ENVIRONMENTAL IMPACT ASSESSMENT

Proposed development of 1120 housing units in Hulhumalé

Pruksa-HDC Housing Pvt. Ltd., Maldives

Proponent: Pruksa-HDC Housing Pvt. Ltd.

December 2010
# Table of Contents

TABLE OF CONTENTS ......................................................................................................................... I

TABLE OF FIGURES ............................................................................................................................. III

TABLE OF TABLES ............................................................................................................................... III

NON TECHNICAL SUMMARY .............................................................................................................. IV

1 INTRODUCTION .............................................................................................................................. 1

1.1 INTRODUCTION .......................................................................................................................... 1

1.2 AIMS AND OBJECTIVES OF THE EIA ...................................................................................... 1

1.3 METHODOLOGIES ...................................................................................................................... 1

1.4 EIA IMPLEMENTATION ............................................................................................................... 2

2 PROJECT DESCRIPTION .................................................................................................................. 3

2.1 GENERAL CONTEXT OF THE STUDY ....................................................................................... 3

2.2 THE PROPONENT ....................................................................................................................... 3

2.3 PROJECT LOCATION AND STUDY AREA .................................................................................... 3

2.4 THE PROJECT ............................................................................................................................. 4

2.5 WORK METHODS ....................................................................................................................... 4

2.6 ENVIRONMENTAL INFRASTRUCTURE ....................................................................................... 5

2.6.1 Water supply .......................................................................................................................... 5

2.6.2 Sewerage ............................................................................................................................... 5

2.6.3 Electricity and Gas .................................................................................................................. 5

2.7 PROJECT DURATION ................................................................................................................... 5

2.8 PROJECT INPUTS AND OUTPUTS .............................................................................................. 6

2.9 NEED AND JUSTIFICATION ....................................................................................................... 6

3 THE SETTING ................................................................................................................................... 8

3.1 APPLICABLE LAWS AND REGULATIONS ............................................................................... 8

3.1.1 Environmental Protection and Preservation Act ................................................................. 8

3.1.2 EIA Regulations .................................................................................................................... 9

3.1.3 Regulation on Felling and Transplantation of Trees ............................................................ 10

3.1.4 Law on Trees in Inhabited Islands ....................................................................................... 11

3.1.5 Land Act 2002 and Landuse Regulation ............................................................................. 11

3.2 REGULATION ON CORAL, SAND AND AGGREGATE MINING ................................................ 11
3.3 POLICIES, PLANS AND GUIDELINES ................................................................. 11
  3.3.1 Water and Wastewater ............................................................................ 12
  3.3.2 National Waste Management Policy ....................................................... 13
  3.3.3 Public Consultation and Participation ..................................................... 14
  3.3.4 National Energy Policy ............................................................................ 14
3.4 ENVIRONMENTAL PERMITS REQUIRED FOR THE PROJECT .................. 15
  3.4.1 EIA Decision Statement ......................................................................... 15

4 EXISTING ENVIRONMENT ............................................................................... 16
  4.1 HULHUMALÉ .............................................................................................. 16
  4.2 SITE CONDITIONS ...................................................................................... 16
    4.2.1 Topography .......................................................................................... 16
    4.2.2 Soil and Groundwater ......................................................................... 17
    4.2.3 Vegetation ............................................................................................ 17
    4.2.4 Utilities ................................................................................................ 17
    4.2.5 Health and Safety ................................................................................ 18
    4.2.6 Transport ............................................................................................... 18
    4.2.7 Built Environment and Services ........................................................... 18
    4.2.8 Occupation ......................................................................................... 18

5 IMPACTS AND MITIGATION MEASURES ...................................................... 20
  5.1 IMPACT IDENTIFICATION .......................................................................... 20
  5.2 IDENTIFYING MITIGATION MEASURES .................................................... 20
  5.3 EXISTING CONCERNS .............................................................................. 21
  5.4 CONSTRUCTIONAL IMPACTS AND MITIGATION MEASURES .................. 21
    5.4.1 Waste ................................................................................................... 22
    5.4.2 Excavation and dewatering ................................................................... 22
    5.4.3 Noise and emissions ............................................................................ 22
    5.4.4 Employment ......................................................................................... 23
    5.4.5 Occupational health and safety ............................................................. 23
  5.5 OPERATIONAL IMPACTS AND MITIGATION MEASURES ....................... 23
    5.5.1 Water and wastewater ......................................................................... 23
    5.5.2 Energy .................................................................................................. 24
    5.5.3 Waste ................................................................................................... 25
    5.5.4 Housing issues and living conditions .................................................... 25
    5.5.5 Employment ......................................................................................... 25
  5.6 OVERALL IMPACT EVALUATION .............................................................. 26
5.7 UNCERTAINTIES IN IMPACT PREDICTION ................................................................. 28

6 ENVIRONMENTAL MONITORING .............................................................................. 29
   6.1 RECOMMENDED MONITORING PROGRAMME ................................................... 29
   6.2 COST OF MONITORING ..................................................................................... 30
   6.3 MONITORING REPORT ...................................................................................... 30

7 DECLARATION OF THE CONSULTANT ...................................................................... 31

8 SOURCES OF INFORMATION ....................................................................................... 32

APPENDIX 1: TERMS OF REFERENCE .......................................................................... 33
APPENDIX 2: COMMITMENT LETTER FROM THE PROPONENT ........................................ 35
APPENDIX 3: HULHUMALÉ LANDUSE PLAN .................................................................. 36
APPENDIX 4: APPROVED DRAWINGS ......................................................................... 37

Table of Figures

Figure 2-1: Coralville Housing project location at Hulhumalé (source: Google Earth, 23 August 2009) .................................................................................................................................................... 4
Figure 2-3: Proposed project layout ......................................................................................... 7
Figure 5-3: Existing site conditions .......................................................................................... 19

Table of Tables

Table 2-1: Main inputs of the proposed project .................................................................... 6
Table 2-2: Matrix of major outputs ....................................................................................... 6
Table 5-2: Water quality results (20 October 2010) ................................................................. 17
Table 7-1: Impact evaluation scale ........................................................................................ 26
Table 7-2: Impact matrix for the proposed project ................................................................. 27
Table 7-3: Impact potential indices for the proposed project ................................................ 28
Table 9-1: Costs of the annual monitoring programme ....................................................... 30
Non Technical Summary

This report addresses the environmental concerns of the proposed new development of 1120 Housing apartments by Pruksa- HDC Housing Pvt. Ltd, Hulhumale’ Kaafu Atoll. The primary objective of the project is to provide social housing needs to those applied for the apartments. The site for the proposed area is located at the heart of Hulhumale where hospital, public buildings (cafes and restaurants) and main administration building are located.

The overall environmental impacts of the project have been assessed using appropriate matrices and the results indicated that the proposed project had net positive impact. That is, the project has no major adverse impacts on the environment as far as current knowledge is concerned. Given that the project has major socio-economic benefits mainly housing, ease of population congestion, improved health and employment, it is recommended to allow the project to proceed as proposed.

Environmental monitoring recommended for the project includes the monitoring of groundwater quality and work-related incidents and accidents during construction stage and water and energy consumption during construction and operational stage. Groundwater quality monitoring is a requirement under the Terms of Reference and has been included for both construction and operational phases. Noise levels and dust monitoring has not been considered relevant.
1 Introduction

1.1 Introduction

This Environmental Impact Assessment (EIA) report has been prepared in order to meet the requirements of Clause 5 of the Environmental Protection and Preservation Act of the Maldives to assess the impacts of the proposed 1120 housing units in Hulhumalé, Kaafu Atoll. This report will identify the potential impacts (both positive and negative) of the proposed project. The report will look at the justifications for undertaking the proposed project components. Measures to mitigate any negative impact on the environment would be suggested. An environmental monitoring programme that would help to demonstrate the long term impacts of the proposed project would also be suggested.

The major findings of this report are based on qualitative and quantitative assessments undertaken during site visit on 20 October 2010, information provided by the Client, experience and professional judgment. This EIA has been produced in accordance with the EIA Regulations 2007, issued by the Ministry of Environment, Energy and Water (now the Ministry of Housing and Environment).

1.2 Aims and Objectives of the EIA

This report addresses the environmental concerns of the proposed CoralVille Housing Project in Hulhumalé. It helps to achieve the following objectives.

- Allow better project planning
- Assist in mitigating impacts caused due to the project
- Promote informed and environmentally-sound decision-making
- To demonstrate the commitment by the proponent on the importance of environmental protection and preservation.

1.3 Methodologies

Internationally recognized and accepted methods have been used in this environmental evaluation and assessment. This EIA is based mainly on data collected during a field investigation mission on 20 October 2010 by a team from BluePrint Associates and Sandcays Pvt. Ltd., Maldives.
1.4 EIA Implementation

This EIA has been prepared by Ahmed Zahid, a registered EIA consultant with a number of years of experience in Environmental Impact Assessment in the Maldives and has been involved in some of the housing project EIAs undertaken in the Maldives.

The different steps involved in the implementation of the EIA and the time frame for those steps/activities are given below.

- Approval of TOR 4 November 2010
- TOR Received by Consultant 7 November 2010
- Field mission 20 October 2010
- Draft report submission to Proponent 30 December 2010
- Submission of final EIA report 6 January 2010

Once the EIA has been submitted it is expected that the review process will not take more than 4 weeks. The review process may result in the requisition of additional information. However, all efforts have been made to ensure that adequate information has been provided with specific attention paid to meet all requirements of the Terms of Reference (TOR). The TOR for this EIA is given in Appendix 1.
2 Project Description

2.1 General context of the study

A total of 1,120 apartments will be available to the general public spread out within 54 residential complexes over the next 3-4 years. The exterior layout of each building will be designed to ensure that people can make a distinction from one building to another by differentiating the wall colour under the concept of “Deep Blue Sea”. A total of 3 types of apartment choices will be available: 1-bedroom apartments, 2-bedroom apartments and 620 units of 3-bedroom apartments.

“Pruksa-HDC has currently announced the sale of 178 units including 119 of 3 bedrooms and 59 of 2 bedrooms apartments. This EIA report will consider these 178 units developed under the Coral Ville Housing Scheme plus the remaining 942 units to be developed under other schemes. In fact, the EIA applies to the housing units as well as the associated buildings in the same neighbourhood proposed under this project.

2.2 The Proponent

Pruksa-HDC Housing Pvt. Ltd. is a joint venture company between Pruksa International Company Limited, based in Bangkok, Thailand and Housing Development Corporation, based in Hulhumale’, Maldives. The objective of this joint venture is to develop affordable and quality residential units in Hulhumale’ and to set up a residential project in Male’.

In this joint venture business relationship, the partners have sought to combine the relative strength of both companies towards delivering a successful project. Pruksa is very well known in the state-of-art of construction technology, pre-cast. Pruksa International, a sub-company under Pruksa Global under Pruksa Thailand, act as a subsidiary in investing abroad such as India, Maldives, and Vietnam. Meanwhile, Housing Development Corporation (HDC) is an organization with experience in providing affordable housing units (flats) to Maldivian people.

2.3 Project Location and Study Area

The project site is located in the heart of Hulhumlé, which is the planned part of Malé, the capital of the Maldives. The site is located next to a prestigious complex of buildings. Within the project, there will be a lifestyle complex community mall, set in 2 acres of land with approximately 20 retail shops which offers grocery stores, bookstores, coffee shops as well as many fast food chain restaurants. The concept design for the project is given in Figure 2-2. Architectural drawings approved by the relevant Government authorities are attached in Appendix 4.
2.4 The Project

“Coral Ville” Project is a residential housing project being undertaken by a Joint Venture Company, Pruksa-HDC Housing Pvt. Ltd., established between Housing Development Corporation, Maldives and Pruksa International Company, Thailand. “Coral Ville” is Pruksa-HDC’s pioneer project and consists of 9 Condominium Buildings comprising of 2 and 3 Bed Room apartments, complete with surrounding infrastructure facilities, in terms of foot paths, jogging tracks, communal gardens, etc.

Over 90% of the 178 flats being developed are currently sold out on pre-sale basis, and construction works of the project is underway. It is scheduled that 40 flats will be delivered by January 2011 and the rest of the flats will be delivered in sub phases between the period February to July 2011. The contractor for the project is Kaysorn Construction Company, Thailand, a subsidiary of Pruksa Real Estate and also a leader in pre-fabricated construction methods in Thailand.

2.5 Work Methods

In this system of formwork construction, cast in-situ concrete wall and floor slabs cast monolithic provides the structural system in one continuous pour. Large room sized forms for walls and floor slabs are erected at site. These forms are made strong and sturdy, fabricated with accuracy and easy to handle. They afford large number of repetitions (around 250). The concrete is produced in RMC batching plants under strict quality control and conveyed to site in transit mixers.
The frames for windows and doors as well as ducts for services are placed in the form before concreting. Staircase flights, façade panels, chajjas and jails etc. and other pre-fabricated items are also integrated into the structure. This proves to be a major advantage compared to other modern construction techniques.

The method of construction adopted is no different except that the sub-structure is constructed using conventional techniques. The super-structure is constructed using MIVAN techniques. The integrated use of the technology results in a durable structure.

2.6 Environmental Infrastructure

2.6.1 Water supply

Water will be supplied by a piped public water supply network provided by Malé Water and Sewerage Company (MWSC) for the entire island of Hulhumalé. This water supply is a desalinated water supply based on the energy-intensive process of reverse-osmosis. Groundwater will not be used even for construction purposes. Desalinated water will be purchased from MWSC for construction purposes.

2.6.2 Sewerage

All sewer connections in the building will be connected to the main sewerage network provided by Malé Water and Sewerage Company. However, septic tanks will be constructed at the labour camp during the construction period. There are four septic tanks of 18m3 each installed for the ongoing phase.

2.6.3 Electricity and Gas

Electricity to Hulhumalé is provided by State Electric Company, STELCO. In the same way, electricity to the proposed buildings will be provided by STELCO. Even constructional needs will be met by temporary provisions made by STELCO. STELCO’s generators are currently run on diesel.

Gas is currently provided in cylinders delivered by local service providers. Although this involves socio-economic and especially environmental impacts related to the transport of gas cylinders, there are no other provisions made at present.

2.7 Project duration

The project is expected to be completed around July 2011. Over 90% of the 178 flats proposed under this project (Coral Ville) are sold on pre-sale basis. Construction is currently underway as EIA was delayed due to unspecified
reasons. It is scheduled that 40 flats will be delivered by January 2011 and the rest will be completed between February and July 2011.

2.8 Project Inputs and Outputs

The project has inputs in terms of human resources and natural resources such as water and fuel. The main output of the project is the socio-economic and some environmental benefits associated with the different components. These inputs and outputs are summarised in Table 2-1 and Table 2-2.

Table 2-1: Main inputs of the proposed project

<table>
<thead>
<tr>
<th>Input resource(s)</th>
<th>How to obtain resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jobs/work force during construction</td>
<td>300 of which 1/3 would be locals</td>
</tr>
<tr>
<td>Jobs/workforce during operational phase</td>
<td>About 20 jobs (locals)</td>
</tr>
<tr>
<td>Cement, aggregate, rebar and sand</td>
<td>Imported (mainly from India)</td>
</tr>
<tr>
<td>Food, water and other resources for construction workforce</td>
<td>Provided on site for workforce</td>
</tr>
<tr>
<td>Machinery</td>
<td>Contractor</td>
</tr>
<tr>
<td>Energy for machinery operation</td>
<td>Diesel fuel</td>
</tr>
<tr>
<td>Water during operational phase</td>
<td>Desalinated water (piped water supply), no groundwater</td>
</tr>
<tr>
<td>Fuel during operational phase</td>
<td>Diesel and possible hybrid including solar (local electricity network)</td>
</tr>
</tbody>
</table>

Table 2-2: Matrix of major outputs

<table>
<thead>
<tr>
<th>Products and waste materials</th>
<th>Anticipated quantities</th>
<th>Method of disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater from workers</td>
<td>No. of workers x 95l/c/d</td>
<td>Through existing island sewerage system</td>
</tr>
<tr>
<td>Possible oil leak from machinery, etc</td>
<td>Trace amount</td>
<td>N/A</td>
</tr>
<tr>
<td>Waste from workforce</td>
<td>Small</td>
<td>Disposed of through island waste disposal system</td>
</tr>
<tr>
<td>Domestic wastewater from occupants/flats</td>
<td>130-160l/c/d</td>
<td>Island sewerage system</td>
</tr>
<tr>
<td>Household waste from occupants/flats</td>
<td>Considerable</td>
<td>Island-wide waste management system exists</td>
</tr>
<tr>
<td>Carbon emissions</td>
<td>Small quantities from related vehicular emissions and considerable emissions due to use of household appliances</td>
<td>Island powerhouse emission stacks</td>
</tr>
</tbody>
</table>

2.9 Need and Justification

The project has been awaited by several people. The pre-sale of 98% of the units under development indicates the demand for housing in the greater Malé region, especially Hulhumalé. With Hulhumalé being the only planned city development in the country today, it is expected that Hulhumalé will provide the kind of atmosphere that many people have been waiting for. The rents are quite high in Malé and Hulhumalé compared to the income of the general public. Yet, the demand for housing is ever growing and with lack of land in the capital zone, the price of housing in this area is not expected to go down. This is certainly an incentive enough for investors.

The proposed project will also provide some ease to the ever growing congestion in Malé, providing more people with greater comfort and better facilities. The facilities such as pre-schools and Community Center associated with the project will make settlements more feasible and especially provide young families with better opportunities and their kids with a better surrounding to live.
3 The Setting

The project is set in the beautiful residential area of the reclaimed island of Hulhumalé. Hulhumalé is the most ambitious land reclamation and urban development project undertaken by the Government of Maldives to date. The concept for the development of Hulhumalé was conceived as a decisive step in improving the quality of life of the population and revitalizing the Maldivian economy. It is to serve as an effective solution to the growing problem of congestion within the capital region as well as a means to facilitate the continual growth of the country’s two dominant economic sectors, fisheries and tourism. For these reasons, Hulhumalé has its own developmental policies, regulations and guidelines in addition to others that apply on a national context. These will be discussed in the following subsections of this report.

3.1 Applicable Laws and Regulations

The following laws and regulations of the Maldives are relevant to this project.

- Environmental Protection and Preservation Act, Law No. 4/93
- EIA Regulations
- Regulation on the Felling, Uprooting and Transplantation of Mature Trees
- Law on Trees in Inhabited Islands
- Land Act and Landuse Regulations

3.1.1 Environmental Protection and Preservation Act

The main legal instrument pertaining to environmental protection is the Environmental Protection and Preservation Act (Law No. 4/93) of the Maldives passed by the Citizen’s Majlis in April 1993. This Act provides the Ministry of Environment with wide statutory powers of environmental regulation and enforcement. This umbrella law covers issues such as environmental impact assessment, protected areas management and pollution prevention. The following clauses of the Environmental Protection and Preservation Act (Law No. 4/93) are relevant to the project:

**Clause 5a:** An impact assessment study shall be submitted to the Ministry of Environment, Energy and Water before implementing any development project that may have a potentially detrimental impact on the environment.

**Clause 5b:** The Ministry of Environment, Energy and Water shall formulate the guidelines for EIA and shall determine the projects that need such assessment as mentioned in paragraph (a) of this clause.
Clause 6: The Ministry of Environment, Energy and Water has the authority to terminate any project that has an undesirable impact on the environment. A project so terminated shall not receive any compensation.

Clause 9a: The penalty for minor offences in breach of this law or any regulations made under this law, shall be a fine ranging between Rf5.00 (five Rufiyaa) and Rf500.00 (five hundred Rufiyaa), depending on the actual gravity of the offence. The fine shall be levied by the Ministry of Environment, Energy and Water or by any other government authority designated by that Ministry.

Clause 9b: Except for those offences that are stated in (a) of this clause, all major offences under this law shall carry a fine of not more than Rf100,000,000.00 (one hundred million Rufiyaa), depending on the seriousness of the offence. The fine shall be levied by the Ministry of Environment, Energy and Water.

Clause 10: The government of the Maldives reserves the right to claim compensation for all damages that are caused by activities that are detrimental to the environment. This includes all activities mentioned in Clause No. 7 of this law as well as those activities that take place outside the projects that are identified here as environmentally damaging.

Clause 5 is of specific relevance to this EIA. The EIA Regulations, which came into force in May 2007 has been developed by the powers vested by the above umbrella law.

### 3.1.2 EIA Regulations

The EIA Regulations have been the basis for Environmental Impact Assessment in the Maldives and since its advent it had helped to improve the quality of EIAs undertaken in the country. Today, registered consultants are required to sign EIAs, the EIAs are reviewed by two independent reviewers and final decisions based on the reviews. This EIA would also be subject to these requirements and review criteria.

Schedule D of the EIA Regulations lists the different environmental projects that require an Environmental Impact Assessment study and large scale housing projects have been included in the list. The EIA Regulations sets out the requirements for the contents of Environmental Impact Assessment reports in Schedule E and format for monitoring reports have been given in Schedule M. Therefore, these requirements have been taken into consideration in preparing this EIA report.
3.1.3 Regulation on Felling and Transplantation of Trees

Following several public complaints relating to the Reethi Rah Resort Redevelopment Project in which over 10,000 coconut palms were transplanted from different islands, a Regulation on the Felling, Uprooting and Transplantation of Mature Trees was enforced to ensure that large scale felling or transplantation of trees are undertaken in a manner in which landuse, pest control and other environmental issues such as leftover dug holes are dealt with appropriately. The regulation states that the felling, uprooting, and transplantation of mature trees and coconut palms from one island to another can only be done if it is absolutely necessary and there is no other alternative. It further states that for every tree (including coconut palm) removed from any island two trees should be planted and grown on the same island.

The Regulation prohibits the removal of the following vegetation areas and types:

- The coastal vegetation growing around the islands extending to about 15 meters into the island;
- All the trees and palms growing in mangrove and wetlands spreading to 15 meters of land area;
- All the trees that are in a Government protected area;
- Trees that are being protected by the Government in order to protect species of animal/organisms that live in such trees;
- Trees/palms that is abnormal in structure.

This Regulation is of relevance to this project, however, the project takes place in barren or reclaimed land on which few trees that have been grown exist on the road peripherals. The land area in which the proposed housing project takes place does not have any mature trees that would be affected due to the development. In fact, the area will have additional trees planted during the construction phase and a green landscape will be created without the need for felling or uprooting of trees elsewhere. However, it is recommended that the Project Manager be familiar with the contents of this regulation. The overall project execution work has to be carried out in line with this Regulation.

Clause 7 of the Regulation states that the Ministry of Housing and Environment would decide the number of trees that can be removed based on the number and type of vegetation on the island. Clause 8 states that if more than ten coconut palms measuring above 15 feet height above ground is to be felled or removed from an island, permission should be sought from the Ministry of Housing and Environment whereas for smaller palms permission from the Island Office shall be sought. In the latter case, only less than a third of the trees in the area can be felled or removed. Clause 5(f) states that only those trees that are proposed to be removed shall be removed and no other trees (mature) shall be affected during the removal process. Clause 9 states that the holes created from uprooting of trees shall be covered with sand or soil only and made firm and level.
3.1.4 Law on Trees in Inhabited Islands

The above Regulation specifically states that it does not apply to the scope of provisions in Law No. 21/98 (Law on Trees in Inhabited Islands). Clause 11b of the Law on Trees in Inhabited Islands (Law No. 21/98) is of specific relevance to this project. It states that felling or removal of trees outside house plots, which have not been declared to be protected by the Government, is allowed only if it is removed with its roots, i.e. carefully uprooted.

3.1.5 Land Act 2002 and Landuse Regulation

Law no. 1/2002 (Land Act of the Maldives) and especially the Regulation on Landuse Planning and Implementation are of relevance to this project. Hulhumalé currently falls into Category A of the Regulation on Landuse Planning and Implementation. Clause 3.1 states that category B and C islands will be planned by Regional or Provincial Office while Housing Ministry will plan only Category A islands. Since Hulhumalé is a planned city and possibly the only city in the Maldives in which adequate planning provisions have been provided, landuse planning takes place under the guidance of the Technical Committee as per Clause 4 of the Regulation. However, Hulhumalé Development Corporation (HDC), which later became Housing Development Corporation, is mandated with the planning and development of Hulhumalé. Clause 7 states that landuse plan should be based on 20 year population growth, density and household ratios, and is the basis of Hulhumalé landuse planning. The presently available landuse plan prepared for Hulhumalé is available for the general public on the website of the Housing Development Corporation. This landuse plan is annexed.

3.2 Regulation on Coral, Sand and Aggregate Mining

This regulation addresses sand mining from uninhabited islands that have been leased; sand mining from the coastal zone of other uninhabited islands; and aggregate mining from uninhabited islands that have been leased and from the coastal zone of other uninhabited islands.

Coral mining from the house reef and the atoll rim has been banned through a directive from the President’s Office dated 26th September 1990. Under Article 7 (c) of the Regulation on Sand and Coral Mining issued by the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) on the 13th of March 2000, it is an offence to mine sand or coral from the beach, lagoon or reef of any inhabited island and islands leased for the purpose of building a tourist resort. Coral would not be mined and used in this project.

3.3 Policies, Plans and Guidelines

Several policy documents of relevance have come up in the recent years which are expected to guide the proposed development. One important policy document is the National Environment Protection Plan. This document contains environmental policies and guidelines that should be adhered to in the implementation of the
proposed project activities, especially impact assessment, stakeholder consultation, biodiversity conservation and human settlement and urbanisation. The other similar document is the National Biodiversity Strategy and Action Plan, which focuses on biodiversity conservation and sustainable use of biological resources. In terms of conservation, the Maldives has an ever increasing list of protected species and protected areas, which mainly include marine areas. None of these is of specific relevance to the development of the proposed housing project in Hulhumalé.

The Population Policy is of relevance to this project. The objective of the Population Policy of Maldives is to contribute to improve standard of living and quality of life of the Maldivian people through socio-economic development with a sustainable balance between population and development. One important aspect of the Population Policy is the strategy of population and development consolidation, which focuses on organising human settlements in such a way that sustainable development is fostered and economies of scale are met. Hulhumalé is the main contributor to this policy, however, its growth and expansion has been a bit slow than expected. With its large size and ease of access from the capital, Malé, especially with the ferry system, it has a large scope for rapid economic as well as social development. The proposed project will foster such development while ensuring that elements of nature are protected and preserved.

3.3.1 Water and Wastewater

In the past decade or so, as regulator of water and wastewater, Maldives Water and Sanitation Authority (MWSA) has mainly focused on regulating the service provider, Malé Water and Sewerage Company, MWSC and environmental controls have not been given adequate emphasis. With the functions MWSA incorporated into the functions of Environment Protection Agency formed in early 2009, it has been believed that much will be done in improving the regulatory framework for water and sewage disposal.

Although several attempts have been made to introduce regulations and standards, they are still at a draft stage. Consequently, upon increasing requests from donors under the tsunami relief assistance programmes, the Maldives Water and Sanitation Authority drafted the General Guidelines for Domestic Wastewater Disposal in the Maldives. Recently, with assistance from JICA, these Guidelines have been improved and a final draft has been sent for comments from all concerned. The proposed project is in line with the requirements set forth in these Guidelines. However, since these are a set of Guidelines, the Proponent is not legally binding by these Guidelines or the requirements set forth in the document.

The Maldives adheres to WHO guidelines for its drinking water standards. However, due to the small size of the islands and the time water remains within the waterworks, free chlorine levels have been set below WHO guideline values. This adjustment has been mainly due to public complaints of chlorine levels in their drinking water but has not been technically justified.
Currently, there are no surface water quality standards for the Maldives, but this issue has been addressed to some extent in the “Guidelines for Domestic Wastewater Disposal” in the Maldives. These guidelines do not have any legal binding on any person, however, the requirements set out in these guidelines have been taken into consideration in the overall planning of Hulhumalé. Therefore, the project is in line with these Guidelines.

Although it is of little relevance to the proposed project, it is thought to be necessary to consider the Water and Sanitation Policy Statement, which was made public in 2008. Although the policy document states that “dissemination of information regarding the policy will be given a very high priority”, to this day, there has been little information dissemination with regard to the policy document. Seventeen key policy principles have been outlined in the policy document. These include political commitment, supportive legal framework, integrated approaches, private sector participation, environmental protection, participatory planning and management, community empowerment and ownership, incremental development, equitable service provision, and information dissemination.

### 3.3.1.1 Design Criteria for Sewerage Systems

In early 2007, MWISA prepared design criteria for sewerage systems. These include design standards, testing requirements, submittals and drawing standards, impact analysis procedures and service fee requirements. Some important considerations are that:

- All buildings shall be connected to sewer lines
- Storm water drainage can be deviated to sewers with special permission
- Sewerage system design shall allow for sewage resulting from future landuse and new reclamation
- Sewerage systems shall be designed with a single outfall. If multiple outfalls are required, pumping stations shall be provided
- All systems shall have a bypass sea outfall
- An operation and maintenance manual shall be furnished for all sewerage projects

The sewerage system for the proposed project and overall Hulhumalé will be in conformity to the given criteria.

### 3.3.2 National Waste Management Policy

Although solid waste has been one of the most pressing environmental problems of the Maldives for a long time, a National Waste Management Policy was drafted in 2007 and published in 2008. 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. The following policies have been laid down.

- Establish proper governance structure for solid waste management
- All waste producers shall be responsible for the management of the wastes they generate
- Wastes will be managed and disposed as close to the place of their generation
- Accommodate the specific requirements of special wastes (hazardous, MARPOL and WEEE)
- Planning based on verifiable facts and known and effective strategies
- Create a financially viable waste management system using polluter pays principles
- Development of a legal framework for waste management
- Facilitate private sector participation
- Pursue financial incentives and disincentives to support good waste management practices
- Products such as plastic bags that are harmful to the environment or cause public nuisance would be discouraged
- Increase community participation and awareness

The project design includes waste management mechanisms that ensure safe disposal of waste that is generated. There will be provisions for the collection and delivery of waste to the waste management site(s). The details of these have not been provided in the project document.

### 3.3.3 Public Consultation and Participation

Public participation in project development and management is of importance and is one of the key elements of environmental impact assessment. In the Maldives, public participation has been limited to the review stages of the EIS until recently with the EIA Regulation, which considers public consultation as an important and integral part of the EIA process. However, in the preparation of this EIA report, public consultation has not been undertaken. Most of the public consultations have been undertaken prior to the EIA process and further detailed public consultations especially meetings with community level stakeholders was considered unnecessary.

### 3.3.4 National Energy Policy

As one of the first countries to sign and ratify the Kyoto Protocol in 1998 and as a member of the UN Framework Convention on Climate Change, the Maldives is committed to implement national policies towards sustainable energy management and reduction of greenhouse gas emissions. The President has recently announced that the Maldives would work towards becoming the world’s first carbon neutral country by 2020. The National Energy Policy introduced subsequently is focussed on this goal. As such the National Energy Policy looks at existing issues, constraints and emerging issues. The policy addresses issues of energy supply, consumption, environment, renewable energy, energy efficiency and sustainability. Sustainable supply and consumption is the main focus of the policy.

The key policies outlined in the National Energy Policy are:

- **Policy 1:** Provide all citizens with access to affordable and reliable supply of electricity
- **Policy 2:** Achieve carbon neutrality by Year 2020
Policy 3: Promote energy conservation and energy efficiency to reduce costs

Policy 4: Increase national energy security by diversifying energy sources

Policy 5: Promote Renewable Energy Technologies

Policy 6: Strengthen the institutional and legal framework of the energy sector

According to the policy document, only 3% of energy is from biomass and solar energy while the rest is from refined petroleum products with diesel fuel accounting to 83% of the total energy consumption in the Maldives. The proposed project would have some alternative sources of energy; however, the main contributor to energy would be diesel fuel. Therefore, the contribution to the President’s carbon neutral policy from the proposed project would be very little. However, with alternative energy sources being fed into the local electricity grid in the future, especially the proposed wind farm in Gaafaru, Kaafu Atoll, carbon neutrality will be achieved for the proposed project components as well.

3.4 Environmental Permits required for the Project

3.4.1 EIA Decision Statement

The only environmental permit to initiate proposed works would be a decision regarding this EIA from the Environmental Protection Agency (EPA). The EIA Decision Statement, 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 Statement may only be given to the Proponent after a review of this document following which the EPA 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 EPA may provide the Decision Statement while at the same time requesting for further information.
4 Existing Environment

This section covers the existing environmental conditions of the project site. The key environmental, social and economic components of the project under consideration are described below.

Vital Environmental, Social and Economic Components

- Topography
- Ground water quality
- Vegetation
- Utilities
- Health and safety
- Transport
- Occupation (employment and other economic opportunities)

4.1 Hulhumalé

As mentioned earlier, Hulhumalé is the most ambitious land reclamation and urban development project undertaken by the Government of Maldives so far. A total area of 188 hectares of land that comprises Hulhumalé was reclaimed in 2002. Primary physical and social infrastructure and the first residential developments were completed in 2004 following which the very first people settled in Hulhumalé towards the middle of 2004 with a resident population of just over 1000 people. The Census of 2006 indicated a total population of 2,866 with 1,246 females (www.isles.egov.mv).

According to HDC, by the year 2020, Hulhumalé will be transformed into a world class city where 60,000 people will live, work and raise their families. As well as providing a superb living environment for its residents, Hulhumalé will also serve as a catalyst for broad based investments in the fields of commerce, education, health, recreation, tourism, fisheries and a number of other related areas by both foreign and national parties.

4.2 Site Conditions

4.2.1 Topography

Hulhumalé being a reclaimed island has flat topography. The entire island has been levelled to approximately 2m above mean sea level (MSL). Therefore, the site at which the proposed housing units will be developed would have the same level. The island was reclaimed using sand dredged from the Hulhumalé lagoon. The material varies from rubble to fine sand as a result of which the ground is naturally well-compacted.
4.2.2 Soil and Groundwater

The project site has very poor soil composition. Since the land is reclaimed using coralline sand from the lagoon, soil consists only of compacted coral material. As time has elapsed and vegetation has been grown to some extent, there is a thin humus layer and nitrogen-fixing species such as ipil-ipil has improved the soil condition.

The fragile groundwater lens of the island of Hulhumalé is young because it was formed below recently reclaimed land. The groundwater lens is about 1.8 to 1.9m below ground. The superficial nature of the groundwater lens makes it susceptible to pollution. However, the water lens in Hulhumalé (as well as the site) is deeper than most of the islands in the Maldives, because the natural elevation of most islands are only about 1.5m above MSL.

Table 4-1: Water quality results (20 October 2010)

<table>
<thead>
<tr>
<th>Unit</th>
<th>WQ1</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Location</td>
<td></td>
</tr>
<tr>
<td>WGS1984, Zone43 UTM</td>
<td>338354.33E</td>
</tr>
<tr>
<td></td>
<td>466119.49N</td>
</tr>
<tr>
<td>Temperature oC</td>
<td>30.2</td>
</tr>
<tr>
<td>E-Conductivity mg/l</td>
<td>4.940</td>
</tr>
<tr>
<td>DO mg/l</td>
<td>7.46</td>
</tr>
<tr>
<td>pH</td>
<td>7.14</td>
</tr>
<tr>
<td>Nitrate mg/l</td>
<td>0.0</td>
</tr>
<tr>
<td>Phosphate mg/l</td>
<td>0.0</td>
</tr>
</tbody>
</table>

4.2.3 Vegetation

Vegetation in Hulhumalé is not closely simulated to any uninhabited island with a lot of beef wood (fithuroanu) found in most places. Beef wood does not occur naturally in local island landscapes. However, the species with its small soft leaves and strong branches makes it ideal for diffusing or absorbing wind energy thereby protecting structures behind it. However, local wind speeds rarely exceed above 50km/h.

Vegetation in the project site was assessed by visual observation. There is mainly nitrogen-fixing species such as ipil-ipil, which are good for carbon sequestration. Most of the vegetation is on the road-side, and the project site is mainly barren with mainly weeds and some shrubs.

4.2.4 Utilities

Water supply, sewerage and electricity are provided by Malé Water and Sewerage Company (MWSC) and State Electric Company (STELCO), whose main offices are located in the capital, Malé. Since Hulhumalé is in the Greater Malé Region and considered part of Malé, all services provided to Malé are provided in Hulhumalé, probably in a more organised and planned manner. Household connections of water and sewerage system that takes care of household wastewater are provided to all buildings. Electricity is provided via high-voltage distribution boxes on the road. Gas and other utilities (cable TV, etc.) are provided by local services providers.
4.2.5 Health and Safety

Health and safety during the construction stage would be ensured by the contractor’s health and safety personnel at site. It was observed during the field visit that all workers are provided with appropriate safety gear and that all works are undertaken within the project site. No works fall within the roads adjoining the worksite. Warning signs are used where appropriate.

4.2.6 Transport

Hulhumalé has one of the best transport systems in the Maldives with the first domestic bus service combined with local taxis. Regular ferries connect Hulhumalé with Malé while Airport Express services in Malé and Hulhumalé provides transport to and from the airport. Convenience in terms of transport is one of the most important contributors to the development prospects of Hulhumalé.

4.2.7 Built Environment and Services

The project site is the middle of the residential area of Hulhumalé with existing residential buildings/flats on its north and east (beachside). Within the project area, there is the Hulhumalé Hospital. On the west of the site is the Hulhumalé School with another neighbourhood adjoining the school. Clearing and paving of the roads behind the school is ongoing. All roads adjoining the site had been paved.

The neighbourhood of the project site has the Hulhumalé Hospital and School. Hulhumalé mosque is also in close proximity. Restaurants, cafes and shops can be found in the neighbouring residential block. The site can be easily accessible by the island-wide bus service.

4.2.8 Occupation

Major economic activities of the people of Hulhumalé are retail trade, carpentry, construction work, fixed salary jobs in the resorts, Malé and mostly government jobs in the several government institutions in Malé and Hulhumalé. Since the Industrial area of Hulhumalé and the proposed hotel and various other developments proposed under the ongoing phases of Hulhumalé development are still at the initial planning or development stage or under-developed, there is a scarcity of employment opportunities in Hulhumalé. Therefore, most people commute to work in Malé using the ferry service.

In terms of fishing, the island does not yet have commercial fishery developments and fishing vessels are few. There are some fish processing facilities proposed for in the industrial area. However, they are yet to be developed.
5 Impacts and Mitigation Measures

This section covers potential environmental impacts due to the construction of the proposed apartment blocks. A total of 1120 housing units would be developed under the project and the impacts of it will be spread over several phases. It is proposed that each phase will have a particular area allocated for the development. Therefore, the impacts of each phase will be particular to the site or area proposed for each phase although the impacts described here are common.

The section also describes the mitigation measures for each identified impact. Methods of identification of potential impacts and possible mitigation measures have been described. Before proceeding on to the potential impacts from the project, it is considered worthwhile looking at the existing environmental concerns so that cumulative and residual impacts of the proposed project are better understood.

5.1 Impact Identification

Impacts on the environment from various activities of the proposed project have been identified through:

- A consultative process within the EIA team
- Purpose-built checklists
- Past projects of similar nature undertaken in the Maldives
- Baseline environmental conditions described in Chapter 4
- Consultants experience of projects of similar nature

Possible negative impacts on the environment have been considered in worst-case scenario to recommend mitigation measures in the best possible ways so that these impacts would be minimized and perhaps eliminated in the implementation phase. Potential positive impacts of the project have been considered on a moderate note so that the negative impacts are not ignored, especially during planning as well as implementation of the project.

5.2 Identifying Mitigation Measures

Where an impact identified can be mitigated, mitigation measures are identified and discussed along with the identification of the impact. The mitigation measures proposed will help to alleviate or eliminate environmental problems before they occur. Mitigation measures are important because if identified impacts are significant and/or important, it would be necessary to identify and implement mitigation measures. Mitigation measures are selected to reduce or eliminate the severity of any predicted adverse environmental effects and improve the overall environmental performance and acceptability of the project. Where mitigation is deemed appropriate, the proponent should strive to act upon effects, in the following order of priority, to:

1. Eliminate or avoid adverse effects, where reasonably achievable.
2. Reduce adverse effects to the lowest reasonably achievable level.
3. Regulate adverse effects to an acceptable level, or to an acceptable time period.
4. Create other beneficial effects to partially or fully substitute for, or counter-balance, adverse effects.

5.3 Existing Concerns

As mentioned earlier, concrete for the project is produced in RMC batching plants under strict quality control and conveyed to site in transit mixers. The concrete batching plant is established in the industrial area of Hulhumalé. Although, the consultant was not able to find any environmental impact assessment reports for the batching plant, it should be noted here that the RMC batching plant conforms to sound environmental management principles. It is not within the scope of this EIA, therefore, details of it have not been considered.

There is a road construction project underway. The roads in the project site and neighbouring areas are being laid. The dust from the operation of machinery is in fact, of a greater magnitude than the works at the project site. Therefore, any dust emissions from the proposed project is expected to add cumulatively to the existing dusty operations such as the road project. Since some of the project components are also underway, it is clear that there is very little nuisance from the existing components of the project to the school and hospital in the area. These are discussed in the constructional impacts considered below.

There are no other major concerns in terms of health, environment, safety and socio-economic aspects related to the overall development of Hulhumalé that has any bearing on the project. Therefore, the project is expected to continue without much environmental concerns or public dismay or grievances. There exists a mechanism for public grievance redress for all projects undertaken in Hulhumalé. The Housing Development Corporation (HDC) deals with all such complaints or grievances and HDC is easily accessible to the residents of Hulhumalé.

5.4 Constructional Impacts and Mitigation Measures

As has been described earlier, the project site does not have any vegetation that needs to be cleared as it is barren or reclaimed land and there are no ecologically sensitive areas in or close to the project site that may be affected by the project activities. However, there are sensitive social components which need to be considered. These are the existing hospital and school within the project area. The current activities are being undertaken close to the hospital and it has been observed during the field mission undertaken in October 2010 that there are no dust or noise emissions that may have negative effects on the operation of the hospital. The workers in the area are confined to the project site and therefore there are no disturbances to pedestrians either. Work activities are at a distance from the roadside; therefore, none of the work activities require closure of the roads. In the unlikely event of any works on the roadside, necessary signs will be placed and diversions provided.
Other constructional impacts are discussed below.

5.4.1 Waste

In housing projects, one of the main concerns is the generation of green waste or demolition waste due to site clearance. However, the proposed project occurs in reclaimed barren land and there will be no green or demolition waste. The only wastes during the construction phase would be that of general waste from construction workforce and construction wastes such as paint, thinners, damaged bricks and tiles, cardboard, plastic, glass, wood and water proofing chemicals. Waste, especially Plastic (PET) bottles, is one of the serious environmental problems in the Maldives today and it is important to ensure that waste is appropriately managed and disposed to designated disposal locations. Minimizing waste of materials used in the construction would not only help the environment but also reduce the cost of the project. Since waste bins have not been observed at construction site, it is proposed that waste bins be strategically placed within the work sites and keep the sites clean at all times. Cigarette butts are also a concern and get easily thrown around. It would be necessary to provide butting stations at different work areas or alternatively ensure that the work area is a non-smoking area. Skips and bins should be adequately covered and emptied regularly.

5.4.2 Excavation and dewatering

Excavation and dewatering has visual concerns. Since the works will be undertaken in an open area, the visual amenity of the surrounding will be lost. However, the significance of this impact would be low given the high level of community acceptance of the project. The project includes buildings that are no higher than 5 stories, the foundations would be low. Therefore, there will not be any dewatering. It was observed so during the site visit on 20 October 2010. In case, any dewatering was required, it will be minimal and the impact on the groundwater lens would be small and the lens would recover from the impacts in the short term or almost immediately upon completion of the project. Since groundwater would be conserved or not used in the project area, this impact would be insignificant. No mitigation measures are proposed for these negligible to minor adverse impacts.

5.4.3 Noise and emissions

Site clearance was not required for the project as the project takes place in reclaimed barren land. Therefore, heavy machinery requirements were minimal. Small excavators are used for excavation, as deep foundations are not required. Ready mix concrete is used and, therefore, concrete mixers are not required. Hence, noise emissions are low and there will be no vibrations. No further mitigation measures are recommended.
Atmospheric emissions from the use of machinery at site are very low and considered negligible given the scale and socio-economic importance of the project. The emissions due to transport of materials and personnel to site would be considerable and unavoidable. The following mitigation measures are proposed.

- Working hours shall be restricted to daytime mainly, especially the use of any machinery.
- Material transport shall be minimized to the greatest possible extent by appropriate planning.
- Materials should be transported in bulk, as much as possible.
- Shortest possible transport routes shall be maintained.
- Machinery shall be well maintained and low emission vehicles shall be given preference.

### 5.4.4 Employment

Employment is the main positive socio-economic impact of the project during the construction phase as 300 jobs will be provided by the proposed project. It is proposed that at least 100 of the jobs will be filled in by locals. This is due to lack of local skilled or semi-skilled labour. However, local labour regulations would be followed strictly, which will ensure that local labour is given preference. No further mitigation measures are proposed.

### 5.4.5 Occupational health and safety

Occupational hazards are rare in projects of this nature, if appropriate precautions are taken. In addition, there are minor occupational hazards as risks are well managed. Scaffolding and appropriate supervision are built into the project management system. However, it is proposed that incidents and accidents at site shall be monitored, recorded and immediately dealt with. Personnel should be appointed for dealing with incidents and accidents at site and all personnel are made aware of the need to report all incidents to him/her. Since Hulhumalé Hospital is just next door, it may not be necessary to have first aid kits on site, however, prior arrangements shall be made with Hulhumalé hospital to attend to accommodate any emergencies.

### 5.5 Operational Impacts and Mitigation Measures

#### 5.5.1 Water and wastewater

Groundwater will not be extracted, therefore, there will be no impacts of salinization of the groundwater lens due to pumping or over abstraction as is the case in Malé. The source of freshwater that will be piped to all housing units would be desalination using reverse osmosis. Since desalination using RO technology is an energy-intensive process which currently depend on diesel fuel, the emissions will be considerable. It is therefore recommended to incorporate water saving or water efficient devices into the design of the proposed housing units.
The pollution of the groundwater aquifer due to leaking catchpits is a concern in Malé. However, this is not considered to be a problem in the case of the sewerage system in Hulhumalé as there will be no household catchpits in the Hulhumalé sewerage system. Hence, it is expected that the sewage and wastewater emanating from the proposed buildings would be discharged into the open ocean via existing deep sea outfalls.

5.5.2 Energy

Energy for the domestic and institutional electricity use in the proposed buildings will be from STELCO’s diesel generators in Hulhumalé. The greatest known impact of fossil fuel burning is the production of greenhouse gases, especially carbon dioxide in high quantities, which result in global climate change resulting in frequent floods, hotter days, frequent cyclones and other natural hazards and sea level rise on a global scale. While there is increasing awareness of the dangers of climate change including global warming and sea-level rise, there is little action on a global scale. The Maldives has been greatly concerned about rising sea levels, although climate change on a global scale may lead to even greater catastrophic events, this small nation has been at the forefront of lobbying sustainable development and now it is moving to act and is striving to become the world’s first carbon neutral country. Therefore, it is important to identify energy conservation and carbon sequestration measures for each and every project.

Since STELCO’s power grid is expected to be fed by alternative energy sources in the future, such as proposed wind farm in Gaafaru, the impacts of increased carbon emissions from burning diesel would minimize in the long term. According to the Carbon Dioxide Information Analysis Center (CDIAC), the per capita emissions for the Maldives is 2900kg of CO₂ in 2006. Therefore, at present the proposed housing project will emit about 3000kgs of carbon dioxide per person annually. In addition to this, desalination plant consumes between 3.5-4.5 kWh/m³ of water produced (Rachel et al 2002). However, measures can be taken to minimize energy use and to sequester carbon that is being emitted in relation to the proposed project. These include:

- Conduct awareness campaigns for people to reduce energy consumption during peak load hours. The campaign could provide information on how to reduce energy consumption in generally used items and procedures for energy efficiency. For example, keep drying, ironing, and similar high load activities for the night. This should be an ongoing programme.
- Provide people with the option of doing certain outdoor activities during day time while keeping their air-conditioners off. The proposed mini shopping mall can be such an avenue.
- Provide as much natural ventilation and lighting in housing units as possible. Further design changes may be considered.
- Provide energy efficient lights in all buildings and make provisions for solar garden lights and solar lights on road side.
- Increasing plantation in the project area where there are open spaces would also help the environment in
a special way by helping to reduce carbon dioxide levels in the atmosphere. Each plant is expected to offset about 20kg of carbon dioxide annually. Ipil-ipil and other nitrogen fixing plants are good carbon sequesters.

5.5.3 Waste

The waste generated during the operational phase would be predominantly household wastes including kitchen or food waste. It would be necessary to have arrangements for dealing with waste. Since lifts will be provided in the buildings, it is important to ensure that biodegradable wastes are not carried in lifts and separate Service Lifts are provided in all buildings.

Roadside waste bins will be necessary on all roads to ensure littering can remain prohibitive. Green wastes would be minimal and it may be necessary to use green waste in green areas as natural compost material. To do this, necessary landscaping arrangements shall be made. In the Maldives, waste management is not incorporated into such projects during the design stage and not even in the implementation phase, as a result of which waste management becomes a major issue during the operational phase of a project. HDC or other party responsible for the management of the housing complexes or waste management in Hulhumalé shall have good public relations and ensure good waste management practices starting from the household.

5.5.4 Housing issues and living conditions

The proposed project will help ease the population pressure on Malé, the capital. This will be one of the primary benefits of the proposed project. As pointed out recently by the Managing Director of HDC, the increasing number of housing projects in the Malé Region would also make housing more affordable with improved living environments. An improved living environment with better space for individual families will indirectly create social harmony and lead to better health and improved living conditions.

5.5.5 Employment

The employment opportunities that the project will create in the operational phase would be much smaller compared to the construction phase. There will be about 20 direct jobs and locals are expected to be employed for all these jobs. Indirect employment opportunities will arise with the development of associated facilities in the proposed project such as the pre-schools, shops, mini shopping mall, school and various other aspects related to the proposed development.
5.6 Overall Impact Evaluation

This section provides a summation of the impacts of the project components discussed above. The impacts of the project have been evaluated according to the following criteria:

1. Magnitude (or severity): the amount or scale of change that will result from the impact
2. Significance: importance of the impact. Reversibility is considered part of its significance
3. Duration: the time over which the impact would be felt
4. Extent/spatial distribution: the spatial extent over which the impact would be felt

The scales associated with the above criteria are given in the table below.

Table 5.1: Impact evaluation scale

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Scale</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude Change caused by impact</td>
<td>-3</td>
<td>Major adverse</td>
</tr>
<tr>
<td></td>
<td>-2</td>
<td>Moderate adverse</td>
</tr>
<tr>
<td></td>
<td>-1</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Minor positive</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate positive</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Major positive</td>
</tr>
<tr>
<td>Significance/Reversibility Impact</td>
<td>0</td>
<td>Insignificant</td>
</tr>
<tr>
<td>Implications/Reversibility of impact's effects</td>
<td>1</td>
<td>Limited implications / easily reversible</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Broad implications / reversible with costly intervention</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Nationwide or global implications / irreversible</td>
</tr>
<tr>
<td>Duration Duration / Frequency of Impact</td>
<td>0</td>
<td>Immediate</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Short term/construction period only</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Medium term (five years of operation)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Longterm/continuous</td>
</tr>
<tr>
<td>Extent/Spatial Distribution Distribution of impact</td>
<td>0</td>
<td>None/within 1m from point of discharge/no affected party</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Immediate vicinity/household level/developer/consumer</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Specific areas within the island/atoll/specific parties</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Entire island/atoll/nation/all stakeholders</td>
</tr>
</tbody>
</table>

Based on the above scale, an impact matrix was developed for the proposed or recommended option to determine that overall impact of the proposed project. This matrix is given in the table below.
### Table 5-2: Impact matrix for the proposed project

<table>
<thead>
<tr>
<th>PROJECT ACTIVITIES</th>
<th>KEY COMPONENTS</th>
<th>Environment</th>
<th>Socio-Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Groundwater</td>
<td>Vegetation</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavation and dewatering</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Water and wastewater</td>
<td>-1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Energy/eletricity</td>
<td>0</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>Machinery and construction equipment</td>
<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Workforce management</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Habituation/migration</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Energy/eletricity</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Water and wastewater</td>
<td>-1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**KEY: M S Magnitude Significance**

<table>
<thead>
<tr>
<th>D E</th>
<th>Duration</th>
<th>Extent (spatial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

An impact potential index was then developed from the above table. The impact potential index table below represents a product of the magnitude (M), significance (S), duration (D) and extent/spatial distribution (E) given in the above table. The sum of all key component specific indexes for one activity (i.e. sum by rows) provides the Activity Potential Impact Index (API) and the sum of all activity specific indexes for one key component (i.e. sum by column) provides the Component Potential Vulnerability Index (CPVI) which gives an indication of the vulnerability of each key component to activity related impacts. The table below represent the impact potential indices for the proposed project.
Table 5-3: Impact potential indices for the proposed project

<table>
<thead>
<tr>
<th>PROJECT ACTIVITIES</th>
<th>KEY COMPONENTS</th>
<th>Environment</th>
<th>Socio-economic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Groundwater</td>
<td>Vegetation</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excavation</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Dewatering</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Energy/electricity</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Machinery</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Habituation/migration</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Energy/electricity</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Water and wastewater</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>TOTAL CPVI</td>
<td>-0.01</td>
<td>0</td>
</tr>
</tbody>
</table>

API = Activity Potential Impact Index
CPVI = Component Potential Vulnerability Index

The table above indicates that the project has some negative environmental impacts during the construction phase as well as the operational phase, which are not as strong as the positive outcomes of the project, as a result of which the total potential impact index for the project is positive.

5.7 Uncertainties in Impact Prediction

The level of uncertainty, in the case of the proposed project in Hulhumalé may be expected to be low due to the experience of similar projects in Hulhumalé as well as Malé. Nevertheless, it is important to consider that there will be uncertainties and to undertake voluntary monitoring during and after project implementation as recommended in the monitoring programme given in this report.
6  Environmental Monitoring

Environmental monitoring is essential to ensure that potential impacts are minimized and to mitigate unanticipated impacts. The purpose of the monitoring is to provide information that will aid impact management, and secondarily to achieve a better understanding of cause-effect relationship and to improve impact prediction and mitigation methods. The proposed monitoring programme will yield beneficial results if it is undertaken for a longer period. Therefore, the proposed monitoring programme is recommended for at least three years from the onset of the proposed project. Longer term monitoring would also be useful.

The parameters that are most relevant for monitoring the impacts that may arise from the proposed project are included in the monitoring plan. Therefore, the monitoring programme will cover the following aspects of the proposed project:

- Energy consumption
- Water consumption
- Job opportunities
- Groundwater quality at site
- Desalinated water quality
- Incidents/accidents
- Building occupant satisfaction

6.1 Recommended Monitoring Programme

Outlined here are minimum project specific monitoring requirements that can be considered. This monitoring programme for the proposed project includes at least three monthly monitoring and covers the three stages of the project implementation.

Stage 1: During construction

Stage 2: Operational phase

The monitoring needs of each stage are discussed in detail below:

Stage 2 (during construction)

- Current energy demand (STELCO) and water demand (MWSC)
- Incidents and accidents (site logs)
- Groundwater quality
- Job opportunities for locals (no of jobs)
Stage 2 (operational phase)

Three or six monthly monitoring starting from the completion of proposed works shall be undertaken.

- Increase in energy and water demand (STELCO and MWSC)
- Energy and water consumption (STELCO and MWSC)
- Groundwater quality
- Direct job opportunities for locals (no of jobs)
- Indirect job opportunities
- Occupant satisfaction survey (once a year)

6.2 Cost of monitoring

The following table outlines a maximum cost estimate for the monitoring assuming the monitoring will be undertaken by HDC and most of the parameters would be tested in-situ.

Table 6-1: Costs of the annual monitoring programme

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Details</th>
<th>Unit cost (Rf)</th>
<th>Total (Rf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monitoring equipment and other charges</td>
<td>1,500.00</td>
<td>4,500.00</td>
</tr>
<tr>
<td>2</td>
<td>Laboratory charges</td>
<td>500.00</td>
<td>1,500.00</td>
</tr>
<tr>
<td>3</td>
<td>Compliance reporting (annual report)</td>
<td>15,000.00</td>
<td>15,000.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>21,000.00</strong></td>
</tr>
</tbody>
</table>

6.3 Monitoring Report

A detailed environmental monitoring report is required to be compiled and submitted to the Environment Protection Agency of the Ministry of Housing and Environment. The report must be based on the data collected for monitoring the parameters included in the monitoring programme given in this report.

The report will include details of the site, strategy of data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed. The Proponent’s commitment to undertake the monitoring programme and to report annually to the Environmental Protection Agency is attached with this report.
7 Declaration of the consultant

This EIA has been prepared according to the EIA Regulations 2007. I certify that the statements in this Environmental Impact Assessment study are true, complete and correct to the best of my knowledge and abilities.

Name: Ahmed Zahid (EIA 08/07)

Signature:

Date:
8 Sources of Information

1. www.hdc.com.mv

2. www.coralville.com.mv


Environmental Protection Agency  
Ministry of Housing and Environment  
Male', Republic of Maldives

Terms of Reference for Environmental Impact Assessment

The following is the TOR based on the scoping meeting held on 4th August 2010 for undertaking the EIA for the proposed Coral Villa Housing project at Hulhumale’ Maldives

1. Introduction – Identify the development project to be assessed and explain the executing arrangements for the environmental assessments. Describe the rationale for the development and its objectives.

2. Study Area – Specify the boundaries of the study area for the assessment.

3. Scope of Work - The following tasks will be performed:

   Task 1: Description of the Proposed Project – Describe the proposed developments with needs and justification of the proposed developments. Specific emphasis should be placed on the following

   - Provide a clearly labeled concept design including architectural drawings (approves by the relevant authorities)
   - Provide a scaled site plan of the project boundary
   - Provide details of the foundation of the proposed buildings
   - Provide details how electricity, water and gas would be supplied to the buildings
   - Submit a detailed description of how the project activities will be undertaken
   - Provide a detailed project schedule should be included
   - Provide a matrix of input and output related to the proposed activities of the project
   - Provide details how waste will be managed in the construction stage
   - Provide details of how the National policies on Carbon Neutrality are addressed in this project

   Task 2: Description of the Environment – Include a description of the existing environment conditions of the project site with photo of the site where relevant. Consideration of likely monitoring requirements

ToR for the EIA for the proposed Coral Villa Housing project at Hulhumale’ Maldives
11th January 2011

Hon. Mohamed Aslam
Minister of Housing and Environment
Ministry of Housing and Environment
Ameenee Magu
Malé

Dear Sir,

This is in reference to the Environmental Impact Assessment (EIA) report for the proposed CoralVille Housing Project in Hulhumalé.

As the Proponent of the project, we assure you our commitment to undertake the mitigation measures and monitoring programme outlined in the EIA report. We would also take all necessary precautions and measures to ensure that the negative environmental impacts of the project are minimized and all positive impacts of the project are enhanced.

Yours Sincerely,

[Signature]

Mahjoob Shujau
Board Director

Pruksa - HDC Housing Private Limited
HDC Building, 2nd Floor, Hulhumalé, Maldives
www.pruksahdc.com.mv | mail@pruksahdc.com.mv
Hulhumalé Land Use Map

Legend:
- Institutional
- Pure Commercial
- Government/Civic
- Pure Residential
- Mix-Office
- Mix-Office/Government
- Open/Green Spaces
- Industrial
- Municipal
- Mosque
- Embassy Government
- Mix-Use Residential
- Pure Office
- Sports and Recreation
- Hotels
- MSO
- Road/Road Parking