two-dimensional checklist, where the columns of the matrix contains the project's activities while the rows list the environmental receptors under the three main categories – Physical components, Biological components, and Socio-economic and Cultural components. This interaction matrix helps to identify impacts on individual factors of the three main categories of the impact. Furthermore, the sum of the magnitude from each impact activity and/or a certain environmental factor could be identified.

118 This method analyses three aspects of each action which may have an impact on the environment – Magnitude, Duration, and Probability.

- Probability – Likelihood of an impact to be produced from a said activity.
- Duration – Defines the duration of which the environmental impacts would persist.
- Magnitude – Defines the severity of the impact, for both positive and negative. A score is given from a scale of +10 to -10. +10 being major positive and -10 being major negative.

Table 12: Scale used to assess impact criteria

Evaluation criteria	Magnitude Score	Category
Probability	O	Impact is possible (Probability < 50%)
	M	Impact is likely (Probability >50%)
	X	Impact is certain (Probability = 100%)
Duration	T	The effects of the activity would not be identifiable within a few months of its completion.
	S	The effects of the activity would not be identifiable within months to a year of its completion.

	L	The effects of the activity would not be identifiable within multiple of its completion.
	P	The effects of the activity will persists endlessly causing irreversible impacts.
Magnitude	9 & 10	Major Positive
	7 & 8	Moderate Positive
	5 & 6	Minor Positive
	-4 to 4	Negligible
	-5 & -6	Minor Negative
	-7 & -8	Moderate Negative
	-9 & -10	Major negative
Cumulative		Impacts that are cumulative

119 Significance of the impacts can be identified based on the criteria of probability, duration, and magnitude of the impacts. For each potential impact, there are many combinations of magnitude, duration, and likelihood that can occur. There is no universally accepted measure of significance. None of the criteria (probability, duration, and magnitude) should be considered more important than any other. Instead, they should be examined in an equal manner to help frame the rationale for deciding of significance. These are decided based on the consultant's experience and results of similar projects. In the case of this project, a team of consultants who have worked on similar projects in Maldives allocated scores based on the primary and secondary data. Table below shows the options to be considered to evaluate the significance of the impacts based on the 3 criteria.

Table 13: Scale used to assess the significance.

Probability	**Duration**	**Magnitude**	**Significance**
Possible (O)	Temporary (T)	Major Negative (-9 & -10)	Not significance
Likely (M)	Short Term (S)	Moderate Negative (-7 & -8)	Minor significance
Certain (X)	Long Term (L)	Minor Negative (-5 & -6)	Moderate significance
	Permanent (P)	Negligible (-4 to 4)	High significance
		Minor Positive (5 & 6)	
		Moderate Positive (7 & 8)	
		Major Positive (9 & 10)	

120 There is also uncertainty with the smooth continuation of this project. Minor or even major changes to the project's concept plan could alter the series of impacts. Major changes would require an additional EMP to be made.

5.3 Impact Boundary

121 Proposed project has components that will impact the environment of the project site. The physical impacts (such as direct habitat loss) will usually be felt within the project footprint and close proximity to project area. However, some impacts such as noise and impact on groundwater can be felt on a large area without proper mitigation measures. The indirect impact of a project can be observed from a larger area as well. For example, operation of ISWMC will help to keep the whole island clean improving the living condition. Also, other positive social impacts of ISWMC can be felt by the whole island in the long term.

5.4 Environmental Impacts Related to Location

122 The siting of the IWMC has been the identified by the island council and is subject both to approval from the Ministry of National Planning, Housing and Infrastructure and the national EIA process. The proposed site is distant from residential areas, but close to the shore and therefore containing leachate from stored waste and composting is important.

123 **Effects on the surrounding seawater and marine ecosystems.** The IWMC is to be located close to the shoreline. The risk of loss of waste or leachate IWMC will be mitigated by (i) ensuring that waste enters and leaves the IWMC on the landward side of the facility (ii) collecting and containing leachate at IWMC and (iii) that site security and management is ensured by the island council. The measures must ensure no deterioration of water quality in the vicinity of the IWMC.

124 **Effects on vegetation**. The site is on a sparsely vegetated area on the island. 27 mature trees will be removed from the site and will be relocated on the island. Minor impact on vegetation is envisaged.

125 Only the trees that fall in the footprint of the proposed ISWMC area will be cleared and removed. Few trees and few bushes were found on the site. The detail of the vegetation is given in the table below.

TYPE OF TREES	**NUMBER OF TREES**
Coconut Palm (*Cocos nucifera*)	12 (Compensation will be given to the owners by the Island Council.
Indian lavender *(Cadamba jasminiflora)* (Uni)	1
Tahitian screw pine *(Pandanus tectorius)* (Boakashikeyo)	11
Cork Wood Tree *(Ochrosia oppositifolia)* (Dhunburi)	1
Alexandrian Laurel (*Calophyllum inophyllum)* (Funa)	2

126 **Surrounding land use.** The surrounding land is not inhabited though likely to be developed for recreational use. While improved management of the IWMC will reduce odour and attraction to pests such as rodents, the effect on existing land use can be mitigated by (i) ensuring security, regular cleaning operations and maintenance takes place and (ii) planning of further developments such that receptors such as dwellings are not placed close to the facility, and preferably separated by a belt of trees or open space.

127 **Impedance of traffic**. Due to low levels of traffic on Thinadhoo, the transport of waste to and from the facility is not expected to impede traffic.

128 **Loss of land and effects on property**. No private property will be affected and land acquisition will be required and there is therefore no impact.

5.5 Environmental Impacts Related to Construction

129 Impact during the construction phase include impacts that arise from site preparation, mobilization, and from the construction activities. Waste generated during the construction is also a potential impact generating activity especially if not properly disposed. Positive sociocultural impacts will be felt during the construction by means of employment and negative impacts could arise from temporary traffic during mobilization. The table below shows the impact assessment matrix for the construction phase of the project.

Table 14: Impact assessment matrix of the construction phase

		Construction phase					
		Probability	**Duration**	**Magnitude**	**Direct or indirect**	**Significance**	**Cumulative**
Physical components	Air quality	O	T	-2	Direct	Minor significance	Cumulative from different project activities and other projects that fall within the same construction period.
	Noise	O	T	-2	Direct	Minor significance	Similar to air quality.
	Groundwater	M	S	-5	Direct	Moderate significance	Cumulative from different project activities
Biological components	Terrestrial environment	M	S	-5	Direct	Moderate significance	NA
	Protected / sensitive areas	NA	NA	NA	NA	-	NA
Socio-economic and cultural component	Health and safety of workforce	O	T	-5	Direct	Moderate significance	Cumulative from different project activities
	Health and safety of staff	NA	NA	NA	NA	-	NA
	Employment	X	S	8	Direct	High significance	Cumulative from different project activities
	Visual amenity	M	S	-3	Direct	Minor significance	NA
	Living standard	O	L	6	Indirect	Moderate significance	Cumulative from different project activities
Total impact magnitude				-6			

		Construction phase					
		Probability	Duration	Magnitude	Direct or indirect	Significance	Cumulative

130 **Site preparation**: Proposed land plot in Thinadhoo is located on the west side of the island near new STELCO building. Excavations to form foundations for structures will involve making temporary stockpiles of material that will either be removed or re-used. To prevent the release of silt into sea contractors will be required to ensure that (i) excavated areas are rapidly refilled on completion of works, (ii) to place silt fences around temporary piles of excavated material and (iii) avoid excavation in wet weather to the extent practicable.

131 **Construction method**. The methods to be used for site preparation, and construction, as well as associated arrangements to ensure sound environmental management and safety at all times, are to be defined by the Contractor in a Contractor's Environmental Management Plan submitted to the PMDSC for approval.

132 **Transportation of construction machinery and materials**: Transportation of machinery and materials implies movement traffic that will lead to possible negative impacts to the surrounding area (dust, spillage, emissions, and noise) as well as disruption to the existing traffic flow of the island. construction vehicle movements are not expected to impede traffic, as levels of traffic on the island are very low.

133 Improper storage of construction materials, especially gravel, sand, and cement, on the construction site could lead to inadvertent dispersal of materials during heavy rains or high winds. This could have a negative impact on the surrounding environment. As the proposed project sites are close to sea, there is a chance of lose materials dispersing to marine environment.

134 **Water pollution**. The use of vehicles and plant can cause risks of water pollution, in the event of leaks and spills of fuel, lubricants, hydraulic fluid or other fluids used for vehicle operation. To reduce risks and limit impacts the contractor will be required to ensure that vehicles and plant are maintained in sound operable condition, free of leaks and that the condition of vehicles and equipment is regularly checked. The contractor will prepare and submit a plan for spill management, including provision of spill kits, training/briefing of workers on procedures on handling spills and allocation of responsibility within the contractor's team for ensuring that spill kits are available and that workers know how to use them.

135 **Waste management**: Construction waste will include packaging of equipment, fuels, lubricants, materials, equipment and food and some rubble where existing structures need to be demolished. Some specialist lubricants and paint for marking may be hazardous. Contractors will be responsible for removing waste to Thilafushi. Approval from the PMDSC must be obtained prior to importing materials rated as hazardous under the Globally Harmonized System of Classification and Labelling of Chemicals.

136 **Noise pollution and vibration**. Construction operations, particularly excavations and compaction will cause noise and vibration, which will be potentially be a temporary use to some residents. To mitigate the impacts the contractors will be required to (i) identify households that are likely to be affected by noise and vibration (if any), (ii) provide information to these households on scheduled work (iii) limit construction activities to normal daylight working hours (iv) adhere to the planned work schedule and (iv) ensure that all construction equipment and vehicles are kept in good working order with working exhaust mufflers.

137 **Air and dust pollution**. Potential sources of air pollution are exhaust fumes from vehicles and plant, dust from transport of construction and waste materials and areas around work sites where soil and debris are deposited. The effect will be limited due to the largely open environment where dust and fumes will be rapidly dispersed by wind. However, emissions will be mitigated by ensuring that vehicles and equipment to be well maintained and tuned and fitted with exhaust baffles.

138 **Community health and safety risks**. The use of plant and machinery, use of compressed air lines and cables and excavations are potentially hazardous but most work sites are within the transfer station areas where public access is restricted. The contractor will ensure that restrictions to access are enforced and provide notices to the public identifying hazards and, where warranted, erect safety barriers/covers around areas of open excavation. Personal protective equipment to be provided to the workforce, appropriate to each site. Given the COVID-19 related current health crisis in the Maldives, social impact may arise due to the workers who are coming from other islands with a community spread. With proper measures such impacts are avoidable.

139 **Socio-economic impacts**: Socio economic impacts of the project involves the positive and negative impacts that arise during the construction stage. Negative socio-economic related impacts may include traffic flow and during the transportation of construction materials. If such materials are piled on the harbour area for long term, it will be a nuisance to the harbour users. In case of this project, construction material will be very minimal and will be transported to site for storage since the site has lot of empty land space. Since the island does not have many vehicles, impact of traffic will be temporary and minute. However, impact could be cumulative and significant if multiple projects are taking place in the island at the same time.

5.6 Environmental Impacts Related to Operation

140 General. The IWMCs and management of them are intended specifically to address existing poor practices of open burning of waste and to ensure safe and efficient handling, collection of recyclables and shipment of waste to the RWMF at Thilafushi. Existing impacts that are addressed including smoke nuisance and health risk, damage to the habitat in the existing dump area, and reduced pest issues. The table below shows the impact assessment matrix for the operation phase of the project.

141 Table 15: Impact assessment matrix of the operation phase

		Operation phase					
		Probability	**Duration**	**Magnitude**	**Direct or indirect**	**Significance**	**Cumulative**
Physical components	Air quality	O	T	-2	Direct	Minor significance	Cumulative from different project activities and other projects that fall within the same construction period.
	Noise	O	T	-2	Direct	Minor significance	Similar to air quality.
	Groundwater	M	S	-3	Direct	Minor significance	Cumulative from different project activities
Biological components	Terrestrial environment	NA	NA	NA	NA	-	NA
	Protected / sensitive areas	NA	NA	NA	NA	-	NA
Socio-economic and cultural component	Health and safety of workforce	NA	NA	NA	NA	-	NA
	Health and safety of staff	O	T	-3	Direct	Minor significance	Cumulative from different project activities
	Employment	X	S	8	Direct	High significance	Cumulative from different project activities and from other projects undertaken in the island

		Operation phase					
		Probability	**Duration**	**Magnitude**	**Direct or indirect**	**Significance**	**Cumulative**
	Visual amenity	M	S	-2	Direct	Minor significance	NA
	Living standard	O	L	8	Indirect	High significance	Cumulative from other projects undertaken in the island
Total impact magnitude				4			

142 Most of the impacts that are envisaged to arise during the operational phase of the project are expected to be mostly positive if all the mitigation measures highlighted in the report are followed. However, there are few negative impacts that could arise during the operational stage mostly due to improper operational practice.

143 **Use of containers**. While containers provide a more efficient system of handling and loading waste, reducing potential losses into the sea, any breakages or mishandling of containers will result in significant discharge of waste into the sea. Operation and maintenance training must provide for instruction on maintenance of containers, loaders, cranes and vessels and sound operation including licensing of vehicle and plant operators and restrictions on operation during stormy weather.

144 **Waste management**: Construction of ISWMC will provide a sufficient solution for the current waste management issues of the island. Waste management center has dedicated areas to store the waste and dedicated areas to handle certain types of waste. This will improve the waste handling and management process of the island. The waste collected in the center will be packed and stored according to the guidelines provided by the authorities and hence spillage during transfer will be minimum. The project also aims to transfer waste from ISWMC to the regional waste management center in Thilafushi. Waste will not be stored in the ISWMC not more than a week after the start of the full operation of the Zone 3 waste management project. This will be a positive impact to the island waste management.

145 **Pests**. Although improvements will reduce access to them, the transfer stations will still be subject to pests such as birds and rodents. Numbers of these can be kept down by improved operation regimes, including site hygiene and regular cleaning of surfaces.

146 **Occupational health and safety**. Potential hazards to workers arise from the handling of compost, when workers can breathe micro-organisms that cause respiratory and other disorders, and accidents associated with the operation of collection trucks and loading containers into the vessels that take the waste to the RWMF at Thilafushi. Risks are mitigated by training in handling of compost and of machinery, and sound supervision and management of operation of the facilities. Personal protective equipment will be provided including a fire extinguisher on site.

147 **Delayed collection**. Waste can be accumulated due to delayed collection. This could cause the IWMC to reach maximum capacity and be unable to handle further waste production, and lead to problems with odour and pests. In the case of delays IWMC design allows storage of waste for 4-6 weeks until waste can be collected and transported. With proper handling of waste in containers any impacts from accumulation due to delays can be mitigated until transport.

5.7 Global, Transboundary and Cumulative Impacts

148 IWMCs are to be established, where they do not exist or are not operational, on each inhabitated island in zone 3 under the project and also elsewhere in the country. Operation of the IWMC and efficient removal of waste to the RMWF will reduce risks to the island and marine environment. Effective institution of sound management of the IWMCs and of waste collection and handling will provide a demonstration of good practice, of value to island councils and workers on other islands who need to develop capacities for improved waste management.

149 Capacity building for the island council will assist in the build-up of capabilities required to further improve and manage waste management facilities throughout the Maldives.

6 Analysis of Alternatives

6.1 Alternatives for the IWMC

150 As stated in section 0, there is an existing but a dumpsite on the island. The alternative of rehabilitating and extending this area and putting it back into operation has not been pursued, as the site requires the removal of the existing waste dump at the site which is not part of this project.

6.2 Alternatives within the Project Scope

151 Improvements to waste management on Thinadhoo envisages the use of containers, to receive waste from truck and transfer it to vessels. An alternative to this is an “open” system where trucks are offloaded mechanically, or they tip the waste to a central area or directly onto awaiting vessels. The use of containers however provides a much higher level of control, and greatly limits the risk of waste being lost to the sea during the offloading and loading processes.

6.3 The no project alternative

152 Under the “no project” scenario, the existing practice of open incineration of household waste will continue, even as volumes of waste generation grow with population and economic growth. It is unlikely that composting will be done on a community scale, foregoing the opportunity to reduce the volume of plant waste that can be composted and re-used. While the island council has made moves and/or expressed intention to raise public awareness on waste reduction and separation, the opportunity to support the council as well as schools and the wider community through the ICT component will also be foregone.

6.4 Composting alternatives

153 The table below shows the comparison of the types of composting that can be practiced in an ISWMC. All methods mentioned below require excess area within the ISWMC.

Table 16: Comparison of types of composting

Criteria	Open windrow composting simple	Mechanized/aerated composting	In-vessel composting	Anaerobic Digestion (AD)
Area needs	Requires large area of land	Requires large area of land	Minimal space is required	Requires large area of land
Simplicity of technology	The process relatively simple, the windrows are turned regularly. The process can take up to 12 weeks.	Complex compared to Open windrow composting. Air is supplied to the composting materials through perforated pipes embedded in each wind-row, thereby eliminating the need for turning.	Complex compared to aerated composting. More technologies and knowledge are required for the composting process.	Requires air tight containers or to bury the waste underground. There are new technologies that produce biogas using anaerobic digestion.
Maintenance	Low infrastructure set-up is required, so maintenance would be minimal.	More infrastructure maintenance then open windrow composting. Maintenance of pipes and machineries is required	High maintenance. Takes place in a confined space, which is usually a highly controlled, sealed chamber.	High maintenance if the new technology is used. Low maintenance if pits are used but require digging up.
Odor and leachate	Open windrow will generate leachate as well as odor	Aerated composting will also generate leachate as well as odor	Better maintenance of odor and leachate	Produces strong odour but can be avoided if practiced in air

				tight containers. If buried underground, there is a possibility of leachate seeping to groundwater.
Cost	Low-cost	Higher cost than open windrow composting	Higher cost than aerated composting	Cost depends on the type of AD adopted

7 Information Disclosure, Consultation and Participation

7.1 Consultations and information disclosure during design

154 Consultations took place between the consultants, a representative of MECCT and representatives of the island council and stakeholders on the island during a visit on 11st February 2020 and 20th January 2021. These consultations enabled the consultants and MECCT to understand the intentions and existing actions of the island council to improve waste management on the island and to gauge capacity development needs.

155 Below is a summary of the points discussed in the meeting.

- Currently waste is burned in the dumping site. Dump site is located western side of the island, near the new STELCO building,
- Thinadhoo is famous among tourist. Residents and tourists visiting the island complain about the smoke.
- Kitchen waste is being dumped into the ocean, mostly to southern side of the island. The current is quite high because it's a channel, so the waste is not being washed into the beach,
- We do not have much options to manage the waste, due to less machinery and proper education about waste management,
- Bins are being placed at different parts of the island, to keep the island clean. Kitchen wastes are not allowed to dump in it. Its only used for daily wastes like tins and water bottles,
- Council hopes that the proposed IWMC will end the current waste burning practices. Also, they want to regularly transfer waste to Thilafushi to make sure the ISWMC is not filled with waste that they cannot dispose without burning.

Table 17: Summary of participants in stakeholder consultations

Name	Sex	Designation	Office
Shifag Hussain	M	Vice President	Thinadhoo Island Council
Mohamed Naeem	M	Finance Officer	Thinadhoo Island Council
Ahmed Jameel	M	Environmental Consultant	Water Solutions
Mohamed Asif	M	Safeguard Specialist	Ministry of Environment, Climate Change and Technology
Mohamed A. Latheef	M	Civil Engineer	Ministry of Environment, Climate Change and Technology
Yoosuf Ismah Firag	M	Intern	Water Solutions
Ibrahim Faiz	M	Consultant	Water Solutions
Mohamed Umar	M	Consultant	Water Solutions
Samir Ahmed	M	Council President	Thinadhoo Island Council
Adil Ibrahim	M	Resident	Red House
Ashraf Ali	M	Resident	KaneeruVaadhee
Amshad Ibrahim	M	Resident	Manzil
Aishath Luyana Waseem	F	Resident	Rasfaru
Wafir Easa	M	Resident	Farudhaa
Ahmed Naseem	M	Resident	Havaa
Shazleenaa Waseem	F	Resident	Hathaa
Sathuma	F	Resident	
Ahmed Naseer	M	Resident	Veenus Villa
Abdul Gayyoom	M	Resident	Dhoadhi

156 Initially workshops were planned to be carried out at each of the islands. However, due to Covid-19 and related restrictions these could not be held and consultations were limited to a smaller group of stakeholders. Therefore, many of these consultations were conducted via online questionnaires, or over the phone.

7.2 Further Information Disclosure and Public Consultation

157 This report and a Dhivehi translation of the executive summary will be provided to commune officials for public disclosure. Stakeholders will be kept informed of construction activities that are likely to cause noise and dust nuisance and will be made aware of the grievance redress mechanism and consultations will take place regularly to gain feedback and ensure that impacts are being adequately managed.

8 Grievance Redress Mechanism

158 To ensure consultation, disclosure, and community engagement continues throughout project implementation, a grievance redress mechanism will be established based on existing mechanism. The grievance redress mechanism will allow for concerns and grievances about the waste management projects' social and environmental performance raised by individuals or groups and to facilitate resolution of those concerns and grievances. The Grievance Redress Mechanism includes 3 tiers. Every effort shall be given to find an amicable solution before higher tiers could be engaged. To facilitate such, following would be done by Ministry of Environment, Climate Change and Technology.

159 A register of grievances should be maintained at Island Council and Ministry of Environment, Climate Change and Technology.

First Tier (Island Council)

160 An individual or an interest group can contact Island Council for grievances.

- At the project location there will be an Information Board listing the names and contact telephones/emails.
- If the grievance cannot be resolved informally by contacting Island Council on (960) 6700604, or an aggrieved party must submit a complaint on the Tier I by sending an email to info@vaavthinadhoo.gov.mv
- If the complaint is resolved within 15 days Island Council must communicate the decision to the aggrieved party in writing.
- 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 days.
- A copy of the form should be provided to the aggrieved party as evidence of receipt. The complaint form should be available from the Island Council.
- The grievance redress committee (GRC) includes the island's representatives as well as project officers related to each island, as shown in the Figure 3 below.

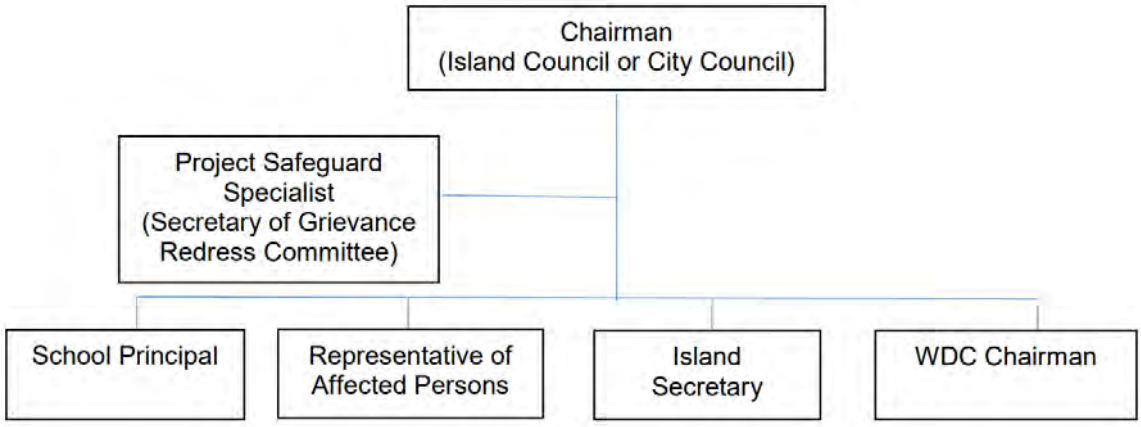


Figure 16: Grievance Redress Committee for first tier

Second Tier (Ministry of Environment, Climate Change and Technology)

161 If the grievance cannot be resolved through Tier 1, an aggrieved party must submit a complaint on the Tier 2 to Ministry of Environment, Climate Change and Technology.

- An aggrieved party must contact Ministry of Environment, Climate Change and Technology on (960) 3018300 sending a mail to secretariat@environment.gov.mv.
- The complain will be screened to determine if it is related to the project.
- If Ministryfinds that the complaint is not related, the aggrieved party must be notified in w riting with a way forwarded including the necessary government institutions to follow up with
- If the Ministry of Environment, Climate Change and Technology finds the complaint is related, Ministry to start the Second-Tier process.
- A written notification by Ministry of Environment, Climate Change and Technology will be provided to the aggrieved party if a solution is reached within working 15 days.
- An acknowledgment of the receipt of the decision of Ministry of Environment, Climate Change and Technology in acceptance or denial of the decision Ministry of Environment, Climate Change and Technology must be provided by the aggrieved party within 10 days. If no acknowledgement is submitted from the aggrieved party, then the decision will be considered as accepted.
- If a satisfactory solution was not reached through the Tier II process, the aggrieved party may notify Ministry of Environment, Climate Change and Technology, in writing of the intention to move to Tier III.

Third Tier (Judiciary)

- An individual or an interest group has the option of going to established judiciary system of the Maldives.
- The legal system is accessible to all aggrieved persons.
- Assistance from the Ministry of Environment, Climate Change and Technology would be available only for vulnerable person as per this grievance redress mechanism.
- 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 verdict of the Courts will be final.
- A vulnerable person(s) for the purpose of this project is a person who is poor, physically or mentally disabled/handicapped, destitute, and disadvantaged for ethnic or social reasons, an orphan, a widow, a person above sixty-five years of age, or a woman heading a household.

9 Environmental Management Plan

9.1 Objectives

162 This EMP sets out the needs for environmental management of transfer station improvements within the GMEIWMP in terms of institutional responsibilities to ensure mitigation and monitoring takes place during the pre-construction, construction and operation phases, meeting the requirements of the Government of the Maldives and the ADB's SPS.

163 A copy of the EMP must be kept on work sites at all times. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

164 For civil works, the contractor will be required to (i) establish an operational system for managing environmental impacts (ii) carry out all of the monitoring and mitigation measures set forth in the EMP; and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

9.2 Institutional Responsibilities

165 The planning, design and construction of IWMCs is set through a process that covers data collection, consultations, and involvement of the island council, approvals, EIA preparation, design and tender. A flow diagram for this process is given in Figure 17. This IEE will be updated to reflect the findings of the EIA carried out as part of this process, and also detailed design.

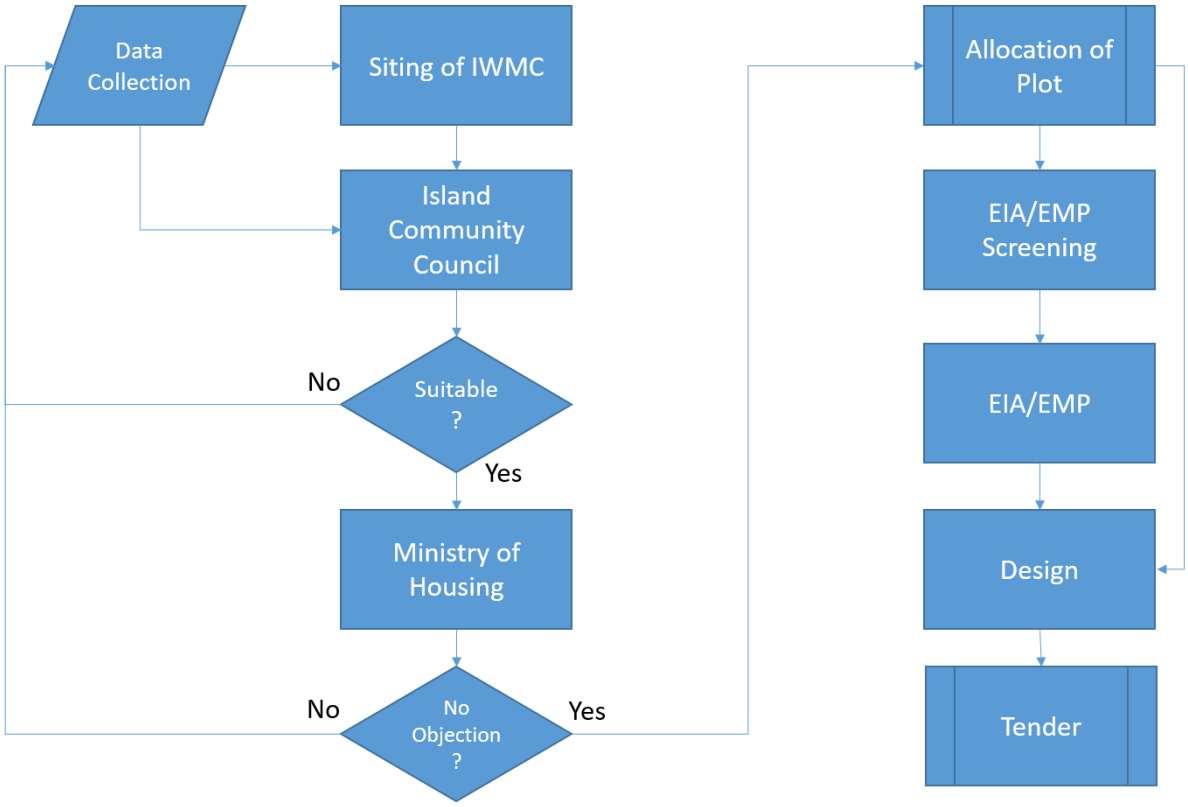


Figure 17: IWMC planning process

SOURCE: MECCT

166 The Executing Agency for the Greater Malé Environment Improvement and Waste Management Project (GMEIWMP) is the Ministry of Finance and Treasury (MOFT) and the implementing agency is the MECCT. Project Management, Design and Supervision Consultants (PMDSC) will have responsibility for overseeing project management. EMP implementation will be the responsibility of the island council, with support from the PMDSC.

9.2.1 Roles and Responsibilities of Project Implementation Organizations

167 The table below shows the roles and responsibilities of the Project Implementation Organizations

Table 18: Roles and Responsibilities

Project Implementing Organizations	Responsibilities
PMU	• Responsible for overall project management, implementation and monitoring • Monitors and ensures the compliance of covenants • Maintaining project accounts and project financial records • Reviews the reports submitted by the PMDSC with respect to detailed design, costs, safeguards, financial, economic, and social viability • Prepare, with the support of PMDSC, bidding documents request for proposals, and bid evaluation reports • Serves as point of contact with ADB and maintains project documents • Consolidates expenditures and prepare withdrawal applications for direct payment, reimbursements and use of advance account • Opens and manages advance account for ADB Grant • Organize project orientation for participating island councils • Establishment and maintaining of project website by disclosing progress reports, safeguard monitoring reports and design reports • Collect supporting documents and submit withdrawal applications to ADB via MOFT
PMDCSC	• surveys, studies and investigations; • concept design, detailed engineering and design; • bidding process support; • procurement and contract award; • construction supervision; • contract administration; • project management and monitoring; and • ensure compliance with social, environmental, and, occupational health and safety aspects.
Island Council	• Operators of solid waste services on outer islands • Responsible for management and O&M of Island Waste Management Centers • Monitors site in close cooperation with site engineers and environmental experts
Contractor	• complies with all applicable legislation, is conversant with the requirements of the EMP, and briefs staff about the requirements of same; • ensures any sub-contractors/ suppliers, comply with the environmental regulations of the EMP • provides environmental awareness training to staff; • bears the costs of any damages/ compensation resulting from non-adherence to the EMP or written site instructions;

	• conducts all activities in way to minimize effects on residents of the area, and the environment • ensures that its staff or engineers are informed in a timely manner of any foreseeable activities that will require input from the environment and safety officers (or equivalent); • appoints one full time environment and safety officer (or equivalent) for implementation of EMP • receives complaints from public and takes remedial measures

9.2.2 Capacities for Environmental Management

168 The regulatory body responsible for approving environmental impact assessments and issuing of permits is the responsibility of the Environmental Protection Agency (EPA), which has further responsibility for environmental research and conservation and development of facilities for waste, water supply and sanitation. This body is under the Ministry of Environment, Climate Change and Technology but funded and administered separately.

169 The EPA has few trained technical staff and the agency relies on external consultants for functions such as environmental monitoring for projects. The EPA clearly does not have resources for regular support to island councils and monitoring of their effectiveness in ensuring EMP implementation. The EPA will be reliant on the support of the PMDSC for overseeing EMP implementation.

9.2.3 Awareness Training on Compliance to Safeguard Requirements

170 The PMDSC will be responsible for ensuring compliance with safeguard aspects during the construction phase of the project. PMDSC will provide awareness material to the contractor. In addition to this training will be provided at the beginning of the works to the contractor. Afterwards periodical visits and monitoring will be held. The responsibility for further training during the operation will lie with the PACCB and PMU.

9.2.4 Institutional Arrangement During Operation and Maintenance

171 At the end of the construction, Island Council will take over the operation of the IWMC. Therefore, at the operation stage, island council will be the owner of the facility and will be responsible to implement the EMP during the operation and maintenance phase of the project. PMDSCS/PMU site engineers and environmental experts will be in close corporation with the island council during the process.

9.3 Impacts and Mitigation

172 Table 19 summarizes the potential impacts and mitigation measures in relation to location, construction and operation identified in the report.

Table 19: Environmental Management Plan

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Pre-Construction Stage					
Effects on surrounding seawater and marine ecosystems	Sea surrounding the IWMC	(i) ensuring that waste enters and leaves the IWMC on the landward side of the facility (ii) detailed design to include both a system for collecting and containing leachate from piled household waste awaiting collection and from composting and (iii) site security and management to be ensured by the island council. The measures must ensure no deterioration of water quality in the vicinity of the IWMC.	Project funds	Island council	MECCT
Odor and attraction to pests	Nearest residential area	(i) ensuring security, regular cleaning operations and maintenance takes place and (ii) planning of further developments of the reclaimed land such that receptors such as dwellings are not placed close to the facility, and preferably separated by a belt of trees or open space.	Island council	Island council	MECCT
Construction stage impacts					
Noise pollution and vibration	Nearest residential area	Identifying potentially affected households, providing information on operations, limiting construction activities to daylight hours, adhering to schedule, maintenance of construction equipment and vehicles in good operable order.	Construction Cost	Contractor	PMDCSC
Construction waste	IWMC area	All solid waste must be disposed of at the RWEMF/Thilafushi. Importation of any materials rated as hazardous under the Globally Harmonized System of Classification and Labelling of Chemicals to be subject to approval by PMDSC, which will be conditional on stating adequate arrangements for disposal. Prohibit burning of construction and/or domestic waste. Conduct site clearance and restoration to original condition after the completion of construction works.	Construction Cost	Contractor	PMDCSC
Release of silt	IWMC construction site	Excavated areas to be rapidly refilled on completion of works. Use of silt fences around temporary piles of excavated material. Avoid excavation in wet weather to the extent practicable.	Construction Cost	Contractor	PMDCSC

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Water pollution	IWMC construction site	Vehicles and plant are to be maintained in sound operable condition, free of leaks. The condition of vehicles and equipment will be periodically checked. Contractor to prepare and submit a plan for spill management, including provision of spill kits, training/briefing of workers on procedures on handling spills and allocation of responsibility within the contractor's team for ensuring that spill kits are available and that workers know how to use them.	Construction Cost	Contractor	PMDCSC
Vegetation	Proposed IWMC area	The trees proposed to be removed can be relocated. There is empty area just outside the land plot where the material storage is temporarily proposed.	Construction Cost	Island council	PMDCSC
Community health and safety hazards	IWMC construction site and immediate surrounds	Restriction of access to work site, warning notices to the public on hazards, barriers when warranted. If the workforce is sourced from an island with COVID-19 community spread, the workers must be tested negative for COVID-19 before the start of the construction work.	Construction Cost	Contractor	PMDCSC
Occupational health and safety hazards	IWMC construction site	Contractor to focal point for health and safety at site and to ensure regular briefing of construction workforce on health and safety issues. Adequate personal protective equipment to be provided to the workforce.	Construction Cost	Contractor	PMDCSC
Impacts During Operation					
Risks of loss of containers and contents	Dock area	O&M training to include instruction on maintenance of containers, loaders, cranes and vessels and sound operation including licensing of vehicle and plant operators and restrictions on operation during stormy weather	Training budget	Contractor	MECCT
Pests: Rodents and birds	IWMC area	Maintenance of site cleanliness, minimizing storage time for putrescible waste, provision of enclosures for putrescible waste. Introduction of home composting limits attraction of pests to IWMC site.	Operation Cost	Island council	MECCT

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Operator occupational health and safety	IWMC and dock area	Operators trained to recognize risks and hazards. Provision of personal protective equipment (Helmets, safety goggles etc.) Personal safety equipment issued and worn. Health and safety recognized as primary employer responsibility. Training carried out to operate equipment (balers, shredders etc.) Fire extinguishers will be provided as part of equipment.	Operation Cost	Island council	MECCT
Accumulation of waste due to delayed collection	IWMC area	Proper storage of waste within containers and use of machineries to reduce the volume of waste will allow IWMC to maintain capacity for up to 4-6 weeks in the case of a delay. Inform island council of the delayed collection so impacts can be addressed early.	Operation cost	Island Council	MECCT

9.4 Environmental Monitoring

9.4.1 Monitoring Plan

173 The design of the environmental monitoring system is based on an analysis of the key environmental performance issues associated with each stage of the project, set out in Table 20 below.

Table 20: Analysis of Environmental Monitoring Needs

Phase	**Key Environmental Performance Issues**	**Environmental Performance Indicator**	**Means of Monitoring**
Design/Preconstruction	Inclusion of mitigation measures in design/build and/or detailed design documentation and construction activities	Compliance with EMP design measures	Compliance monitoring
Construction	Adherence to provisions in the EMP to mitigate construction impacts	Compliance with EMP	Compliance monitoring
	Direct effects on communities from impacts such as accidental damage, dust generation, noise generation and safety	Views and opinions of communities	Community feedback Grievance redress mechanism
Operation	Effectiveness of IWMC, collection system and removal to RWMF	Cessation of practice of burning of waste, regular removal to RWMF, limited odor, effective pest control	Site observations Community feedback

174 Two areas of environmental monitoring are identified: compliance monitoring and community feedback, which are in addition to monitoring measures in the Design and Monitoring Framework for the project. These provide a means of gauging whether the stations operate more efficiently and with less loss of waste into the sea.

175 Compliance monitoring is required during detailed design and construction of the IWMC, to ensure that mitigation specified in the EMP is carried out to an adequate standard. Compliance monitoring is a function of the PMDSC and its cost of this monitoring is part of the running cost of the PMDSC.

176 Community feedback provides for the monitoring of environmental indicators gauged by public perception. Appropriate indicators are:

- Reduced incidence of nuisance of smoke from burning waste
- Clean area surrounding the IWMC
- Effectiveness of waste handling (regular collection and removal to RWMF)

177 Costs of environmental assessment and monitoring during construction are project costs. Environmental monitoring during operation is carried out by the island council, and costs will be met from O&M budgets prepared and managed by the island council.

Table 21: Environmental Monitoring Plan

Impact to be Monitored	Means of Monitoring	Construction Phase			Operation Phase		
		Frequency	**Responsible Agency**	**Indicative Annual Cost**	**Frequency**	**Responsible Agency**	**Indicative Annual Cost**
General Construct-ion Impacts	Comm-unity Feed-back	To be established by PMDSC	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Compliance with EMP	Inspections	As set up by super-vising engineers	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Occurrence of floating waste	Comm-unity Feed-back	To be established by PMDSC	PMDSC	To be determined in design ICT component of Project 1	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Groundwater quality	Conductivity, pH, salinity, temperature,	Every 6 months	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Noise levels	Decibels (db)	Every 6 months	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Waste generation	Amount of waste generate (tonnes)	Every 6 months	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Accidents	No. of accidents	Every 6 months	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Marine water quality (near the project site)	Conductivity, pH, salinity, temperature,	Every 6 months	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Inspection of leachate collection system	Inspection	Every 6 months	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost
Inspection of septic tank	Inspection	Every 6 months	PMDSC	Included in project management and consultancy cost	To be established by MECCT	Island Council in collaboration with MECCT	Operational Cost

9.4.2 `Reporting

178 EMP compliance monitoring will be undertaken by the PMDSC with the help of the contractor and island council. Effects will be monitored by means of community feedback and laboratory testing.

179 A detailed environmental monitoring report is required to be compiled and submitted to the EPA based on the data collected for the monitoring the parameters included in the monitoring plan given in the EMP. To facilitate monitoring and enable responses to emerging issues, quarterly reports will be prepared by the PMDSC and MECCT. These reports will also be provided to PMU and PMU would report to ADB.

180 The report will include details of the site, data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed.

181 The monitoring report main headings are as follows:

1. Introduction
2. Methodology
3. Parameters measured.
4. Analysis and Results
5. Conclusion

182 Monthly reporting will be carried out and these reports will be included in the detailed environmental monitoring report submitted to the EPA at the end of the construction phase.

9.4.3 Budget

183 To implement the components highlighted in Table above, provisional sum of 9,000 USD is estimated.

10 Recommendation and Conclusion

184 Developing an island waste management center in Thinadhoo is would improve the current waste management practices in the island. Developing an ISWMC and adopting the practices highlighted in this report will help to alleviate the current waste related environmental pollution and public health issues of the island. Managing an ISMWC will also induce economic benefits as it will generate employment opportunities in the island.

185 This EMP is prepared in accordance with the EIA Regulations of 2012 from EPA. Impact on the island terrestrial environment will be very minimal, very few vegetation will be removed. Most of the negative impacts of the project can be avoided or minimized if the mitigation measures provided in the report are adhered.

186 The overall finding of the EMP is that the Project will result in significant environmental benefits, as it is conceived and designed to address environmental issues associated with existing practices of poor waste disposal including open burning of household and food waste. It will not have significant adverse environmental impacts and potential adverse impacts are manageable through the effective implementation of the EMP.

187 No further environmental assessment is therefore required, beyond the issues to be reviewed during detailed design however this EMP must be updated to reflect the EIA process to be undertaken as part of the MECCT supported IWMC Implementation.

188 It is recommended to include this EMP report in the contract of the construction and operation contractors. This will bind the contractor with an agreement to implement the mitigation measures provided in the report and to conduct the monitoring highlighted in the report.

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Annex 1: EIA Screening Decision from EPA

Annex 2: Approved Location for IWMC

Annex 3: Site Location

Annex 4: Approved Concept Plan

Annex 5: Stakeholder Attendance

Annex 6: **HPA Quarantine Guideline**

Annex 7: **Groundwater Test Results**

Annex 8: **Atoll and Island Council Submission Receipt**

Annex 9: **Criteria for Planning and Design for Subprojects**

Annex 10: **Rapid Environmental Assessment Checklist**

Annex 11: **Grievance Redress Mechanism Complaint Form**

Annex 12: **Template for Monitoring Report**

Annex 13: **Detailed Tentative Project Schedule**

Annex 14: **IBAT Screening Report**

Annex 15: **Biodiversity Impact Assessment Report**

Annex 16: Technical Report