ENVIRONMENTAL IMPACT ASSESSMENT

For Development of
80 Housing Units at Goidhoo, Baa Atoll, Maldives

Proposed by: Ministry of Housing and Environment

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December 2011

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Executive Summary

This Environment Impact Assessment is an evaluation of the potential environmental, soci-economic and natural impacts for the development of 80 housing units at Goidhoo, Baa Atoll. This EIA is 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 proposed development at B. Goidhoo.

The primary objective of the project is part of the Government commitment to provide affordable housing to all the people of the Maldives. The total area of the development is approximately 184,800 square feets (17,168 sqm) and the size of a housing plot is 1707 square feets. Each housing unit would consist of 3-4 bedrooms, a sitting room, dining room, 2 toilets, laundry and a small backyard and a well to provide water for domestic use.

This report as considered the impacts the project could have on the environment. It is found that a major impact would be due to the waste produced during construction. However, the impact would only be for the project duration and mitigation measures for this and other impacts are also provided. Another high impact is anticipated on the social environment. If the progress of any delays could be shared with the public, this impact could be minimized. Improvement in the local economy of the island and improved livelihood are seen as positive benefits of the project.

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Chapter 1

Introduction

1.1 Background, Project Need and Justification

One of the key pledges of the government is to provide adequate and affordable housing for the people of the Maldives. In this regard the government is committed to develop 10,000 housing units throughout the country by 2013. In order to achieve this, plans have been made to develop housing units at various locations. This project aims to contribute towards achieving this target of developing 80 housing units at B. Goidhoo and the islands nearby.

The total area of the development is approximately 184,800 square feets (17,168 sqm). The proposed layout of the housing units is to increase the living space with reasonable distribution, better lighting and ventilation. The flats are grouped by 5-7 of flats, creating a semi public courtyards space. Each flat would consist of 3-4 bedrooms, a sitting room, dining room, 2 toilets, laundry and a small backyard.

This document has been produced to fulfil the requirements under Article 5 of the Environment Protection and Preservation Act (4/93) of the Maldives and has been structured to meet the requirements of the EIA Regulations 2007.

1.2 Structure of the EIA

The structure of this report conforms to the necessary provisions of the Environmental Impact Assessment Regulation 2007, which is outlined below;

- Information about the existing baseline environmental conditions of the site
- An assessment of the potential impacts during both construction and operational stages
- Identification of the potential mitigation measures to prevent or reduce significant negative impacts during these phases
- Assessment of alternatives
- Details of the environmental monitoring plan.

1.3 Terms of Reference

The terms of reference for this EIA have been attached as an annex in Appendix A. This EIA has been prepared based on these terms of reference.

1.4 EIA Team Members

Team members of this EIA are:

- Ali Shareef (EIA Registration No: EIA 19/11)
- Miruza Mohamed (EIA Registration No: EIA 01/10)
- Ahmed Ali (Energy Engineer)
- Zammath Khaleel (Environmental Analyst)

Chapter 2

Policy, Legal and Administrative Framework

2.1 Overview

This section outlines the relevant environmental legislations that have to be respected in carrying out the proposed development.

2.2 Applicable Policies Laws and Regulations

2.2.1 Environmental Protection and Preservation Act

According to Article 5.(a) of the Environmental Protection and Preservation Act (Law No. 4/93) an Environment Impact Assessment study shall be submitted to the Ministry of Housing and Environment before implementing any development that may have a potential impact on the environment.

2.2.2 Regulation on 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.

This regulation would not have any implication on the project as sand and aggregate mining will not be carried for this project. It is proposed to purchase sand from a local provider.

2.2.3 Environmental Impact Assessment Regulation 2007

New EIA regulations were issued by the Ministry of Housing and Environment on May 2007, which guides the process of undertaking the Environmental Impact Assessment in the Maldives.

This guideline outlines every step of the IEE/EIA process including the roles and responsibilities of the consultants and the proponents. This report adheres to the guidance provided in this Regulation.

2.2.4 The Land Act

This law was passed in 2002. This law addresses the following aspects among others.

- Identifying the lands of Maldives for different purpose and use.
- Allocation of such land for government use.
- Allocation of government owned land for public and private use.
- Buying, selling and leasing land

In addition to this, there are various other issues addressed. The law also states that any any resource other than trees and coconut palms, found during excavation of the Maldivian soil remains as a property of the government. Furthermore, this law permits to sell or distribute the excavated soil with the permit of Male' Municipality.

Since, excavation is part of the proposed project, all items found during excavation would be handed over to the government and soil excavated would not be sold.

2.2.5 Regulation on the Construction of Buildings in Malé

Ministry of Housing and Environment implements the regulation on the construction of buildings in Malé. This regulation deals with building heights, design guidelines and requirements for building permits for constructions in Male'. According to this regulation a permit is required by the local authority for the construction on site, which has to be displayed at the site at all times during the construction.

Although this regulation is not relevant to this project, the necessary permits by the councils and island office would be obtained and displayed on site.

2.2.6 Waste Management Policy

Solid waste has always been an environmental threat to the Maldives and is growing to be a big concern. To tackle this, a national waste management policy was published in 2008. The aim of the waste management policy is to formulate and implement guidelines and means for solid waste management to maintain a healthy environment. The project ensures that the waste in properly managed. Provision is given to collect and deliver the waste to the respective waste management site(s).

2.2.7 Regulation on cutting down, uprooting, digging out and export of trees

This regulation states that it is prohibited to cut down, dig out and export trees from one island to the other unless for absolute necessity and in the absence of any other alternative. It obliges to plant two trees for every tree or palm cut down. The explicitly prohibited categories include coastal vegetation extending to a distance of 15 m into land, trees and palm trees growing in wetlands and mangroves extending to a distance of 15 m into land area, all trees in protected areas, any tree protected to protect the living species in those trees and trees or palms of abnormal structure. The project will abide by this regulation.

2.2.8 Montreal Protocol on Substances that Deplete the Ozone layer

Maldives is a party to the Vienna Convention and the Montreal Protocol on Substances that Deplete the Ozone Layer. Maldives is classified as an Article 5 country of the Montreal Protocol, and has ratified all the amendments, including London, Copenhagen, Montreal and Beijing Amendments. The upgrade and redevelopment considers the Maldives commitment to the implementation of the Montreal Protocol on Substances that deplete the Ozone Layer. The accelerated HCFC phase-out schedule for Maldives is given Table 1. Hence, the new infrastructure that would be added for the development in the area of cooling and refrigeration systems would comply with the national requirements that have been outlined.

Table 1: HCFC phase-out schedule.

Control measure	Schedule
Baseline	Average 2009-2010 consumption
Freeze at baseline level	2011
10 % reduction	2013
20% reduction	2015
35% reduction	2016
67.5 % reduction	2018
100 % reduction	2020 except 2.5% for servicing use until: 2025

Chapter 3

Project Description

3.1 Project Proponent

This project is proposed by Ministry of Housing and Environment. On behalf of the Ministry, the project will be implemented by Sea Life Private Limited.

3.2 Project location and Study Area

The project is implemented at Goidhoo island of Baa Atoll. Goidhoo island is located in south maalhosmadhulu atoll having a longitude 73.000051 and latitude 4.870928. The island is 58.61 miles from country's capital Male'. The area of the island is 162.7 ha from which its vegetation area is 147.7 ha, and beach area is 15.0 Ha. The island also has a reclaimed Land of 1.6 ha and a Wet Land of 7.4 ha. Project location is shown in the landuse plan attached in the Appendix B.

3.3 Project Boundaries

The land area allocated for this project would consist of 80 housing units. Although no significant trees are found at, the area is filled mostly with weeds. Therefore, this area will have to be cleared before construction can take place.

The housing units will be approximately 1707 sqft sized plots. Details of the housing units including their sizes, floor plans and others are attached in Appendix B.

3.4 Project Duration and Schedule

The project is expected to commence as soon as EIA clearance is sought and will be completed within 16 months.

The Gant Chart is as below:

Figure 1: Work Schedule of the project.

3.5 Proposed Activities and Work Methodology

The following description attempts to capture the main activities and construction methodology that would have the highest impact on the environmental setting of the locality.

3.5.1 Site Preparation:

Before construction can begin, the site has to be first cleared and levelled. This will be done by removing all debris, roots, grass or rocks (if any). For leveling, machinery such as lorries, trucks and levelers would be used. Purchased sand will be used for leveling.

The site is an empty plot with only weedy plants underbush and about 206 young coconut trees. The clearing work will include cutting down of all weeds, clearing the underbush and relocation of young coconut trees to other areas after consulting with the island council and or to interested nearby resorts. Green waste from clearing of weeds and underbush will be dumped at a dumpsite shown by island office.

3.5.2 Temporary Facilities for Construction Workers

Accommodation for the labour force and a temporary site office will be provided by the contractor. For the project duration, basic facilities such as drinking water, toilets and accommodation will be setup by the contractor for 15-25 laborers. These facilities and storage space for the equipments and construction vehicles would be constructed on site.

Power needed for these facilities and construction will be provided using a small generator set. All these facilities will be removed at the end of the project by the contractor.

3.5.3 Laying out the Foundation

The units are single storey houses and therefore no deep foundation will be required. Foundations for each house will be laid by outlining the "footprint" of each. The footprint would be marked using pegs or steel rods after a survey. Excavated solid will be used to backfill after the foundation is laid. Details of the foundation are attached in Appendix B.

3.5.4 Sand Mining for Making Cement Blocks

To reduce the cost, the cement blocks used for construction would be made on site. Cement and sand will be purchased from a local supplier. Small cement mixers will be used to make the cement blocks.

3.5.5 Construction of Housing Units

The 80 housing units to be constructed will consist of minimum 2-3 bedrooms, a living room, kitchen and a small open area. Foundation used will be reinforced concrete and the walls will be constructed using cement blocks. General feature of the three bedroom housing units are:

- Three sleeping areas or bedrooms.
- Cooking and dining spaces.
- Sitting area.
- Two toilets.
- Waste water disposal will be through sewerage systems.

Architectural drawings for a standard three bedroom house are attached as an Appendix B.

3.5.6 Management of Construction Waste

The contractor is to prepare and abide a waste management plan to manage the waste produced during construction. This plan should identify a schedule and an appropriate location on site to stockpile the waste and construction debris on a regular basis. Maximum effort should be given to segregate the waste into recyclables and non-recyclables. After the segregation waste should be removed from the site to a designated dump site. The dump site should be an approved dump site for the specific purpose and this should be done in collaboration with the island waste management center.

3.5.7 Water Supply for houses

Small desalination units will be used to provide water for construction. Ground water will not be used for construction purposes.

For domestic use, rain water and ground water will be provided to the housing units. The users of house are to establish a system to collect the rainwater from the roof. A groundwater well will be installed in each house for domestic uses such as washing and cooking.

3.5.8 Electricity and Power Needs

The installed capacity of the island is 240 kW. Electricity will be provided by connecting the houses to the existing power grid of the island. The existing capacity of the islands might have to be increased to meet the increased demand, when the project is completed.

3.5.9 Construction of Septic Tanks

Since the island does not have sewerage system at present, temporary septic tank and a disposal trench or soakpit will be provided for house to treat black and grey water. Septic tanks are installed as a temporary measure until a proper sanitation system is installed.

3.6 Project Inputs and Outputs

3.6.1 Project Inputs

Following table (Table 2) provides the inputs and outputs of the project.

Table 2: Major Inputs

Input	Source/Type	How its obtained
Labourers (engineers, masons, site supervisors, etc...)	Local and foreign	Contractor's employees or by announcement
Water supply (during construction)	Well water/rain water and small desalination unit.	Rain water collection tanks would be installed at temporary staff units. A small desalination unit would be installed and would be complemented should a water shortage occur.
Electricity/Energy (during construction)	Temporary power supply by generator sets at the construction site.	Generator sets will be supplied by contractor
Machinery	Concrete Mixer, lorries, pick-ups, dumper and general construction tool	Contractor provided or hired
Sand for concrete blocks	Sand and cement.	Purchased from local supply or Male'
Telecommunications	Mobiles, Fax, E-mail and internet facilities	Provided by contractor
Transport	Material would be delivered on carrier barges, dhonies and speed boats. If allowed domestic planes would be used	Vessels would be hired
Maintenance materials	Maintenance parts and fluids required for the machinery and piping	Import or local purchase where available

3.6.2 Project Outputs

Major outputs are summarized in Table 3.

Table 3: Major Outputs

Products and waste Materials	Source	Method of disposal
Green waste from land clearing	Approximately 5150 m^3 of compacted green waste	Green waste will be disposed at a site allocated by island office.
Hazardous waste	Waste oil from generators	Collected and stored until the project is over and will be disposed at Thilafushi. Alternatively, it will be made available general public for free.
Noise/ Air pollution	Only local to the project site during construction.	Limited noise/air pollution will be occurred since the site is south and away from the existing residential area.
Construction waste	Debris and construction waste	Waste would be sorted and stored. It will be disposed to a designated location on a daily basis or transferred to Thilafushi once the project is over.
Sewage and waste water	Sewage and waste water from laborers	Sewage and waste water will be managed by installing septic tanks.

Chapter 4

Existing Environment

4.1 Introduction

This section covers the information regarding the existing environmental conditions for the proposed project site. It provides a brief outline of the information about the physical and human environment.

4.2 The Goidhoo Island

Goidhoo Island is located in south maalhosmadhulu atoll (Figure 2) having a longitude 73.000051 and latitude 4.870928. The island is 58.61 miles from country's capital Male'. The area of the island is 162.7 ha from which its vegetation area is 147.7 ha, and beach area is 15.0 ha. The island also has a Reclaimed Land of 1.6 ha and a Wet Land of 7.4 ha.

This Island is in a small separate atoll along with Fulhadoo and Fehendhoo. Goidhoo Atoll is separated from South Maalhosmadulhu by a broad channel. This atoll is oval in shape and small, its greatest length being 10 miles. The inner lagoon has a depth of 17 to 20 fathoms; it has a sandy bottom mixed with mud and clay. Unlike the lagoons of most small atolls of the Maldives, this lagoon is free from coral heads in its centre.

Figure 2: Geographic location of Goidhoo.

4.3 Terrestrial environment

The island vegetation of Goidhoo is mostly dominated mature and young coconut palms. Dhigga (Hibiscus tiliaceus) is abundant throughout the island and Hirundhu (Thespesia populnea) and Kaani (Cordia subcordata) are occasional while Nika (Fiscus benghalensis) is rare on the island. The island also has wetland areas.

4.4 Vegetation Cover

The site is devoid of any trees like Hirundhu (Thespesia populnea) and Kaani (Cordia subcordata) which are abundantly seen on the island. The vegetation of the allocated site is limited to shrubs, weeds and young coconut palms (refer Figure 3).

Figure 3: Grass weeds at the project location

4.5 Groundwater

Ground water at the site was met at about 1m to 1.2 m from the surface. The ground water samples were collected from 4 ^{0} 52 ‘ 33.06” N and 72 ^{0} 59 ‘ 42.63 “ E. As a baseline a basic water quality test was carried out for the ground water from National Health Laboratory. The results are shown in the Table 4.

Table 4: Water test results.

Parameter	Test Result	WHO standards
Physical Appearance	Pale yellow	No standards
PH	9.6	6.5 – 8.0
Electrical Conductivity	541µs/cm	250µs/cm
Turbidity	0 NTU	5NTU
Total Suspended Solids	5mg/L	No standards
Ca Hardness	89.8mg/L	200mg/L
Total Alkalinity	146.6 mg/L	No Standards
Sulphates	47 mg/L	500mg/L

In comparison to the portable water standards set by WHO, it could be concluded that the ground water is not fit for any portable use.

4.6 Built environment

Goidhoo island in Baa Atoll is located in a separate atoll ring (Figure 4). This island has an existing harbour which was constructed with coral rocks, however it was repaired with sand-cement bags. The harbour is badly damaged and requires extensive repair for adequate usage.

Figure 4: Location of Island and Harbour

4.7 Climate

The climate in the Maldives is dictated by the tropical monsoons. Seasons are usually classified into 4 periods based on the wind direction and intensity of rainfall. The 4 periods in chronological order is NE-monsoon, Transit period from NE to SW monsoon, SW monsoon and transit from SW to NE monsoon. Figure 5 summarizes the distribution of the seasons.

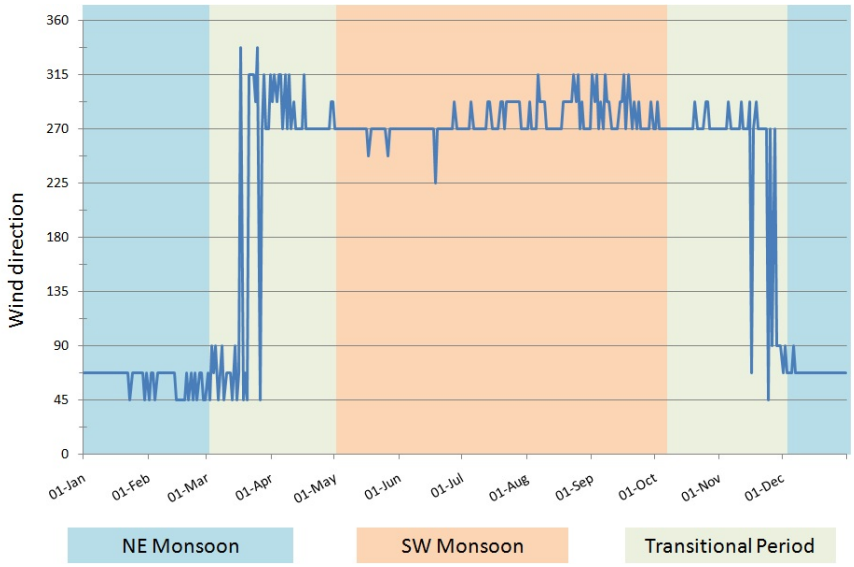


Figure 5: Maldives Climate Classification

SW monsoon is characterized by strong westerly winds and is considered to be the high rainfall season of the year with over 80% of the yearly rain coming in this season. The seas are comparatively rougher in this period. In contrast, NE Monsoon is characterized milder wind from NE quadrant and dryer sunny climate with 9 hours of average daily sunshine. Gale and storm winds (wind speed exceeding 28 knots) experienced are rare as shown in Figure 6.

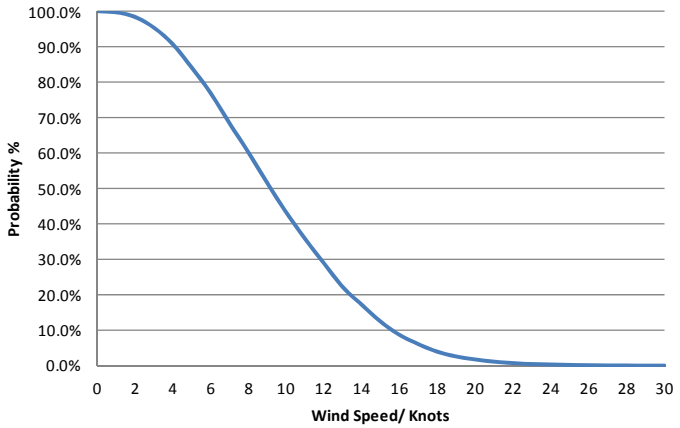


Figure 6: Wind speed probability based on 1975 – 2010 wind data

4.8 Socio-Economic environment

4.8.1 Social environment

Goidhoo has a population of approximately 700 people. Distribution of the population is show in Figure 7. The major economic activities in Goidhoo are agriculture, fishing, rope making, carpentry, and thatch weaving. Fishing is the main economic activity for the islanders with about 40 mechanized fishing vessels of different sizes and 12 trolling vessels (see Table 5).

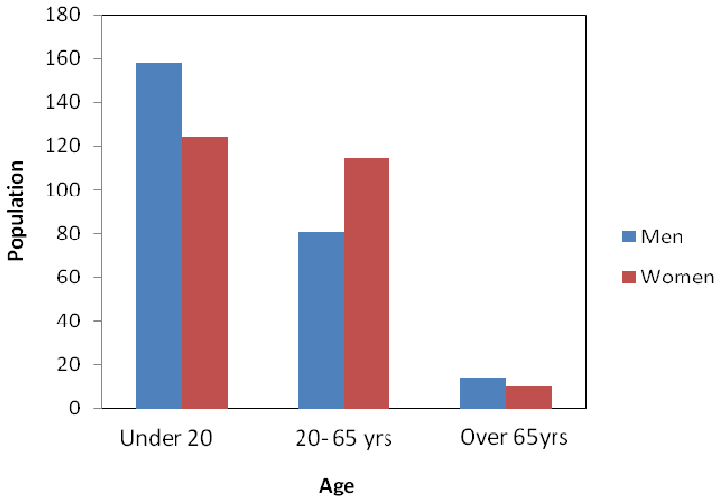


Figure 7: Population distribution of Goidhoo Island (Population and Housing Census 2006 website: www.planning.gov.mv)

Table 5: Vessesls registered to Goidhoo

Vessel Type	Total	Used for
Mechanized Dhoni	5	Fishing
Sathari Dhoni	4	Used in resorts
Vadhu Dhoni	3	Fishing

Chapter 5

Environmental Impacts & Mitigation Measures

Following sections provide the details of potential environmental impacts and its associated mitigation measures which could be undertaken to minimize the environmental impacts due to the proposed project.

5.1 Impact Identification

This sub section outlines potential impacts the project would have on the existing environment during and after the project. In order to estimate the impact, consideration has been made on the construction methodologies and the existing condition of the socio-economic environment and usage of these housing units. The impacts has been classified in to two parts; 1. During construction phase and 2. Impacts after the construction.

5.1.1 Impacts during the construction phase

During the construction phase activities carried out will be site clearing, transport raw materials, operation of light to mid weight level construction machineries, construction of household units with all amenities.

The loss of vegetation is unavoidable at site during this phase. In site clearing activities all grass weeds would be removed from site.

During the operation of construction machineries, all required fuel and maintenance personnel would accompany these vehicles at the site. Thus if properly managed there would be no direct impact of the machineries. During the construction phase neither sand from the island nor ground water would be utilized for the process. Also as the households are single storey buildings, the foundation for each unit would be at less than 1 m (well above the water table), therefore there would be no dewatering required for the construction of the household units. Thus the impact these activities would have to the environment is minimal and reversible.

5.1.2 Impacts after the construction phase

The housing unit developed under the project would be used residents of Goidhoo and residents from the islands in goidhoo atoll. Thus after the completion of project there would be an additional pressure on the existing natural resources such as ground water and the vegetation in the periphery of the site.

In addition to the impacts on ground water, there would be increase of waste produced and energy use on the island. It is anticipated that the energy demand on the island would rise by about 100 kW in peak demand for the island and a future increase in power might be needed. As these household units would mostly be used by the existing residents of the islands the anticipated impact would be lower. And these impacts can be further minimized or completely avoided with proper awareness and sustainable management of natural resources.

In addition to this, there would be an impact on the social environment. If there are project delays, this could lead to social unrest. However, it could bring positive benefits such as increase in the economy of the island and improved quality of life once the project is finished.

5.2 Mitigation

The mitigation activities for the above mentioned impacts are simple and easy to be carried out during and after the construction of the project. To better understand the inter-relation between the impacts and the different mitigation activities it is expressed in the matrix below (Table 6).

Table 6: Mitigation of impacts.

Phase or activity	Impact	Severity of impact	Mitigation	Severity after mitigation
Site clearing	Loss of vegetation	Medium	Relocate the vegetation removed to another site	Low
Construction of household units	Waste generation	High	Prepare a waste management plan. Collected waste must be dumped at local waste site or transported to Thilafushi	Minimal
	Impact on ground water	Low	Not allowing contaminated waste water to be dumped in to the ground	Minimal
	Social environment	High	Provide project progress to the public.	Low
Usage of household units	Increase demand in energy (GHG emissions)	Medium	Raising awareness on demand side management	Low
	Increase in household waste generation	Medium	Promote 3Rs for the residents	Low
	Exploitation of ground water	Medium	Make provision for rain water harvesting and storage and discourage use of groundwater	Minimal

Chapter 6

Stakeholder Consultations

6.1 Consultation with the Proponent

The proponent of the project is the Ministry of Housing and Environment. Necessary information regarding the site and drawings were obtained from the proponent.

6.2 Consultation with Engineers

Engineers were consulted regarding the construction details, structural and foundation details.

6.3 Consultation with Island Office

Consultations were made with the island office. They agreed to provide the every necessary aid they could such as construction of the temporary structures to implement the project at its earliest.

Chapter 7

Alternatives

EIA Regulation requires alternative options to be suggested. The proposed options are:

- No project option
- An alternative location for construction.
- Another housing scheme
- Alternative technology or method of construction

Various issues regarding these options are discussed in turn.

7.1 No project option

It is vital to consider this option as this would be the baseline option to which any other option would be compared. The main advantages and disadvantages of "no project" option are given in Table 7.

Table 7: Advantages and disadvantages of no project option

Strategy	Advantages	Disadvantages
Leave the plot of land in its current condition	• Very little or no advantage in leaving the land in its current state as Environmental problems related to development can be avoided or mitigated.	• The problem of housing congestion would not be solved. • Due to congestion, it will lead the way to more social problems. • Congestion will lead ways to health issues. • Land is becoming more and more expensive. Leaving the land as it is could not yield any revenue either to the public or to the private.

Considering the above results, it is noted that there are more disadvantages than advantages if this option is chosen. Although the proposed development will have some environmental impacts, most of them are short term and reversible and based on the above results, "no project" is not an option which could be considered.

7.2 Alternative location

The two major types of land-use currently seen are for residential use and forestry. Due to scarcity of land, this project cannot be undertaken in the existing residential area and which is the reason why land clearing has to be carried out for the project. The already cleared land slots are allocated for other use.

The current location is provided by the Ministry of Housing and Environment who is responsible for the existing land-use planning. Since this location is chosen after deliberate planning for current and future use, this is the best location for this project. If another location is to be chosen, re-planning of the land-use has to be carried out, which will cost a considerable amount of time in the planning process. Due to these reasons, the current proposed location is the best option.

7.3 Alternative housing scheme

In order to reduce the amount of land to be cleared, another alternate option is to construct multi-storey housing flats rather than individual housing flats. However, there are pros and cons for this option.

The main advantage of construction of multi-storey flats is that it would be more cost effective in the long term. Less ecological damage would be done to the island and, more land space could be saved for future developments as the population expands. In addition to this, natural resources such as ground water; and basic facilities such as provision of sanitation services could be better managed. However the main drawback is, construction of multi-storey flats would incur a higher cost and construction takes a longer time. This could lead to social issues and community unrest as they are forced to wait to be relieved from the housing congestion.

Individual housing flats also have their own advantages. Traditionally on islands like B.Goidhoo and other islands in Maldives, people are used to live in private houses of their own. These houses would have their own access to ground and drinking water facilities. In a multi-storey housing, these facilities are provided on commercial terms. Moreover, these private houses would have their own private garden which would be used for in-house gardening and other local needs. In these islands, multi-story housing flats are not common and are even unwished for.

Due to the above mentioned reasons, the best option to meet the government goals would be to provide these housing flats to meet the short term needs. However it is obvious that

multi-story housing flats would be much suitable for long term. Either option chosen, the environmental impact would be more or less the same.

7.4 Alternative technology or method of construction

The proposed method of construction is to use cement blocks and concrete. Cement blocks can be manufactured using sand which is readily available locally. Since a lot of sand would be needed for this project, another alternative which could be considered is use of timber for construction.

Use of timber is a widely practiced technology in elsewhere of the world but Maldives. Timber can be used for rapid construction, for better aesthetic and is known to be last longing and durable. However, since timber has to be imported and transferred it would be more expensive and logistically difficult. In addition to this, timer might not be suitable for a humid environment like Maldives as this leads to deterioration of the quality and attract growth of insects like beetles, cockroaches, termites etc... Timber frames or building are more susceptible to fire risks which the island communities are not ready for.

Chapter 8

Environment Management & Monitoring Plan

This Chapter outlines the environment management and monitoring plan for the project. The measures undertaken would ensure that environmental damage caused by the project could be reduced or kept at minimum. Although utmost care is taken to implement these measures, unforeseen impacts could be observed. Some of the predicted impacts could be more than expected and more stringent measures might have to be implemented to minimize the impact. Monitoring would be carried out during the implementation phase and after completion of the project.

8.1 Objectives of the Monitoring Plan

Objectives of the monitoring plan are to:

- Identify the effectiveness of the predicted impacts and their mitigation measures.
- Predict and minimize any unforeseen impacts.
- Minimize impact on the social and terrestrial environment

8.2 Monitoring Timeframe

Activities of the project will be monitored during all phases of the project. Project supervisor would be responsible to keep the daily logs. The ministry of housing and environment will make frequent visit to the site to ensure the smooth progress of the project. Project manager would be responsible to prepare the monthly progress reports and the annual reports where the social and environmental aspects will be addressed.

8.3 Aspects of the monitoring plan

The monitoring plan would consist of the following aspects:

- Impact on ground water – one observation would be carried out during mid-term of construction and other would be carried out after completion of the project.
- Construction impacts – generation of waste, noise, traffic, dust, tree relocation etc...
- Impact on socio-economic environment.

The following matrix (Table 8) provides the details of these aspects in the monitoring plan.

Terrestrial environment

Table 8: Detail aspects of the monitoring plan.

Category	Indicator	Action to be taken	Frequency
Quality of ground water from project site	pH, conductivity, COD, BOD, appearance, odour	Sample collection and laboratory testing	Once during construction and annually after construction
Noise pollution	Noise levels	Measure noise level in the field	Once every month during construction
Energy usage	Consumption rate	Monitor logs at island power house	Annually after completion
Waste	Mass or volume of waste	Collect information about waste and method of disposal	Monthly during construction and yearly after construction

Socio-economic environment

Category	Indicator	Action to be taken	Frequency
Population	Population size	In collaboration with the island council analyse the population of the island	Annually after construction
Impact on local economy	Number of shops, cafes, restaurants, fishing vessels, jobs	In collaboration with the island council analyse the respective data	Annually after construction
Social conflicts	Assess if there are any social conflicts	In collaboration with the island office carryout a survey or conduct personal interviews	Annually after construction
Quality of life	Assess the overall quality of life	In collaboration with the island office carryout a survey or conduct personal interviews	Annually after construction

8.4 Cost of monitoring

No	Details	Total cost (MRF)
1	Transport to B. Goidhoo (2 consultants for 2 day total of 8 trips within project duration)	30,000
2	Food and accommodation (2 consultants for 2 day total of 8 trips within project duration)	15,000
3	Environmental consultancy (monitoring reporting, data collection etc...)	80,000
	Total	**115,000**

8.5 Monitoring Report

Based on the monitoring parameters included in the plan, a detailed monitoring report will be compiled during midterm and after completion of the project. This report will cover all aspects covered above. The proponent has agreed to carry out the work plan and bear the costs involved.

8.6 Declaration of the Consultant

This EIA has been prepared according to the EIA Regulations 2007.

We certify that the statements in this Environmental Impact Assessment study are true, complete and correct, to best of our knowledge and ability.

Ali Shareef (EIA Registration No: EIA 19/11)

Miruza Mohamed (EIA Registration No: EIA 1/10)

8.7 Commitment by the Proponent

The proponent is fully committed to undertaking the monitoring program outlined in this report and the evidence of commitment is annexed in Appendix D.

Chapter 9

Conclusions

One of the government's key pledges is to provide affordable housing to the Maldivians. In this respect, government decided to build 80 housing units at the B. Atoll Goidhoo Island. The island has a population of approximately 700 people. These houses are target to the existing population of the island and for the people who wants to migrate to this island. This EIA is prepared to meet the requirements of the EPA before starting the project.

The total area of the development is approximately 184,800 square feets (17,168 sqm) and the size of a housing plot is 1707 square feets. Each housing unit would consist of 3-4 bedrooms, a sitting room, dining room, 2 toilets, laundry and a small backyard and a well to provide water for domestic use. Since the island does not have an existing sewerage network, temporary facilities are provided for sewage and waste water treatment. The flats are not provided with rainwater storage facilities as the households are to sought their own rainwater harvesting once they move in. It is anticipated that there would be an increase in the demand for power once these flats are being utilized. Thus, to meet this power increase, the installed power capacity might have to be increased in the future.

This report also considered the impacts the project could have on the environment. It is found that a major impact would be due to the waste produced during construction. However, the impact would only be for the project duration and mitigation measures for this and other impacts are also provided. Another high impact is anticipated on the social environment. If the progress of any delays could be shared with the public, this impact could be minimized. Improvement in the local economy of the island and improved livelihood are seen as positive benefits of the project.

Appendix A – Terms of Reference

بسم الله الرحمن الرحيم

Environmental Protection Agency

EPA

Terms of Reference for the Environmental Impact Assessment.

The following TOR is based on the scoping meeting held of 24th November 2011 for undertaking the EIA of the proposed development of 80 housing units at Baa Atoll. Goidhoo, Maldives. While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the audit report.

1. Introduction – Identify the development project to be assessed. Provide background information on the project and its cost, the proponents and their experience with similar projects. Provide and executive summary of the EIA report highlighting important findings from the EIA study.

2. Study Area – Submit an A3 size scaled plan with indications of all the proposed infrastructures. The study area should include adjacent and nearby environmentally important areas (e.g. coral reef. mangroves. freshwater lakes marine protected areas, protected species, special birds site, sensitive species nursery and feeding grounds).

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

Task 1. Description of the Project Components -

Provide a brief description of the proponent, location of the proposed project, how the project will be undertaken and fill description of the relevant parts of the project using clearly labeled maps and scaled site plan. Inputs and outputs of the project should be presented.

Task 2. Description of the Environment *– Present baseline data on the following environmental characteristics:-*

- *Groundwater quality prior to the beginning of construction activities. Parameters shall include physical appearance, salinity, temperature and pH.*
- *Noise levels*
- *Social impact arising from construction activities within a 30 meter radius of project site.*

Specific emphasis should be placed on the following environmental aspects of the project:

- *Terrestrial environment and extent of land clearing. A vegetation survey including the number and type of vegetation to be removed*
- *Construction methodologies*
- *Management of green waste*
- *Environmental condition of the borrow site, if sand is burrowed for construction purposes. A photoquadrat analysis shall be provided together with water quality, parameters shall include, pH, salinity, e-conductivity, temperature, Total Suspended solids and Total dissolved solids.*
- *Description of all flora and fauna and any threatened or endangered species in the area to be cleared and/or in vicinity to the area to be cleared.*

UNEP WORLD ENVIRONMENT DAY 5 JUNE Forests: Nature at Your Service

Ministry of Housing and Environment Complex
Ameenee Magu
Male', Rep. of Maldives
Tel: 333 5949 / 333 5951 Email: secretariat@epa.gov.mv
Fax: 333 5953 Website: www.epa.gov.mv

INTERNATIONAL YEAR OF FORESTS 2011

Task 3. Legislative and Regulatory Considerations *- Describe the legislation, regulation, policies standards and international conventions relevant to the proposed project.*

Task 4. Determine the Potential Impacts of the Proposed Project *– Use of a check list of parameters to identify impacts of significance. Impacts on the physical and human environment shall be explored. Distinguish between significant positive and negative impacts, short and long term impacts during construction. Identify impacts that are cumulative, unavoidable or irreversible. Identify any information gaps and evaluate their importance for decision making.*

Task 5. Mitigation and Management of Negative Impacts *– Identify possible measures to prevent or reduce significant negative impacts to acceptable levels during construction. Cost of mitigation measure and commitment of the proponent to undertake the mitigation measures should be included.*

Task 6. Analysis of Alternatives to the Proposed Project *– Describe the alternatives examined for the proposed project that would achieve the same objectives including the 'no project' alternative.*

Task 7. Environmental Monitoring *– Provide monitoring details for water quality monitoring, noise monitoring (during construction activities and during operational phase, noise of the generators) and traffic monitoring during construction. Provide commitment of the proponent to conduct monitoring and costs associated with it.*

Task 8. Stakeholder Consultations *– Provide a list of persons consulted, information on how when and where the consultations were conducted and a summary of the outcomes of the consultations including the main concerns identified. Consultation shall be specifically undertaken with the general public of the island and also the island council and the atoll council.*

Presentation *– The EIA report shall be presented in print and digital format and shall be concise and focus on significant environmental issues. It shall contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations, 2007.*

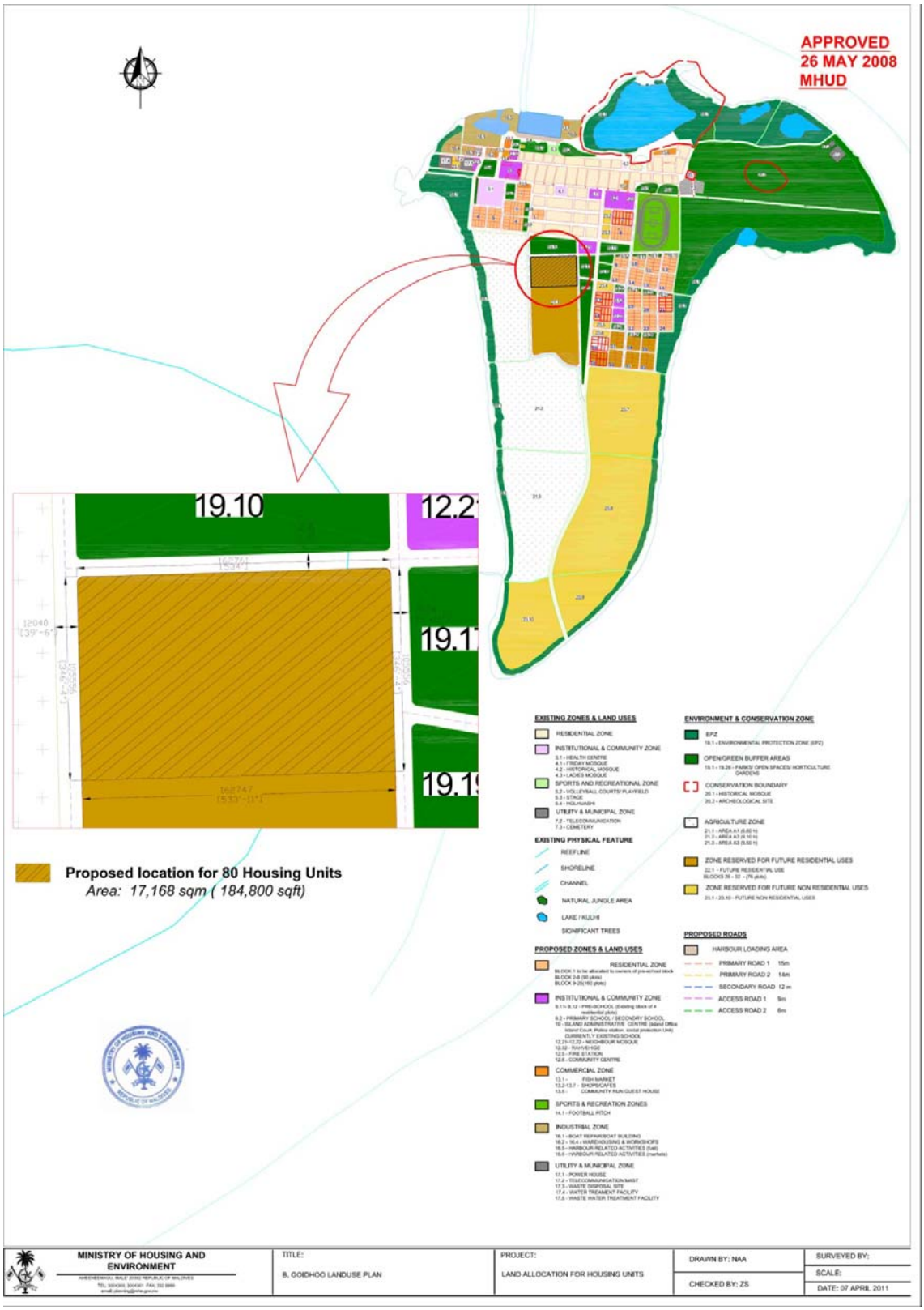
Timeframe for submitting the audit report *- The developer must submit the completed EIA report within 3 months from the date of this ToR.*

.....

05th December 2011

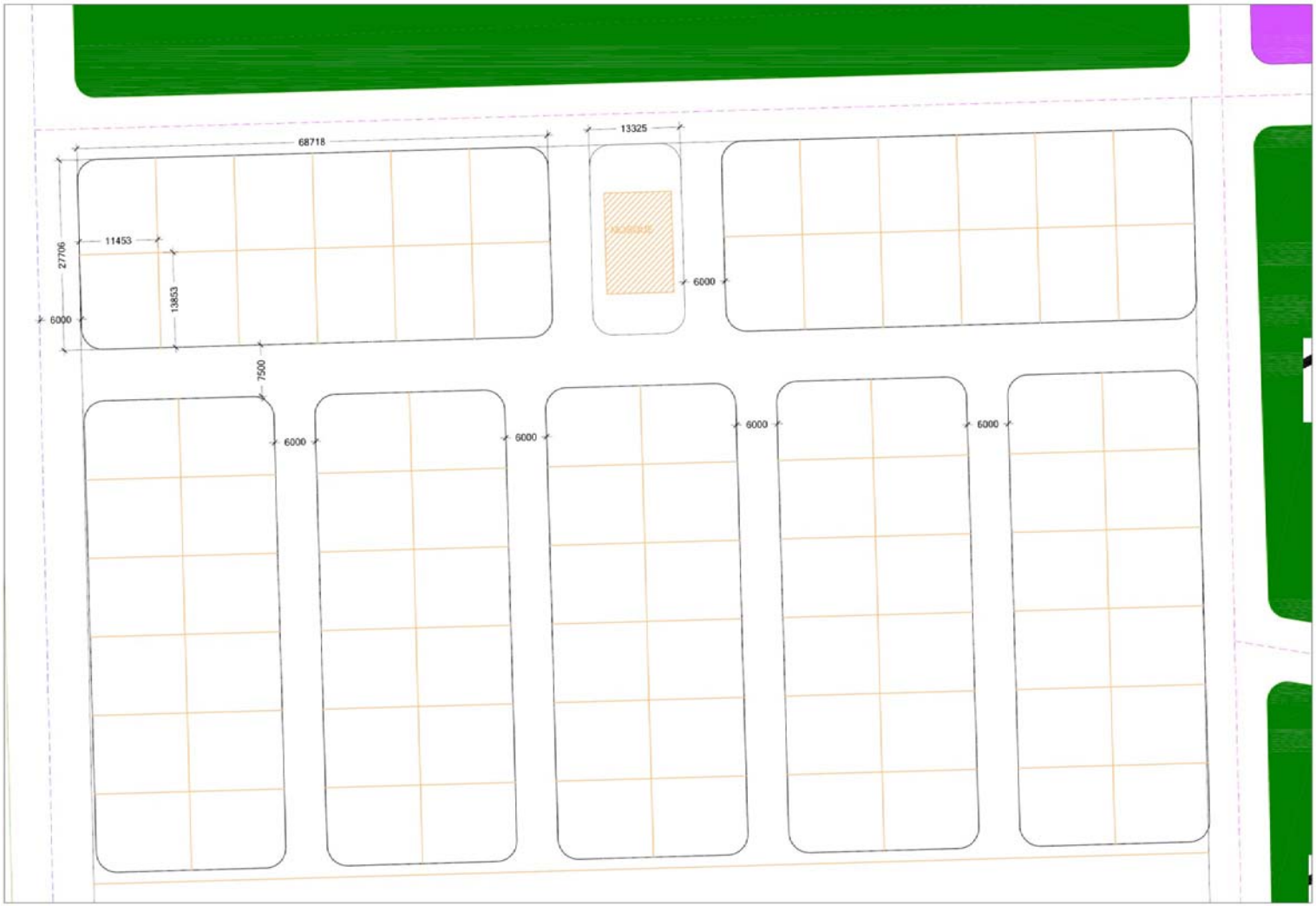
Ministry of Housing and Environment Complex
Ameenee Magu
Male', Rep. of Maldives
Tel: 333 5949 / 333 5951
Fax: 333 5953
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

Appendix B – Layout Plans

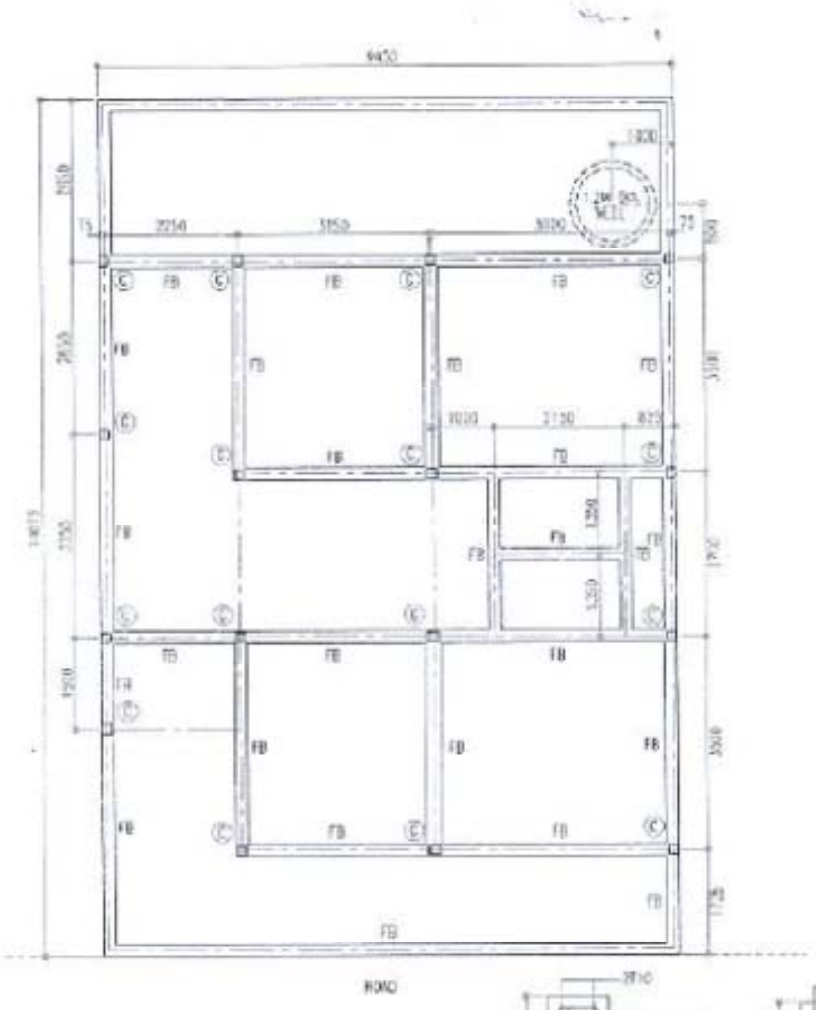


SITE PLAN - 80 HOUSING UNIT AT B. GOIDHOO

SCALE 1:500

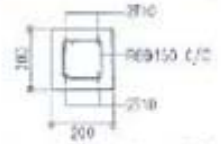


FURNITURE PLAN 1:100

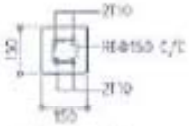


FOUNDATION PLAN 1:100

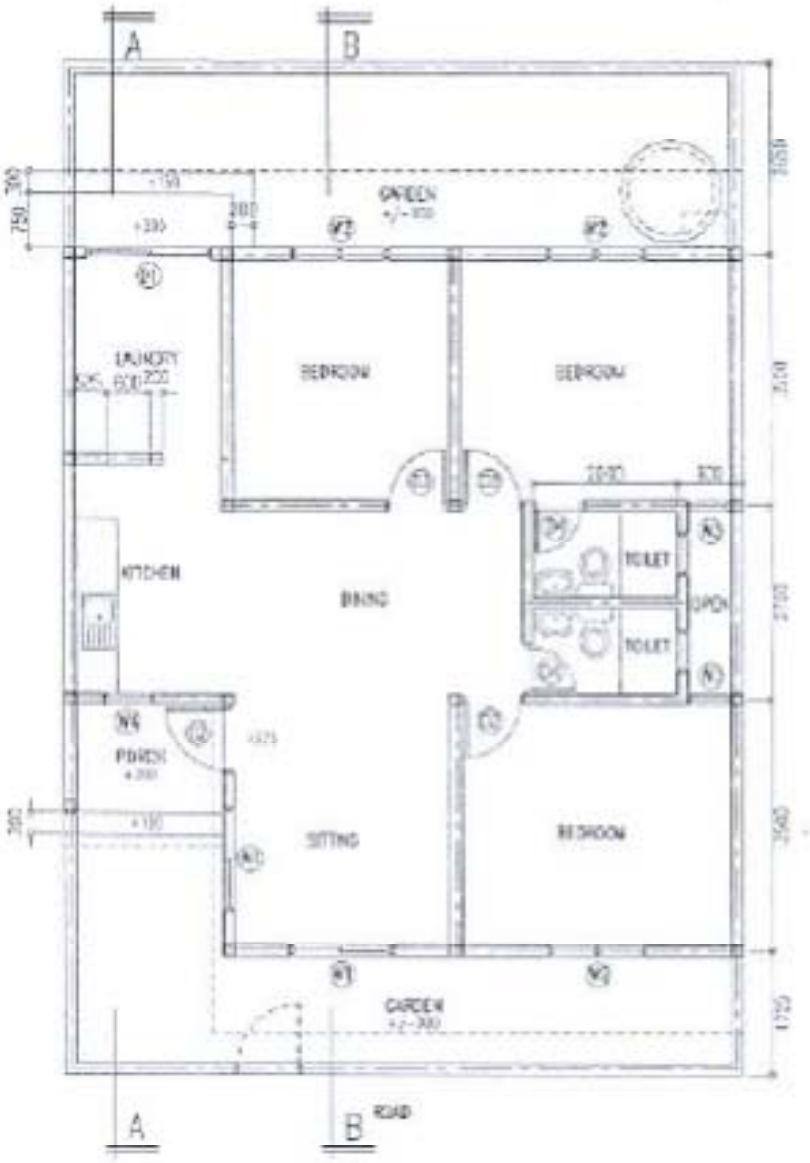
FOUNDATION DEPTH 600MM BELOW GROUND LEVEL



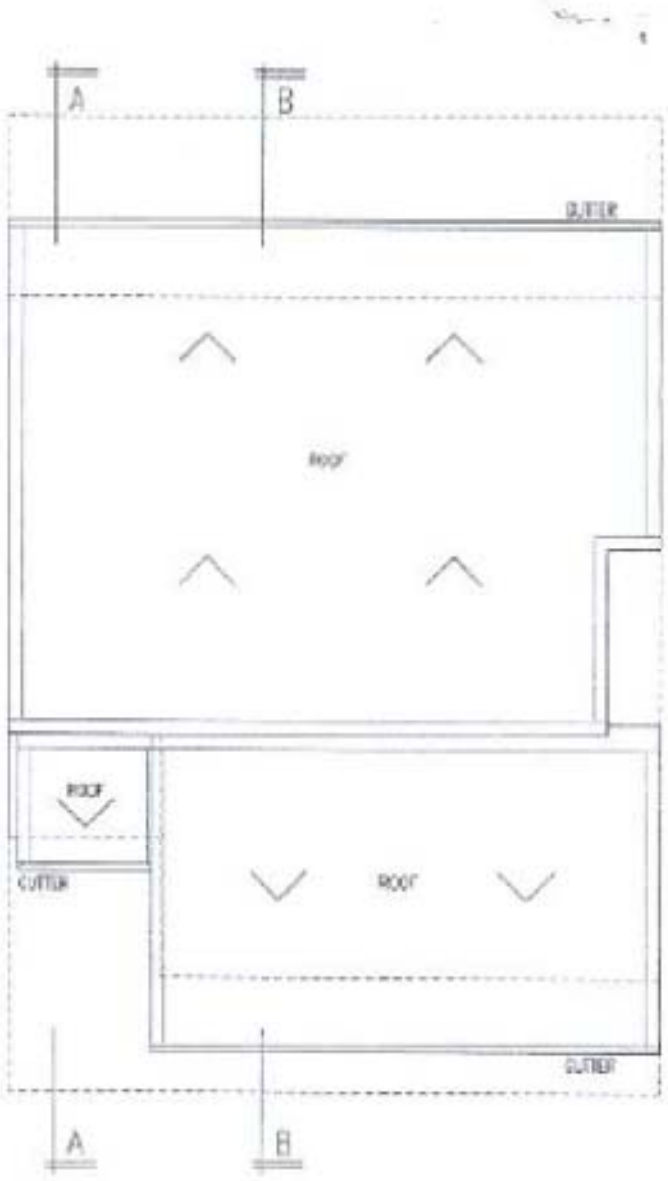
FOUNDATION BEAM (FB)



COLUMN (C)
CAST WITH WALLS

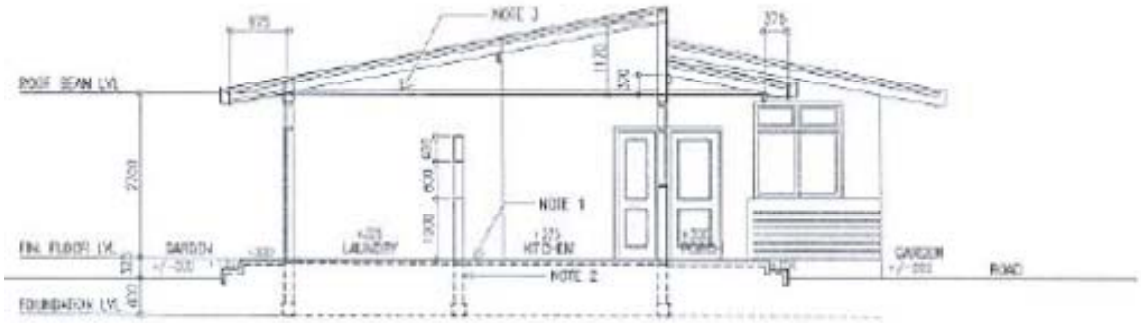


FLOOR PLAN 1:100

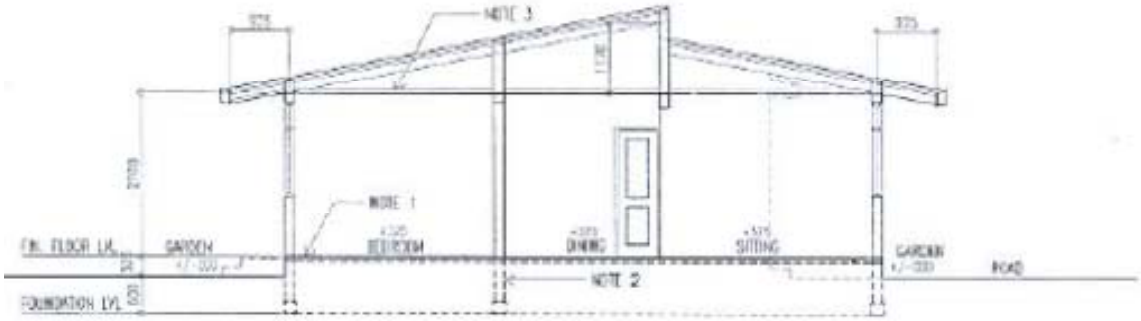


ROOF PLAN 1:100

NOTE: USE 'COLOURBOND' PROFILED ROOF SHEETS.
USE 'COLOURBOND' FLAT SHEETS FOR FLASHING AND GUTTERS.



SECTION A-A 1:100

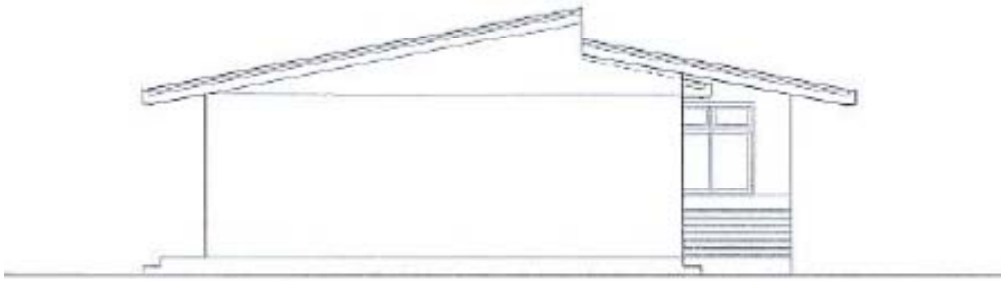


SECTION B-B 1:100

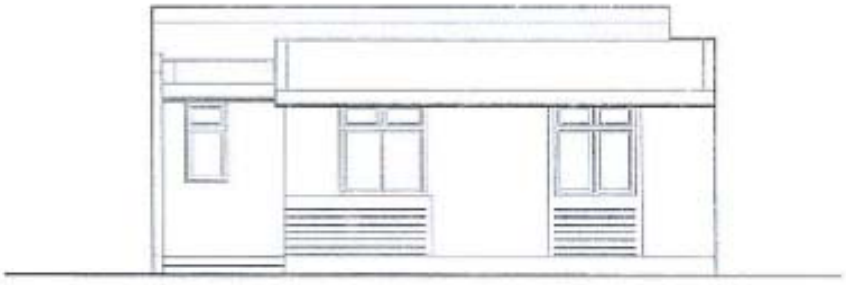
NOTE 1: CERAMIC TILES WITH SCREEDING ON 75MM THK RC GROUND SLAB REINF. R6@250 C/C SPACING

NOTE 2: 6" THK HOLLOW BLOCK PROP WALL PLASTERED ON BOTH SIDES

NOTE 3: PROVIDE 50MM THK KFAF INSULATION OVER CEILING, OVER SUSPENDED GYPSUM BOARD CEILING (ALUMINIUM FOIL SIDE UP).



SIDE ELEVATION 1:100



FRONT ELEVATION 1:100

Appendix C – Water Quality Test Results

National Health Laboratory
Maldives Food and Drug Authority,
Sosun Magu, Male' 200500, Republic of Maldives
Telephone # 3014310, Fax # 3014307

Accreditation No: 1150/51

WATER CHEMISTRY ANALYTICAL RESULTS

REPORT NUMBER: NHL/TR-WC/RC01288

*NAME AND ADDRESS OF CLIENT: AHMED ALI,
H.NASREEN,
TEL: (+960) 7930913

TIME TESTED: 14.30
* COLLECTED BY: Ahmed

*PURPOSE OF TESTING: Quality Monitoring

*LOCATION OF SAMPLE	B.GOIDHOO	TEST METHOD
	GROUND WATER	
Requisition Form No:	NHL/WC-2011/RQ1010	
*Date sampled	19/11/2011	
*Time Sampled	10.00	
* Type of water	Ground	
Date tested	20/11/2011	
Sample ID	201111WC102	
PARAMETER TESTED		
Physical Appearance	Pale yellow with suspended particles	-
pH	9.6	Method 4500-B ch4 page 66 electrometric method Adapted from standard methods 19th edition for the examination of water and waste water by APHA
Electrical Conductivity	541 µs/cm	Adapted from corning checkmate II meter instruction manual
*Turbidity	0 NTU	(Adapted from DR4000™Spectrophotometer procedure manual) Adapted from HACH 2100 N TURBIDIMETER instruction manual
*Suspended Solids	5 mg/L	Method 8006(Adapted from DR2010™/4000™/5000™ Spectrophotometer procedure manual)
*Calcium Hardness	89.8 mg/L	METHOD 3500 -D Adapted from standard methods (19th edition for the examination of water and waste water by APHA Chapter 3,page 57 Method 8374) (Adapted from DR4000™ /5000™ Spectrophotometer procedure manual)
*Sulfate	47 mg/L	Method 8051, (Adapted from DR2010™/4000™/5000™ Spectrophotometer procedure manual)
*Total Alkalinity	146.6 mg/L	Adapted from standard methods (19th edition) 2320b ch2 page 26

COMMENT:

Authorized by

Technical Manager
Khadeeja Nashwa

Date: 21st November 2011

NOTE: *Information supplied by the client
This laboratory is not accredited for the test marked by *
This Result is wellid only for this sample. This report is not for duplicate or advertisement without prior approval from NHL

Appendix D – Letter of Commitment

Sea Life Maldives Pvt Ltd. H. Neemaa, Roshanee Magu, Male' Rep of Maldives.
Tel: +960 3305002 - +960 3305004 - +960 3345005 - +960 3305006 - +960 3305007 - +960 3305008 - +960 3325009
Fax: +960 3305003 - +960 3305001 - Mobile: +960 9991619 - +960 7771619 - +960 7722323 - +960 7721111.

Mr. Ibrahim Naeem,
Director General
Environmental protection Agency
Ameenee Magu, Maafannu,
Male' 20392, Maldives.
Tel: +960 333 5949, Fax: +960 333 5953
Email: secretariat@epa.gov.mv

Date: 12 December 2011

Dear Sir

Environmental Impact Assessment for Development of 80 Housing Units at B. Goidhoo

As the developer of the above mentioned project, I hereby confirm my commitment to carry out and bear costs of environmental mitigation measures and monitoring outlined in the EIA report.

Thanking You
Yours faithfully

Ahmed Moosa Mohamed
Managing Director
Sea Life Maldives Pvt. Ltd

Maldives Pvt. Ltd.
C 711/2009