Environmental Impact Assessment

Document Stage: Draft
Project Number: 51077-003
March 2020

MLD: Greater Malé Waste-to-Energy Project – Waste to Energy Plant PART G

Prepared by Ministry of Environment of the Republic of Maldives for the Asian Development Bank.

Attendance - Focus Group Discussions 5

Following people were at FDG.

Name	Gender	Country	Contact
Shahid Haleem	M	Maldivian, Supervisor, Heavy Force	7902107
Hussain Fayaz	M	Maldivian, Excavator Driver, Heavy Force	7920107
Haithim	M	Bangladesh, Labourer, Heavy Force	
Sumon MD	M	Bangladesh, Labourer, Heavy Force	
Shibu bai	M	Bangladesh, Labourer, Heavy Force	
MD Suhail	M	Bangladesh, Labourer, Heavy Force	
MD Turaab	M	Bangladesh, Labourer, Heavy Force	
MD Suraab	M	Bangladesh, Labourer, Heavy Force	

Photos from the Focus Group Discussions 5

8 Focus Group Discussions 6

Venue: Waste Management Site at Thilhafushi, Maldives
Date: 1st September 2019
Time: 1230 hrs

A focus group discussion was carried out with the people working at Thilhafushi waste management site. The focus group discussion was held at WAMCO Office during their lunch time break hours. A total of 13 people participated in the discussion: 11 were Bangladeshi and two were Maldivian. All of the Bangladeshi participants are employed under work permit working at Thilafushi. Their work ranged from cook to excavator drivers. The two Maldivians worked in supervisory positions. Most of the group members has been living at Thilafushi for more than one year. The supervisors comes to Thilhafushi to work and return back to Male' in the afternoon. They take the public ferry to Thilhafushi.

The participants of the FGD were presented the Greater Male' Environment Improvement and Waste Management Project by Mr. Mohamed Asif, Social and Environmental Safeguards Specialist. Mr. Ahmed Jameel, EIA Consultant at Water Solutions provided the findings of the EIA to the group members. Colour Maps printed on A3 was used as aid to show the present situation of Thilafushi, the proposed Greater Male' Waste to Energy Project and bird eye view of Thilafushi after the completion of the project.

Everyone in the group are familiar with smoke issuing facing Thilafushi as they work at the waste management site on a daily basis. Most of the members of the group have bad experiences working in the smoking conditions. Some said, they get red eyes when they work and others said they get throat infection. Some say, they have to take sick leave on regular basis.

The members of the group said, the smoke from the dumpsite could be extinguish when they get additional heavy machineries to handle the waste and manage the dumpsite. The group felt that improving the waste management at Thilhafushi will improve the condition of people working at the island. All of the participants said they would be happy to continue to work at Thilhafushi when the dumpsite if properly managed. Some of the participants said they did not have any concerns of losing their job in the future, when the project is completed.

Closure

The meeting ended at 1300 hrs.

Attendance - Focus Group Discussions 6

Following people were at FDG.

Name	Gender	Country	Contact
Hazim Ibrahim	M	Maldivian, Assistant Manager, WAMCO	799146
Mohamed Asraf	M	Maldivian, Supervision, WAMCO	9908430
Mohamed Yoosuf	M	Bangladesh, Driver, WAMCO	
Sadir	M	Bangladesh, Driver, WAMCO	
Asadhul	M	Bangladesh, Driver, WAMCO	
Narayan	M	Bangladesh, Lorry Driver, WAMCO	
Oulal	M	Bangladesh, Labor, WAMCO	
Halim	M	Bangladesh, Cook, WAMCO	
Habib	M	Bangladesh, Lorry Driver, WAMCO	
Sohel	M	Bangladesh, Lorry Driver, WAMCO	
Sadik	M	Bangladesh Lorry Driver, WAMCO	
Muneer	M	Bangladesh, Lorry Driver, WAMCO	
Faisal	M	Bangladesh, Lorry Driver, WAMCO	

Photos from the Focus Group Discussions 6


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9 Focus Group Discussions 7

Venue: Thilhafushi, Maldives
Date: 2st September 2019
Time: 0930 hrs

A focus group discussion was carried out with the people working at the MTCC Boat Yard at Thilhafushi, All participants were male and their age ranged from 30 years to 50 years. The site is located directly north of the waste dumpsite at Thilafushi. The group mainly had Maldivian working at the site. Most of the members of the group had been working at Thilafushi for a long time. Some of the members in the group works and live at the site at Thilafushi. There was a high rate of job satisfaction amongst the workers. Their key reasons include high salaries, regular pay and good benefits such as food and accommodation. The group members said around 100 people work at Thilafushi site. The work at the site requires them to work outdoors all the time. Hence it makes very difficult during south west monsoon as most of the days the site is covered by the smoke. The

Most of them, especially the supervisors believed that the equipment in the Waste Management Section need to be upgraded immediately. The constant smoke from open burning, particularly during southwest monsoon when their site is directly in the path of the smoke plume, causes discomfort. Some workers said that they have got used to it and thus they no longer are able to understand its effects.

The participants of the FGD were presented the Greater Male' Environment Improvement and Waste Management Project by Mr. Mohamed Asif, Social and Environmental Safeguards Specialist. Mr. Ahmed Jameel, EIA Consultant at Water Solutions provided the findings of the EIA to the group members. Colour Maps printed on A3 was used as aid to show the present situation of Thilafushi, the proposed Greater Male' Waste to Energy Project and bird eye view of Thilafushi after the completion of the project.

Everyone in the group knows about smoke issuing facing Thilafushi as they see it every day which is across the bay on other side of their site. The group member said, the situation of smoke depends on the wind direction. If they have to work downwind, the situation becomes very difficult. Some days, they have to stop work because the smoke makes it impossible for them to work. Even when they come indoors, the smoke will fill the rooms and the smoke will come through the air conditioning unit. The group members said, urgently the smoke issue need to be addressed and better waste management need to implement at Thilhafushi. The group were brief that one of the activity of the project is to stop the smoke coming from the exiting dump and it will happen early next year. The group members said that because of the smoke and current situation at Thilafushi, they are unable to attract good talents and experience professionals to work at the boat building yard at Thilhafushi.

A group member said he have seen a number of cases where the workers get stick and he believes it is due to the smoke. Improve the situation at Thilafushi waste site with the proposed project will have a very positive impact on industries at Thilafushi. They would be able to improve their services by attracting good and experience professional to work at their site.

The group felt that improving the waste management at Thilhafushi will improve the condition of people working and living at the island. Everyone welcomes the project said they are hoping the implementation of the project would commence soon. They said they hope that the big stack at the new waste to energy plant will not have any visible smoke when it becomes operational.

Closure

The meeting ended at 1030 hrs.

Attendance - Focus Group Discussions 7

Following people were at FGD

Name	Gender	Country	Contact
Moahmed Husham	M	Maldivian, General Manager, MTCC	7773653
Abdulla Abdu Shakoor	M	Maldivian, Manager, MTCC	791220
Mohamed Rasheed	M	Maldivian, Engineer, MTCC	7785716
Mohmed Fahty	M	Maldivian, Engineer, MTCC	7747379
Iqbal	M	Maldivian, Engineer r, MTCC	7708026
Sameeu	M	Maldivian, Engineer, MTCC	7914961
Ghina	M	Maldivian, Engineer, MTCC	
Inrhaim Mohamed	M	Maldivian, Accounts Officer, MTCC	7795575
Abdul Shafeeu	M	Maldivian, Welder Supervisor, MTCC	7795575
Abdul Hussam	M	Maldivian, Senior Engineer MTCC	78397615

Photos from the Focus Group Discussions 7

10 Focus Group Discussions 8

Venue: Gulheefalhu, Maldives
Date: 2st September 2019
Time: 1130 hrs

A focus group discussion was carried out with the people working and living at Gulheefalhu. Gulheefalhu is an island which is located east of Thilafushi. The group mainly Maldivian working at Greater Male' Industrial Zone Limited. The group members said that they have been working at Gulheefalhu over many years. There was one member of the group who had work at Thilfushi waste management site before he joined Greater Male' Industrial Zone Limited. He said working at Gulheefalhu is very comfortable than working at Thilhafushi due to the smoke and difficulties related to the smoke. The group members said, Gulheefalhu is impact during south west monsoon on some days when the wind takes smoke over the island from Thilafushi waste dump site. Some of the group members comes to work at Gulheefalhu in the morning and leave to Male' in the afternoon. They take the public ferry to Male' from Gulheefalhu. Others live in Gulheefalhu.

The participants of the FGD were presented the Greater Male' Environment Improvement and Waste Management Project by Mr. Mohamed Asif, Social and Environmental Safeguards Specialist. Mr. Ahmed Jameel, EIA Consultant at Water Solutions provided the findings of the EIA to the group members. Colour Maps printed on A3 was used as aid to show the present situation of Thilafushi, the proposed Greater Male' Waste to Energy Project and bird eye view of Thilafushi after the completion of the project. The group were briefed that when the Greater Male' Waste to Energy project is implemented and the facility is operational in 2022/2023 there will be no emission from the stack of the incinerator.

Everyone in the group knows about smoke issuing facing Thilafushi. The group members said, urgently the smoke issue need to be addressed and better waste management need to implement at Thilhafushi. The group member said they have seen a number of development near the waste dumpsite but the small incinerators that were installed at the site was a waste of money as it is not been used. The group was informed that those incinerators would be moved to other islands as these were installed temporarily.

A member of the group asked whether it is safe to fish from the Gulheefalhu house reef. The EIA consultant explained no government agency, including Health Protection Agency, Environmental Protection Agency or Marine Research Center has issued any notice restriction of fishing at the Gulheefalhu or Thilhafushi House reef. It has been general practice that no fishing would be carried out from the reef nest to the waste dumpsite. Hence it would not advisable to fish from such reefs. The test carried out by the EIA team has not seen an increase of heavy metals in sediments and marine water that was sampled for the study.

The group felt that improving the waste management at Thilhafushi will improve the condition of people working at Gulheefalhu. Gulheefalhu is a nice place to work, but the work condition gets deteriorated on some days because of the smoke from Thilafushi.

Closure

The meeting ended at 1200 hrs.

Attendance - Focus Group Discussions 8

Following people were at FGD.

Name	Gender	Country / Office	Contact
Ahmed Faisal	M	Maldivian, Greater Male' Industrial Zone	9930909
Mohamed Ziyaad	M	Maldivian, Greater Male' Industrial Zone	7912228
Mohamed Adil	M	Maldivian, Greater Male' Industrial Zone	7741234
Sheer Ahmed	M	Maldivian, Greater Male' Industrial Zone	9558184
Ahmed Ihrish	M	Maldivian, Greater Male' Industrial Zone	9724819
Ibrahim Razee	M	Maldivian, Greater Male' Industrial Zone	7743049
Hassan Saeed	M	Maldivian, Greater Male' Industrial Zone	7753347

Photos from the Focus Group Discussions 8

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Ministry of Environment
Male', Republic of Maldives.

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ދާދި، ދިވެހިރާއްޖެ.

Minutes of the Meeting

Meeting Title: Public Consultation for Environmental Impact Assessment (EIA) of Regional Waste Management Facility
Date: 28th October 2019
Location: MNU Auditorium

Participants:

- Ministry of Environment (ME) -
  - Ibrahim Zameel — Project Manager
  - Mohamed Asif — Social and Environmental Safeguard Specialist
  - Sham'aan Shakir — Information Education and Communication Specialist
  - Hana Farook — Assistant Project Coordinator

- Waster Solution- EIA Consultant
  - Ahmed Jameel — EIA Consultant

- *Other* Participants
  - Fathimath Rishana
  - Abdullah Adam
  - Ahmed Mohamed
  - Adam Isham
  - Humaida Abdul Gafoor
  - Ahmed Afrah Ismail
  - Mariyam Mohamed
  - Juma Ahmed
  - Aleef Naseem
  - Hoodh Ahmed
  - Mohamed Rasheed (Bari)
  - Abdul Aleem

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Ministry of Environment މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް

Male', Republic of Maldives. މާލެ، ދިވެހިރާއްޖެ.

Points presented:

- Overview of the Project
- Results of the Environmental Impact Assessment of the Regional Waste Management Facility

Issues raised *and response:*

Timing and venue of the public consultation

- Some of the participants raised concern that the timing of the public consultation was not ideal as it falls within the official working hours. A participant also suggested that the University Auditorium was not ideal and that the closed space would discourage people from attending the public consultation. It was suggested that future public consultations should be held after the official working hours in the evening and at a public space such as the "Jumhooree park" to encourage more people to attend.
  - *ME informed that the points mentioned would be taken into consideration for future public consultations*

High-level Technology fund

- A participant inquired what was meant by the high-level technology fund
  - *ME informed they would clarify and inform later. Towards the end of the discussion it was informed that a High-Level Technology Fund is a multi-donor trust fund that provides grant financing to encourage more widespread adoption of high-level technology (HLT) to address development challenges in ADB's developing member countries*

Capacity building

- A participant inquired since there is capacity building in phase 1, what was already being done to acquire information
  - *ME informed that a firm would be hired for capacity building activity and that that the firm would be working throughout the project to build the capacity of the community.*

Involvement of Women.

- A participant inquired why involvement of women was specified in awareness raising.
  - *ME noted that the project aims to increase the involvement of women throughout the different activities planned in the project and as such even the committee under the Grievance Redress Mechanism also specifies that the president of the island's women's committee be included. Women had been involved in all stages of the project development.*

Reduction of Waste

- A participant inquired the plans to reduce waste. Another participant added that instead of incinerating, the solution would be to reduce wast, and decrease the import of items that would create waste.
  - *ME informed that under the project there were plans to increase community awareness with regard to waste reduction. The EIA consultant added that there would be a focus on 3R under the community awareness and behaviour change strategies.*

- A participant raised concern that incineration was being used as the solution to reduce waste and stressed that incineration and re-using the 'gunk' from the incineration plant was not the solution.

  - *In the management of waste, even after carrying out successful waste reduction strategies, there will be residual waste that need to be treated and disposed. Incineration has been recommended as an optimum technology for the Maldives. ME informed that the bottom ash could be utilised for road development and that currently a feasibility study was being undertaken.*

- A participant inquired if the government's pledge to reduce waste to 3 percent would have an impact on the operation of the plant.
  - *The proposed waste management strategy had taken account to waste reduction strategies. The proposed system would have no impact with current change of policy to ban the use of single use plastic by 2024.*

Public involvement for the whole project

- A participant raised concern that the public consultation was only for the regional waste management facility and not for the whole project.
- Moreover, it was added that public involvement should have been at an earlier stage, before incineration was chosen as the way forward to manage waste, as it is similar to the World Bank waste management project in Vandhoo which had failed.
  - *ME noted that the waste management project for Zone III has been formulated based on the lesson learnt from the Vandhoo Project. Vandhoo project was s a Design and Build project, and the project had failed because the operator of the facility was different and the Government took a while to handover the facility to WAMCO to run the facility. The current project for the Zone III is a DBO, Design, Built and Operate, building on the lessons from Vandhoo case..*
- A participant added that they were not aware of the level of consultations which had taken place with regard to the project. And that since all government infrastructure development projects (such as the Gulhifalhu Reclamation, development of resorts on shallow, development of harbours in the islands) are related, it needs to be considered, and Mministries and other big companies needs to consulted before undertaking such a project.
  - *ME informed that stakeholder consultations had taken place at all the stages of project formulation from feasibility to EIA. During the feasibility stage, stakeholders were consulted and stakeholder meetings were held. During the designing stage of the project, stakeholders were consulted. Various stakeholders and communities meeting were held for the EIA for this project in the past 24 months. During these meetings, relevant ministries, resorts and companies had also been invited to participate in the stakeholder meetings and workshops.*
- Many participants suggested that a multi sectoral discussion should be held for the consultation to be more meaningful. It was also noted that the outcome of the stakeholder meetings was not known to the public.
- A participant inquired how much the comments received from the public would be incorporated. Another participant also inquired if the minutes of the meeting would be available.
  - *ME informed that the project formulation has been guided by the inputs from stakeholders in different stages of the project. The minutes of the consultations will be included in the EIA*

Sustainability of the project

- A participant inquired how the project aligns to the SDG goals 1,2,3. He also added that the project had no engagement of the community. He also stressed that civil society should be part of the project instead of creating mega-companies. He also questioned if such a project would be financially sustainable and the dollar value of the cost to the community. He also inquired how the project would affect the human capital and enhance human development. He also drew

examples of the Male' Sewerage Project which in his opinion had failed and did not work as designed, because there was no proper oversight from the regulator of the company.. He also highlighted that a gap between the design, installation and operation of a project could affect the sustainability of the project, thus a systematic approach would be needed. Another participant also questioned if the approach was sustainable.

  - *ME noted that the various stakeholders including NGOs and Civil Society groups has been engaged in the project development. The project aims to build the overall institutional capacity in the country. And as such, improving the institutional capacity of EPA is a priority. Moreover, since it's a DBO (Design Build Operate) project, the operational issues would be minimized and local capacity would be developed before the operation is handed over to the Ministry/WAMCO at the end of the DBO period.*

- A participant inquired if ME could assure that project would be sustainable and the sustainability plans of the project. Similarly, another participant also questioned the sustainability of the project and inquired if all these aspects had been considered.
  - *ME informed that lessons from similar projects were being considered, and feasibility studies were undertaken to ensure the project was viable.*

No solution for bottom ash

- A participant raised concern that there was no solution for the bottom ash produced from the WTE facility. And stressed that before the project starts there should a proper way for it to be utilised as currently its only a study which is being undertaken.
  - *EIA consultant briefed that currently there is work going to study the alternative uses for the bottom ash. Presently the study is being focused to use the bottom ask on the production of paving blocks and other similar kind of use in the construction industry. It was also noted that a key objective of the project is to address the waste issue in Thilafushi.*

Producer responsibility and consideration of other government projects

- A participant inquired about the details of the grant and loans and suggested that producers should take responsibility of the waste they generate, and if not, it would be a misusing state funds. As such, she highlighted that resorts are one of the biggest generators of waste and that currently waste from all resorts are being taken to Thilafushi. Thus, the participant questioned how thoroughly the project had considered all these issues, and stated that the project seems like a reactionary project and a band-aid solution. She also inquired if the increasing number of resorts and other infrastructure projects had been considered. Another participant also inquired if the population growth in the Greater Male' region had been considered.
  - *EIA consultant briefed the waste to energy facility for the zone III is being financed by ADB through a grant/concessional loan. Resorts bring the waste to Thilafushi because current regulations requires the waste from the resorts to be brought to Thilafushi for disposal. The feasibility considered that waste generated from the resorts in the zone III would be brought to Thilafuishi for treatment and disposal. WAMCO will be collecting the waste from the resort and the resorts will pay collection fee to WAMCO which includes the cost of treatment/disposal. The feasibility study considered the populations in the zone III, including the planned increase of resort beds in the region.*

EIA

- A participant also informed that they had been requesting for the EIA and was yet to receive it. Another participant also questioned the results of the EIA, as the participant stated that Thilafushi was dead in terms of bio-diversity thus the results were questionable.
  - *ME informed that the EIA would be shared once the EIA is finalised. It was mentioned that the EIA and annexes including the studies that is part of the EIA would be made available at the ADB website soon for comments. It would be made available on the*

website for a period of 3 months. EPA would also publish it on their website, once the ME submits the final EIA to EPA.

Inefficiency and ineffectiveness of ME and EPA

- Participants raised concern over the ineffectiveness of Ministry of Environment and the Environmental Protection Agency. It was noted that they do not hear back from the organisations in a timely manner for other matters that they have contacted to those institutions. It was also noted that EPA should have the capacity monitor air emission levels from the project.
    - *PM noted that the project would response on any queries regarding this waste project. ME noted that part of the project is to build the capacity of EPA and strengthen institutional capacity to monitor the air pollution emissions. Air pollution emission stations are recommended to be established at Thilafushi to monitor the impacts of stack emission on Thilhafushi.*

Other waste

- A participant inquired how hazardous waste, medical waste, construction and demolition waste, and end of life vessels would be handled at Thilafushi when this project is completed.
    - *ME noted that all the hospitals and health care facilities are required to have autoclaves to treat the medical waste before it is send to Thilhafushi for treatment and disposal. The proposed facility can manage the hazardous waste in the household. The facility would store any other hazardous waste received. The facility can receive end of life vehicles. ME noted that the facility at Thilhafushi is a municipal solid waste incinerator facility. Government is developing another facility to treat hazardous waste.*

Terms of Reference

Greater Male Waste-to-Energy Project

Project Management, Design and Construction Supervision (PMDCS) Consultant

A Background

1. The Greater Malé capital region and its outer islands (classified as Zone 3 in the national solid waste management policy) suffer from severe environmental pollution and deteriorating livability because of inadequate collection and haphazard disposal of solid waste. Zone 3 covers 35 inhabited islands, 73 tourist resorts, 14 city hotels, and 177 guest houses, in the North Ari Atoll (Alifu Alifu Atoll), South Atoll (Alifu Dhaalu Atoll), Malé' Atoll (Kaafu Atoll) and Vaavu Atoll, including the capital city of Malé, with a total population of 216,000 (51% of Maldives). Lack of a sustainable system to manage the 774 tons per day (tpd) of solid waste generated in Zone 3 (results in waste spillage into the ocean, and open dumping and burning of garbage at the 30-year old 10-hectare dumpsite on Thilafushi Island which has no pollution control measures creating a public health and an environmental hazard.[1] Plumes of smoke visible from the capital Malé, the international airport and nearby resorts compromise air quality and pose nuisance to residents and tourists, while leachate and plastics contaminate the surrounding marine environment.

2. The Government of Maldives is committed to improve the environmental conditions and to strengthen the solid waste management (SWM) system in the country. For Zone 3, the government plans to develop a sustainable regional waste management facility on a newly reclaimed 15 ha land on Thilafushi island adjacent to the current dumpsite. The facility will include a 500 tons per day waste to energy treatment plant (WTE) including a bottom ash processing plant, a landfill for air pollution control (APC) residues and bottom ash including leachate treatment plant. The facility will be developed through a Design-Build-Operate (DBO) Contract (the "Contract") pursuant to the FIDIC Gold Book, with design and build period proposed to be financed by the Asian Development Bank (ADB), Asian Infrastructure Investment Bank, ADB's Japan Fund for Joint Crediting Mechanism, and the government under the Greater Male Waste to Energy Project (the project). The government will cover the cost for the 20 years operation period. The project will mitigate greenhouse emissions and will be registered as joint crediting mechanism.

3. A shortlist of pre-qualified firms was finalized in fourth quarter 2019 and invitations for bids for the DBO contract is expected by December 2019. The DBO Contractor (the "Contractor") will be awarded in the fourth quarter of 2020, with the facility to be commissioned within 3.5 years after the notice to proceed. Included in the scope of the Contractor is design, build and operation of the facility, and also preparation of the permitting application for the construction and operation of the WtE plant. The volume of the design-build (DB) component of the DBO Contract is expected to be around $120 million.

4. The WTE facility will receive waste that is collected in Zone 3 and transferred to Thilafushi Island. Collection and transfer of solid waste is not part of the Contractor's scope. Besides this waste, a stockpile of baled waste that is generated in the transition phase after closing the dumpsite and the commissioning of the WTE will also be incinerated.

[1] The population is expected to grow to 300,000 within the next five years. In 2022 the expected generation of municipal solid waste (MSW) of residents, commercial and industrial entities and institutional bodies is approximately 115,000 tonnes which is complemented by another 70,000 to 100,000 tonnes of construction and demolition waste. Breakdown of solid waste by type: construction and demolition = 530 tpd (68%), household = 149 tpd (19%), resort = 48 tpd (6%), commercial = 27 tpd (3%), airport = 9.3 tpd (1.2%), industrial = 6 tpd (0.8%), market = 2.5 tpd (0.3%), hazardous = 1.5 (0.2%), and end-of-life vehicles = 0.65 tpd (0.1%). Source: Government of Maldives, Ministry of Environment and Energy. 2018. Feasibility Study for an Integrated Solid Waste Management System for Zone III (including Greater Malé) and Preparation of Engineering Design of the Regional Waste Management Facility at Thilafushi. Malé

5. The Ministry of Finance (MOF) is the executing agency while Ministry of the Environment (MOE) is the implementing agency. MOE will own and be in charge of the WTE facility operations. The state-owned Waste Management Company Ltd. (WAMCO) or other contractors will be the supplier of waste to the WTE facility. The Environmental Protection Agency (EPA) is responsible for regulatory activities for waste management and pollution prevention. The State Electricity Company Ltd. (STELCO), Greater Malé Industrial Zone Limited (GMIZL), Ministry of Planning and Infrastructure and Malé City Council are relevant stakeholders.

6. With respect to the FIDIC terminology, MOE will be the Employer.

Further information

7. The Greater Male Waste to Energy Project will complement the ongoing Greater Male Environmental Improvement and Waste Management Project (GWEIWMP), assisted by ADB $33 million grant. GWEIWMP supports (i) solutions for immediate control of nuisances from Thilafushi Island dumpsite and interim measures to manage the incoming waste until a new treatment facility is commissioned (e.g. baling of municipal solid waste); (ii) development a construction and demolition (C&D) waste treatment plant; (iii) island waste management centers in outer islands; and (iv) installing an appropriate collection and transfer system in Malé and other islands/resorts in Zone 3, including transfer stations in Malé and Villimale, (v) construct a disassembling plant for end-of-live vehicles, (vi) institutional capacity building and public awareness in sustainable SWM and reduce, reuse and recycling.

8. The state-owned Waste Management Company Ltd. (WAMCO) operates the waste collection in Malé, Hulhumale and Villimale and dumps waste on a dumpsite on the island of Thilafushi. On inhabited islands, the islands councils are in charge of collection and basic disposal. WAMCO took over the operational responsibility for waste management in December 2015.

9. The government also plans to i) rehabilitate the existing dumpsite in Thilafushi and ii) develop a transfer station in Hulhumale. The dumpsite rehabilitation invitation for bids is expected in the fourth quarter of 2020 or first quarter 2021. These two components are proposed to be financed on a parallel basis by the Islamic Development Bank.

B Objectives of the Assignment

10. To successfully implement the Greater Male Waste to Energy Project through high quality management, design and construction supervision, the government (executing agency and implementing agency also referred as the Client) will require the support of a professional engineering and management consulting firm (“the Consultant”). The firm will assist in the delivery of the different project components, which include the design, construction and initial operations (including capacity building of EPA and Employer in monitoring operations) of WTE facility and associated landfill of air pollution control residuals and non-marketable incineration bottom ash.

11. The Consultant will act as Employer’s Representative (ER, FIDIC Gold Book) during the design and build period and the first two years after the successful commissioning of the WTE plant (operation period).

C Scope

12. The Consultant's scope evolves from the roles and responsibilities stipulated in the relevant general conditions of the FIDIC Gold Book.

13. The Consultant is expected to provide inputs relating to the conceptual and detailed engineering and design reviews, construction supervision and contract administration, project management and monitoring, cost control, ensure compliance with social, environmental, occupational health and safety aspects, amongst others, provide capacity building support but not limited to the following:

    i. Ensure that the facilities and the equipment are designed according to the Employer's Requirements that are part of the DBO Contract;
    ii. Supervise, monitor and control the progress of design and construction of the WtE facility and the ancillary components in sufficient detail by, for example but not limited to, design reviews, inspection of manufacturing and construction sites, site meetings etc., as necessary and stipulated in the relevant contracts;
    iii. Monitor and manage any occurring interface during the construction activities of the Contractor and the contractor carrying out the dumpsite rehabilitation and minimize their impact on the timeline of the Project;
    iv. Supervise the construction of the new landfill and validate the bottom liner system construction Quality Assurance/Quality Management;
    v. Monitor and control the construction activities to minimize their environmental impact;
    vi. Monitor and control the commissioning and trial run operations including the tests on completion of the design-build period of the WtE plant including all ancillary facilities;
    vii. Support the Employer during processing of claims and invoices submitted by the contractors;
    viii. Assure that the contractor complies with relevant ADB safeguard standards;
    ix. Instruct and train the Employer's and EPA's staff in performance analyses and monitoring related to statutory compliance and to the performance guarantees of the WtE plant and its ancillary facilities;
    x. Draft a Joint Crediting Mechanism (JCM) methodology and support the Employer in registering the WtE facility for the GHG emission reductions;
    xi. Support the Employer during the first two years after of operation after issuing the commissioning certificate to monitor and review the performance of the DBO facilities.

D Responsibilities and Deliverables

14. The overall responsibility to deliver the outputs will rest with the consulting firm through the Team Leader/Project Manager. The Consultant will ensure timely delivery of the documents, establish coordination among all stakeholders and within the team members of the Consultant, scheduling mobilization/demobilization of team members and to interact with the Client on regular basis and as needed.

D.1 Project Management

15. Project management, control and monitoring responsibilities and tasks the Consultant will assume are as follows:

    i. Plan and manage the project, and assist the Employer on the project management, including risk management, cost control, scheduling, monitoring, auditing, reporting, and compliance monitoring for the project required under both the government and ADB rules

and guidelines;

ii. Review, comment and, if required, approve the Contractor's programs that are to be submitted including all pertinent activities and work packages, analyze critical paths, responsibilities and functions assigned and flag any time and cost over-run if required;
iii. Prepare a work programme for each of the Consultant's team members in line with the Contractor's schedule;
iv. Establish, coordinate and manage the information exchange between the Consultant, Contractor and the Employer and, as the case may be, other Project stakeholders;
v. Attend meetings necessary to manage the Project, prepare minutes and control the outcomes decisions taken;
vi. Establish a document control and proper filing system for project offices, including official correspondence, drawings, site instructions, variation orders and site records;
vii. Monitor open topics, claims of the Employer towards the Contractor, defects to be rectified, potential malfunctions of equipment etc. and track solutions to be implemented;
viii. Review and recommend on the Contractor's claims for progress payments;
ix. Review and examine the Contractor's requests for variation orders, extra items, new rates, claims for time extension and extra payment, filed by the contractor etc. and submit recommendations for approval, if appropriate;
x. Develop and implement procedures for timely payments to the Contractor and monitor for compliance;
xi. Assist constructively and submit recommendations in resolving any potential difficulty or dispute that may arise between the Contractor and the Employer;
xii. Prepare essential reports and documents including quick report on progress, quality, disbursement or any other relevant matter as may be required by the Client, Employer or the ADB and other funding institutions;
xiii. Assist the Employer in conducting regular meetings with all stakeholders, Contractor, and other government entities, etc., to discuss progress and issues related to implementation, and prepare minutes for recording and circulation;
xiv. Establish all necessary records and the procedures of maintaining/updating such records for each package and component of the Project;
xv. Assist on liaison with local authorities and government agencies, liaison with ADB and other funding institutions. Assist the Client/Employer in reporting to these institutions;
xvi. Review all proposed sub-contractors and verify their insurance, performance bond and collateral warranty or hereto relating parent company guarantees;
xvii. Assist the Client in ensuring compliance with all loan covenants during Project implementation and assist in reporting towards the funders.

16. Besides the responsibilities above, the Consultant will work closely with the Employer's project management unit by sharing relevant and requested information.

D.2 Review of the Design of the DBO Contract Components

17. The Consultant's responsibilities with respect to the design stages will include the review and approval of the proposed designs (submitted by the Contractor) including concept, detailed and works designs.

18. As per DBO Contract, the detailed design will be provided in packages to facilitate an appropriate design progress to develop the WtE facility and the residual waste landfill including permit application within 3.5 years. The Contractor may apply Building Information Modelling (BIM) to facilitate a smooth design and construction.

19. The Consultant's scope will include, but is not limited to, the following:

i. Review the design program of the Contractor with respect to feasibility, critical paths, achievement of milestones etc.
ii. Agree with the Contractor on the format and content to be delivered during the design stages, such as concept, detailed and works design, to achieve a timely delivery of the works included in the contract package;
iii. Assist the Employer in facilitating the Contractor to obtain the permit upon due consultation with the EPA, Ministry of Planning and Infrastructure, and key authorities or stakeholders;
iv. Agree with the Contractor on a defined conceptual design status in line with the milestones as per contract to limit variations during later design and construction stages;
v. Review, examine and, if required, approve during the different design stages (concept, detailed, works), drawings, design reports, calculations, technical specifications of equipment and materials etc., in due course as per phasing requirements that are stipulated in the DBO Contract;
vi. Check the design towards the functional and design criteria and specifications, H&S and environmental aspects, operability matters, flood and storm resilience, product quality and the supply chain to be established;
vii. Arrange and manage design review meetings in Malé to expedite and to facilitate a smooth design review;
viii. Monitor the design progress and inform the Employer about any deviations and potential delays;
ix. Suggest design changes if necessary and advise the Employer on these changes and potential cost and schedule implications by furnishing appropriate reports. In the event costs have to be borne by the Contractor, advise the Employer accordingly;
x. Review and, if needed, approve the contractor's method statements, site organization arrangements, utilities, shipment plans etc.;
xi. In the event procurement/manufacturing is carried out during the design stage, inspect or coordinate the inspection of manufacturing of critical components of the WtE plant as per contractual provisions incl. the review of certificates, technical specifications and workmanship;
xii. Check the hazard and operability (HazOp) analyses and hazard area classification drawings;
xiii. Review, comment and, as the case may be, approve the plans and documents the Contractor has to submit during the design-build phase, such as, but not limited to, operations and maintenance plan, the Contractor's environmental management plan (CEMP), quality management and assurance plan, the H&S plan, residual waste and landfilling plan, the programme on tests on completion of design-build, etc.; and
xiv. Ensure disaster- and climate-resilient features are incorporated in the final designs.

D.3 Construction Supervision

20. The Consultant will:

i. Review method statements, work drawings and construction methodology for their correctness and adequacy prior to the start of works, report findings and propose/recommend modifications or corrections to any defect or omissions and issue for execution; monitor impact and report on physical progress of the works and financial disbursements;

ii. Maintain sufficient site-based staff, with clear allocation of duties, to monitor, inspect and closely follow up the day-to-day construction activities in line with the timely requirements of the construction works;
iii. Maintain daily records of execution progress in an appropriate format to be shared with the Employer;
iv. Co-ordinate with all stakeholders to achieve timely completion of contractual obligations on the part of Contractor and the Employer;
v. Review any upcoming design changes in the course of the construction and advise the Employer on potential cost and design/construction schedule implications;
vi. Monitor the Contractors' performances against the stipulated milestones and the agreed project progress, furnish an updated list of open topics and advise the Employer about any expected or unexpected delay and potential cost implications;
vii. Check the adequacy and quality of the Contractor's input in terms of material, equipment & machinery, personnel and safety arrangements prior to commencement of the works and periodically during the construction activity;
viii. Inspect and control the executed works and the supplies of equipment to be in compliance with the approved work drawings (design for construction) and with the Employer's Requirements;
ix. Review, inspect and/or coordinate the review and inspection of manufacturers of major and critical components and their manufacturing sites pursuant to the Contract provisions with respect, but not limited, to certificates evidencing skills and experiences of workers, documented and certified materials used, technical specification of (sub)components embedded, the general workmanship and the final product quality;
x. Monitor the assembly of components and its progress towards expected milestones;
xi. Agree with the Contractor on the test programme prior to completion of the design-build, attend the tests, review the test reports and endorse test certificates;
xii. Review and approve the as-built-documentation and, as the case may be, request changes prior to acceptance;
xiii. Record and follow up on defects identified during the design-build period and ensure that all defects are remedied within the time stipulated;
xiv. Scrutinize the quality assurance system and quality control plan of the Contractor, prepare quality compliance and progress reports;
xv. Support and assist the Employer in Contract administration and compliance with contractual conditions and ADB's Project Administration Manual;
xvi. Support the Employer during the processing of payment and claims providing any necessary input (such as measurement of works progress, judgement and information concerning milestone achievements, acceptance of variation orders, deduction of retention money);
xvii. Assist the Employer in forecasting the progress of works and finalization of periodic targets for the expenditure and disbursement.

D.4 Commissioning Supervision

21. Responsibilities of the Consultant related to commissioning of the DBO contract components will include:

i. Maintain a sufficiently staffed and skilled team to keep up with the responsibilities assigned during the commissioning period including the demonstration of performance guarantees that were defined in the Contract;
ii. Support the Contractor, as far as required, to obtain the necessary permits to conduct

the commissioning activities;

iii. Assist the Employer in making available the required amount of waste prior to the tests on completion of the design-build;
iv. Review and approve the Contractor's test programme on the completion of the design-build and agree with the Contractor on a final programme;
v. Request to commission parts and sections of the works if need be;
vi. Attend and monitor the commissioning tests (incl. pre-commissioning) and trial operations including the tests on completion of design build to demonstrate the performance requirements, standards and guarantees;
vii. Furnish commissioning attendance protocols and highlight issues that might affect the scheduled tests on completion of design build;
viii. Review the test reports on completion of design-build and make necessary comments and adjustments, and, in the event of failure of the tests, request the Contractor to conduct a retest;
ix. Support the Employer during any claims related to the commissioning period;
x. After due consultation with the Employer, issue the commissioning certificate upon successful completion of the test on design build;
xi. Summarize the performance of the facilities being tested and give necessary instructions to the Employer and the EPA relating the performance monitoring and the compliance measurements.

D.5 Environmental and H&S Components

22. Responsibilities related to environmental, occupational health and safety are:

i. assist PMU in meeting requirements of ADB SPS and government on environment, occupational health and safety, and labor standards.
ii. assist PMU in obtaining all necessary permissions and complying with statutory requirements;
iii. ensure Contractor submits requirements per EMP and government clearances/permits,
iv. provide support to Contractor in preparing the Contractor's EMP (CEMP) to ensure ADB SPS and conditions in government clearances are incorporated accordingly;
v. assist PMU in updating the EIA for any change in scope, design, location, or unanticipated impacts that are not reported in the EIA;
vi. review any changes in the Contractor's design and support PMU in ensuring environmental assessment, impacts avoidance and mitigation measures are reflected in the CEMP and updated EIA
vii. assist the Contractor and the PMU in all EPA related clearances, and ADB's no-objection, and monitor and control construction and assembly compliance against the updated EIA, ADB's safeguards policy statement (2009), and CEMP;
viii. monitor the contractors' compliance with all safety requirements as stated in DBO contract and CEMP, during and prior to any construction activity.
ix. assist in preparation of accident report and keeping accident records on-site as required;
x. monitor the implementation of the CEMP during construction and pre/post construction phases;
xi. assist PMU in continuing stakeholders engagement, consultantations, information disclosure and addressing complaints/grievances;
xii. develop public awareness program and materials to support wider understanding of

the project, potential impacts and measures to ensure impacts are avoided, mitigated and affected people, if any, are compensated;

xiii. assist PMU in preparation of environmental monitoring reports
xiv. coordinate with external environmental experts on results of independent monitoring and support PMU to prepare corrective actions, if required
xv. provide and organize trainings/workshops/seminars on environmental safeguards, occupational health and safety, and labor standards
xvi. assist PMU in review of contractor's health and safety program and in monitoring its implementation
xvii. support PMU during ADB review missions
xviii. support PMU in developing data management system on environmental safeguards; and
xix. other tasks related to environmental safeguards, occupational health and safety, and labor standards

D.6 Capacity Building of EPA and the Employer's Personnel

23. Given the limited capacity of both the Employer's and EPA's staff to monitor the facility, the Consultant will provide training for the eligible MOE and EPA staff. The timing of the training activities will be aligned with the construction progress and the visits during the Operation Service Period to provide a firm understanding of the built facilities. The waste supplier's personnel will be included as far as necessary.

24. The Consultant's scope will cover the following aspects:

i. Prepare a training program for the Employer's and EPA's staff on monitoring the WtE plant and its ancillary facilities with respect to environmental compliance and best operational performance;
ii. Conduct induction training for the Employer and EPA amongst others on the following subjects relating the design:
    a) Technical design and construction characteristics of the WtE plant built and its ancillaries, particularly the furnace, boiler, turbine and APC system, landfill and leachate treatment;
    b) Continuous emission monitoring systems, its functionality and calibration;
    c) Access to the Plant Information Management System PIMS);
iii. Instruct the EPA and the Employer's staff on relevant H&S aspects, such as
    a) Fire hazards, safety, fighting and alarm system;
    b) Operating highly pressurized vessels;
    c) Handling chemicals, dust and toxic substances;
iv. Detail the operations and maintenance of a WtE plant, amongst others:
    a) Input control and fueling according to stoker capacity diagram and the hereto relating bottle necks (boiler, turbine, bottom ash quality etc.)
    b) Bunker management and mixing of waste for a steady state operations;
    c) Function and malfunction of the CEMS and how to detect those;
    d) Use of the SCADA (or DCS archives) and the interfaces to SCADA via the PIMS for a constant access of data;
    e) Necessary down times for inspection, revision or overhaul and typical annual maintenance schedule (incl. expenses) and its consequences towards the waste delivery;

v. Monitoring the facility is regarded as a primary task of both EPA and the Employer which makes it necessary to enhance the capacity in the following subjects:
   a) Reporting requirements towards the contractor;
   b) Scrutinizing regular reports, e.g. by assessing throughput, steam generation and flue gas volume vs. backwards calculated calorific value;
   c) How to utilize the access to archived SCADA data and to online data via the PIMS;
   d) Calibration records of essential components (weighbridge, crane scales, CEMS);
   e) Operational meetings on the facilities performance;
   f) Solving any potential conflicts prior to arbitration and what to tolerate and where to intervene.

vi. Contract management, such as performance guarantees and damages mechanisms, asset replacement fund utilization, milestones, timeframes for payments, dispute resolution etc.;

25. The training will be complemented by appropriate visits of the construction site and the operating plant to facilitate a better understanding of the characteristics of relevant components that are of a particular importance for EPA and the Employer (such as the continuous emission monitoring system, the APC system, the residue handling etc.).

D.7 Operation Service Period

26. The Consultant will be responsible within the first two years after issuing the commissioning certificate of the WTE facilities and components to assist the Employer to monitor and control the Contractor's performance amongst others in the following areas:

i. Follow up on a timely remediation of defects after issuing of the commissioning certificate and scrutinize the Contractor's final claim for reimbursement of the retention money as per DBO contract provisions;

ii. Assist the Employer in inspecting the facilities and reviewing their performance using the relevant data as per SCADA records or any other records to be made available by the Contractor with respect to
   a) the waste delivery (quality and quantity) and performance of WAMCO's C&D waste processing unit,
   b) the compliance to statutory requirements,
   c) the performance parameters and guarantees as per DBO contract,
   d) the production and quality of bottom ash and prospects of the bottom ash marketing;
   e) the production and contract compliant landfilling of APC residues;
   f) the consumption of supplies;
   g) scheduled down-times of the facility;
   h) the envisaged and applied maintenance;

iii. Suggest appropriate measures (e.g. within the DBO contract) in the event the Contractor fails to meet performance standards/guarantees;

iv. Advise the Employer of any issues identified during visits and suggest rectifications;

v. Prepare reports on each inspection visit;

vi. Upon reasonable request by the Employer, assist in solving occurring contractual issues arising out of the operations.

27. The responsibility of the Consultant will include two visits per year of appropriate staff of a duration of at least two weeks each to accommodate both the inspection and the training needs as per section D.6.

D.8 JFJCM Related Project Components

28. To apply for the Joint Crediting Mechanism (JCM), MoE will define the JCM methodology and prepare a project design document, and monitoring methodology that will be submitted for final approval and registration with the JCM. The Consultant will collaborate closely with MoE and take into consideration the requirements as defined in Annex 1. To obtain the approval, the Consultant will:

i. Draft JCM methodology for the proposed WtE and assist the project management unit (PMU) to have the methodology approved;
ii. Draft a project design document for the proposed JCM project, assist PMU to have the project design document validated, and have the project registered;
iii. Conduct a local stakeholder consultation (LSC) as required for the JCM process.
iv. Conduct a capacity building of the PMU to meet the requirement for the JFJCM including monitoring of GHG emission reductions, drafting a monitoring report, having the monitoring report verified, and requesting issuance of JCM credits;
v. Assist PMU to conduct monitoring and draft monitoring report, have the monitoring report verified, and request issuance of JCM credits;
vi. Train PMU staff in carrying out the JCM monitoring, reporting and verification process.

E Qualification Requirements for the Key Experts & Team Composition

29. **Expected qualification requirements and tasks assigned to the Key Experts:** The Consultant will provide experts to cover all aspects of the facilities as per the contractual agreements either being concluded already or to be tendered (e.g. fire engineering expertise). Because of the nature of a WtE facility, several experts may be required for the one or other field of expertise. It will be within the Consultant's discretion to name as many experts as deemed necessary to cover all elements of the WtE plant and its ancillaries that are subject of this DBO contract. The team composition and minimum requirements are as follow.

30. **Team Composition with estimated Input**: The Consultant team will comprise of International Key-experts (87 person-months), National Key-experts (76 person-months), and non-key experts (33 person-months) excluding those required for Consultant's administrative, clerical and support staff. The Consulting firm will be engaged for 5 years to cover 3.5 years for the DBO design-build and the first two years of the operation service period. The expert's positions with their estimated inputs are provided in Table 2 below.

Table 2: Team Composition

I	International Key Experts	Person Months
1	Team Leader cum WtE Expert	22
2	Financial/Commercial Expert	1.5
3	Site Engineer(s)	32
4	Civil Engineering Experts (infrastructure/structural)	6
5	Process/Mechanical Engineering Experts	7
6	Electrical Engineering Expert	3
7	Instrumentation and Control Engineering Expert	3
8	Environmental Safeguard Expert	6
9	JCM Expert	6
	International Key Experts Sub-Total	**87**
II	**National Key Experts**	
1	Deputy Team Leader/Construction Management Expert	34
2	Financial/Commercial Expert	6
3	Contract Management Expert	6
4	Civil/Structural Engineering Experts	10
5	Mechanical Engineering Experts	7
6	Electrical Engineering Expert	7
7	Environmental Expert	6
	National Key Experts Sub-Total	**76**
III	**Non-Key Experts**	
1	Assistant site engineers (international)	12
2	Other international experts (fire/building service engineers etc.)	6
3	Assistant site engineers (national)	15
	Non Key Experts Subtotal	**33**
	Overall total	**196**

31. **Team Leader cum Waste-to-Energy Expert (International):** The Team Leader cum WtE Expert will be responsible for overall project management and administration, construction supervision, quality control and monitoring, contract management, establishment of construction management and project performance monitoring and reporting system, assist in resolving contractual issues, preparation of progress and other reports as required. Jointly with the team, the Team Leader will fulfill the role of Employer's Representative. The Team Leader cum WtE Expert (International) will preferably i) be graduate mechanical/civil/environmental engineer and post graduate in project management or contract management with a certificate like or similar to PMP®, ii) have at least 15 years of working experience in WtE works of similar complexity and volume (400 tpd or higher, USD 50 million or higher), iii) experience and sound knowledge of FIDIC contract conditions and DBO contract management, and iv) knowledge and experiences in the application of building information modelling (BIM), and experience with international financial institutions (IFI) funded projects will have added advantage.

32. **Financial Expert (International):** The Financial Expert will support the Employer in financial management issues. He/she will work closely and supervise with the Employer in all matters related to the subject. Financial Expert (International) will preferably i) be a post graduate in economics or finance, ii) have at least 15 years of experience in carrying out economic and financial analysis of large (preferably similar) projects, and iii) good knowledge of ADB or other IFIs procedures/policies, and experience in WtE projects will have added advantage.

33. **Site Engineer(s) (International):** The Site Engineer(s) will be the point of contact towards the Contractor and the Employer for all construction related aspects and issues. He/she will

manage all day-to-day activities with the support of the national Deputy Team Leader and specialist construction and assembly supervisors (non-key assistant site engineers, both international and national) as required. He/she will be i) either a technician or a graduate engineer in mechanics/civil engineering with a post-graduate in construction management, ii) have at least 15 years of experience in similar projects and will be familiar with supervising and monitoring a WtE plant's construction site, iii) preferably will have knowledge of FIDIC Gold Book or similar DBO contract packages.

34. **Civil Engineering Experts (International):** Civil Engineering Experts will be responsible for the review and approval of civil engineering designs/drawings/details submitted by the Contractor. They will assist in monitoring and ensure quality assurance and control. Civil Engineering Experts (International) will preferably i) be graduates in civil engineering, and, as required per, expertise with post graduates in structural engineering, geotechnics, landfill engineering etc. ii) have 10 years of experience in the relevant design and design review in similar work environments, iii) be versed in the application of relevant CAD tools, iv) construction supervision, design and implementation related to similar works in low-lying land, knowledge of BIM and related tools will have added advantage.

35. **Process or Mechanical Engineering Experts (International):** Process or Mechanical Engineering Experts will be responsible for review of design, drawings and data, technical specifications and PI&Ds prepared by the Contractor, ensure quality assurance and quality control. They will assist in resolving technical and contractual issues. Process or Mechanical Engineering Experts (International) will preferably be i) post graduates in process/mechanical engineering, ii) have 10 years of experience in process or mechanical engineering related to WTE facilities such as, but not limited to, cranes, furnace, boiler, turbine and water steam system, APC system etc., iii) be familiar with the application of relevant process engineering and CAD applications, and iv) construction supervision and implementation of works related to WtE facilities and knowledge of BIM will be regarded as advantage.

36. **Electrical Engineering Expert (International):** Electrical Engineering Expert will be responsible for review and approval of designs, drawings, specifications and data, ensure quality assurance and quality control, assist in resolving technical and contractual issues. Electrical Engineering Expert (International) will preferably i) post-graduate in electrical engineering, ii) have 10 years of experience in electrical engineering designs of similar projects, 5 years thereof in the WtE field, and iii) construction supervision and implementation of works related to WtE plants will have added advantage.

37. **Instrumentation and Control Engineering Expert (International):** Instrumentation and Control Engineering Expert will be responsible for review and approval of lay-out, design, drawings, data related to SCADA/DCS, ensure quality assurance and quality control of SCADA/DCS design and implementation, assist in resolving technical and contractual issues. Instrumentation and Control Engineering Expert (International) will preferably i) hold a post-graduate in instrumentation & control engineering, ii) have 10 years of experience in instrumentation and control engineering design and implementation, 5 years thereof in the field of WtE facilities, iii) be versed in the application of relevant process engineering and CAD applications, and iv) experience in construction supervision in the WtE field will be regarded as advantage.

38. **Environmental Safeguard Expert (International):** Environmental Expert will be responsible for management and supervision of environmental safeguard requirements in line with the

Contract, EIA including ADB SPS (2009) and the Government of Maldives. Among the responsibilities will be the preparation and implementation of environmental safeguard action plan, review of the (updated) EIA report, monitor the implementation of the CEMP. Environmental Safeguard Expert (International) will preferably i) be graduate in civil engineering, environmental science, structural engineering, environmental management or related field. Post graduate degree related to the field will be an advantage; ii) have 10 years of experience in preparing, and/or carrying out EIA/IEE/EMP, 5 thereof in WtE facilities-related projects, and iii) good knowledge of ADB or other IFI safeguards policies, design and construction with respect to implementation of environmental safeguards will have added advantage.

39. **JCM Expert (international):** The expert will have experience in carbon offset mechanisms and knowledgeable in rules on the Joint Crediting Mechanism (JCM). The expert will have a bachelor's degree in science, environment, or engineering; with 10 years of post-qualifying experience; have worked in at least two JCM or similar activities, to develop documents, prepare trial calculations and measurement systems, to establish the emission reductions accrued. The consultant will have experience in developing methodologies that have been approved under the JCM scheme preferably. Knowledge and experience of waste to energy system are assets. The qualification will be verified by JFJCM Secretariat of the ADB.

40. **Deputy Team Leader Cum Construction Management Expert (National):** Deputy Team leader cum Construction Management Expert will assist the international team leader, will support in overall project management and administration, construction supervision (jointly with the international site engineer(s)), quality control and monitoring, contract management, establishment of construction management and project performance monitoring and reporting system, assist in resolving contractual issue, preparation of progress and other reports as required. Deputy Team Leader cum Construction Management Expert (National) will preferably i) be graduate mechanical or civil engineer and post graduate in engineering or management, ii) have 10 years of working experience in leading and managing construction and/or turn-key projects and iii) sound knowledge of FIDIC contract conditions and contract management will be preferred. Experience in externally funded projects will have added advantage.

41. **Contract Management Expert (National):** Contract Management Expert will support the management and administration of the Project effected by the Team Leader and Deputy Team Leader. He/she will assist in establishment of the contract management and reporting system. He/she will elaborate an adequate documentation on contract administration, time & cost control, variations and change orders, billing & payments to the contractors. He/she will be responsible for documentation to ensure adequate progress of works, control the project and minimize the cost over-run and time over-run, timely review and disposal of contractor's claims. Will assist in resolving contractual issue and dispute resolutions during implementation. Contract Management Expert (National) will preferably i) be graduate in process, mechanical, or civil engineering and post graduated in contract management, ii) have 10 years of experience in contract administration related to procurement of Works and Goods for urban infrastructure projects, and iii) sound knowledge of FIDIC contract conditions and experience with IFIs will be regarded as advantage.

42. **Civil/Structural Engineering Experts (National):** Civil/Structural Engineering Experts (National) will assist the international Civil Engineering Experts in the review of the design of all civil/structural engineering elements as required and as submitted by the Contractor. Civil/Structural Engineering Experts (National) will preferably i) be graduate civil engineers,

and will be post-graduated in structural, geotechnical, building services engineering, ii) have 7 years of experience in civil/structural, geotechnical and building services engineering , iii) be versed in the application of relevant CAD tools, and iv) construction supervision, design and implementation related to similar works. Experience in externally funded projects will have added advantage.

43. **Mechanical Engineering Expert (National):** Mechanical Engineering Expert will assist the international Process/Mechanical Engineering Experts in the review of the design of all process and balance of plant related documents and drawings and P&ID as required and submitted by the Contractor. Mechanical Engineering Expert (National) will preferably i) be post graduated mechanical engineer, ii) have 10 years of experience in mechanical designs and implementation of goods and plants in multi-lot projects, iii) be versed in the application of relevant CAD tools, and iv) construction supervision of similar works will be preferred. Experience in externally funded projects will have added advantage.

44. **Electrical Engineering Expert (National):** Electrical Engineering Expert will be responsible for review and approval of designs/drawings/details as submitted by the Contractor, for the quality assurance and quality control and resolving contractual issued related to his/her field of expertise. The Electrical Engineering Expert (national) will assist the international expert in reviewing the electrical engineering design and the documentation, drawings and specifications submitted by the Contractor. Electrical Engineering Expert (National) will preferably i) be a graduate electrical engineer, preferably post graduate in control engineering, ii) have 10 years of experience in electrical design and implementation in multi-lot projects, iii) be versed in the application of relevant CAD tools, and iv) construction supervision of similar works will be preferred.

45. **Environmental Safeguard Expert (National):** The national Environmental Safeguard Expert will support the PMU and the international Environmental Safeguard Expert in the overall management and implementation of environmental safeguard policies of ADB and the Government of Maldives. Environmental Safeguard Expert (National) will preferably i) be graduate in civil engineering, structural engineering, environmental engineering, environmental management, environmental science or related field. ii) have minimum of 5 years work experience on monitoring/supervision capacity, and iii) sound knowledge of ADB procedures and policies, design and construction supervision, design and implementation of similar works will be preferred.

46. **Non-key experts and supporting staff:** The Consultant is expected to deploy non-key experts having qualifications and experience as necessary to deliver the project, such as, but not limited to:

    i. International engineers to support the design review, to attend the factory acceptance testing, the commissioning procedures etc. of the DBO contract's scope;
    ii. National and international site engineers;
    iii. CAD operators and office support staff.

F Reporting Requirements and Time Schedule for Deliverables

47. **Reporting Requirements:** During the performance of the services, the Consultant will prepare required reports for submission to the Employer/Client in electronic form and/or hard copies as per Employer's instructions and in English language. The report format will be consistent with the requirements of ADB and Government of Maldives and will be proposed by the

Consultant in its inception report. The reporting formats will be subject to amended time-to-time in consultation with the Client. As a minimum the Consultant will submit following reports at periods stated in Table 3 hereunder.

Table 3: Reporting Requirements

Reports	Number of Copies	Time Schedule
Inception Report	Electronic copy only	Within a period of 30 days from the date of issuance of Notice to Proceed.
Monthly Progress Reports	Electronic copy only	Every month within 5 days of the commencement of next calendar month.
Quarterly Progress Reports	Electronic copy only	Every quarter within 10 days of commencement of next quarter.
Annual Progress Report	Electronic copy and 3 hard copies	Every year within 15 days of commencement of next year. For the purpose of Annual Progress Report the year will mean and refer either to Calendar year or other suitable period as the Client may decide in consultation with the Consultant.
Draft Completion Report	Electronic copy and 3 hard copies	Within 30 days of completion of Consulting Services Assignment.
Final Completion Report	Electronic copy and 3 hard copies	Within 30 days of issuance of Client's comments on Draft Completion Report.
Training programme for the capacity building	Electronic copy	At least 30 days prior to the commencement of the first training session
Any other reports	As required	As and when required by the Client.

G Employer's Input and Counterpart Personnel

48. Services, facilities and property will be provided by the Employer: Office accommodation with power and water supply for office establishment on site and in Malé.

49. Professional and support counterpart personnel will provided by the Employer.

H Inputs, Project Data and Reports to Facilitate Preparation of the Proposals

50. The Consultant will have access to the following inputs, project data and reports available with Client to facilitate preparation of the Proposals:

    a) Data, reports, maps etc. as available with the Employer;

    b) Feasibility reports, design reports and drawings as available with the Employer.

51. Any other input the Consultant deems necessary and the Employer is able to share will be provided upon request by the Consultant.

I Commencement of the Assignment

52. It is envisaged that the assignment will start three months prior to awarding the DBO contract (pls. refer to clause **Error! Reference source not found.**) to allow the Consultant to familiarize with the Contract.

ANNEX 1: REQUIREMENTS FOR EXECUTING AND IMPLEMENTING AGENCIES OF THE JAPAN FUND FOR THE JOINT CREDITING MECHANISM (JFJCM) GRANTS

1. The Ministry of Environment (MOE) will be responsible for developing a Waste to Energy plant project in Thilafushi under Greater Male Waste to Energy Project in the Maldives as a joint crediting mechanism (JCM) projects, and for fulfilling requirements as the project participant of the JCM project.

2. MOE will develop the JCM methodology and submit it to the JCM Joint Committee (JC) for approval. In case the methodology is not approved, MOE will revise the methodology and make best efforts to have it approved by the JC. Methodology approval is to be achieved before JCM project registration.

3. Upon methodology approval, MOE will prepare a project design document (PDD), hire an accredited third-party entity (TPE) to validate the project, and submit the project for registration to the JC. In case the project is not registered, the MOE will make necessary revisions to the PDD considering comments received and make best efforts to have the project registered. Project registration is to be achieved before commissioning of the project supported under the JFJCM.

4. MOE will monitor the project in line with the PDD and prepare a monitoring report at least once a year, based on the recorded monitoring data. The monitoring report will be reported to ADB. MOE will monitor the JCM project from commissioning until the end of the project operation or the expiry of the JCM bilateral document between the Maldives and Japan, whichever is earlier.

8. The Waste to Energy project supported under the JFJCM cannot apply for any other international carbon market mechanisms.

GREATER MALÉ ENVIRONMENTAL IMPROVEMENT AND WASTE MANAGEMENT PROJECT
PHASE TWO: WASTE TO ENERGY (WTE) PLANT

Draft Terms of Reference for an Independent Environmental Monitor (IEM) (Subject to Finalization)

I. BACKGROUND

1. The Government of the Maldives is commissioning a design, build and operate (DBO) Contract for a Waste-to-Energy (WTE) Facility Project for the Greater Malé region to help in managing solid waste. The WTE Facility Project will be set up on the island of Thilafushi, Kaafu Atoll in the Greater Malé area. The project will be funded by the Asian Development Bank (ADB) and Asian Infrastructure Investment Bank (AIIB).

2. A concept design for the WTE Facility Project has been prepared by an engineering firm commissioned by the Maldives Ministry of Environment (ME). According to the concept design, the initial capacity of the facility shall be 167,000 Mg/y (two trains 250 tons per day or 10.5 tons per hour each), which then can be extended by a third train. Baled waste will be used as buffer to accommodate any waste volume fluctuations.

3. In relation to environmental management, the project is classified as Category A project per ADB Safeguard Policy Statement (SPS). The Category A classification derives from the project's likely significant adverse environmental impacts to air and marine environment that are irreversible, diverse, or unprecedented. Such classification requires the need of an independent external monitor or IEM.

4. The IEM shall be retained as an international expert under the WTE Facility Project with non-objection from ADB, and will report directly to ADB. The IEM shall not be involved in the day-to-day project implementation or supervision of the project. The IEM will closely coordinate his/her site visits and work with the project management unit (PMU).

II. PURPOSE.

5. An environmental impact assessment (EIA) report has been prepared for the project. The EIA contains an environmental management plan (EMP) developed to address the potential impacts and risks identified by the environmental assessment. The EMP includes the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. This will be updated by the DBO Contractor based on the final detailed design, including the construction methods and materials to be used. The IEM will monitor compliance of the project in implementing the EMP.

III. DURATION

6. The engagement of the IEM shall commence on the Commencement Date of the DBO contract and end at the conclusion of the defects notification period following Commissioning of the plant. This duration is expected to be sixty (60) months. The engagement of the IEM may be

extended and should this be the case, notification of such an extension will be provided at least six (6) months before the expected date of the Commissioning Certificate.

7. The work will involve an initial visit of two months prior to or during the DBO Contractor mobilization, and every six months visits thereafter. Home office time will be allocated to report preparation and handling comments and questions from reviewers.

IV. QUALIFICATIONS

8. The IEM shall have the following qualifications:

(i) Degree in engineering, chemistry, environmental management or a related field. Masters or doctorate degree will be preferable.
(ii) Has extensive experience with day-to-day management and/or monitoring of incineration plants of municipal solid wastes, or other facilities involving incineration, and reporting of regular monitoring against the relevant emissions standards.
(iii) Prior experience on monitoring ADB-funded projects is preferable.

V. DUTIES

9. The IEM shall have the following duties:

(i) Become familiar with the project, including the EIA report and implementation arrangements for the project.
(ii) Contribute to the review of the updated EMP following the final detailed design, and provide comments and recommendations as necessary relating to (i) the adequacy of monitoring arrangements, (ii) the construction work method statements and (iii) the proposed mitigation measures to address newly identified negative environmental impacts and risks.
(iii) Review monthly environmental monitoring reports submitted by the Contractor to the project management unit (PMU) and quarterly environmental monitoring reports of PMU to ADB.
(iv) Inspect the project construction works and following construction, plant operations (depending on final arrangements in the future) every six months, assess the environmental impacts of the project based on the EMP and any other critical issues that may arise, and prepare a report on the findings.
(v) Recommend improvements to effectively implement the EMP and provide professional opinion on the degree of impacts, if any.
(vi) When on site, comply with all health, safety and welfare requirements, and participate in project meetings as required.
(vii) Submit all findings and reports directly to ADB.

VI. INDICATIVE COST

Cost Item	Description	Unit Cost (US$)	Total (US$)
A. Remuneration	Retention of international consultant for 77 equivalent days[1]	1,000.00	77,000.00
B. International Travel	11 international travels[2]	5,000.00	55,000.00
C. Per diem	Field work in Maldives for total of 55 days[3]	288.00.	15,840.00

Cost Item	Description	Unit Cost (US$)	Total (US$)
D. Miscellaneous Travel Expenses	Lump sum per international travel[4]	150.00	1,650.00
E. Contingency	5% of total cost		7,474.50
Grand Total			**156,964.50**

[1] (5 field working days + 2 home office days) for each monitoring activity
[2] 1 international travel prior to DBO Contractor mobilization plus 10 international travels for the next 5 years
[3] average of 5 field working days per monitoring activity
[4] lump sum of $150 per international travel

SAMPLE Quarterly Environmental Monitoring Report Template

1. INTRODUCTION

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category per national laws and regulations
- Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number	Roles
1. PMU				
2. Consultants				

- Overall project progress and status
- Description and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Components/List of Works	Contract Status (specify if under bidding or contract awarded)	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M)[1]	If On-going Construction	
			%Physical Progress	Expected Completion Date

[1] If on-going construction, include %physical progress and expected date of completion

2. COMPLIANCE STATUS WITH NATIONAL/STATE/LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS[2]

Statutory Environmental Requirements[3]	Status of Compliance[4]	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish[5]

3. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

4. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT PLAN (REFER TO EMP TABLES IN APPROVED EIA REPORT)

- Confirm submission of Contractor's EMP (CEMP) by DBO Contractor.

EIA Documentation Status

DBO Contract Number	Final EIA Report based on Detailed Design				CEMP approved by Project Director? (Yes/No)	Remarks
	Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final EIA report provided to DBO Contractor (Yes/No)		

- For the DBO Contractor, provide name/s and contact details of contractor's EHS Manager and trained engineers on EHS, EMP and CEMP implementation.

[2] All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.
[3] Specify (environmental clearance? Permit/consent to establish? Etc.)
[4] Specify if obtained, submitted and awaiting approval, application not yet submitted
[5] Example: Environmental Clearance requires ambient air quality monitoring, etc.

DBO Contractor's Focal Persons for Environmental Safeguards

DBO Contract Number and Project Name	DBO Contractor	Focal Persons (EHS Manager / Trained Engineers)	Email Address	Contact Number

- With reference to approved EMP/CEMP, complete the table below

Summary of Environmental Monitoring Activities (for the Reporting Period)[6]

Impacts (List from EIA Report)	Mitigation Measures (List from EIA Report)	Parameters Monitored (As a minimum those identified in the EIA Report should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

[6] Attach Laboratory Results and Sampling Map/Locations

Overall Compliance with EMP/ CEMP

No.	DBO Contract Number and Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

5. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

- Briefly describe the approach and methodology used for environmental monitoring of the project.

6. MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (AMBIENT AIR, WATER QUALITY AND NOISE LEVELS)

- Discuss the general condition of surroundings at the project site, with consideration of the following, whichever are applicable:
    - Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
    - Identify if muddy water is escaping site boundaries or if muddy tracks are seen on adjacent roads.
    - Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these are intact following heavy rain;
    - Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area in the Appendix.
    - Confirm spill kits on site and site procedure for handling emergencies.
    - Identify any chemical stored on site and provide information on storage condition. Attach photograph.
    - Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
    - Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
    - Provide information on barricades, signages, and on-site boards. Provide photographs in the Appendix.
    - Indicate if there are any activities being undertaken out of working hours and how that is being managed.

- Briefly discuss the basis for environmental parameters monitoring.
- Indicate type of environmental parameters to be monitored and identify the location.
- Indicate the method of monitoring and equipment used.
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements.

As a minimum the results should be presented as per the tables below. Complete parameters should follow the recommendations in the EIA report.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Recommendations of the EIA)				
			PM10 µg/m3	PM2.5 µg/m3	SO2 µg/m3	NO2 µg/m3	Hg µg/m3

Marine Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Recommendations of the EIA)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (WHO Standards)	
			Day Time	Night Time

7. GRIEVANCE REDRESS MECHANISM

- Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM.

8. COMPLAINTS RECEIVED DURING THE REPORTING PERIOD

- Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved EIA report. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

9. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

- Summary of follow up time-bound actions to be taken within a set timeframe.

10. APPENDIXES

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors
- Others

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

NAME: _____ DATE: _____
TITLE: _____
LOCATION: _____

WEATHER CONDITION:
_____

INITIAL SITE CONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory _____ Unsatisfactory _____ Incident _____Resolved _____ Unresolved _____

INCIDENT:
Nature of incident:
_____

Intervention Steps:
_____

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Site Restored to Original Condition Yes ☐ No ☐

Signature
_____

Sign off

_____ _____

Name **Name**
Position **Position**

Appendix 21

PEMPHIS .48

Environmental Newsletter
Ministry of Environment and Energy

INVASIVE ALIEN SPECIES

Editor's Note

In this edition, Pemphis undertakes to highlight the obscure but important issue of Invasive Alien Species (IAS). We have always been concerned about our heritage, tradition and culture by our ancestors; but have we pondered about the identities and traits of our ecosystem?

The set of species inhabited in Maldives living in harmony and equilibrium over the generations are now challenged with **Invasive Alien Species**, since some species introduced to the Maldives have the ability to survive, reproduce and compete with native species.

The impacts does not confine to detriments to the ecosystem alone but is associated with illegal issues of trafficking of wildlife, drugs, and business fraud as well.

Pemphis greatly acknowledges the time and contribution provided by Maldives Customs Service for this edition. Senior Superintendent of Customs, Hussein Hameed shared some valuable insights and concerns regarding the issue of Invasive Alien Species and its associated problems.

Hope you all would find out more on " Invasive Alien Species" and its associated concerns from this month's issue.

Wish you all a safe and blessed days ahead.

Feedbacks, comments, articles, photos, etc .
environment@environment.gov.mv

"Invasive species are a major threat to biodiversity. Given the way they quickly become established and spread, measures taken by one Member State can have no eff ect if neighbouring countries fail to take action or respond in an uncoordinated manner. The ecological, economic and social consequences of the spread of invasive species for the EU countries are serious and need a harmonised response." EU Environment Commissioner Stavros Dimas

Ministry of Environment and Energy organized a stakeholder consultation meeting on invasive alien species on the 8th of this month. Participants which include government ministries and enforcement agencies expressed their concern over the issue. To conclude the meeting Director General of Environment Ministry Mr. Mohamed Zahir remarked upon the importance of putting a cooperative effort in addressing the issue.

Invasive Alien Species

"Invasive alien species (IAS) are species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity." Convention on Biological Diversity

Basic Rule: Arrive, Survive & Thrive

For an alien species to become invasive, its introduced habitat should complement its survivability and reproducibility. However, it must also out-compete the native organisms and spread through and increase its population in its new environment. The local ecosystem can be subjected to negative impacts since this causes disruptions and alterations in the food chain and other associated biological features.

Common Characteristics of IAS

Rapid reproduction and growth
High dispersal ability
Phenotypic Plasticity *(Phenotypic Plasticity: ability to adapt physiologically to new conditions)*
Ability to survive on various food types and environmental conditions.

The Giant African snail, *Achatina fulica*, or locally referred to as "Finihaka" is said to make its mark in the Maldives in the 1960s. Upon the introduction, its population is known to increase dramatically. It is considered as a garden pest but with it can reproduce to such numbers to cause public nuisance. The Giant African snail can alter the habitat properties by feeding on the native plants. Furthermore it is known to out-compete the native snail population as well. It can also act as a vector of human pathogens and parasites.

Coconut Hispid Beetle, *(Brontispa longissima)* distresses seedlings, mature coconut trees and other palms, specifically palms up to five years old are at the greatest risk of infestation.

The beetle is known to attack the closed young fronds of the palm. As the spear unfurls the beetle moves on to other palms or the next emerging spear. Coconut hispid beetle invasion can kill the underlying tissue and reduce the leaf photosynthesis of the leaflets. Infestations may result in the complete defoliation of the palm and in worst cases palms can die.

The beetle was introduced to the Maldives in the late 1990s from ornamental palms imported from Malaysia and Indonesia. It is believed that these originated from adult or immature stages of the pest that were concealed in these palms. Even with the fragmented and isolated geography of the nation the beetle had spread to several islands in a year's period. A severely affected resort of Maldives has reported to have incurred direct economic loss of over US$ 200,000 within a period of 3 years.

Impacts of Invasive Alien Species

Predicting the progress and consequences of a biological invasion is a difficult endeavour packed with complex variables and uncertainties.

IUCN describes the impacts of alien invasive species as **"immense, insidious and usually irreversible".**

American botanist Warren Wagner of Michigan University explains the difficulty of predicting the effects of invasive alien species before it's arrival and invasion
"Nothing is more difficult than to predict what will happen to an exotic"

Impacts: Ecological and Environmental

Alien Invasive Species can impact the environment at all levels of organization including gene, species, habitat and ecosystem.

Gene Pool

Same as humans, it is important to recognize that each organism is genetically unique with respect to the habitat and nature of the ecosystem.

"If introduced or spread into habitats with closely related species, alien invasive species could interbreed with native species resulting in changes to the genetic makeup of either species (Secretariat of the Convention on Biological Diversity, 2003)."

Possible negative consequences of alterations in gene pool:

- Reduction in the survival of either species
- Creation of a more successful invader
- Creation of hybrids that could be more susceptible to certain pests and pathogens
- Loss of gene pools

Ecosystems

The impacts of alien invasive species at the ecosystem level include changes to trophic structures, changes in the availability of resources such as water and nutrients, and changes in the disturbance regimes (McNeely et al., 2001; Secretariat of the Convention on Biological Diversity, 2003a).

Species

Invasive alien species can influence species diversity, richness, composition and abundance. At the species level, direct effects of alien invasive species occur through processes such as the predation of, competition with, and pathogen and parasite transmission to individual organisms, eventually leading to population declines and species extinctions (Loehle, 2003; Secretariat of the Convention on Biological Diversity).

Habitats

Through their impacts on species and ecosystem processes, alien invasive species can result in the fragmentation, destruction, alteration or complete replacement of habitats which in turn, has cascading effects on even more species and ecosystem processes (McNeely et al., 2001; Secretariat of the Convention on Biological Diversity, 2003a).

Ecosystems

Changes subjected to the ecosystem can include changes to trophic structures, changes in the availability of resources, etc.

Economy

Economic impacts can be either direct or indirect. Direct costs are of those related to mechanisms adopted in controlling the spread of invasive species, while the degradation of ecosystem services can be accounted as the indirect.

Social & Health

These species often triggers skin complications, while they act as vectors for dangerous pathogens and diseases. Loss of food sources and decrease of land value are often associated with the introduction of invasive species.

Asian Tiger Mosquito, *(Ades albopictus)* native to South East known to carry over 20 highly dangerous human pathogens such as dengue, yellow fever and chikunguya was introduced to Europe in the form of eggs on used tyres or heavy duty equipment. Regular mosquito outbreaks have been reported across western and southern Europe, where it poses a major health risk.

Since the 17th Century invasive alien species is accountable to nearly 40% of all animal extinctions for which the cause is known

-UNEP-

Through direct impacts on species or through alterations of habitats, invasive alien species are responsible for placing 762 forest species at risk (IUCN, 2005). The loss of such species is leading to a more homogenous world which is perhaps the biggest threat to global biological diversity, behind habitat loss

(Perrings, Williamson and Dalmazzone, 2000; McNeely et al., 2001; Richardson and Rejmánek, 2004).

-Shades out native plants and completely takes over forests

-Shallow root systems encourage erosion -Decreases the amount of rainwater into the watershed

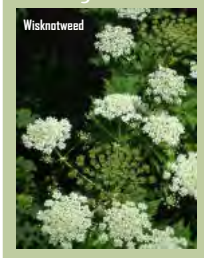
-The seeds spread easily through animals and even through dirt/mud stuck in vehicles, shoes, clothing, etc.

Has overtaken two-thirds of Tahiti's Forests, since its introduction in 1937 and is directly responsible for threatening 25% of their native forest species with extinction.

Invasive alien species are often associated with many emerging infectious diseases such as **Lyme disease, Ebola, Marburg hemorrhagic fevers, malaria, yellow fever, leishmaniasis, trypanosomiasis** and **Kyasanur forest disease**

(Morse, 1995; Sanchez et al., 1995; Wilson, 1995; Daszak, Cunningham and Hyatt, 2000; Chivian, 2001; Chivian, 2002; Cinco et al., 2004).

Giant Hogweed Plant
Heracleum mantegazzianum



Has been introduced to countries as an ornament. The plant has the potential to readily disperse and can grow along roadsides, ditches and streams. It contains high toxins which can cause severe dermatitis and burns when exposed to sunlight. If in contact with the eyes it can cause blindness to the eyes. Each year in Germany alone, 6 to 21 million Euros are spent for eradication and medical treatment. With its dense impenetrable strands, it can also reduce the biological diversity of the native plant species.

80% of the threatened species in the Fynbos biome of South Africa are endangered due to invasions by alien species

North American Red Swamp Crayfish,
Procambarus clarkii

The North American red swamp crayfish, *(Procambarus clarkii)*, was originally introduced into Europe for use in aquaculture. Having escaped into freshwater streams, this aggressive species has since spread across several EU countries, actively colonizing new territories at the expense of rarer native crayfish, such as ***Austropotamobius pallipes*** which is listed in the Habitats Directive. Apart from causing local extinctions, the red swamp crayfish is also a carrier of a fungus-like organism that is wiping out entire populations of European crayfish. The disease alone is estimated to have an economic cost of over €53 million/year.

Annual environmental losses caused by introduced pests in the US, UK, Australia, South Africa, India, Brazil have been calculated at over **US$100 billion**

-CBD-

It is estimated that US spends around 80 Billion to combat biological invaders.

Islands & Invasive Alien Species

As an island nation with dispersed and isolated geographical characters, Maldives limits immigration of new species, allowing established species to evolve with few strong competitors and predators. However, through human activity invasive alien species can be introduced causing dramatic changes to the island ecosystems. Island ecosystems are more prone to invasion by alien species with the lack of natural competitors and predators.

Being a small island developing state the issue threatens the fragile ecosystem, livelihood, economy and the wellbeing of its citizens.

Common pathways for the arrival of IAS

Ship ballast water, hull fouling, cargo containers and packaging materials, unprocessed commodities such as timber/agricultural goods, imported food species such as fish, horticultural/plant imports, waste material, military activities, and biological agents to combat pests.

Island Birds & IAS

Invasive alien species are stated among the most common threat to the avifauna of islands. Introduced rats, cats and diseases are accounted for half of the global bird extinctions over the past 500 years.

Invasive alien plants and trees have decreased water supplies for nearby communities and increased fire hazards in South Africa (McNeely et al., 2001; van Wilgen et al., 2001; Petit et al., 2004)

Australian Acacia species, such as *A. cyclops* and *A. saligna*, have radically altered nutrient cycling regimes in nutrient poor ecosystems due to their ability to fix atmospheric nitrogen (van Wilgen et al., 2001).

Island birds & IAS

Invasive species are among the most common threat to global avifauna and islands in particular. Invasive alien species, mostly from introduced rats, cats and diseases are responsible for half of the global bird extinctions over the 500 years.

Bird Life International

ScrewPine. *Pandanas*

Screwpine or locally referred to as Kashikeyo have been one of the core ingredients in many delicacies in Maldives. With the absence of common staple foods in the World War II, it is known that Maldivian communities relied on Screwpine to fill the void.

The native species of the screwpine are now threatened with the introduction of alien specimens. It is believed that these specimens were first introduced from a Caribbean country and distributed throughout the Maldives. Since the introduced screwpines had preferable features over the natives, farmers tend to promote the introduced foreign species of screwpine. At present the local vegetable and fruit market is occupied by these alien specimens, side-lining the natives.

Countering the issue of Invasive Alien Species

Each invasive alien present deserves individual management plans with respect to the habitat and environmental conditions.

Counter actions can be categorized into prevention, mechanical, chemical, biological, indirect and integrated.

Prevention

As a rule of thumb, prevention is the most cost-effective method against the issue of alien invasive species. Throughout the world, governments have imposed stringent laws and regulations to minimize the entry of invasive species. Common practices under prevention can be custom checks, shipment inspections and quarantine. Awareness of the general public is important for successful implementation of preventive measures.

Mechanical

These methods include use of machines, hand picking, soil tillage, trapping, shooting, etc.

Biological Methods

Biological control includes various methods which is associated around the use of a living organism as a predator with the aim of controlling a particular target alien invasive species.

Control strategies of biological means include:

Introduction (classical biological control) of a herbivore or parasite from the 'pest's' area of origin;
Inoculation - repeated releases (of sterile males, for example) so as to prevent pest build-up;
Inundation - where large numbers of natural enemies are cultured and released during critical periods in the life cycle of the crop or other alien species;
Conservation - where measures are taken to conserve and enhance the numbers of natural enemies already present in an area thus decreasing the mortality of the affected species; and
Augmentation - where natural enemies of a pest are at too low a level and the numbers are augmented by artificial rearing and release.

Chemical Methods

Herbicides/Pesticides: The most widely used method in eradicating unwanted animals and plants.

Anti-Coagulant poisons: Used to eradicate rodents by effectively blocking the vitamin K cycle, inhibiting the ability to produce essential blood-clotting factors.

Immunization: Animals are given immunization doses to combat from potential invasive species. In Ontario, raccoons and skunks are immunized to prevent the rabies virus.

Impeding reproductive ability: The method utilizes hormones to lower the reproductive potential of the species.

Pheromones: uses traps based on chemicals produced by the target species to attract members of the same species.

Pimentel, Zuniga and Morrison (2005) estimates that the 50 000 alien species in the United States cost almost US$120 billion in environmental damages and losses yearly. Pimentel et al. (2000) gave an estimate of US$137 billion per year.

Pimentel et al. (2001) looked at over 120 000 alien species of plants, animal and microbes that have invaded Australia, Brazil, India, South Africa, the United Kingdom and the United States causing significant economic losses in the agriculture and forest sectors and negatively affecting ecosystems. They estimated that the total cost in the six countries was US$314 billion in damages per year - Australia ($13 billion), Brazil ($50 billion), India ($116 billion), South Africa ($7 billion), the United Kingdom ($12 billion) and the United States ($116 billion).

OTA (1993) concluded that about 4 500 exotic species occur in the United States and that about 20 percent of them have caused serious economic and environmental harm. The cumulative loss caused by 79 of these species was estimated at almost US$97 billion for the period 1906 to 1991.

Pemphis Talk

Pemphis meets Senior Superintendent of Maldives Customs Service.

Hussain Hameed

Procedure followed by Customs when dealing with imported species

Since Customs is an enforcement agency, we follow laws and regulations set by policy making institutes. As per norm, Customs will ensure the species to be imported have been granted permissions from the relevant institutes.

If the species is found to be illegal, Customs will confiscate the species and handover to the relevant authorities; in required cases, extermination of the species will be carried out in presence of the relevant authorities.

Experience sharing of Customs with other countries:

Illegal doings along the border are shared with Regional Intelligence Liaison Office, World Customs Organization and countries of interests as well.

Trend in the imports of Alien Species:

A study is required to derive the actual statistics but with regard to the cases we can assume that the **trend is definitely not decreasing.**

Most Common Cases:

Snakes and Birds

Highest priority of Customs:

Narcotics comes first, followed by others

Advice to the general public on this matter:

The importers should know legal status of the subject to be imported. People should find out information about legal and illegal species before trying to import it. **Individuals should bare their responsibility towards the wellbeing of the nation before their own personal amusements**. Don't get involved in any illegal activity even if it's related to a friend of a family member. The general public is not aware. **People should share the information with customs or police about alien species; (if it's being smuggled into the country or if anyone is in possession of such a species)**. There is a mechanism in which information could be shared without disclosing who you are.

Health and Safety concerns of Customs officers when dealing with these species

Since Customs is an authority working at the frontlines the threat of such an event is there. As per health and safety Customs may always not be prepared in terms of work health and safety since such events would be isolated and dispersed.

Mechanism in identifying alien species:

At present there is no such mechanism formulated, but we are in need of one. Customs do have some difficulties therefore we need more training to be informed of the species.

Emergency plan, such as a virus infected shipment:

At the moment we lack a plan; but we are formulating such a plan which covers the required procedures.

Customs perspective on the relation between illegal imports of species and narcotics:

These species have been confiscated from Police operations regarding narcotics, so therefore it is known that there is a link between these two. With respect to the available information, drug dealers have these exotics as their pets.

Challenges faced by Customs in dealing with Alien Species:

Customs are required to check a lot of areas; it is fairly easy to check the airport passenger terminal area while Customs face difficulties in the air-cargo area. With the dispersion of sea vessels and the marine routes poses the greatest challenge for customs.

Another challenge is that the lack of coordination between the institutes working at the border. **To have a dedicated law and regulation to tackle the issue would be one of the solutions while implementing a documented rigid coordinating system to manage the ports among the relevant authorities and stakeholders.**

Public awareness and awareness campaigns regarding the issue is inadequate. **It is important to step up these campaigns as it is not just Customs officers who should be aware of this.**

Reason for the demand in smuggling Alien Species:

As per Customs perspective the demand is dependent upon two factors; import duty and legality of the subject. If the import duty is high or if the subject is banned or illegal; smuggling and demand does increase along with the associated profit of the sale.

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