ENVIRONMENT IMPACT ASSESSMENT

FOR THE PROPOSED

ESTABLISHMENT OF A WATER BOTTLING PLANT AT STATE ELECTRIC COMPANY LIMITED (STELCO)

March 2016

Prepared for

State Electric Company Limited (STELCO)

Maldives

Consultant

CDE Consulting, Maldives
ساعت تخصصی برای تکمیل پروژه (سمت چپ) دار
ساعت تخصصی برای تکمیل پروژه (سمت راست) کمک کننده

در دوره ۲۰۱۶

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پروژه تخصصی برای تکمیل پروژه مضر (سمت چپ)

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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPH</td>
<td>Bottles Per Hour</td>
</tr>
<tr>
<td>COADS</td>
<td>Comprehensive Ocean-Atmosphere Data Set</td>
</tr>
<tr>
<td>DO</td>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>IPPC</td>
<td>International Plant Protection Convention</td>
</tr>
<tr>
<td>MEE</td>
<td>Ministry of Environment and Energy</td>
</tr>
<tr>
<td>MHI</td>
<td>Ministry of Housing and Infrastructure</td>
</tr>
<tr>
<td>MoTAC</td>
<td>Ministry of Tourism, Arts and Culture</td>
</tr>
<tr>
<td>MoTCA</td>
<td>Ministry of Tourism and Civil Aviation</td>
</tr>
<tr>
<td>MSL</td>
<td>Mean Sea Level</td>
</tr>
<tr>
<td>MWSC</td>
<td>Maldives Water and Sewerage Company</td>
</tr>
<tr>
<td>NAPA</td>
<td>National Adaptation Programme of Action</td>
</tr>
<tr>
<td>NE</td>
<td>North East</td>
</tr>
<tr>
<td>NEAP II</td>
<td>National Environmental Action Plan II</td>
</tr>
<tr>
<td>NW</td>
<td>North West</td>
</tr>
<tr>
<td>SAP</td>
<td>Strategic Action Plan</td>
</tr>
<tr>
<td>SE</td>
<td>South East</td>
</tr>
<tr>
<td>SW</td>
<td>South West</td>
</tr>
<tr>
<td>TSS</td>
<td>Total Suspended Solids</td>
</tr>
<tr>
<td>ToR</td>
<td>Term of Reference</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change and the Kyoto Protocol</td>
</tr>
</tbody>
</table>
Acknowledgements

The lead author of this report is Dr. Ahmed Shaig

Field assistance was provided by the following members

Mr. Ali Nishaman (Report compilation and Environmental Assessment)

Ms. Shahdha (Report compilation and Environmental Assessment)

Mr. Mohamed Faizan (Marine Environment Specialist)

Mr. Mohamed Ali (Marine Surveys)

The curriculum vitae’s of the EIA consultants are attached in Appendix F of this report.
Lead Consultant’s Declaration

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

Dr Ahmed Shaig
Proponent’s Declaration

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(Please refer to Appendix H)
Executive Summary

The purpose of this document is to fulfil the requirements to get necessary environmental clearance from the Environmental Protection Agency (EPA) to carry out the proposed ‘Establishment of a Water Bottling Plant Project’ at State Electric Company (STELCO), Male’. The proponent of this project is State Electric Company Limited (STELCO).

This project mainly involves establishing a bottling plant on STELCO’s main premise in Male’ city with a production capacity of 6000 bottles per day. A prefabricated building has been assembled on site to house the bottling plant. The project will be using the existing desalination plant at STELCO.

All project activities are in conformance to the laws and regulations of the Maldives, and relevant international conventions that Maldives is party to. The key laws and regulations applicable to this project are Environmental Protection and Preservation Act, Environmental Impact Assessment Regulation 2012, Hygiene Regulation for Food Establishments 2014 and Waste Management Regulation 2013.

The proposed site for the installation of the bottling plant is located on the main premises allocated to STELCO on the southern end of Male’. Proposed project activities do not require any major alterations to the terrestrial and marine environment.

The most significant impact from this project is the increase in plastic waste. The proponent is looking into the prospects of a recycling venture for their bottles to mitigate this impact. This project will generate new jobs in Male’, which is a significant positive impact.

The main alternatives assessed for the project are alternative bottling materials and alternative site for establishing the bottling plant. “No project” option has also been considered and given the economic and environmental factors the best option would be to proceed with the project.

Stakeholder consultations were conducted with Environmental Protection Agency (EPA) and Maldives Food and Drug Authority (MFDA). EPA’s main concern was to get the desalination plant of STELCO registered at EPA before starting the bottling process. MFDA did not have any major concerns but advised to carry out the necessary water quality assessments.

The Environmental Management Plan (EMP) for this project is designed to produce a framework for anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions. In addition, provide evidence of compliance to legislation, policies, guidelines and requirements of relevant authorities.
Monitoring plan is designed to assess any changes to the physical environment as well as operational aspects of the resort.
EIA for the proposed Establishment of a Bottling plant at STELCO, Male’

Prepared by: CDE Consultancy
EIA for the proposed Establishment of a Bottling plant at STELCO, Male’
EIA for the proposed Establishment of a Bottling plant at STELCO, Male’
1 INTRODUCTION

1.1 Purpose of the EIA

This Environment Impact Assessment (EIA) report is an evaluation of the potential environmental, socio-economic and natural impacts of the proposed establishment of a bottling plant at STELCO.

This document is submitted by the proponent to EPA to fulfil the requirements for an EIA under Article 5 of the Environment Protection and Preservation Act (4/93). The EIA Regulations 2012 has been used as the basis for preparing this document.

This report provides the background to the proposed project components as well as an assessment of their likely environmental and social impacts, both beneficial and adverse. The proposed enhancement and mitigation measures are outlined where necessary together with an environment management plan and a monitoring programme.

1.2 Project Proponent

The proponent, State Electric Company Ltd, STELCO, is a company owned by the Government of Maldives, with their core business being power generation. The company emerged from modest beginnings in 1949 with an installed capacity of only 14 KW. The company is now established as the leading company in providing electricity.

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Email: admin@stelco.com.mv
1.3 Project overview and background

STELCO is a State-owned company whose primary business at present is power generation. The company plans to diversify its business by producing desalinated water using waste heat from power generation and bottling the water for distribution. This project mainly involves establishing a bottling plant on STELCO’s main premise in Male’ city with a production capacity of 6000 bottles per day.

The main components of the project are:

1. Mobilization
2. Site Preparation
3. Installation and commissioning of the Machinery
   a. Water treatment plant
   b. Disinfection systems
   c. Tanks
   d. Bottling equipment’s
   e. Other related equipment’s / structures
4. Decommissioning

The bottling plant will be housed in a prefabricated building. This building has already been assembled at STELCO and is ready for use. STELCO has a desalination plant which has the capacity to provide the water for the bottling plant. Thus, no additional desalination plants are required.

See Project Description chapter for more details.

1.4 Project Rationale

STELCO wishes to diversify their existing business portfolio, while utilizing some of their existing infrastructure. The desalination plant in STELCO is already established, and is mainly used for industrial purposes (for cooling the generators). They wish to use their excess product water for the bottling plant and provide affordable bottled water to the public. Thus a plant with a capacity of 6000 bottles per day is proposed to be installed on site. This plant is designed to meet the appropriate standards and supplement the demand across Maldives.

1.5 Aim and Objectives

The project aims at diversifying the business of STELCO by producing bottled water while simultaneously maximizing the use of the existing desalination plant and utilizing the exhaust heat from generators.
1.6 **Consultants, Contractors and Government Institutions**

All the EIA related work is undertaken by consultants from CDE Consulting. Design criteria and technical specifications have been developed by the proponent.

The project is financed and executed by the proponent.

1.7 **Scope and Terms of Reference of EIA**

The scope of this EIA is broadly based on the Environmental Impact Assessment Regulations 2012. The assessment more specifically adheres to the Terms of Reference (ToR) issued by the Environmental Protection Agency on 6th March 2016. The ToR is based on scoping meetings held between the stakeholders on 6th March 2016. A copy of the ToR is attached in Appendix A.

The EIA report contains the following main aspects:

A description of the project including the need for the project, how the project will be undertaken, full description of the relevant parts of the project, implementation schedules, site plans and summary of project inputs and outputs (*Chapter 1&2*).

A description of the pertinent national and international legislation, regulations and policies that are relevant and applicable to the project and a demonstration of how the project conforms to these aspects (*Chapter 3*).

Information on the baseline environmental condition of the project site; this includes information on marine flora and fauna, marine water quality, marine environment near the project site (*Chapter 4*).

An assessment of the potential impacts during both construction and operational stages of the project as well as identification and cost of the potential mitigation measures to prevent or reduce significant negative impacts during both construction and operation stages of the project (*Chapter 5 & 6*).

Assessment of alternatives for the proposed project (*Chapter 7*),
Details of the environmental management plan (*Chapter 8*).
Details of the environmental monitoring plan (*Chapter 9*).
Stakeholder consultations (*Chapter 10*),
Potential gaps in information (*Chapter 11*),
Main conclusions (*Chapter 12*)
1.8 Assessment Methodology

1.8.1 General Approach

This EIA is broadly guided by the EIA Regulations 2012.

This report has been prepared to ensure that the significant environmental and social impacts of the proposed project at the preconstruction, construction, operation and demobilising stages have been considered and assessed at the project planning phase.

The process followed in the preparation of this EIA report consists of six parts. These are: scoping consultations; literature review; field surveys; stakeholder consultations; analysis of results; and compilation of the assessment in the form of a report.

In order to conduct a broad based and inclusive study, the proponent and the consultant have from the onset ensured the exercise is participatory. As such, discussions have been held with community members in the projects area and relevant stakeholders with the assistance and coordination of the proponent.

1.8.2 The Study Area

The area impacted by projects like these can be quite wide particularly when the socio-economic impacts are considered. Study area of the project is the main premises at STELCO, and the marine environment in the immediate vicinity.

The adjacent marine environment was considered, as the intake location for the existing desalination plant at STELCO is found within this area.

The study area boundary is presented in Figure 1.1 and survey locations map for the project is attached in Appendix D.
EIA for the proposed Establishment of a Bottling plant at STELCO, Male’
1.8.3 Field Observations

Field assessments were undertaken in and around the site on 21st February 2016. Field visits mainly covered marine assessment and marine water quality. In addition stakeholder consultations were carried out with EPA and MFDA between 16th and 21st March 2016.

1.8.3.1 Marine Assessments

Fish census

Fish and invertebrates species assemblages and abundance was surveyed using 50 m line transects, whereby the monitor swam along transect and recorded the number and the different species of fish and invertebrates observed within 2.5 m either side of the transect line.

A category-based methodology was adopted to estimate fish abundance and the mean number of fish per category and observation was extracted to estimate species and family abundance. The categories used to estimate abundance is displayed in Table 1.1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2 - 4</td>
</tr>
<tr>
<td>3</td>
<td>5 - 16</td>
</tr>
<tr>
<td>4</td>
<td>17 - 64</td>
</tr>
<tr>
<td>5</td>
<td>65 - 256</td>
</tr>
</tbody>
</table>

Photo Quadrat survey

The composition of the substrate was assessed by taking twenty high-resolution images every 5 m (pictures covering 0.5 m² of the seabed) along the same transect line used for the fish surveys. These were later analysed using CPCe. CPCe, or Coral Point Count with excel extension, developed by the National Coral Reef Institute, is software designed to determine coral community coverage and diversity using transect photographs. Underwater photographic frames are overlaid by a matrix of randomly generated points, and the fauna/flora of species or substrate type lying beneath each point is identified. 20 random points per picture were analysed to characterize the substrate composition (sample size: 200 points per transect).
Visual Snorkelling Survey

Visual snorkelling surveys were carried out at select locations of the lagoon. General status of these sites were recorded, special attention was given to types of corals and fishes present at these sites and the environmental conditions that could affect growth such as suspended solids, depth, and other threats to coral life.

1.8.3.2 Water Quality

Water quality was assessed from MWSC laboratory. Water quality samples were taken at different locations selected based on proposed developments. Parameters measured include electrical conductivity, total dissolved solids (TDS), salinity, pH, temperature, and dissolved oxygen (DO). Nitrates, nitrites and phosphates were analysed at the Public Health Laboratory which uses methods prescribed in “Standard Methods for Examining Water and Wastewater”. Samples were collected in clean 1.5L PET bottles after washing them with the water to be sampled. Water samples were collected at mid depth. Biological samples were collected in sterilized 100 ml glass bottles provided by the Public Health Laboratory.

1.8.4 Desk Study Review

A literature review was conducted to acquire background information on the site and its environment as well as to identify possible environmental impacts of similar developments in island settings. In this context, the EIA Regulations 2012, best practices from similar development activities, scientific studies undertaken in similar settings around Maldives and previous documents/historical publications was considered.

The literature review comprised of, but is not limited to, the following:

- EIA for the proposed Establishment of a Bottling plant in Hulhumale, MWSC
- Relevant laws, regulations and guidelines.

1.8.5 Public and Key Stakeholder Consultation

Stakeholder consultations were undertaken with the following stakeholders:

- The proponent
- Environmental Protection Agency
- Maldives Food and Drug Authority
1.8.6 Data Analysis

The EIA experts used their experience and knowledge in their respective fields to analyse the data from the previous studies and field visits in order to determine the potential impacts of the proposed projects, the severity of effects arising from these impacts and how any adverse impacts can be best mitigated and positive impacts enhanced. This analysis provides the framework for the recommendations on corrective actions and remedial measures and provides the basis for the formulation of the environmental management plan which forms part of this EIA report.

1.8.7 Report Format

The report format and structure presented here follows the report formatting guidelines issued by EPA.

1.9 Study Team Members

The team members of this EIA are:

- Dr. Ahmed Shaig (EIA and coastal environment Specialist)
- Mr. Ali Nishaman (Report compilation and Environmental Assessment)
- Ms. Shahdha (Report compilation and Environmental Assessment)
- Mr. Mohamed Faizan (Marine Environment Specialist)
- Mr. Mohamed Ali (Marine Surveys)

The curriculum vitae’s of the EIA consultants are attached in Appendix F of this report.
2 PROJECT DESCRIPTION

2.1 Project Location

The project location is in Male’, located on the south eastern rim of North Male’ Atoll at approximately 73°30'49.63"E and 4°10'13.51"N.

The proposed site for the installation of the bottling plant is located on the main premises allocated to STELCO on the southern end of Male’ (see figure 2.1). The site comprises of approximately 4063 ft² which at present has a prefabricated house with no vegetation in the project footprint area.

2.2 Project Outline and Project Site Plan

The proposed site plan is presented in Appendix B. This project involves the installation of a bottling plant at STELCO, Male’.

The main components of the project are:

1. Mobilization (equipment and machinery already at site)
2. Site Preparation (Prefabricated house already in place)
3. Installation and commissioning of the Machinery
   a. Bottling equipment
   b. Other related equipment’s / structures
4. Demobilization

The next section provides the details of the project components.
2.3 Detailed Project Outline and Work Methodology

2.3.1 Scope of Works

The major project component is to install the machinery for the bottling process. The bottling machinery includes; water treatment plant, disinfection system, bottling machinery and tanks.

Project Site plan is presented in Appendix B.

2.3.2 Facility design

The facility is installed in the site allocated for water production and bottling within the STELCO plot in Male’. A prefabricated building has been assembled on site to house the bottling plant. The floor has been constructed using reinforced concrete. The building structure and design has been configured such that the building is sound and vibrations proofed and insulated.

The project will be using the existing desalination plant at STELCO, which has been producing water for use at the power station. The original capacity of this plant at the time was 200TPD. However, over the 20 years it has been in operation, the plant’s efficiency has been reduced to 40TPD. The capacity of current desalination plant is not sufficient for the bottling plant to operate at its full capacity. Hence, the proponent has plans to procure a second desalination plant of 40 TPD to increase the production of bottled water.

2.3.3 Water Treatment system

Desalinated water obtained from the existing desalination plant at STELCO will be used as feed water for the proposed bottling plant. This water is subjected to disinfection and mineralization in the water treatment unit of the proposed facility.

The following are the major processes, which will be carried out, in the bottling plant:

**Filtration**

Feed water is passed through three layers of filters; sand and silica filter, active carbon filter, and a micron filter.

**UV disinfection of permeate water:**

UV is used as a disinfectant to destroy pathogens such as bacteria, viruses and parasites that can contaminate the water. Water passes through a chamber in which an ultraviolet source emits UV radiation on the water. The UV radiation causes changes in the genetic material of the organism
and inactivates it. UV treatment of water is automatic and adds no taste, odour or chemicals to the water.

**Ozonation of the water:**

Ozone treatment is used in achieving oxidation of organic and inorganic contaminants, control of algae and perfect improvement of colour, taste and odour.

**Mineralization:**

The desired minerals for the product water to be used for bottling operation are dosed through a dosing pump system into the bottling line.

The water is ready to be used for bottling after passing these treatment stages.

### 2.3.4 Bottling Operation:

The bottling plant to be setup is a mineral water bottling plant for local sales. Market studies carried in the analysis phase of this project indicates that demand for mineral water exceeds the current supply, hence there is a market for the bottled water produced at STELCO. Fig.2.2 represents an overall view of the bottling system and given below is the process sequence for the system. All the processes in the bottling plant are automated thus requires minimal human handling. This minimizes the chances of contamination and reduces labour cost.
Figure 2.2 Process diagram for bottling plant
The first step of the bottling process is the moulding of the bottles. PET preforms from storage are automatically loaded on to a hopper into the bottle-molding unit where the preforms are heated and moulded into the desired shapes and cooled.

The second process is filling. The PET bottles received at the outlet of the moulding unit are transferred into the bottle uploader, which feed the bottles into the 3 in 1 Filling block via an air conveyor. In this unit, treated water from the treatment unit is passed into the bottles via automated valves. Flow meters attached to the valves, which gauges the amount of water flowing through. The filled bottles are passed on to the light checker and capping area. Caps from the storage area are aligned into the correct position and fed into the light checker and capping area and applied to the bottles.

Labelling is the third process of the bottling process. The capped bottles are cooled and passed onto the labelling area. An automatic rotary labelling machine applies pre-glued labels on to the bottles.

The labelled bottles are aligned and conveyed to the packaging area where the bottles are packed in corrugated card boxes. Once packaging is done, the product is ready for distribution.

2.4 Storage

There is an existing building adjacent to the bottling plant house. This building will be utilized as a storage house. The building has the capacity for one month’s storage of bottled water, equivalent to 2200 tons.

2.5 Water quality assurance

Water quality testing is assured through regular water testing at the National Health Laboratory. Samples will be collected at random from feed water and product water storage once every week and sent to National Health Laboratory for testing for parameters such as pH, conductivity, Total Dissolved solids, Chloride, chlorine, Iron, turbidity, sulphide etc.

2.6 Pest Control

The bottling house is a tightly sealed facility thus entry of pests inside the facility is well prevented. Doors are closed at all times during the operation. Regular maintenance check-ups will be done to inspect the facility for damages. Any damages observed that might allow pests inside will be repaired immediately.
2.7 Export Import Plan

Major project inputs and their export import plan are as follows;

Table 2-1: Project Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Required quantity (1 month)</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caps</td>
<td>180,000</td>
<td>Foreign supplier</td>
</tr>
<tr>
<td>PE labels</td>
<td>180,000</td>
<td>Foreign supplier</td>
</tr>
<tr>
<td>Corrugated Carton boxes</td>
<td>2,000</td>
<td>Foreign supplier</td>
</tr>
<tr>
<td>Shrink films</td>
<td>30 rolls</td>
<td>Foreign supplier</td>
</tr>
</tbody>
</table>

The inputs will be imported through STELCO’s company policy under best practices of business.

2.8 Project Schedule and Life Span

Mobilisation for the project will begin after the EIA is approved. The whole project will take approximately six weeks.

The preliminary work plan is provided below.

Table 2-2: Project Schedule

<table>
<thead>
<tr>
<th>No</th>
<th>Activity Description/Weeks</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>W4</th>
<th>W5</th>
<th>W6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preliminaries</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mobilisation</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Site preparation</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Plant &amp; Equipment Installation</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Demobilisation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

2.9 Labour Requirements and Availability

Approximately 20 staff of the contractor will be involved in the construction activities of the project. During operations stage 12 staff will be recruited, with priority being given to existing staff members of STELCO.

2.10 Transportation

Transportation and distribution of bottled water will be outsourced to private parties. These parties have not been decided at the time of this EIA.
2.11 Recycling Ventures and Faulty bottle disposal

STELCO will be sending faulty bottles to their site in Thilafushi where they already have an existing industrial scale incinerator. Where possible, plastic materials will be sold to local recycling companies as scrap materials.

However, STELCO has plans to reuse faulty bottles in the future; by grounding it into fine resin, which can then be melted to make preform for new bottles. There are also plans to obtain used bottles through a scheme whereby monetary or other forms of incentives will be provided. The details of these recycling plans has not been finalised at this stage.

2.12 Electricity for operation

Electricity for operation of the bottling plant will be provided by STELCO.

2.13 Waste Management, Logistics and Safety Measures

2.13.1 Waste Management and Disposal

Small amounts of waste oil may be generated during the installation of the bottling plant. All waste oil will be disposed as per the approved standards of the Environment Ministry.

During operation of the bottling plant, small amounts of wrapping and plastic waste may be produced. These wastes will be transferred to Thilafushi Waste Management area and incinerated using STELCO’s industrial standard incinerator.

2.13.2 Pollution and Emission Control Measures

The following measures will be taken to ensure minimal pollution during construction stage.

− Machinery will be properly tuned and maintained to reduce emissions and minimize risk of spills/leaks.

− All paints, lubricants, and other chemicals used on site will be stored in secure and bunded location to minimize risk of spill.

2.13.3 Health and Safety Measures

− The contractor would ensure that Health and Safety procedures are complied with at all times.
− Construction activities would be carried out under the supervision of a suitably experienced person.

− All reasonable precautions will be taken for the safety of employees, and equipment will be operated by competent persons.

− Warning signs, barricades or warning devices will be provided and used. Necessary safety gear will be worn at all times.

− Fire extinguishing equipment would be readily available and employees will be trained in its use. In general, water-based fire extinguishers would be used.

2.13.4 Utilities

− Desalinated water will be obtained from the existing desalination plant at STELCO which is owned and operated by STELCO.

− Power for bottling plant will be provided by STELCO. Desalination plant is currently operated from exhaust heat from STELCO’s power house.

2.14 Summary of Project Inputs and Outputs

The types of materials that will go into the development and from where and how this will be obtained are given in Table 2.4 and the type of outputs (products and waste streams) and what is expected to happen to the outputs are given in Table 2.5

2.15 Demobilization

Bottling plant house and foundation for bottling plant has already been constructed. Hence, no construction machinery or materials are mobilized for this project. Equipment and tools used for installation of the bottling plant will be demobilized in the final week of the project.
Table 2-3 Major Project Inputs

<table>
<thead>
<tr>
<th>Input resource(s)</th>
<th>Source/Type</th>
<th>How to obtain resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caps</td>
<td>Foreign Supplier</td>
<td>Foreign Supplier</td>
</tr>
<tr>
<td>PE labels</td>
<td>Foreign supplier</td>
<td>Foreign supplier</td>
</tr>
<tr>
<td>Corrugated Carton boxes</td>
<td>Foreign supplier</td>
<td>Foreign supplier</td>
</tr>
<tr>
<td>Construction workers</td>
<td>Local and foreign</td>
<td>Contractor</td>
</tr>
<tr>
<td>Shrink Films</td>
<td>Foreign Supplier</td>
<td>Foreign Supplier</td>
</tr>
<tr>
<td>Engineers and Site supervisors</td>
<td>Local and foreign</td>
<td>Employees of STELCO</td>
</tr>
<tr>
<td>Water supply (for operation)</td>
<td>Existing plant at STELCO</td>
<td>Obtained from STELCO</td>
</tr>
<tr>
<td>Preform raw materials</td>
<td>Imported</td>
<td>Foreign suppliers</td>
</tr>
<tr>
<td>Bottling plant</td>
<td>Components of water treating, bottling and labelling</td>
<td>Foreign Supplier</td>
</tr>
<tr>
<td>Maintenance material</td>
<td>Maintenance parts and fluids required for the machinery and piping.</td>
<td>Import or purchase locally where available</td>
</tr>
<tr>
<td>Food and Accommodation</td>
<td>Responsibility of the contractor</td>
<td>Contractor</td>
</tr>
<tr>
<td>Firefighting equipment</td>
<td>Fire Extinguishers...etc.</td>
<td>STELCO</td>
</tr>
<tr>
<td>Fuel</td>
<td>Light Diesel, Petrol, Lubricants</td>
<td>Local suppliers</td>
</tr>
</tbody>
</table>

Table 2-4 Major Project Outputs

<table>
<thead>
<tr>
<th>Products and waste materials</th>
<th>Anticipated quantities</th>
<th>Method of disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste oil</td>
<td>Small quantities</td>
<td>Barrelled and sent to Thilafushi site</td>
</tr>
<tr>
<td>Hazardous waste (diesel)</td>
<td>Small quantities</td>
<td>Barrelled and sent to Thilafushi site.</td>
</tr>
<tr>
<td>Plastic and packaging wastes</td>
<td>Small quantities</td>
<td>Sent for incineration at STELCO’s waste management area in Thilafushi</td>
</tr>
</tbody>
</table>
3 POLICY AND LEGAL FRAMEWORK

These legal and policy provisions have to be fully respected in carrying out the proposed development. All contractors and sub-contractors will be informed of these requirements. This project conforms to all relevant laws and regulations of the Maldives.

3.1 Relevant Environment Legislation

3.1.1 Environment Protection and Preservation Act (Act no. 4/93)

The Environmental Protection and Preservation Act (4/93) enacted on 19 March 1993 is the framework law related to environment protection in the Maldives. The authority responsible for the Environment Act is the Ministry of Environment and Energy.

Articles 2, 4, 5, 6, 7, and 8 of the law are relevant to the 11-storey building construction project.

Article 2 states that the concerned government authorities shall provide the necessary guidelines and advise on environmental protection in accordance with the prevailing conditions and needs of the country. All concerned parties shall take due considerations of the guidelines provided by the government authorities.

*The project developers and contractors shall abide by any guidelines or advice given by the concerned Government authorities for the project.*

Article 4 states that the Ministry of Environment shall be responsible for identifying protected areas and natural reserves and for drawing up the necessary rules and regulations for their protections and preservation.

*The project developers and contractors shall ensure that there is no negative impact from the proposed project on sensitive environments in the vicinity or protected species.*

According to Article 5 (a) of the Act, an Environmental Impact Assessment study shall be submitted to the Ministry of Environment before implementing any development project that may have a potential impact on the environment.

According to Article 5 (b), The Ministry of Environment shall formulate the guidelines for EIA and shall determine the projects that need such assessment as mentioned in paragraph (a) of this clause.

*This report is prepared to fulfil this clause.*
According to Article 6, the Ministry of Environment has the authority to terminate any project that has any undesirable impact on the environment. A project so terminated shall not receive any compensation.

All project developer and contractors shall be aware of this provision and contractors shall take all practical measures to ensure there is no irreversible and significant negative impact of the projects on the environment.

Article 7 of the EPPA (4/93) states that any type of waste, oil, poisonous gases or any substances that may have harmful effects on the environment shall not be disposed within the territory of the Maldives. In cases where the disposal of the substances becomes absolutely necessary, they shall be disposed only within the areas designated for the purpose by the government. If such waste is to be incinerated, appropriate precaution should be taken to avoid any harm to the health of the population.

All project contractors shall comply with the Environmental Management Plan presented in this report, which specifies how the wastes, oil and gases generated by the project will be disposed.

Article 8 of the EPPA (4/93) states that Hazardous/Toxic or Nuclear Wastes that is harmful to human health and the environment shall not be disposed anywhere within the territory of the country.

Any hazardous wastes that may be generated from this project shall be transferred to the designated waste site in Thilafushi for disposal according to Government regulations and standards. It should not be disposed on site or in Male’, as it does not have the necessary facility.

3.2 Relevant Regulations and Guidelines

3.2.1 Environmental Impact Assessment Regulations 2012

Environmental Impact Assessment regulations were issued by Environment Ministry on 8 May 2012. The first step in environmental assessment process involves screening of the project to be classified as one that requires an EIA or not. Based on this decision, the Ministry then decides the scope of the EIA, which is discussed with the proponent and the EIA consultants in a “scoping meeting”. The consultants then undertake the EIA starting with baseline studies, impact prediction and finally reporting the findings with impact mitigation and monitoring programme. This report follows the principles and procedures for EIA outlined in the EIA regulations.

The EIA report is reviewed by MEE following which an EIA Decision Note is given to the proponent who will have to implement the Decision Note accordingly. As a condition of
approval, appropriate environmental monitoring may be required and the proponent shall have to report monitoring data at required intervals to the Ministry. The project proponent is committed to implement all impact mitigation measures that are specified in this EIA report. Furthermore, the proponent is committed to environmental monitoring and shall fulfil environmental monitoring requirements that may be specified in the EIA decision note as a condition for project approval.

This report complies with the EIA regulations.

3.2.2 Hygiene Regulation for Food Establishments 2014

Hygiene Regulation for Food Establishment was published in October 2014. The regulation is pursuant to articles 55, 57, 58, 59 and 94 of the Health and Protection Act 2012. It provides the hygiene standards for food establishments essential to ensure public health safety related to food and drinks provided at these establishments. Articles 4(a) of this regulation requires all food establishments, including commercial establishments where food or drinks are produced or packaged, to be registered at Health Protection Agency (HPA) as per Annex 1 of the regulation. Article 5 of the regulation states that all food establishments listed in article 4(a) and any temporary food establishments should acquire approval from HPA or an authority appointed by HPA.

The proponent shall register the bottling plant at HPA and acquire approval from HPA or the authority appointed by HPA before the operation of bottling plant begins. The proponent shall further ensure that all applicable provisions of this regulation are strictly followed.

3.2.3 Waste Management Regulation 2013

Waste Management Regulation (WMR) was published on August 2013 and came into effect in February 2014. It will be implemented by EPA. The aim of WMR is to implement the national waste policy, which contains specific provisions to:

- Implement measures to minimize impacts on human health
- Formulate and implement waste management standards
- Implement an integrated framework for sustainable waste management
- Encourage waste minimisation, reuse and recycling
- Implement Polluter-Pays Principle
- Introduce Extended Producer Responsibility

WMR contains four main sections:
3.2.4 The Environmental Liability Regulation (Regulation 2011/R-9)

This law is pursuant to Article 22 of national constitution that states that protection, preservation and maintenance of the Maldivian natural environment, the richness of the living species, the natural resources and the beauty of the Maldives for the present generations as well as for the future generations is a basic obligation of the Maldivian government. The government shall enforce that the activities conducted in order to gain economic and social development should be of sustainable nature that protect the environment and such activities shall not deteriorate the environment, endanger any species, damage the environment, and shall not waste any natural resources.

This regulation is also pursuant to Environment Protection and Preservation Act of Maldives (4/93). The regulation is aimed at maintaining equal standards for reprimanding and enforcing environmental liabilities, fines for those who violate the rules and regulations and give guidance to those who are involved in the implementation process of the regulations pursuant to Preservation Act of Maldives (4/93).

One of the key objectives of the environmental liability regulation is also to practice polluter-pay-principles in the Maldives.

All project developer and contractors shall be aware of this provision and contractors shall take all practical measures to ensure that all relevant laws and regulations, and the EMP proposed in this EIA is followed.

3.2.5 Compliance

In general, the proposed developments are in compliance with the laws and regulations described above. Where there is a special requirement to comply, the EMP identifies measures and mechanisms required to comply.
3.3 Environmental Permits Required for the Project

3.3.1 Environmental Impact Assessment (EIA) Decision Note

The most important environmental permit to initiate project work would be a decision regarding this EIA. The EIA Decision Note, as it is referred to, shall govern the manner in which the project activities must be undertaken. This EIA report assists decision makers in understanding the existing environment and potential impacts of the project. Therefore, the Decision Note may only be given to the Proponent after a review of this document following which the Ministry may request for further information or provide a decision if further information is not required. In some cases, where there are no major environmental impacts associated with the project, the Ministry may provide the Decision Note while at the same time requesting for further information.

3.3.2 Plant Registration at EPA

The Bottling Plant has to be registered with the EPA before the operation. The EPA provides the registration when the registration form with necessary information requirements is complete.

The registration process assures the noise levels, accidental preparedness and environmental impacts are minimised through the EIA’s and plant specifications and construction methodologies.

In addition plant water quality is assured by EPA to confirm to EPA and WHO standards before the registration process.

3.4 Responsible Institutions

The main government institutions that have roles and responsibilities relevant to this project are summarised below.

3.4.1 Ministry of Environment & Energy

The Ministry of Environment and Energy (formed in 2012) formerly the Ministry of Housing and Environment is mandated for the effective implementation of the Environmental Protection Act of the country and has the statutory power over issues related to the environment. It has the central control over the environment protection, management, conservation and environmental emergencies. The Ministry operates mainly at a policy level and the more regulatory and technical assessment activities are mandated to the Environmental Protection Agency (EPA). In this respect EPA has now been mandated to manage all issues relating to Environmental Impact Assessment of individual projects.
The Ministry of Environment also seeks the advice of National Commission for the Protection of Environment (NCPE) on all significant environmental matters. The commission is appointed by the president and is mandated to advice the Minister of Environment on environmental matters such as environment assessment, planning and management, and political decisions with regard to the protection of environment.

3.4.2 City Council

Under the Decentralization Act, Male’ City has an elected City Council comprising representatives from the wards. The Council Office is the main focal point of Government Ministries and they co-ordinate and liaises with Government Ministries on all issues relating to Male’. A copy of all EIAs need to be submitted to the Council.

* A copy of this EIA will have to be submitted to the City Council.

3.5 Guiding Policies and Documents

3.5.1 Waste Management Policy

The aim of the waste management policy is to formulate and implement guidelines and means for solid waste management in order to maintain a healthy environment. Accordingly, the key elements of the policy include:

- Ensure safe disposal of solid waste and encourage recycling and reduction of waste generated;
- Develop guidelines on waste management and disposal and advocate to enforce such guidelines through inter-sectoral collaboration;
- Ensure safe disposal of chemical, hazardous and industrial waste.
4 EXISTING ENVIRONMENT

4.1 Physical Environment

4.1.1 Meteorology

4.1.1.1 Climate

The climate in Maldives is warm and humid, typical of the tropics. The average temperature ranges between 25°C to 30°C and relative humidity varies from 73 percent to 85 percent. The annual average rainfall is approximately 1,948 mm. As Maldives lies on the equator, Maldives receives plenty of sunshine throughout the year. Significant variation is observed in the climate between the northern and the southern atolls. The annual average rainfall in the southern atolls is higher than the northern atolls. In addition, greater extremes of temperature are also recorded in the southern atolls. On average southern atolls receive 2704 hours of sunshine each year. Table 4.1 provides a summary of key meteorological findings for Maldives.

Table 4.1: Key Meteorological Information of the Maldives

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

4.1.1.2 Monsoons

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

The winds that occur across Maldives are mostly determined by the monsoon seasons. The two monsoons are considered mild given that Maldives is located close to the equator. As a result, strong winds and gales are infrequent although storms and line squalls can occur, usually in the period May to July. During stormy conditions gusts of up to 60 knots have been recorded at Male’.

Wind has been uniform in speed and direction over the past twenty-plus monsoon seasons in the Maldives (Naseer, 2003). Wind speed is usually higher in central region of Maldives during both monsoons, with a maximum wind speed recorded at 18 ms⁻¹ for the period 1975 to 2001. Mean wind speed as highest during the months May and October in the central region. Wind analysis indicates that the monsoon is considerably stronger in central and northern region of Maldives compared to the south (Naseer, 2003).

Besides the annual monsoonal wind variations there are occasional tropical climatic disturbances (tropical storms or low intensity tropical cyclones) in the central region which increases wind speeds up to 110 km/h, precipitation to 30 to 40 cm over a 24 hour period and storm surges up to 3 m in open ocean (UNDP, 2006).

Table 4.2 summarises the wind conditions in central Maldives throughout a year. Medium term meteorological data from Hulhule meteorological centre (see Figure 4.1, Figure 4.2 and Figure 4.3) and findings from long-term Comprehensive Ocean-Atmosphere Data Set (COADS) are used in this analysis.
Table 4.2: Summary of General Wind Conditions from National Meteorological Centre

<table>
<thead>
<tr>
<th>Season</th>
<th>Month</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE - Monsoon</td>
<td>December</td>
<td>Predominantly from NW-NE.</td>
</tr>
<tr>
<td></td>
<td>January</td>
<td>High Speeds from W</td>
</tr>
<tr>
<td></td>
<td>February</td>
<td></td>
</tr>
<tr>
<td>Transition Period 1</td>
<td>March</td>
<td>From all directions. Mainly W.</td>
</tr>
<tr>
<td></td>
<td>April</td>
<td>High Speeds from W.</td>
</tr>
<tr>
<td>SW - Monsoon</td>
<td>May</td>
<td>Mainly from W.</td>
</tr>
<tr>
<td></td>
<td>June</td>
<td>High Speeds from W.</td>
</tr>
<tr>
<td></td>
<td>July</td>
<td></td>
</tr>
<tr>
<td></td>
<td>August</td>
<td></td>
</tr>
<tr>
<td></td>
<td>September</td>
<td></td>
</tr>
<tr>
<td>Transition Period 2</td>
<td>October</td>
<td>Mainly from W.</td>
</tr>
<tr>
<td></td>
<td>November</td>
<td>High Speeds from W</td>
</tr>
</tbody>
</table>

Figure 4.1: Monthly Frequencies of Wind Direction in Central Maldives based on National Meteorological Center 10 year Data (adapted from Naseer, 2003).
The Disaster Risk Profile of Maldives (UNDP, 1006) reports 11 cyclonic events over the Maldives in the last 128 years and only one event over the central Maldives. All of these events were of category 1 cyclones. There have been no cyclonic events since 1993.
Male’ Island is located in a moderate risk cyclonic hazard zone which has the potential for a maximum probable cyclonic wind speed of 55.9 kts (UNDP, 2006).

The project site is expected to receive regular annual strong winds during the peak SW monsoon and NE monsoon.

### 4.1.1.4 Rainfall

The average annual rainfall for the archipelago is 2,124 mm. There are regional variations in average annual rainfall: southern atolls receive approximately 2,280 mm, and northern atolls receive approximately 1,790 mm annually (MEC, 2004). Mean monthly rainfall also varies substantially throughout the year with the dry season getting considerably less rainfall. This pattern is less prominent in the southern half, however. The proportions of flood and drought years are relatively small throughout the archipelago, and the southern half is less prone to drought (UNDP, 2006).

The nearest meteorological station to Male’ is the National Meteorological Centre in Hulhule’ Island. The mean annual rainfall in Hulhule’ is 1991.5 mm with a Standard Deviation of 316.4 mm and the mean monthly rainfall is 191.6 mm. Rainfall varies throughout the year with mean highest rainfall during October, December and May and lowest between February and April (See Figure 4.4).

![Mean Monthly Rainfall in Hulhule’](image)

*Figure 4.4: Mean Monthly Rainfall in Hulhule’ (1975-2004)*

Analysis of daily maximum annual rainfall data shows high variability, including extremes (see Figure 4.5 below). However, no significant long term trends are evident in the Hulhule data.
The probable maximum precipitations predicted for Hulhule’ by UNDP (2006) are shown in Table 4.3.

Table 4.3 Probable Maximum Precipitation for various Return periods in Hulhule’

<table>
<thead>
<tr>
<th>Station</th>
<th>Return Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 year</td>
</tr>
<tr>
<td>Hulhule’</td>
<td>187.4</td>
</tr>
</tbody>
</table>

Source (UNDP, 2006)

4.1.1.5 Temperature

Daily temperatures of Maldives vary little throughout the year with a mean annual temperature of 28°C. The annual mean maximum temperature recorded for Male’ during the period 1967-1995 was 30.4°C and the annual mean minimum temperature for the same period was 25.7°C. The highest recorded temperature for Male’ was 34.1°C on 16th and 28th of April 1973. The hottest month recorded was April 1975 with a maximum monthly average temperature of 32.7°C, the next highest being 32.6°C in April 1998. The lowest minimum average temperature of 23.7°C was recorded in July 1992.

There is considerable inter annual variability in extreme temperatures for Hulhule as shown in Figure 4.6. A maximum temperature of at least 33.5°C is rare at Hulhule and has a return period of 20 years (Hay, 2006).
4.1.2 Water quality assessment

The primary objective of the marine water quality sampling was to determine the baseline conditions of the marine water at the intake and outfall locations for the desalination process that feeds water for the bottling plant. All water quality tests were done at the Male’ Water & Sewerage Company- laboratory.

The following table shows (see 4.5) the test results of the ground water samples collected on 24 February 2016. See Appendix E for more details.

Table 4-1 Marine water quality assessment results from MWSC laboratory

<table>
<thead>
<tr>
<th>Parameter</th>
<th>EPA guide</th>
<th>Intake</th>
<th>Outfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical appearance</td>
<td>Clear</td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Conductivity</td>
<td>51400</td>
<td>48700</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>8.0 – 8.3</td>
<td>8.16</td>
<td>8.20</td>
</tr>
<tr>
<td>Salinity ($%_o$)</td>
<td>33.70</td>
<td>31.79</td>
<td></td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>7.99</td>
<td>7.92</td>
<td></td>
</tr>
<tr>
<td>Temperature ($^\circ$C)</td>
<td>18-32</td>
<td>23.4</td>
<td>23.4</td>
</tr>
<tr>
<td>Biological Oxygen Demand (mg/L)</td>
<td>&lt; 2</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td></td>
<td>25700</td>
<td>24400</td>
</tr>
<tr>
<td>Total Coliforms</td>
<td>0</td>
<td>71</td>
<td>NA</td>
</tr>
<tr>
<td>Faecal Coliform (CFU/100ml)</td>
<td>0</td>
<td>8</td>
<td>NA</td>
</tr>
</tbody>
</table>
Marine water qualities for majority of the parameters tested appear to be within acceptable ranges at all sites. Total Coliform and Faecal coliform were detected in the sample collected from the water intake site. Total coliform levels were observed to be significantly high in the sample collected. Biological Oxygen Demand (BOD) in the two samples was slightly higher than the optimum range specified by EPA. As BOD is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions, it denotes that a significant quantity of decomposable organic matter is present in the sampling sites.

4.1.3 Land use

The main premises of STELCO (Ameeneemagu), includes the Company’s headquarters, and the power generation plants that supply electricity to the entire Male’ City grid. The proposed site for the bottling plant is an existing prefabricated structure within the premises. As the site is found within the premises of STELCO, no land use conflicts were raised for the project.

4.2 Natural and Biological Environment

4.2.1 Terrestrial ecology

The proposed site is located within the main premises of STELCO, an industrial area in Male’. The desalination plant is an existing facility, and the proposed bottling plant is being housed in an existing prefabricated structure within the premises. Therefore, no vegetation removal or site modification is required for this project.

No particular species of importance in terms of flora or fauna was observed at the site as well.
4.2.1.1 Existing facilities in the surrounding area

Figure 4-1 Existing multi-phase desalination plant facility at STELCO
Figure 4-2 Bottling Plant equipment and machinery mobilised at existing prefabricated house at STELCO
4.2.2 Marine Ecology

The aim of this assessment is to establish the baseline condition at the proposed project location; specifically the marine area designated for the desalination plant’s intake. Marine assessments were carried out from 21st February 2016, the sea was calm during the survey. The main objectives of this assessment were:

1. to determine the general status of the reef associated with the island
2. to assess the condition of the marine environment which will be directly impacted by the project
3. to determine the fish species abundance and composition of the reef system

The following sub-sections provide details site, the methodology adapted for this assessment and the results.

4.2.2.1 Photoquadrat Survey and Fish Census

Transect 1

This transect was deployed at 10 m depth, along the reef edge on the south-eastern side of the island, near the existing water intake and outfall pipe for the desalination plant.

Analysis of the photos shows that the dominant benthic substrate at this site is dead rock (55%) and coral rubble (39.5%). Generally, coral life was very low at this site, making up about 3% of the survey area. Only small sub-massive type corals were observed at this site.

A total of 31 fish species 12 fish families were recorded during the fish census. Highest number of fish species was recorded from families Surgeonfish family (5 species). This most abundant fish species recorded was Blue Triggerfishes, which feeds on zooplanktons in the water column.

Figure 4-3 Select images showing variety of coral species along transect 1
4.2.2.2 Visual Snorkelling Survey

Visual snorkelling surveys were carried out from the tetrapod breakwater towards the reef slope. This site is located on the south eastern side of Male’. Live coral cover near the tetrapod breakwater was higher than the coral cover on the top reef. Coral recruits were observed on the large dead rocks near the breakwater. The rocky bottom is covered with turf algae. Algal grazers such as parrot fishes and surgeon fishes were the most abundant fish families observed.
4.2.3 Marine protected areas and sensitive sites

There are no Marine Protected Areas (MPAs), or Environmentally Sensitive Areas in Malé. The nearest MPA to Male’ is Hans Hass Place (Gulhifalhu Beyrufaru Kohlavaanee) (> 5 km).

4.2.4 Breeding or nursery grounds for protected or endangered species

All coral reef areas have the potential to be used as breeding/nurseries for reef fishes. No literature is available to indicate that the reef system of Male’ is used as breeding/nursery for fishes, crustaceans, marine mammals, sharks or turtles. Further studies are required to determine the specificity of the sites.

4.3 Natural Hazard Assessment

The primary sources of natural hazard risks in Maldives are strong winds during monsoons or freak storms, earthquakes, island interior flooding caused by heavy rain, coastal flooding caused by high surf, storm surge, prolonged strong monsoonal wind, high astronomical tides or tsunamis, and sea level rise (Pernetta and Sestini, 1989, Woodroffe, 1989, Severe weather events in 2002 2003 and 2004(2005), UNDP 2005). Coastal flooding and wind damage can be considered as the most frequent natural hazards that occur in Maldives (see Maniku (1990), Luthfy(1994)). Most of these risk factors (apart from earthquake, wind damage and rainfall flooding), stems from the extremely low elevation of all Maldivian islands: the average elevation is 0.8m above sea level. Despite the occasional natural hazards, Maldives in general is relatively safe from high risk natural disasters.

Spatial variations in hazards are evident across Maldives (Shaig, 2005, Maniku, 1990). Northern atolls are more exposed to intense storm systems, increasing the risk of wind damage in these atolls. In comparison, southern atolls experience less storms systems, but are more exposed to flooding events, probably as a result of exposure to intense South Indian Ocean storm surges and wind-waves during south west monsoons.

According to the UNDP Disaster Risk Assessment Report of Maldives in 2006, Male’ is located in an area less exposed to wind storms, storm surges, swell waves and to tsunamis.
5 Socio-economic Environment

5.1.1 Male’ Social Setting

5.1.1.1 Demography

Male’ is the capital city of the Maldives and is currently administered by an elected city council. It has 6 administrated wards, namely, Heneveiru, Galolhu, Mahchangolhi, Mafannu, Villimale’ and Hulhumale’. Villimale’ and Hulhumale’ are the latest addition to the greater Male’ area and exist as geographically separate islands from Male’.

According to the preliminary results of Maldives Population and Housing Census of 2014, the total number of people residing in the greater Male’ area at the time of census was 153,379. This accounts for 38.35% of the total population of the Maldives. Out of the 153,379 people, 20,360 were foreigners contributing to 13.27% of the total population residing in Male’. Male’, being the capital city of the country, is home for all government institutions, business and employment opportunities. Furthermore, compared to the rest of the country, the quality of basic services such as education and health care are better in Male’. Consequently, people from across all atolls of Maldives continue to migrate to Male’ for different purposes.

Figure 4.28 below shows how the population size of Male’ have increased from 1985 to 2014.

*Figure 4.28: Population of Male’ between 1985- 2014*


**Sex Ratio**

According to the preliminary results of Maldives Population and Housing Census of 2014, the National Sex Ratio for the country shows that there are more males than females in Maldives.
with a sex ratio of 103 (103 males per 100 females). Sex ratio for the population residing in Male’ shows a slightly smaller gap between the number of males and females with a sex ratio of 99.

**Population Structure**

Figure 4.29 below shows the population pyramid of Male’ based on Maldives Population and Housing Census of 2006.

*Figure 4.29: Population Pyramid for Male’, 2006*

According to the figure, the most dominant age group in Male’ at the time of census 2006 was between 15-25 years, for both male and female populations. This population is now expected to reach 23-33 years age group and is likely to remain as the largest portion of the city population.

According to census 2006, the working age population of Male’ comprised of 72% of its residing population. The overall dependency ratio stood at 39, with a child dependency ratio of 35 and age dependency ratio of 4.

**Annual Population Growth Rate**

Inter-censual average annual growth rate between 2006 and 2014 showed that Maldives as a whole, experienced a positive growth as the average annual growth rate for the country stood at 1.56. Similarly, Male’ also experienced a positive growth during this period with an average annual growth rate of 2.94.
Table 4.9: Average Annual Growth Rate, Male’, 2014

<table>
<thead>
<tr>
<th>Locality</th>
<th>Average Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Republic</td>
<td>1.56</td>
</tr>
<tr>
<td>Male’</td>
<td>2.93</td>
</tr>
</tbody>
</table>

Source: Department of National Planning, 2014

Population Density

Male’ is one of the most densely populated city in the world. While the current size of Male’ is relatively big compared to the rest of the islands in the country, it has the highest population density within the country with 197 people per hectare.

Migration

As discussed earlier, people from across all atolls of the country migrate to Male’ for different purposes including access to better quality services such as education and health care and business and employment opportunities.

5.1.1.2 Service Quality and Accessibility

Water, Electricity and Waste management

MWSC currently provides desalinated water and STELCO provides electricity supply for the greater Male’ area. Waste is collected to allocated waste management sites in Male’ and then taken to Thilafushi dump yard.

Education

According to the Ministry of Education as of March 2013, there were a total of 36 schools in Male’, which includes 13 government schools, 4 community schools and 11 private schools. A total of 27,204 students were enrolled in these schools in 2013. The majority (57%) of the students were studying in the government schools while 20% were enrolled in community schools and 22% in private schools. Statistics from the Ministry of Education show equal gender representation of students in all three types of schools.

Health Service

Indira Gandhi Memorial Hospital, located in Male’, is the main government hospital established in the Maldives providing the most extensive health care services. ADK hospital, also located in Male’, is the main private hospital in the country. There are also a number of private clinics
established in Male’, which provides specialist consultations as well as certain laboratory tests and treatments.

As of 2010, there were a total of 984 health professionals working in Male’. Out of the 984 professionals, 49% were locals.

5.1.1.3 Housing

The increase in the population of Male’ within the past decade have not been met with adequate increase in housing developments. As a result, there is a huge demand for housing in Male’ and the prices of renting in Male’ keep on increasing.

During the most recent call to submit application forms for social housing, a total of 15,650 people living in Male’ applied, indicating the growing demand for housing opportunities in Male’.

Currently, Maldives government has a number of ongoing housing projects in Male’ as well as in Hulhumale’, Villimale’ and Gulheefalhu.

Figure 4.30 below shows the number of living quarters in Male’ between 1985-2006.

*Figure 4.30: Number of Living quarters in Male’ from 1985 to 2014*

Source: Ministry of Planning and National Development 2008
6 IMPACTS IDENTIFICATION

6.1 Introduction

Potential adverse and beneficial impacts of construction and operation stage of the bottling plant are identified and evaluated in this section. Significant impacts are identified and evaluated in two stages. The first stage identifies the environmental and socio-economic components that may be impacted from key project activities. The second stage determines the significance of impacts on each component. The following sections provide details of the evaluation of impacts.

6.2 Nature of potential impacts on key components

Nature of potential impacts is defined here as no impact, adverse impact or beneficial impact. Table 6.1 below provides the nature of potential impacts from the proposed project on environmental and socio-economic components by the project. Where impacts are not applicable to different components, this is indicated as ‘na’. Some components may be affected both adversely and beneficially from the project.

6.3 Identification of significant impacts

Environmental and socio-economic components that may be impacted by the project as identified in Table 6.1 are further evaluated to identify significant impacts. Assessments of the impacts are conducted using the four criteria of magnitude, reversibility, duration and distribution as described below. Evaluation of key impacts is provided in Table 6.2.

1. **Magnitude:** Refers to the quantum of change that will be experienced as a consequence of the impact.

2. **Reversibility:** Refers to the degree of reversibility of an impact (i.e. ease of reversing the conditions).

3. **Duration:** Refers to the temporal scale (i.e. duration, frequency) of the impact. It does not take into account the duration of the impact’s effects.

4. **Distribution:** Refers to the spatial scale of the area impacted (e.g. a small portion of a reef or an entire lagoon)

Estimates for negative impacts represent a ‘worst case scenario’ based on the assumption that the project will undergo full scale development with no consideration for its environmental and social consequences, i.e. significance is assessed prior to implementation of mitigation measures. Values are attributed by the EIA team on the basis of direct observation of surveyed sites, professional judgment and pre-existing experience in development projects of similar nature.
## Table 6-1 Impact Identification Matrix

<table>
<thead>
<tr>
<th>Activity</th>
<th>Noise Level</th>
<th>Air Quality</th>
<th>GHG emissions</th>
<th>Marine environment</th>
<th>Groundwater</th>
<th>Terrestrial Flora</th>
<th>Terrestrial fauna</th>
<th>Soil condition</th>
<th>Freshwater</th>
<th>Protected species</th>
<th>Natural hazard &amp; safety</th>
<th>Health and safety</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workforce</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>na</td>
<td>x</td>
<td>x</td>
<td>+</td>
</tr>
<tr>
<td>Plant installation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>na</td>
<td>x</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Demobilization</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>na</td>
<td>x</td>
<td>x</td>
<td>+</td>
</tr>
<tr>
<td><strong>Operation Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation of the plant</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>+</td>
</tr>
<tr>
<td>Transportation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>+</td>
</tr>
</tbody>
</table>

X (no impact), - (negative impact) + (positive impact)
### Table 6-2 Evaluation of key impacts on the natural environment during construction and operation stage

<table>
<thead>
<tr>
<th>Impact area</th>
<th>Potential impacts</th>
<th>Nature/Distribution/Duration/Magnitude</th>
<th>Reversibility</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient noise level</td>
<td>Noise pollution: Operation of vehicles, machineries during plant installation. However as all the equipment is already in place, not much noise will be generated during installation.</td>
<td>Direct/negative; 200 m radius; Project site; Shore term; Minor negative change</td>
<td>Easily reversible</td>
<td>Insignificant - Limited hours of operation.</td>
</tr>
<tr>
<td>Ambient air quality</td>
<td>Air quality degradation: negligible level of air emissions during construction phase</td>
<td>Direct/negative; 200 m radius; Short term; No change;</td>
<td>Easily reversible, negligible effects</td>
<td>Insignificant - Negligible level of emissions over a short time period.</td>
</tr>
<tr>
<td>Employment</td>
<td>Increase in employment opportunities; 20 workers will be employed for the construction work.</td>
<td>Direct/positive; Island level; Short term; Moderate positive change</td>
<td>NA</td>
<td>Insignificant - Short term employment opportunity</td>
</tr>
<tr>
<td><strong>Operational stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine Environment</td>
<td>Increase in brine outfall: Brine outfall with production of desalinated water. Future plans for expansion of desalination capacity would further increase the brine outfall. Increase in plastic waste: Plastic bottle already form a significant threat to the marine environment due to its improper disposal. The project will indirectly affect</td>
<td>Direct/indirect/negative; 100 m radius around brine outfall; Waste country wide Through-out operation; No change;</td>
<td>Reversible once water production stops</td>
<td>Moderately Significant</td>
</tr>
</tbody>
</table>
### Impact area

<table>
<thead>
<tr>
<th>Potential impacts</th>
<th>Nature/Distribution/Duration/Magnitude</th>
<th>Reversibility</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine environment quality</td>
<td>Direct/positive; National level; Short term; Moderate</td>
<td>Reversible</td>
<td>Significant</td>
</tr>
<tr>
<td>Waste Management Increase in plastic waste - Plastic bottles are already a major source of waste in the country and bottling plants are their main contributor.</td>
<td>Direct/positive; National level; Short term; Moderate</td>
<td>Reversible</td>
<td>Significant</td>
</tr>
<tr>
<td>Transportation Increased noise and Greenhouse gas emissions</td>
<td>Direct/Positive Not localised Long term; Minor negative change</td>
<td>Irreversible</td>
<td>Insignificant</td>
</tr>
<tr>
<td>Employment Increase in employment opportunities; 12 workers will be employed for the operation of the bottling plant</td>
<td>Direct/positive; Island level; Long term; Moderate positive change</td>
<td>NA</td>
<td>Significant - Long term employment opportunity</td>
</tr>
</tbody>
</table>

### 6.4 Overall positive impacts from the project

- Business diversification and increased profits for STELCO
- Reduced cost of bottled water in Male’
- Reduced risk of drinking water shortage in the greater Male’ region
- Labour costs will be reduced to local distributors
- Increased job opportunities in Male’
7 SIGNIFICANT IMPACTS AND MITIGATION MEASURES

7.1 Increase in plastic wastes

The most significant impact from this project is the contribution the increase in plastic waste in the Maldives. As of 2012, 12.5 million bottles were produced per year and it is estimated that only a moderate percentage of it is recycled or properly disposed. Thus, it is essential that the number of bottles recovered from the waste streams is increased from this project.

Although a recycling venture has not been finalized during the time of submission of this EIA, the proponent is looking into the prospects of establishing a recycling venture for their bottling activities. These activities will be carried out along with the expansion of their desalination capacity. STELCO’s Bottling facility will be unable to operate at its full capacity until their desalination plant capacity is increased. Therefore, the increase in plastic waste until these expansion activities are carried out, will be fairly low but not insignificant.

Their recycling venture will look to incentivise the public by introducing some sort of financial or discount incentives.

7.2 Other aspects

The construction period is short with no major construction works apart from the installation process. However during construction phase standard safety and precautionary measures will be employed to minimise and work related accidents and to minimise any impacts to the natural environment as follows:

- Supervise the construction and installation works under a qualified supervisor with extensive experience on such projects
- Make the staffs aware of the environmental and safety aspects if the project
- Erect safety and instructional boards in and around the project site
- Carry out the works during the day time
- Inform the general public on the project activities
8 ALTERNATIVES

This chapter considers possible alternatives for relevant components of the project including the no project option.

8.1 ‘No Project’ Alternative

The option of a no project alternative has been considered for the establishment of the bottling plant. The advantages and disadvantages of the No Project option are presented in Table 8.1.

Table 8-1 Pros and cons of ‘no project’ option

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>− Potential increase in waste associated with the project is avoided (mainly plastic waste)</td>
<td>− Economic losses associated with less industrial activities</td>
</tr>
<tr>
<td></td>
<td>− High opportunity cost</td>
</tr>
<tr>
<td></td>
<td>− Growth of major economic industries hampered</td>
</tr>
<tr>
<td></td>
<td>− Price of bottled water remains high in the region.</td>
</tr>
</tbody>
</table>

Considering the high economic and social benefits of the project and low environmental impacts, the best option is to go ahead with the project.

8.2 Alternative bottling material

The use of glass as an alternative bottling material was discussed with the proponent.

However, given the high costs of production, handling and transportation involved in glass bottles, it was not a feasible option for a small scale bottling facility like this project.

8.3 Alternative Site

As the proposed site has no significant flora and no fauna at all, the environmental impacts relative to the site are insignificant. The site also has a prefabricated house in place that is ideal for establishing the bottling plant. Thus the best option is to carry out the project as planned.
9 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) is an important component of the EIA process, needed to determine the accuracy of impact prediction, the adequacy of mitigation measures, and level of compliance with commitments regarding implementation of mitigation measures and monitoring of relevant environmental aspects.

The main objectives of the environmental management plan are to:

- Produce a framework for managing anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions.
- Provide evidence of compliance to legislation, policies, guidelines and requirements of relevant authorities.

9.1 Environmental management system

The environmental management framework for the proposed project is based on the standards and policies set out by the Environmental Protection Agency of the Maldives.

- Environmental Management Planning and establishment of key performance indicators: The EMP specifies environmental management measures and required performance standards
- Monitoring and corrective action: The implementation of EMP measures will be monitored. Any inconsistencies between the EMP and its on-site implementation will be identified and addressed through corrective actions
- Auditing, reviews and improvement: The EMP will be reviewed. Improvements to the EMP will be made as necessary to achieve desired environmental outcomes.

The environmental management strategy is demonstrated in the following figure.
9.2 Management structure and responsibilities

The following parties are involved in the EMP of this project:

- Project proponent
- Environmental consultant
- Environmental Protection Agency (EPA)

The roles and responsibilities of the parties involved are as follows.

9.2.1 Project proponent

- Execution of all project activities
- Preparation of EMP
Monitoring of the project activities
Submission of annual environmental monitoring reports as required by the EPA

9.2.2 Environmental Consultant

- Preparation of EMP
- Monitoring of performance of project activities according to the EMP
- Auditing the EMP to ensure desired outcomes are achieved
- Making amendments to the EMP according to the results of the audits
- Preparation of environmental monitoring report as required by the EPA (detailed in Chapter 9 of this report)

9.2.3 Environmental Protection Agency

- Review environmental monitoring report
- Intervention in the event of a breach in environmental permit conditions

9.3 Reporting requirements

Reporting shall be undertaken to provide evidence of the ongoing implementation of the EMP and will cover any training activities, site conditions and operations, monitoring data, details of non-conformances, incidents, complaints and follow up action, results of audits and reviews. Reporting shall be undertaken by the project proponent and the Environmental Consultant.

The environmental reporting process is summarized in the figure below. All non-compliances and complaints during the execution of the project are to be reported to the EPA. The environmental management plan for execution of the project is provided below.
Environmental Management Plan for construction and operation phase

**Environmental Protection Agency**
- Issues raised from periodic review of project
- Recording of complaints

**Project proponent**
- Training of personnel
- Environmental monitoring
- Recording of incidents
- Recording of complaints and follow up actions
- Review of EMP

**Environmental consultant**
- Training of personnel
- Environmental monitoring audits
- Review of EMP

- Preparation of draft environmental report

- Submission of report

- Annual environmental monitoring report finalized
### Table 9-1 Environmental Management Plan for construction and operation phase

<table>
<thead>
<tr>
<th>Activity</th>
<th>Management measures</th>
<th>Responsible party</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training of staff and contractors</td>
<td>All construction workers and project management staff will be provided information on general environmental issues, compliance with environmental permits and EMP. All staff involved with environmental monitoring will be provided training in environmental monitoring procedures.</td>
<td>Project proponent &amp; Environmental Consultant</td>
<td>Before commencement of construction activities</td>
</tr>
<tr>
<td>Documenting non-conformances and corrective actions</td>
<td>All non-conformances to the environmental permit conditions, observed during monitoring will be documented. Necessary corrective actions and preventative actions will be identified. Corrective actions will be implemented, with systematic follow ups to ensure effectiveness of these measures.</td>
<td>Project proponent &amp; Environmental consultant</td>
<td>Continuous during construction phase</td>
</tr>
<tr>
<td>Control of water contamination</td>
<td>Oil, solid waste and hazardous waste handled carefully and transported in sealed containers. All paints, lubricants, and other chemicals used on site stored in a secure and bunded location. Littering and accidental disposal of construction wastes avoided by preplanning. General refuse stockpiled in one central area.</td>
<td>Project proponent</td>
<td>Continuous during construction phase</td>
</tr>
<tr>
<td>Waste management</td>
<td>All waste segregated, stored temporarily and transferred to the existing waste management site. Agreements shall be made with the waste management operators to handle commercial waste being generated from the facility. Otherwise a mechanism to transfer waste directly to Thilafushi must be identified.</td>
<td>Project proponent</td>
<td>Continuous, during construction phase</td>
</tr>
<tr>
<td>Supervision of project activities</td>
<td>Assign suitably experienced and qualified personnel to supervise the entire project and ensure that all activities are carried out with minimal adverse impact on the environment.</td>
<td>Project proponent</td>
<td>Before commencement of the project</td>
</tr>
</tbody>
</table>
10 ENVIRONMENTAL MONITORING PLAN

10.1 Introduction

While the negative environmental impacts of the project can be significantly minimised if proper mitigation measures are taken, as identified in Chapter 6, the potential for unforeseen impacts still exists. Furthermore, some of the predicted impacts may turn out to have greater significance than predicted, making the suggested mitigation measures ineffective. Therefore, frequent and regular monitoring of the relevant environmental aspects is a vital component of environment management. This chapter outlines the environmental monitoring plan for the proposed project.

10.2 Objectives of the Monitoring Plan

The main objectives of the monitoring plan are:

− To identify whether the predicted impacts are accurate and mitigation measures taken are effective
− To identify any unforeseen impacts so that appropriate mitigation measures can be taken at the earliest
− To identify and resolve any issues of social unrest at the earliest
− To eliminate or reduce environmental costs

10.3 Aspects of the Monitoring Plan

Table 10-1 below summarizes the key aspects of the monitoring plan. The Table indicates the methodology, frequency and estimated cost for each monitoring attribute that will be required for the proposed project.

<table>
<thead>
<tr>
<th>Monitoring Attribute</th>
<th>Indicator</th>
<th>Methodology</th>
<th>Frequency</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste monitoring</td>
<td>Waste generation levels</td>
<td>Waste census</td>
<td>Once during the construction and once during operation</td>
<td>US$150 per survey</td>
</tr>
<tr>
<td></td>
<td>No of bottles recovered</td>
<td>Logs</td>
<td>Continuous</td>
<td>-</td>
</tr>
<tr>
<td>Monitoring Attribute</td>
<td>Indicator</td>
<td>Methodology</td>
<td>Frequency</td>
<td>Estimated Cost</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
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<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Product Water Quality</td>
<td>pH, E-conductivity, Total Coliform, Faecal coliform, Chloride, Nitrates, phosphates, DO and TSS.</td>
<td>Chemical analysis</td>
<td>Monthly during operational phase</td>
<td>US$250 per survey</td>
</tr>
</tbody>
</table>

### 10.4 Monitoring Report

Based on the data collected, a detailed monitoring report will be compiled annually and submitted to the relevant government authorities for compliance. The report will include methodologies and protocols followed for data collection and analysis, quality control measures and indicate the uncertainties.

### 10.5 Commitment for Monitoring

The proponent is fully committed to undertake the monitoring program outlined in this Chapter (refer Appendix H of this report).
11 Stakeholder consultations

Stakeholder consultations for this EIA were conducted with Environmental Protection Agency (EPA) and Maldives Food and Drug Authority (MFDA) between 20\textsuperscript{th} and 22\textsuperscript{nd} March 2016. In each consultation, a brief introduction of the project was provided to the participants. The stakeholders were then asked for their opinions, concerns and recommendations with regard to the proposed project.

11.1 Environmental Protection Agency (EPA)

Date: 22 March 2016  
Time: 11:00 AM  
Venue: EPA  
Participants:  
1. Aminath Mohamed (Environment analyst)  
2. Nashwa Ahmed Manik (Environment analyst)  
3. Yazeed Ahmed (Director)

Summary of Discussions:
- The main concern of EPA was to get the desalination plant of STELCO registered before bottling can start.  
- EPA stated that they would comment further after submission of EIA for the bottling facility.  
- EPA also expressed concerns of using STELCO premises for bottling ventures. They said they would not approve further land for power production from Male’ since STELCO is using the land for bottling instead of expansion of their power generation activities.

11.2 Maldives Food and Drug Authority (MFDA)

Date: 20 March 2016  
Time: 05:00 PM  
Participant(s):  
1. Mr. Satish Moosa, Microbiologist

Summary of Discussions:
- MFDA did not have any concerns regarding the project since they have already inspected the site and approved the drawing.  
- They advised STELCO to follow strict water quality assurance measures.
12 Potential Data Gaps and Assessment Limitations

12.1 Gaps in Information

The environment of Maldives is generally poorly understood. This may be due to the lack of detailed studies in the Maldives. Much of the literatures on coral islands are derived from studies done in the Pacific which unfortunately has very different climatic and geologic settings.

Detailed environmental analysis for an EIA is often required to be undertaken in a relatively short period of time. Give the seasonal climatic variations in Maldives and the differences in local geomorphologic and climate settings in individual islands such a short time frame is often too little to assess selected aspects of the environment. This problem is compounded by the absence of long-term studies in other parts of Maldives. Hence, most EIA’s end up being based on an environmental snapshot of specific point in time. However, experienced EIA specialists can deliver a close match to reality based on a number of similar assessments. In this regard, the following gaps could be identified in information.

- Absence of long-term site specific or even regional data (at least 2 years). Most critical data include current, wave and terrestrial modification history.
- Absence of historical and long-term records on reef and lagoon environment.
- Lack of detailed data on geology and soil due to time limitation in EIA submission.

These gaps are seriously considered in the assessment and care has been taken to address the issue in designing mitigation measures and the monitoring programme.

12.2 Uncertainties in Impact Prediction

Environmental impact prediction involves a certain degree of uncertainty as the natural and anthropogenic impacts can vary from place to place due to even slight differences in ecological, geomorphological or social conditions in a particular place. As note earlier, there is also no long term data and information regarding the particular site under consideration, which makes it difficult to predict impacts. It is important to consider that there will be uncertainties and voluntary monitoring of natural processes as described in the monitoring programme is absolutely essential.
13 Conclusions:

The major conclusions derived from the project are;

- The proposed developments are in conformance to the laws and regulations of the Maldives.
- The project is targeted to install 6000 BPH plant bottling plant in the premises of STELCO, Male’. The bottling plant will be housed in an existing building at STELCO and will utilize the existing desalination plant at STELCO.
- The site does not have any major vegetation and or presence of fauna. Project activities do not require any major alterations to the terrestrial and marine environment.
- The most significant impact from this project is the increase in plastic waste that may result from production and supply. Establishing a recycling venture for the bottles can mitigate this impact. Increase in employment in Male’ is a significant positive impact of the project.
- The alternatives evaluated for the project are alternative bottling materials and alternative site location In addition no project option has also been evaluated. The present options were preferred since there are no significant environmental impacts.
- The Environmental Management Plan (EMP) for this project is designed to produce a framework for anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions. In addition, provide evidence of compliance to legislation, policies, guidelines and requirements of relevant authorities.
- A management framework has been proposed and it is essential that this framework be used in the construction stage of the project.

As the project has no major adverse environmental or socio economic impact the project should be carried out to provide the locals with the positive impacts highlighted in this report.
REFERENCES

BINNIE BLACK & VEATCH 2000. Environmental / Technical study for dredging / reclamation

CDE Consulting Pvt Ltd 2012. EIA for the establishment of a bottling plant at Hulhumale’, Kaafu Atoll.


APPENDIX A – Terms of Reference
APPENDIX B – Site Plan
APPENDIX C– Detailed drawings
APPENDIX D– Survey Locations
APPENDIX E – Water Quality Results
APPENDIX F – CV’s of Consultants
APPENDIX H – Commitment Letter
## APPENDIX I – Fish Census

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GROUPERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cephalopholis argus</td>
<td>Peacock Rock Cod</td>
<td>3</td>
</tr>
<tr>
<td>Epinephelus spilotoceps</td>
<td>Foursaddle Grouper</td>
<td>2</td>
</tr>
<tr>
<td>Epinephelus merra</td>
<td>Honeycomb Grouper</td>
<td>2</td>
</tr>
<tr>
<td><strong>JACKS &amp; TREVALLIES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caranx melampygus</td>
<td>Blue-fin Jack</td>
<td>3</td>
</tr>
<tr>
<td>Caranx Ignobilis</td>
<td>Giant Travally</td>
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<tr>
<td><strong>SPINECHEEKS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scolopsis bilineata</td>
<td>Monacle Bream</td>
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<tr>
<td><strong>SNAPPERS</strong></td>
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</tr>
<tr>
<td>Lutjanus kasmira</td>
<td>Blue-striped Snapper</td>
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<tr>
<td><strong>FUSILIERS</strong></td>
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<tr>
<td>Pterocaesio tile</td>
<td>Blue Dash Fusilier</td>
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</tr>
<tr>
<td>Pterocaesio trilineata</td>
<td>Striped fusilier</td>
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<tr>
<td><strong>BUTTERFLYFISHES</strong></td>
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<tr>
<td>Hemitaurichthys zoster</td>
<td>Black Pyramid Butterflyfish</td>
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<td>Chaetodon kleini</td>
<td>Brown Butterflyfish</td>
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<td>Chaetodon auriga</td>
<td>Threadfin Butterflyfish</td>
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<td>Forcipiger flavissimus</td>
<td>Long-nose Butterflyfish</td>
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<tr>
<td><strong>DAMSELFISHES</strong></td>
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<tr>
<td>Amphiprion clarkii</td>
<td>Clark’s Anemonefish</td>
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</tr>
<tr>
<td>Amphiprion nigripes</td>
<td>Maldivian Anemonefish</td>
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<tr>
<td>Chromis weberi</td>
<td>Weber’s Puller</td>
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<tr>
<td>Pomacentrus caeruleus</td>
<td>Blue-yellow Damsel</td>
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<td><strong>WRASSES</strong></td>
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<td>Thalassoma hardwicke</td>
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<td>Thalassoma janseni</td>
<td>Jansen’s Wrasse</td>
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<tr>
<td><strong>PARROTFISHES</strong></td>
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<tr>
<td>Cetoscarus bicolor</td>
<td>Two-colour Parrotfish</td>
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<tr>
<td>Scarus sordidus</td>
<td>Shabby Parrotfish</td>
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<tr>
<td><strong>MOORISH IDOLS</strong></td>
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<td>Zanclus cornutus</td>
<td>Moorish Idol</td>
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<td><strong>SURGEONFISHES</strong></td>
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<td>Acanthurus lineatus</td>
<td>Lined Surgeonfish</td>
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<td>Acanthurus blochii</td>
<td>Bloch’s Surgeonfish</td>
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</tr>
<tr>
<td>Ctenochaetus striatus</td>
<td>Fine-lined Bristletooth</td>
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</tr>
<tr>
<td>Naso hexacontus</td>
<td>Sleek Unicornfish</td>
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<td><strong>TRIGGERFISHES</strong></td>
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<tr>
<td>Melichthys indicus</td>
<td>Indian Triggerfish</td>
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<td>Odonus niger</td>
<td>Blue Triggerfish</td>
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<tr>
<td>Sufflamen bursa</td>
<td>Boomerang Triggerfish</td>
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<tr>
<td>Balistoides conspicillum</td>
<td>Clown triggerfish</td>
<td>2</td>
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<tr>
<td><strong>SEA STARS</strong></td>
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<td></td>
</tr>
<tr>
<td>Culcita schmedeliana</td>
<td>Schmedelian pin-cushion sea star</td>
<td>3</td>
</tr>
</tbody>
</table>