ENVIRONMENTAL IMPACT ASSESSMENT

Proposed 5000 Social Housing Units Development Project in Hulhumale’ Phase II

Proponent:
Housing Development Corporation (HDC)

Consultant:
Amir Musthafa (EIA01/13)

January 2018
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Consultants Declaration

This EIA has been prepared according to the EIA Regulations 2012. I certify that the statements in this Environmental Impact Assessment study are true, complete and correct to the best of my knowledge and abilities

[Signature]

Amir Musthafa (EIA 01/13)

1st January 2018
Proponents Declaration

(Attached in the following page)
Letter No.: HDC (161)-PM/203/2018/1 16 January 2018

Ibrahim Naeem
Director General
Environmental Protection Agency,
Ministry of Environment and Energy,
Male',
Republic of Maldives

Dear Sir,

PROJECT: HULHUMALÉ PHASE 2, 5040 SOCIAL HOUSING UNITS PROJECT - 2017
SUBJECT: PROONENTS DECLARATION

As the proponent of the project, we guarantee that we have read this EIA report and to the best of our knowledge, all non-technical information provided here are accurate and complete. We are aware that this report has been prepared in accordance with the EIA regulations.

Thank You.

Yours faithfully,

Nawaz Shaugee.
Director
Non Technical Summary

This report is based on the proposed 5000 social housing units proposed for Hulhumale’ Phase II. 40 buildings in total will be built as part of the project, each 14 storeys high. The exact number of housing units to be developed as part of the project is 5040 units. The project is being developed by Housing Development Corporation (HDC), and constructed by China Nantong Sanjian Construction Group Co. Ltd, which will oversee the development and project management including managing the EIA process.

An Environmental Impact Assessment was necessary for the works due to the large scale of the project with high rise buildings. In addition to meeting the regulatory requirements, the report would further assist the proponent and important stakeholders to make decisions based on favourable environmental conditions with the main focus on sustainability. The project also adheres to several other rules and regulations in the Maldives and has obtained permit from HDC to proceed. HDC is a 100% government entity, which also has the responsibility to set guidelines and oversee all developments in Hulhumale’.

The project consists of the development of 1/3 of the larger program by HDC to establish 15,000 social housing units in Hulhumale’ within the next 2 – 3 years. Other similar EIAs have been done recently, most notably for the 7000 housing units project, 2500 housing unit project and 1394 housing unit project. Apartments in these buildings can generally be regarded as being targeted towards lower class members of the community, who cannot afford commercial housings. The project will contribute to the grand plan by the government of reducing congestion in Male’ by providing a large number of housing opportunities in Hulhumale’. By 2019, it is projected that the new housing units would accommodate approximately 80,000 people.

Similar to the other building EIA’s in Phase II, the existing environment at the project site does not consist of any significant vegetation and the water test result shows normal water quality. There are no residents living in Phase II yet and there is no other structure at the site as well. However, there are other similar developments previously stated projects. Other development in the land include development of the 7000 housing units, shore protection and road construction, which is currently ongoing.
During the construction stage, health and safety standards of the workers at site, and waste generation is the major areas of concern as is the case for similar developments. With proper planning and project management, this can be easily mitigated. Impacts on water quality due to dewatering as identified can be mitigated by dewatering inland. Waste is the main concern during the operational stage of the project, in addition to social issues. Since this will be developed as a condominium with multiple tenants owning the rights of the building, it has to be ensured that the tenants are held responsible to properly maintain the building. Impacts that may occur due to conflicts with other developments being undertaken simultaneously can be mitigated with proper communication and planning before project implementation. Long term social issues are envisaged due to a large population living in a concentrated area. Several social and legislative mitigation measures are proposed to counter this, including greater policing activities, larger public spaces, etc. Also concerns regarding fire safety exists. Proper fire safety measures are very important to be established as well as additional features such as sprinkler systems in each floor. In addition to fire safety, other impacts due to fuel storage at site and use and storage of chemicals are cause for concern. These can be mitigated by following the fuel and chemical storage standards and best practice methods.

Regarding alternatives, there are no viable alternatives available for the project with respect to location, as the most suitable location had been predetermined during the planning stage. The no project option is also not plausible at this stage and possibilities are outside the scope of this study. Other alternatives including material, foundation type, construction methodology are not necessarily recommended. Recommendations had been made to proceed with the project as planned. It is recommended to dewater inland to an empty land close to the project site after excavating the area to ensure that water is contained in the allocated area, and will not have any negative impact on the groundwater aquifer.

An environmental monitoring plan is proposed to be carried out with 2 phases; one for the construction stage, and one for 2 years post construction. Factors to investigate include surveying the amount of waste generation, noise pollution, traffic flow, health and safety at site and water quality.

The project in general has minimum impact as it is being undertaken in newly developing land, similar to the other current developments in the area. All project specific building related impacts highlighted in the study, including those related for fire risks, health and
safety, and fuel and chemical storage and use can be mitigated. The socio-economic benefits to Greater Male’ City from projects such as these is very high. The project would go a long way in providing much needed additional housing opportunities, which would contribute to alleviating the housing issues in Male’ City, and therefore mitigating the issues related to congestion. Thus, after consideration of all these perspectives, it is recommended that this project proceed as planned, after incorporating the mitigation measures given in this study with the commitment to implementing the monitoring plan given.

Furthermore, proper planning and stronger legislation is required to ensure sustainability of all these new major condominium projects and to ensure maximum benefits are reaped from them. Building maintenance legislation needs to be strengthened to ensure such projects provide the maximum benefits to the community with minimum risks over a long period.
ج ہرے ہیں کہ ہم 2 کریں 5000 ڈالر سے 5040 ڈالر کے درمیان کے سمندر اور کرتی ہیں۔ 

یہ ممکن ہے کہ ماہ 14 کے درمیان ہر ظرف 5040 ڈالر کی تعداد پر تحقیق کی جائے۔ 

یہ کام ممکن ہے کہ ہم ہر ظرف، ہر 2 کارڈ کا تحقیق کیں۔ 

سہولت کے لیے، ہمارے لئے ممکن ہے کہ ہم ہر ظرف، ہر 2 کارڈ کا تحقیق کیں। 

یہ ممکن ہے کہ ہم ہر ظرف، ہر 2 کارڈ کا تحقیق کیں۔ 

نیو ہورشاد میں ملک ہر ظرف ہر 2 کارڈ کا تحقیق کیں۔ 

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نیو ہورشاد میں ملک ہر ظرف ہر 2 کارڈ کا تحقیق کیں۔ 

نیو ہورشاد میں ملک ہر ظرف ہر 2 کارڈ کا تحقیق کیں۔
किंमत फुट रुपये 10,000 प्रति अड. की दर 1000 जोड़े के साथ लगभग 1000 जोड़े के साथ खरीदने के लिए करता है। यह समांतर रुपये 10,000 प्रति अड. की दर से 1000 जोड़े के साथ लगभग 1000 जोड़े के साथ।

इसके साथ ही, किंमत फुट रुपये 10,000 प्रति अड. की दर 1000 जोड़े के साथ लगभग 1000 जोड़े के साथ।
1. Introduction

1.1 Background

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 5000 housing units project in Hulhumale’ Phase II. The actual no. of units under the project is 5040 units.

The report will look at the justifications for undertaking the proposed project components and it will identify and determine the significance of the potential impacts of the proposed works. Alternatives to proposed components or activities in terms of location, design and environmental considerations would be suggested along with measures to mitigate any negative impact on the environment. Environmental monitoring programme is vital in order to demonstrate the long-term sustainability of the proposed project as well as to undertake mitigation measures before any impact leads to long-term significant effects. Long term monitoring helps to understand uncertainties in impact analysis improving future impact predictions and project implementation. Therefore, a building monitoring and management plan would be suggested.

The major findings of this report are based on qualitative and quantitative assessments undertaken during site visits in November 2017. Available long-term data were collected from available sources, such as long-term data on meteorology and climate from local and global databases. Long-term data on the project site is lacking. However, to compensate for this, data collected recently in Hulhumale’ for similar projects will be used.

1.2 Aims and Objectives of the EIA

Aims and objectives of the EIA is similar to other similar developments in Hulhumale’ Phase II. This report generally addresses the environmental concerns of the building construction works and also those that will occur during the operational stage of the development. The report attempts to achieve the following objectives.

- Describe the project components to the relevant authorities and to the public
• Allow better project planning and decision-making based on the sustainable development.

• Identify environmental impacts that will occur and gauge their significance for such a project undertaken in the particular location.

• Mitigating impacts caused due to the works outlined in 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

This EIA has been prepared by Amir Musthafa, a registered permanent EIA consultant with years of experience in Environmental Impact Assessment in the Maldives and has been actively involved in numerous coastal protection projects and building construction projects in the country. The consultant was assisted by the developer’s staff throughout the project, most notably for water sample collection from the site.

Internationally recognized and accepted methods have been used in this environmental evaluation and assessment. This EIA is based mainly on data collected during field investigation missions in December 2017 and data gathered for other similar developments recently. The data collection methods are described in detail under the following Section.

1.4 Methods of data collection

Conditions of the existing environment of the study area were analysed by using various surveying techniques and scientific methods. Field surveys were carried out to get a further understanding of the existing conditions at the project location, and were carried out during to collect baseline data.

The following investigations were carried out on site:

• Groundwater quality parameters

• Existing noise levels on site
• Soil conditions at site

• Socio-economic conditions in the area

Due to the nature of the project and the proposed site for the works, there isn’t much baseline environmental conditions to be analyzed at the site. More important aspect of the project is the potential changes the relatively virgin environment will undergo during the lifetime of the project and beyond. As the area does not include any structures or vegetation of notes, vegetation and structural surveys were not required.

1.4.1 Groundwater quality

Groundwater quality was measured at the project location. Groundwater was collected by dipping into groundwater wells using 1500ml glass bottles. The containers were filled and taken for testing at the MWSC laboratory within 6 hours for sampling.

1.4.2 Noise Pollution

Noise pollution at the project area was measured using a handheld noise measurement device using ‘Science Journal’ software. Noise measurements were undertaken for 60 seconds at the locations shown under Existing Environment section.

1.4.3 Stakeholder consultations

Stakeholder consultations was initially carried out in the EIA scoping meeting. The EIA scoping meeting gave the opportunity to consult with the Environmental Protection Agency, STELCO, Project Contractor, and developer Housing Development Corporation (HDC) in one sitting. Additionally, consultation with the Maldives National Defence Force, MWSC, and HPA, were carried out before this particular study was commenced. As required by the approved TOR, consultation was also undertaken with Maldives Energy Authority (MEA). General concerns of these parties with respect to similar projects were discussed. It was also agreed that project specific information will be shared with these agencies for each project to determine if they have any specific concerns with respect to this project and as such information was given and clarified if there were any specific concerns related to this project.
1.4.4 Built Environment

An overview of the built environment around the project site was undertaken by visual inspection with the aid of site and drone photography. A structural defect inspection study is not necessary as the proposed site is bare land and there are no structures in the vicinity.

Once the EIA has been submitted, it is expected that the review process will not take more than 2-3 weeks. The review process may result in the request for additional information before issuing a Decision Statement. 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 Annex 1.

1.5 Literature Review

As there have been several multi-storey building projects undertaken in Male’ City, and especially in Hulhumale’ recently by various consultants, several of them were studied. These include the following:

- EIA for Hulhumale’ mixed use residence, 2015 (Zuhair 2015)
- EIA for the proposed 10-storey building in Plot No. D6-2C, Hulhumale’ – Renaatus Ithaamuiy (Musthafa 2016)
- EIA for the proposed mixed residential building development at Hulhumale’ – Rainbow Oceanfront (Musthafa 2016)
- EIA for the proposed luxury apartment complex at Hulhumale’ – Sandhura Residencies (Musthafa 2017)
- EIA for the proposed mixed residential building development at Hulhumale’, Plot No. D1 – 1 (Musthafa 2017)
- EIA for the proposed 7000 housing units development project in Hulhumale’ Phase II (CDE 2016)
- EIA for the proposed 2500 housing unit development project in Hulhumale’ Phase II (Musthafa 2017)
From among these, the EIA for the 7000 and 2500 housing unit projects were most relevant to this study as they were also proposed to be undertaken in Hulhumale’ Phase II land, and was regarding social housing. The main difference between the proposed project and 7000 units project is with respect to building height. While the proposed buildings are all 14 storeys high, the 7000 housing unit project includes buildings of 25 storey high.

The 7000 housing unit project consist of 16 buildings over 7 plots. Each building will have 25-storeys and the total area allocated for the project is 35,604 sqm. Out of the 16 buildings, 10 buildings will have 16 apartments on every floor and the remaining 6 buildings will have 20 apartments on every floor. A total of 7,000 residential units will be developed. Each building will consist of two bedroom apartments units, parking space and waste collection point in the ground floor. The target population is estimated between 21,000 to 28,000 persons at 3 to 4 persons per apartment

Not much significant impact was noted for the construction stage of either the 7000 and 2500 housing units as significant receptors are non existent in the virtually vacant land. Much negative impacts were not declared for the operational stage either apart from demand for additional parking space, impact on traffic flow and exerting pressure on existing utilities and facilities in Hulhumale’. The main positive impact identified includes the project providing greater housing opportunities for the population living in Greater Male’ area.

As a mitigation, fire prevention had been emphasised, while it was recommended to setup a community police establishment in the area. No alternatives to the proposed project were recommended, while a general environmental management framework was given.

1.6 The Proponent

The project is being proposed by Housing Development Corporation (HDC). HDC is a 100% state owned enterprise formed by a presidential decree, initially established in 2001 to oversee the development of Hulhumale’. HDC functions as the master developer of Hulhumale’ island. HDC had been involved in other housing development projects in other islands as well, although its responsibilities are not as far reaching in other islands.

The project design consultant and contractor is Chinese group, China Nantong Sanjian Construction Group Co. Ltd
1.7 The Project Location

The project is based in Hulhumale’ in the newly reclaimed Phase II. The project area is located on the central eastern area of Phase II. Location coordinates are at around 4°13'30.86"N, 73°32'49.38"E

Hulhumale’ Phase II is currently mostly bare land, with several building construction projects proposed. The only infrastructure project completed is the revetment works as protection to the shoreline against erosion. The foundation works for 7000 housings units project is currently ongoing. Road works are also ongoing. There are no residents living in Phase II yet. However, HDC office and few construction staff, including a team from the Maldives China Friendship Bridge project is based in Phase II, away from the proposed project area.

There are other similar developments proposed in the neighbourhood. Most notably, the 7000 housing units proposed in 25 storey structures.

The precise location is illustrated in the following images.

Figure 1 Location of proposed site in Hulhumaale’ (source: Google Earth)
Figure 2 Location of 5000 housing units in Hulhumale’ Phase II
1.8 Need and Justification

The need and justification for the project is similar to all recent such developments in Hulhumale’. All these projects are part of the same programme implemented by different contractors. The main justification for these project is the alleviation of the poor congested living conditions in Male’.

Hulhumale’ has been regarded as the main residential area in the Greater Male’ region’s future and as such all upcoming housing projects are being proposed to be developed in Hulhumale’. Hulhumale’ is currently a hub for development and is very much intended to play an integral role to drive the housing industry forward. There are additional housing projects being proposed,
while a yacht marina, IT city, tourism zones, and others are also within the plan. All these developments are believed to generate several employment opportunities and therefore will attract additional migration to the area. Furthermore, it is widely anticipated a large influx of people will migrate towards Hulhumale’ once the China Maldives Friendship Bridge between Hulhumale’ and Male’ finishes construction in 2018.

With the development of Hulhumale’ Phase 2 many residential buildings have been proposed for this area. The completion of these buildings would greatly alleviate the housing issues in the region, and also provide a much needed relief to the congestion in Male’. The need for such a relief has never been greater, as the living conditions in Male’ have deteriorated with each passing year.

The population in Male’ has steadily increased with respect to the total population in the Maldives. In 1985, data shows about $\frac{1}{4}$ of the total population was residing in Male’, which increased to $\frac{1}{3}$ of the total population according to 2006 census. Moreover, this includes a large percentage of immigrants living in the capital city. The percentage of people living in Male’ area compared to the rest of the country is illustrated in the following graph. The data has been provided up to 2006. However, the trend has continued up to the present year.
In 2006 there were 14,107 households in Male’ compared to just 9,700 in 2000. The average household size was 7.4 persons per household. The increase in number of households over the 6 year period is regarded as a result of subdivision of housing plots and families sharing a single housing unit.

It has been common for a 2-3 bedroom houses in Male’ to have 15 to 20 people. The proportion of people living in houses with 40 square feet or few of housing area per person has increased from 17 to 22 and percentage of houses without compounds has decreased from 52 to 39 percent. Large households combined with relatively small size of houses create morbid living conditions, with people often sleeping in shifts. It is common to find whole families living in single rooms, which doubles as kitchen and living room. Such living conditions place great strain on families, sometimes leading to social issues including break up of families, above average drug usage among the youth, behavioural problems in children and young adults, etc. (Faisal, n/a)

In order to alleviate the issues, a major housing scheme was underway for the past 2 years titled ‘Gedhoruverikurun’, to provide housing opportunities to residents in Male’. As it is a social housing scheme, the target recipients of the scheme are those that are in need of government subsidised housing. Other bigger housing opportunities such as purchasing own land plots, row
houses, luxury condominiums have been quite expensive, and the price is projected to escalate with each passing year.

Developments such as proposed 5000 housing units provides these opportunities to the working class. Therefore, the developments are intended to alleviate the housing issues and the many other indirect consequences of it as stated above for Maldivians living in Male’ City.
2 Project Description

The project is part of the government scheme for providing affordable housing units to the residents living in Greater Male’ area. Although the project title is 5000 housing units development project, the exact number of housing units to be developed under the project is 5040 units.

Forty (40) buildings in total will be built as part of the project, each 14 floors high. 126 housing units will be in each building. The housing units will be all 2 room apartments with attached toilets. Each unit will be 550 sqft. The project is proposed to take place in Hulhumale’ Phase 2 in the area designated for Social housing development in the Land Use Plan as shown below.

Ground floor will be dedicated for commercial use. A single motorbike parking will be available for each unit. Each floor shall be accommodated with a designated enclosed area for garbage collection. Actively ongoing projects in Hulhumale’ phase 2, including MOFT 25-Storey Office Complex and the Design and Construction of 7000 Social Housing Units integrates rainwater collection and utilization feature and the proponent is giving special consideration to integrate it into the currently planned projects in order to optimize the rainwater resource utilization.

Details of each building are given in the Annex.

During the operation phase of the project, under the management of HDC, the building shall be maintained according to a maintenance agreement which shall be termed and agreed between HDC and the tenants or concerned body.

Major equipment and machinery will be engaged for the project including tower cranes, batching plants, excavators, bull dozers, dump trucks, loaders, etc.

The entire area from N2-10(a) – N3-31 will be a construction site for the full duration of the project, which is scheduled to be 2 years.

The temporary site for the construction will be in Phase 2 as well.
As can be seen from the Land Use Plan given below, the entire area had been designated as residential areas, with some areas designated for education, institutions and industry in between, of which the larger areas are designated for education.

![Land Use Plan for Hulhumale' Phase 2](image)

**2.1 Site setup**

A plot near the project site of the 5000 housing unit development shall be designated for the temporary site setup. Material storage, as well as construction staff accommodation shall be addressed within a demarcated land approved by HDC.

Total area allocated for the site shall be about 15,000 sqm.

5,000 sqm will be allocated for batching plant, material stock and other such activities.

10,000 sqm will be used for accommodation and office use.

However, a specific location has not yet been decided by HDC for the purpose.
2.2 Excavation and Dewatering

It has been estimated that the depth of foundation will be over 1.80m below the existing ground level. The estimated depth of water table in the area is 1.50m from ground level, dewatering must be continuous until casting of the foundation. Excavation will be undertaken with a backhoe excavator. Total excavation quantity is approximately 42,000.00 cbm. This sand will be stockpiled within Hulhumale’ Phase II, while some amounts will be used for back filling.

Dewatering is the localized lowering of the ground water table from its natural level, in order to create a dry environment for construction works. This is a critical process for creating the correct working conditions to establish the building substructures. Dewatering will be a continuous process and will be on-going simultaneously while excavation is being undertaken.

The process will be continued throughout until casting of the foundation. It is envisaged that 5 or 6 pumps each with the flow rate of 30 litres per second will be located at specific locations to pump out the water to the sea, east of the site. It is estimated about 7000 cbm of water will be pumped out. The dewatering works will be done entirely by the contractor. If the dewatering pipe has to cross any road under any circumstances, a ramp will be placed and this will function as a speed breaker.

Water will be initially directed towards a catch pit right before the sea, to minimise sedimentation as only the overflow will get deposited in the lagoon. A schematic of the methodology is given below.
2.3 Foundation construction

For the foundation works, a raft foundation is expected to be used. This is currently the most commonly adopted method of construction in Maldives. It enables to spread the load from a structure over a large area, minimizing the pressure exerted on the base. Beams will then be incorporated into the structure to strengthen the foundation.

Excavation in loose sand requires continuous support, and therefore supports will be placed immediately as excavation commences. Sheets would be closely spaced and horizontal support bracings provided as excavation progresses. Supports and bracings will be placed concurrently with excavation, moving along the periphery of the plot successively. The concrete works for the raft foundation will be done using C30 Grade concrete.

However, this methodology would lead to excavating a larger and deeper area. This will result in excess sand which will need to be disposed. This will not be a major issue in a vast empty area as Hulhumale’ Phase 2. However, deep excavation would also lead to larger quantity of water to be dewatered.

An alternative is to undertake piling or using micro piles for the foundation works. The methodology is elaborated under Alternatives section. Either method can be in use and in this scenario, one is not particularly favorable over the other. The foundation methodology will be finalized after the geotechnical investigations had been carried out.
2.4 **Construction materials and machinery**

Heavy construction equipment and machinery will be engaged as is the case for all similar projects. These include the following major machinery:

- Excavators
- Concrete Mixers
- Dump Trucks
- Concrete pump
- Cranes
- Tower crane

All the materials such as cement, aggregate and sand will be delivered to site based on consumption. Steel and Plywood will be stored at the temporary site. Barb bending and carpentry work will also be undertaken at the site.

Concrete will be mixed on site using a 1,000 m$^3$/hour batching plant. The batching plant will have a total footprint of approximately 5000 sqm and will be operated daily during construction peak period. The batching plant will be placed at the construction site.

Details of the material and equipment used are provided under Project Input and Outputs. As the proposed project site is very close to the temporary site, delivery of materials will be very convenient and will not obstruct or cause hindrance to any activities.

2.5 **Electricity**

As all projects that are being undertaken in Hulhumale’ Phase II, all utilities will be arranged by the contractor on a temporary basis for the construction stage. During the construction stage, it has been reported that the main utility companies, MWSC and STELCO will not be providing their services at the project location.

For electricity, it is envisaged that a 400 kW power genset will be established at the site to cater for all power needs. The genset will be housed within a powerhouse with attenuator, chimney and insulated walls. It is anticipated that the site will consume 1200 litres. Therefore, 3 day tanks of 400 litres each will be established. The main fuel storage reservoir is calculated on 60 days of storage. A total of 70,000 litres diesel will therefore be stored at site. Fuel will be stored in steel tanks, while the tanks will be enclosed by a concrete bund.
with a capacity 110% of the fuel volume. Fuel will be transported to site on oil tanks after receiving fuel from the Phase II jetty area.

Once construction is completed, STELCO services will be operational in Phase II, and the entire 5000 housing unit power requirements will be fulfilled by the STELCO main grid.

2.6 Water and sewerage

Usually, temporary lines for water will be connected by HDC for the construction and if the connections are not available at the time of construction, an RO plant set up at the project site shall cater to the water needs during the construction period.

In the case that RO plant set up is required, all necessary components of the plant will be situated at site including RO filter membranes, sand filter, cartridge filter, chlorine dosage, sedimentation tank and water storage tanks along with distribution points. It is envisaged that two RO plants, with the capacity of 200 tons/day shall be installed, with which the overall setup would approximately take up an area of 360 sqm.

The water intake will be from the ground by constructing boreholes 20-30m deep. Boreholes will be constructed using a drilling rig with bentonite. Excess and by products will be buried at the project site above the ground water level. Water outlet will be towards the lagoon on the eastern side facing the project site. The water will be discharged out about 50m away from the shoreline and about 150m inwards from the reef line. Therefore, it will avoid any sensitive area, including live corals.

It is estimated that 400-450 litre/day will be required per person for common usage, while 400 tons of water will be required at the peak of construction for concreting and other such construction purposes. 450 – 500 ton steel water storage tanks will be setup at the site to cater for this demand.

Sewage will be collected in septic tanks at site, which will be transported to MWSC pump stations in Phase I, which will then be discharged via the main sewage outfall line.

2.7 Project Management

The project is managed by the developer Housing Development Corporation (HDC). Laborers will mostly consist of expatriates from China India and Bangladesh. All labourers
will be accommodated at company labour quarters at the allocated temporary site in Phase II. There will be a consulting engineer hired in addition to an in-house site engineer and site supervisor to manage the project.

The developer HDC had informed that the structure of the building will be checked and approved by a government certified structural consultant before the construction of the building. After the structure has been approved, the construction of the building will be closely monitored by a team of experienced civil engineers and construction officers managed by an assigned project manager. The project manager and assigned team will ensure that the works are carried out in accordance to the approved detail design and construction is maintained within acceptable standards as per the specifications. For any concrete works to be carried out, contractor requires to submit a request for inspection, after which the team will carry out an inspection and give approval if the works are in accordance to the design and specifications. The contractor would also require to submit specifications and/or samples of any material used during construction and get approval from HDC.

All operations, work planning for the on-going construction work will be done at Site Office; Major operations will be done at company head office. Heavy machinery such as excavator, dump truck, tower crane, batching plant, cement mixer, concrete pump, and crane will be used during excavation and casting. Most of the machineries are expected to be owned by the contractor while some heavy duty machinery may be rented.

### 2.8 Waste Management

Sand excavated during foundation work will be stockpiled at the site or transferred to a location within Hulhumale’ Phase II. Upon completion of foundation works, some amount of sand may be reused for back filling. Excess sand can be transported to a stockpile as instructed by HDC, within Phase II land area.

It is estimated that during the construction phase, the project will generate waste around 50 tons per day which will be collected on site, and stockpiled at the site. Organic household type waste will be transported to Hulhumale’ Waste Management Center. The contractor will arrange the transportation of waste outside of Hulhumale’ to Thilafushi on a weekly or fortnightly basis. None of the waste will be placed outside the project boundary at any time. Temporary waste storage will be within the project-demarcated area.
All waste generated during concrete works phase and finishing phase will be collected at the end of each work day and temporarily at the site. Hazardous waste such as empty oil-cans (lube-oil), paint cans or strainers will be kept separate and disposed according to the standards established by relevant government authority. They will also be transported to Thilafushi in separate containers as is the case for all similar projects in Hulhumale’.

For waste generated during operations, an enclosed waste collection area shall be designated in each floor. About 12 sqft area is dedicated for Garbage handling in each floor. Waste will be transported to the ground floor waste collection area from all the other floors in covered bins via lift or staircase.

The waste will be collected by WAMCO vehicles daily and transported to the waste management site in Hulhumale’, to be eventually transported to Thilafushi.

2.9 Work Schedule

The project is expected to take about 2-3 years to complete. The project is expected to commence soon after the approval of this EIA report, which should take approximately 1 week from submission. Dewatering permit will then be obtained.

Initially the architectural and structural design works had been completed and approved before undertaking the EIA. This is already cleared by HDC. Dewatering is scheduled to commence next, which will be carried out by contractor. Upon completion of dewatering, foundation works will begin and soon thereafter structural works will be carried out. Masonry work and interior works will commence afterwards. The work schedule is given in the Annex.

2.10 Safety on site

Ensuring safety on site is a very critical component in a large building construction project such as this. It is absolutely essential all standard protocols are followed. The contractor is to follow the following general safety protocols during the development of the proposed project.

All workers are given instructions about the health and safety at Site. The Site Engineers and Supervisors will give a brief on daily basis before the work starts to all
workers and all proper health and safety precautions will be implemented on site. Safety signs will be used on site, some of which are shown in the following Figure 7.

Personal protective equipment for protection from falling objects, hazardous dust or chemicals, or high working areas will be available for all the workers. Emergency first aid kit will be at site for minor injuries. First aid kit will be provided in the temporary office on the ground floor, after completion of ground and first floor slab where all safety clothing and equipment will be held. All workers and personnel entering the premises will be given hard hats and safety shoes.

Safety measures at site will adhere to Clause F of the draft National Building Code.

![Figure 7 Some safety signboards to be used on site](image)

Specific safety measures for different critical activities of the construction works are given in the following sub sections.

### 2.10.1 Fire prevention

Fire prevention steps will be taken when dealing with hot works as stated below. In addition to this, general fire prevention precautions will be setup at the site. These include fire
extinguishers being available at the site at all times, training staff on the use of fire safety equipment, availability of fire safe clothing and first aid at site.

Upon completion of the buildings, they will comply to the fire safety requirements of Maldives National Defence Force (MNDF).

2.10.2 Hot works

Managing hot work is one of the most essential areas of maintaining health and safety during construction. The following types of work consists of hot work.

- A. Various welding, cutting and sandblasting work
- B. Proofing and lining work
- C. Chemical washing and degreasing work
- D. Heat-treatment and chemical testing work
- E. Flame pipe cutting and asphalt heating work
- F. Motorized vehicles access into worksite

Construction team chief (Project Manager or Engineer) will be responsible for hot work control. HSE control group will inspect and supervise the hot work control.

The following standards and guidelines are followed for undertaking hot works.

- Performing hot work which will produce open fire or sparks should apply for hot work permit in advance
- Before work, the worker who conduct hot work should accept hot work safety training and have a good command of hot work safety basics. He should learn how to use firefighting apparatus and make clear the surrounding conditions and evacuation route.
- Provide firefighting apparatus within the scope of hot work area and keep the fire road clean and smooth.
- If there are inflammable and explosive materials around the hot work area, hot work cannot be started until they are cleared away or safety protective measures are taken.
• No hot work is allowed where there is open flame work.
• When doing blasting and hammering work at inflammable gas area, make analysis on the flammable and explosive gas contents. Only afterwards hot work can be started.
• When doing hot work at elevated area, set up spark preventive facility and take reliable protective measures to the inflammable materials, equipment, cables and gas cylinders below. Otherwise, hot work will not be allowed.
• When working at elevated area, work will not be allowed without proofing work simultaneously in the vertical line.
• Workers for welding and arc welding at elevated area should not turn on power source before they reach work place.
• When hot working at elevated area crosswise, appoint full-time people to monitor fire incidents.
• No hot work at elevated area is allowed when wind force is determined to be strong by the project manager.

2.10.3 Lifting works

Lifting work in another major health and safety hazard.

It is compulsory to strengthen safety control during lifting work in order to prevent personal injury and equipment accident. Following are the standards and guidelines to be followed when operating crane.

• No operation of any types of cranes or tower cranes shall be allowed without prior notice to the contract superintendent.
• Before the use of lifting equipment, effective quality certificate of performance test and inspection should be submitted to the Employer. Crane operators should obtain relative certificate through HSE training.
• Cranes cannot be put into operation at the site without prior inspection and approval by the representative from Employer.
• All the crane, hoister and other lifting equipment should be supported by relative legal certificate, registration documents and other updated information for the sake of inspection by Employer at any time.
• The crane operating cabin should be provided with the comparison table between safety load and turning radius. The hanger should be provided with safety spring device to avoid the movement of rigging or load.

In addition to cranes, standards for other lifting equipment and tools are below:

• Steel wire rope, hanger, hoop and sliding wheel and wheel coupler, relief clamp, rope clamp and hoister should be supported by quality certificate and operation instruction. Undertake full inspection when equipment initially arrives to site and after they are used every time, and establish record table.

• Operation, removal and movement of the lifting equipment and tools should be in accordance with the regulation in the operation instruction and operation procedure.

• Lifting equipment and tools should be inspected, maintained and repaired regularly during operation, if the equipment is found damaged, twisted or weakened which reach the discard standard, force to give a discard treatment and put into discard warehouse to undergo repair.

• Lifting workers, riggers and lifting mechanical operators should accept special learning and safety technical training, get special work permit after qualified test and license issued by the relevant authority.

• All the lifting workers should carry work permit with them. If Employer considers the workers are with lack experience or unqualified training, such staff will be dismissed.

• For the lifting work of the equipment with a weight over 3 tons, parts or small-sized equipment under special condition, it is necessary to prepare construction plan and measures. Submit it to relevant department for approval according to extent. Such lifting plan should be prepared at least 7 days ahead of time and submitted to the contract superintendent from Employer for review and approval

• Give technical presentation to the lifting and erection technicians before lifting work. The operators should understand lifting plan, commanding signal, safety technical requirement and lifting equipment operational method.

• Conduct inspection work step by step for the lifting of the equipment with a
weight over 3 tons, parts or small-sized equipment under special condition before lifting work.

- If problems are found during inspection, the project head will organize to make rectification till work is deemed approved.
- HSE control group will supervise the above lifting work and rectification work for approval.

### 2.10.4 Electricity

Work related to electricity are also regarded as sensitive with respect to health and safety. The following standards shall be followed.

- When the temporary electrical equipment is more than 5 gensets, or equipment capacity within 50KW, prepare electricity construction organization design.
- Temporary electrical consumption at site shall adopt three-phase five-wire system, carry out three-pole electric distribution, two-pole protection with 'one machine one switch one protection'
- Weatherproof shelter should be provided for the electrical facilities such as distribution panel and box located outdoors at site.
- Electrical team shall be responsible for application of construction electrical facilities and equipment, repair and maintenance.

### 2.10.5 Scaffolding

Erection of scaffolding shall have direct influence on operator's safety. Collapse of scaffolding shall cause tremendous injury to the operators. Therefore, it is a must to standardize scaffolding work and prevent collapse and drop accident to protect worker’s personal safety. Following are the standards that shall be followed when undertaking scaffolding work.

- Use steel tube as scaffolding post.
- Before scaffolding work, the scaffolder should check and inspect the materials to see if they are approved.
- Scaffold board should be no less than 50mm in thickness, 250-300mm in width, 4m in length. Railing shall be adopted to support scaffold board every other 1.3
meters. Defected board cannot be used as scaffold board. Boards should be inspected for defects prior to setup.

- Skirts shall be necessary for the gangway, slanted stair and working plane on all scaffolds. Skirts shall have a height of 100mm at least and be tied on the vertical poles at every corner.
- The scaffolders must have qualification certificate and they shall fulfil elevated work requirement.
- Before scaffolding work, everything should be ready and approved to ensure working condition and protective equipment are safe and reliable. For large and special scaffolding work, prepare scaffolding plan and set up scaffold according to it.
- Scaffolders shall carry out work by use of the upper and lower special gangway and work on the scaffolding boards. A safety harness of buffer type double hook shall be applied for working on the scaffold with a gap of excessive 1.8 meters.
- Operators shall go up and down the scaffold by way of stairs. Going up and down the scaffold through handrails, mid-rails or brace shall not be permitted. A rest platform shall be provided every other 8 meters on the stair or a continuous falling protective device be provided.
- All scaffolds shall be established on a sturdy foundation and keep level and vertical. Every vertical pole shall be underlaid with steel plate, under which shall be packed with scaffold board or channel steel.
- Distance between vertical poles shall not exceed 2 meters with a step of not exceeding 1.8 meters. If otherwise calculated or noted in construction plan, any exceeding shall not be allowed. From the second layer, scaffolding shall be tied up and so for every other layer afterward. Every other 5.4 meters in horizontal direction shall be necessarily tied up.
- Platform gang-board shall be fixed at its location. Extruded portion at the terminal of scaffolding board shall be parted from steel tube with a gap of at least 15 cm, but no larger than 30 cm.
- At the access port on the working platform shall be provided with a door to avoid directly going up and down the scaffolding from the railings.
• At the place for personal access under scaffolding shall be provided with a protective shelter, between skirts and handrails shall be set up a fine mesh safety net or the equivalent.
• Scaffolding shall not be in excess of safe work load.
• During scaffolding work, the workers must follow operation regulation. Take adequate protective measures to keep safe. Hang up safety tags at the place where danger exists. No one can be allowed in without permission.
• It is not allowed to throw scaffold materials from the structure up and down. Use ropes, container or belts to convey materials.
• Scaffolding work such as scaffold board and post binding and release fasteners cannot be stopped in the middle of work.
• After scaffolding work, the work team will inspect it by themselves and have it repaired when necessary. It should be approved by construction head. After completion, carry out inspection and acceptance check formality.
• Before application of scaffolding, inspection should be performed by the contractor's safety officer. A repeated inspection should be done after the occurring of any influence on the structural safety. Only such scaffolding as qualified after inspection and attached with efficient inspection board can be employed.
• Divide the incomplete scaffolding at access point and use signing and tagging.
• Workers should go into the work layer from ramp or special ladder. It is not allowed to climb up along scaffolding.
• Inspect scaffold weekly and prepare a written report, list scaffolding defects and repair method. Make an overall inspection to the scaffolding after any extreme weather events such as storms. Immediately tighten or replace parts if loose or inclination found.
• When excavating near scaffolding, strengthen scaffolding first.
• It is not allowed to remove scaffolding post or board during application, even partial cutting and damage.
2.10.6 Operating machinery or equipment

Following standards should be maintained **when operating any significant machinery or equipment**.

- Unauthorized personnel must not operate, interfere or tamper with plant or equipment.
- Persons authorized to use machines must first check that guards are in position and that any other safety device e.g. emergency stops, are in normal working order.
- All plant or equipment brought onto client premises must be properly guarded to prevent injury.
- Security guards shall be employed to ensure the site is secure at all times.
- Personnel and vehicle in and out should accept the client inspection. No materials can be conveyed out of the site without client written permit.
- Personnel coming into the site should carry pass permit prepared by EMPLOYER with him.
- Visitors coming into and going out of the site should get approval and notice in advance.
- Vehicles coming into site should have pass permit.

2.10.7 Inspection Tours

**Inspection tours** at the site shall be strictly monitored. Following standards shall be maintained.

- Inspection tours shall be divided into maximum four groups and shall be accompanied by a health and safety supervisor. Inspection tours shall be undertaken with three shifts in turn per day.
- Provide required quantity of search lights to assure there are no blind area for inspection in foggy, rainy, snowy day and at night.
- Inspectors should be equipped with corresponding walkie-talkie and guard equipment to assure smooth implement of inspection.
2.10.8 Overall site maintenance

Health and safety chief is responsible for overall maintenance of site. Detail work shall be coordinated and organized by the engineering group.

Project manager will make comprehensive arrangement for temporary facilities, transport road, work sequence according to general layout plan. Prepare “Work Layout plan” and submit to client for approval prior to work commencement.

Construction temporary facilities floor area should follow the general layout plan approved by Employer during work. Temporary facilities, equipment, materials should be put in a good order with tags to keep the site in reasonable arrangement and clean condition.

No asbestos materials and products shall be allowed to use at site.

Regular disposal of waste materials area and rubbish bin left at jobsite or office area controlled by project department. Keep worksite clean and tidy. Constructors shall be responsible for storing and periodically disposing of all waste. Burning of trash and other combustible waste materials shall not be permitted. Surplus material and other construction materials shall be disposed to the designated location according to client’s instruction.

Carry out high standard and strict requirement control work at site. Undertake site cleaning once a week.

Carry out equipment and material transportation and erection according to plan.

People appointed by the project department will clean site lavatory. Keep lavatory and drain system unblocked. No bowel movement and urination are allowed at site.

2.10.9 Overall site management procedures.

Electric welding machine and air compressor should be covered with rain-proof shed and three sidings. Cable laying should be in good order.
Immediately retrieve surplus and waste materials. Such materials should be cleared away after work area to guarantee the site cleanliness, road smoothness and ensure that the drainage system is under good condition.

Set up construction marking when working in the place where vehicles will pass.

Put the acetylene cylinder, oxygen cylinder in a good order and capped.

Site water pipe, cable, conductor, welding wire should be installed and used according to the regulation and safety rules and arranged according to construction organization design. The welding flexible cord, oxygen belt and welding rod should be retrieved after work every day.

Any excavated trench or ditch must be backfilled in time. Dispose of soil out of the plant. It is not allowed to cover the equipment with soil or materials.

Before commissioning work, all the materials and articles in the workshop and shop building should be placed in good order. There should be no dust on equipment and pipeline surface.

Various kinds of remaining supplies should be retrieved in time according to the regulation and transported out of the plant.

Strengthen site security and guard work to prevent any theft. Ensure site is patrolled 24 hours by security staff.

**2.10.10 Ensuring compliance to health and safety standards.**

Several systems are in place to ensure the safety standards are followed at site including regular supervision and providing incentives for compliance.

The safety manager and supervisor shall undertake inspection at site every day.

During the inspection, staff who demonstrated an outstanding performance in the implementation of HSE standards are recorded. Summary assessments are carried out every week and bonuses are given.

Staff who do not comply shall be penalized according to the level of non-compliance.
The developer should monitor and supervise if the contractor follows the safety procedures as outlined in this section.

### 2.11 Accident and hazard scenarios

Assessment for accident and Hazard is given below.

The following hazard and accident assessment is based on the following 3 stages of the building lifecycle, including construction, use and maintenance of building. Risk levels & probability are qualitatively assessed based on the following parameters; High, Moderate and Low.

**Table 1 Accident and Hazard Risks**

<table>
<thead>
<tr>
<th>Performance Consideration</th>
<th>Risk Level</th>
<th>Risk Probability</th>
<th>Responsible Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of hazardous substances, which impact on construction work e.g.: asbestos, SMF, hydrogen chloride, etc.</td>
<td>High</td>
<td>Low</td>
<td>Project manager, Site Supervisor</td>
</tr>
<tr>
<td>Accidental spill of diesel</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Site Supervisor</td>
</tr>
<tr>
<td>Sufficient access / space around new section or building for use of cranes, scaffolding during construction</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Construction workers will be protected from / proximity to HV electrical, high risk energy sources</td>
<td>High</td>
<td>Moderate</td>
<td>Site Supervisor</td>
</tr>
<tr>
<td>Roof and balcony design will reduce / eliminate the risk of falls from height during construction</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Sufficient space is planned for access &amp; to install / major fixed plant or</td>
<td>Low</td>
<td>Moderate</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Equipment or specialised equipment, plant rooms</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------</td>
<td>----------</td>
<td>------------------</td>
</tr>
<tr>
<td>Floor loading design has been assessed by engineer to be able to accommodate heavy equipment / plant to be installed in future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor surfaces – even level with no sudden changes in levels – floor coverings non-slip, suitable for levels of traffic use and suitable for type of tasks to be done</td>
<td>Moderate</td>
<td>High</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Stairs and balcony – edge delineation, slip resistant (SR) stair nosing, construction / design suitable for intended use, handrails, non-horizontal railings in balcony</td>
<td>Moderate</td>
<td>High</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Window positioning and solar glare</td>
<td>Low</td>
<td>High</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Safe Access to lighting fixtures to change fitting, bulbs</td>
<td>Low</td>
<td>Moderate</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Safe Access to plant rooms – locked, lighting.</td>
<td>Low</td>
<td>High</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Access to roof tops – safe access to within safety zone, minimised manual handling of material, equipment tools.</td>
<td>Low</td>
<td>Moderate</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Accessible window cleaning methods</td>
<td>Low</td>
<td>High</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Accessible roof cleaning methods</td>
<td>Low</td>
<td>High</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Accessible dirt or rubbish collection points</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Project Engineer</td>
</tr>
<tr>
<td>Maintenance Officer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
High risk scenarios provided by the above table, along with specific mitigation is given below.

- **Presence of hazardous substances, which impact on construction work eg: asbestos, SMF, hydrogen chloride, etc.**
  While the risk level is high, the risk probability is low as material including such substances are not be used. As a mitigation measure, this has to be ensured during material procurement. Moreover, hazardous substances should all be in sealed containers. It should be checked which substances can be stored together or not.

- **Accidental Spill of diesel.**
  Diesel spill may occur during fuel transfer, which may lead to a hazard. Diesel spills from the storage tank will already be mitigated due to the bund. Spills during transfer should immediately be brought to the attention of the project manager or site supervisor in charge. If spill is deemed to be significant, the area should be demarcated and spill cleared. No works using fire should be undertaken at anytime at or near the spill area.

- **Construction workers will be protected from / proximity to HV electrical, high risk energy sources**
  While the risk level is high, the probability is given as moderate. Proper insulator gloves and protective cloth are to be worn by workers in close proximity to high risk energy sources. Moreover, it has to be ensured that these are not exposed at any given time. Additionally, safety measures previously stated to prevent electrical accidents are to be followed.

### 2.12 Project Inputs and Outputs

Each component of the project has inputs and outputs based on human resources, economics, and the environment. However, since the operation is carried out in house, project inputs and outputs are greatly conserved and limited.
The major inputs and outputs associated with the project encompassing all the components, are tabulated below. Table 2 highlights the main material inputs, while Table 3 highlights manpower inputs and Table 4 is regarding other inputs. Table 5 demonstrates the major outputs of the project.

**Table 2 Main material input for the proposed project**

<table>
<thead>
<tr>
<th>Input Resource</th>
<th>Estimated quantity</th>
<th>Main source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>100,000 t</td>
<td>India</td>
</tr>
<tr>
<td>Aggregate</td>
<td>120,000 t</td>
<td>India</td>
</tr>
<tr>
<td>Cement</td>
<td>24000 t</td>
<td>India</td>
</tr>
<tr>
<td>Brick</td>
<td>70,000 m3</td>
<td>China/India</td>
</tr>
<tr>
<td>Steel</td>
<td>30,000 t</td>
<td>China</td>
</tr>
<tr>
<td>Wood</td>
<td>6000 m3</td>
<td>Malaysia/Sri Lanka</td>
</tr>
<tr>
<td>Concrete form</td>
<td>40000 piece</td>
<td>India/Sri Lanka</td>
</tr>
<tr>
<td>Insulation board</td>
<td>35,000 m2</td>
<td>India</td>
</tr>
<tr>
<td>Waterproof chemical</td>
<td>50,000 m2</td>
<td>China</td>
</tr>
<tr>
<td>Waterproof painting</td>
<td>300,000kg</td>
<td>China</td>
</tr>
<tr>
<td>Aluminum windows and doors</td>
<td>90,000m2</td>
<td>China</td>
</tr>
<tr>
<td>Wood door</td>
<td>70,000 m2</td>
<td>Sri Lanka</td>
</tr>
<tr>
<td>Water pipe</td>
<td>3000km</td>
<td>China</td>
</tr>
<tr>
<td>Electric cable</td>
<td>5000km</td>
<td>China</td>
</tr>
</tbody>
</table>
Table 3 Manpower input for the project

<table>
<thead>
<tr>
<th>No</th>
<th>Designation</th>
<th>According to the construction stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pile</td>
</tr>
<tr>
<td>1</td>
<td>Project management team</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Administrators &amp; office persons</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Civil engineer and electrical engineer</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Stakeman</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Carpenter</td>
<td>/</td>
</tr>
<tr>
<td>6</td>
<td>Bar setter</td>
<td>/</td>
</tr>
<tr>
<td>7</td>
<td>Cementer</td>
<td>/</td>
</tr>
<tr>
<td>8</td>
<td>Waterproof worker</td>
<td>/</td>
</tr>
<tr>
<td>9</td>
<td>Plasterer</td>
<td>/</td>
</tr>
<tr>
<td>10</td>
<td>Wall and floor tiler</td>
<td>/</td>
</tr>
<tr>
<td>11</td>
<td>Painter</td>
<td>/</td>
</tr>
<tr>
<td>12</td>
<td>Scaffold</td>
<td>/</td>
</tr>
<tr>
<td>13</td>
<td>Craneman</td>
<td>/</td>
</tr>
<tr>
<td>14</td>
<td>Plumbers</td>
<td>/</td>
</tr>
<tr>
<td>15</td>
<td>Firefighting equipment assemble worker</td>
<td>/</td>
</tr>
<tr>
<td>16</td>
<td>Welder</td>
<td>/</td>
</tr>
<tr>
<td>17</td>
<td>Measure man</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>Electricians</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>Mechanist</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>Laborers</td>
<td>10</td>
</tr>
</tbody>
</table>

Note that the number of personnel are given as estimates and is subject to change.

Table 4 Other inputs from the proposed project

<table>
<thead>
<tr>
<th>Input resource(s)</th>
<th>Estimated Quantity</th>
<th>Main sources of resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machinery and equipment</td>
<td>Tower crane – 10nos</td>
<td>Sourced from contractor’s own equipment/machinery. If new machinery required, sourced from local rentals.</td>
</tr>
<tr>
<td></td>
<td>Excavator – 30 tons</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Batching plant – 2nos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transit mixtures – 2nos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dewatering pumps –</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>Quantity</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>as per the requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil boring machine</td>
<td>2 nos</td>
<td></td>
</tr>
<tr>
<td>Skid loader</td>
<td>2 nos</td>
<td></td>
</tr>
<tr>
<td>1.5 cube tipper</td>
<td>1 nos</td>
<td></td>
</tr>
<tr>
<td>Crane truck</td>
<td>1 nos</td>
<td></td>
</tr>
<tr>
<td>Scaffoldings as per the requirement</td>
<td>about 400 sets</td>
<td></td>
</tr>
<tr>
<td>GI Pipes 50mm</td>
<td>1000 nos</td>
<td></td>
</tr>
<tr>
<td>Arco jacks and based (U</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formwork system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete stationary pump with required length of pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material and passenger hoist</td>
<td>4 nos</td>
<td></td>
</tr>
<tr>
<td>Bar bending machine</td>
<td>6 nos</td>
<td></td>
</tr>
<tr>
<td>Pre stressing jacks</td>
<td>6 nos</td>
<td></td>
</tr>
<tr>
<td>Grout pumps</td>
<td>4 nos</td>
<td></td>
</tr>
<tr>
<td>Compressive testing machine</td>
<td>1 nos</td>
<td></td>
</tr>
<tr>
<td>CBR testing apparatus</td>
<td>1 nos</td>
<td></td>
</tr>
<tr>
<td>Rebound hammer</td>
<td>2 nos</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Water proofing</td>
<td>Water proofing membrane wielding machine – 2nos</td>
<td>Water proofing membrane wielding machine – 2nos</td>
</tr>
<tr>
<td>membrane wielding</td>
<td>Arc wielding plants – 2nos</td>
<td>Arc wielding plants – 2nos</td>
</tr>
<tr>
<td>machine – 2nos</td>
<td>Lighting generators – 2nos</td>
<td>Lighting generators – 2nos</td>
</tr>
<tr>
<td></td>
<td>Silent hammer – 1nos</td>
<td>Silent hammer – 1nos</td>
</tr>
<tr>
<td></td>
<td>Mobile crane 2nos</td>
<td>Mobile crane 2nos</td>
</tr>
<tr>
<td></td>
<td>Backhoe loader – 3nos</td>
<td>Backhoe loader – 3nos</td>
</tr>
<tr>
<td></td>
<td>Plastering Machine – 3nos</td>
<td>Plastering Machine – 3nos</td>
</tr>
<tr>
<td></td>
<td>Small concrete mixture – 6nos</td>
<td>Small concrete mixture – 6nos</td>
</tr>
<tr>
<td></td>
<td>Mobile concrete pump (as per the requirement)</td>
<td>Mobile concrete pump (as per the requirement)</td>
</tr>
<tr>
<td>Energy supply (during</td>
<td>~400kW</td>
<td>From contractor generator at site</td>
</tr>
<tr>
<td>construction)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water supply (during</td>
<td>500 tones/day</td>
<td>From contractor own RO plant at site</td>
</tr>
<tr>
<td>construction)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulics and Drainages</td>
<td>All the UPVC pipes and fittings shall be used high pressure</td>
<td>Procured from abroad</td>
</tr>
<tr>
<td></td>
<td>pipes.</td>
<td></td>
</tr>
</tbody>
</table>


### Table 5 Major outputs from the proposed project

<table>
<thead>
<tr>
<th>Products and waste materials</th>
<th>Anticipated quantities</th>
<th>Method of disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste generated during construction</td>
<td>20-30 tons per day</td>
<td>Collected and sorted at site, and taken to Thilafushi waste collection area.</td>
</tr>
<tr>
<td>Waste water</td>
<td>100 litres/second</td>
<td>Water flow towards the lagoon on the west of Hulhumale’ via established MWSC system</td>
</tr>
<tr>
<td>Waste oil and grease</td>
<td>Minute quantities</td>
<td>Collected in used containers and transported to waste site</td>
</tr>
<tr>
<td>Air pollution</td>
<td>Debris in minute quantities</td>
<td>External influence minimised by site demarcation temporary boundary walls.</td>
</tr>
<tr>
<td>Noise pollution</td>
<td>&gt;75 db(A)</td>
<td>Minimised by site demarcation barriers. Ear muffs and safety equipment for workers on site.</td>
</tr>
<tr>
<td>Waste generated during operations</td>
<td>100 tons per day</td>
<td>Collected on site and transported to waste collection site in Hulhumale’</td>
</tr>
<tr>
<td>Waste water generated during operations</td>
<td>3000 tons per day</td>
<td>Via MWSC sewerage network</td>
</tr>
</tbody>
</table>
3 Description of the Existing Environment

This section covers the existing environmental conditions of the project site. Since this is a housing project, the key components with respect to housing projects are described below.

- Climate
- Existing structures
- Vegetation
- Traffic flow
- Noise pollution
- Water quality
- Hazard vulnerability
- Data was collected using methods discussed in Section 1.4.

However, as the project is to be undertaken on barren newly reclaimed land similar to the previously undertaken 2500 housing unit EIA, there are few components among these that are not relevant for this project. These include status of existing structures, vegetation, traffic flow as there are no structures or vegetation or traffic in the area currently.

3.1 Climate

This section deals with the regional and local climate of the study area. These are general information and the same is provided for all similar projects that are undertaken in the area.

Data has been taken from the weather station at Hulhule’, the island which accommodates the International Airport and adjacent to Hulhumale’. Long-term meteorological data for Hulhulé is available and being less than a kilometre away from the project location, the station is at an ideal location.

The Maldives has a warm and humid tropical climate with average temperatures ranging between 25°C to 30°C and relative humidity ranging from 73 percent to 85 percent. The
country receives an annual average rainfall of 1,924.7mm in the central parts, where Male’ is located. (Department of Meteorology, 2012).

The climate of the Maldives is dependent upon the Indian Ocean Monsoons. Monsoon wind reversal plays a significant role in weather patterns.

The two monsoon seasons observed in the Maldives include the Northeast (Iruvai) and the Southwest (Hulhangu) monsoon. The northeast monsoon is the dry season that occurs from December to February and the southwest monsoon is the rainy season, which lasts from May to September. The transition period of northeast monsoon occurs from October to November while that of southwest monsoon occurs between March and April. The ‘four seasons’ of the Maldives is highlighted in the following Table 6.

Table 6 Four Seasons of the Maldives

<table>
<thead>
<tr>
<th>Seasons</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>South West Transition</td>
<td>March to April</td>
</tr>
<tr>
<td>South West</td>
<td>May to September</td>
</tr>
<tr>
<td>North East Transition</td>
<td>October to November</td>
</tr>
<tr>
<td>South West Transition</td>
<td>December to February</td>
</tr>
</tbody>
</table>

3.1.1 Wind

Wind is an important indirect factor affecting formation, development and seasonal dynamics in the Maldives. Winds often help to regenerate waves that have been weakened by travelling across the reef and they also cause locally generated waves in lagoons. Therefore, winds are an important factor, as being the dominant influence on the hydrodynamics in most coastal areas.

The two monsoon seasons have a dominant influence on winds experienced across Maldives. Since Maldivian islands are spread across the equator, monsoons are relatively moderate while strong winds and gales are rare. However, during South West monsoon
gusts of up to 60 knots (30m/s) have been recorded at Male’. Reversal of winds in the Maldives means change of seasons from North East monsoon to South West or vice versa.

Wind is also important with respect to such large construction projects, especially during heavy wind. In general wind is expected to be within 5m/s – 12m/s during the project. During heavy winds exceeding these amounts, special care must be taken to ensure loose materials are not at project site and/or all loose equipment and materials are tied down.

General wind surface wind pattern over the country during North East monsoon is north-easterly direction whereas during South West monsoon mean wind flow is westerly. Based on the project schedule, the project will encounter heavy westerly winds twice during the project cycle.

Figure 8 Wind rose diagram from Hulhule’ weather station for 2016 (MMS, 2016)
3.1.2 Waves

Wave climate is not as important for a structure situated at the coast. Therefore, for the purpose of the EIA, there were no measurements carried out for the wave generation on a local scale. However, regional data has been studied and visual observation on site was used to analyse the environment, as even though there is low probability that direct wave impact will occur at the project site, inundation due to larger swells is possible for the area.

Two major types of waves are formed on the Maldives coasts: wave generated by local monsoon wind and swells generated by distance storms. The local monsoon predominantly generates wind waves, which are typically strongest during May-July in the aforementioned southwest monsoon period. During this period, swells generated north of the equator with heights of 2-3 m with periods of 18-20 seconds have been reported in the region. Local wave periods are generally in the range 2-4 seconds and are easily distinguished from the swell waves.

Since the project site is at the eastern parts of the island, probability of impact due to easterly waves are there during north east monsoon. However, the area will be well protected via a buffer area in between the shoreline and the project site in addition to the shoreline being heavily protected using rock armour revetment built above 2.0m from MSL.

3.1.3 Rainfall

The average annual rainfall for the archipelago is 1,937mm. There are regional variations in average annual rainfall. Southern atolls receive more rain compared to the northern atolls (MEC, 2004). Mean monthly rainfall also varies substantially throughout the year with the dry season getting considerably less rainfall. The north-east monsoon is known as the dry season and the south west monsoon the rainy season. It is not expected that the project team will have to endure heavy rainfall during the excavation and foundation works based on the current schedule.
3.2 Existing structures

There are no other existing buildings on the same area as proposed for this project. There are upcoming buildings proposed in Phase 2. However, no building has been constructed yet.

3.3 Vegetation

As Phase 2 is largely barren land, there was no vegetation survey required as part of the project.

3.4 Traffic Survey

As there are no developments currently established in Hulhumale’ Phase 2, and no public vehicles are allowed into the Phase 2 area, a traffic survey was not required as part of the project.
3.5 Noise Pollution

Noise pollution can be an environmental and health hazard. However, there are no currently no guidelines for noise levels at residential areas in general. Examples of guidelines with regard to noise for residential areas as set World Bank Environmental Health and Safety guidelines for noise at residential areas are:

Daytime reference value for noise as set by the bank is 55 dBA while night time value is set at 45 dBA. For industrial area the noise reference level is set at 70 dBA.

The background noise levels at the project site is very low due to lack of activities in the area. The baseline Noise levels are at 40 - 45 dBA. This coincides with the finding in the 7000 housing unit development EIA in the same region and of the 2500 housing units project study, where the minimum noise level was at 44 dBA, while in general the maximum was at 59 dBA. This maximum was most likely due to heavy vehicles in the area at the time of noise measurement.

3.6 Water quality

Ground water in the location was sampled and sent for testing to MWSC in December 2017. Results of this test are shown in the Table 7 below (see Annex 3 for results sheet).

Table 7 Groundwater quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>2500 housing Project site</th>
<th>5000 housing site 1</th>
<th>5000 housing site 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS coordinate</td>
<td>-</td>
<td>4°13'28.58&quot;N, 73°32'31.38&quot;E</td>
<td>4°13'29.26&quot;N, 73°32'47.87&quot;E</td>
<td>4°13'42.25&quot;N, 73°32'51.14&quot;E</td>
</tr>
<tr>
<td>Conductivity</td>
<td>µS/cm</td>
<td>825</td>
<td>978</td>
<td>836</td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td>8.03</td>
<td>8.23</td>
<td>8.22</td>
</tr>
<tr>
<td>Salinity</td>
<td>%o</td>
<td>0.40</td>
<td>0.48</td>
<td>0.41</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>23.5</td>
<td>24.6</td>
<td>25.1</td>
</tr>
</tbody>
</table>
As can be seen from the water test results, the water quality is good as expected since there has not been any significant extraction of groundwater or intrusion of any pollutants since the fresh water lens had been formed after reclamation of land. Likewise, TPH content is very low as expected due to lack of any significant activities at the site.

### 3.7 Socio – economic Environment

#### 3.7.1 Population

The population of Hulhumale’ based on most recent official results is 15,769 divided to 8,175 males and 7,594 females. Total no. of foreigners residing in Hulhumale’ is about 1200. However, HDC data shows current residential population in Hulhumale as 65,520 people.

Hulhumale’ population is growing rapidly and is the fastest growing in the country. In 2006 census the total population of Hulhumale was only 2866 people. Therefore, the exponential growth is set to continue. The population is projected to rise up to about 100,000 in 2020. There are many housing projects proposed in the island, and migration from Male’ and even from other islands is anticipated to increase at a greater rate. Moreover, Male’-Hulhumale’ bridge project is currently ongoing and will complete in 2018. This gives incentives to residents in Male’ to move away from the congestion in the capital island.

#### 3.7.2 Transport

Access to Hulhumale’ is currently by ferry operated by the Maldives Transport and Contracting Company Plc Ltd (MTCC). Ferry is available throughout the day except between 3am to 5am. The average carrying capacity of the ferries are about 100 people per boat. Regular bus is available to travel from the Ferry terminal to several locations in the residential areas.
There is also a regular bus traveling between Hulhumale’ and Hulhule’ every 30 minutes. There are more options to travel between Hulhumale’ and Hulhule’ currently; by private vehicles of guest houses operating in Hulhule’. The vehicles, usually vans provide taxi services to locals.

Traveling within Hulhumale’ is by taxi services and also private motorcycles. Currently bicycles are also getting increasingly popular. The island is designed in a pedestrian friendly manner with big pavements available through the island, especially in the main roads.

With the expected completion of the proposed China Maldives Friendship Bridge, it is expected that this will be the main mode of transport for the majority of residents living in Male’ and Hulhumale’.

### 3.7.3 Education

Hulhumale’ currently has 3 secondary and higher secondary schools, namely; Ghaazee School, Rehendhi School and Gateway International School.

Pre-schooling options in Hulhumale’ currently consists of Little Gems Preschool and Gateway International School. A new preschool is currently being built and is anticipated to be operational sometime during 2017. Another secondary school is also currently under construction. While most of the local residents obtain schooling from the local schools, some do travel to Male’ daily. There are fewer occasions where students from Male’ come to Hulhumale’ schools.

By the time the housing units as proposed are constructed, there will be more schooling opportunities in Hulhumale’. Currently, there are 2 significant school projects being undertaken. It is expected 1 additional secondary school and 1 additional preschool will be open within the next 2 years. There are more proposed educational institutes proposed for Phase 2 area, including among the area the proposed buildings will be constructed as shown in the Land Use Plan.

### 3.7.4 Health

There is a main public hospital in Hulhumale’ on the main road. It is the central health care provider in the island. The hospital was previously run by the Ministry of Health and recently management has been shifted to Medical Insurance Provider ‘Aasandha’. Due the
relatively less congestion at the site relative the Male’, the hospital does get patients from Male’ in addition to Hulhumale’ residents. Currently, there are some major renovation works being undertaken at the hospital.

A multi-speciality international hospital has been proposed for Hulhumale’ and is nearing completion. The hospital is expected to be operational very soon. When fully developed, the hospital will have a capacity of 600 beds and will have private access to emergency facilities.

Additionally, there are few clinics currently being opened in Hulhumale’, including dental clinics and general clinics.

There will be further medical institutions that will be developed in Hulhumale’ Phase II area.

### 3.7.5 Utilities

Utility services are provided by the biggest utilities in the Maldives; STELCO and MWSC. Both companies inform they have the capacity to deal with the current developments in Hulhumale’ and are poised for expansion as new developments come in. Current power generating capacity at STELCO, Hulhumale’ is 12MW, while there are plans to upgrade to an additional 3MW in the coming months. Both MWSC and STELCO’s scale of operation will be significantly upgraded with the development of Phase II.

Regarding waste management, HDC has recently signed the contract with WAMCO to undertake all waste management in Hulhumale’, including waste pick up and transport from households, management of the waste site, transporting waste to Thilafushi. Currently WAMCO is in the process of establishing their waste management system to Hulhumale’ Phase II as well. However, phase II operations have not commenced yet.

### 3.7.6 Tourism

Hulhumale’ has been a hub for budget tourism and guest house development. Currently it is estimated there are about 100 guest houses in the island, with the total capacity to cater for about 2000 guests at any one time. International visitors numbers provided by HDC states that in 2016 alone over 126,385 guests visited the island and is projected to rise exponentially to over 650,000 guests in 2020.
Hulhumale’ is also a popular destination for local tourism with many locals travelling to the island on weekends and on holidays, mainly from Male’. In 2016, about 820,144 locals visits are accounted for and the number is projected to rise to over 1,200,000 in 2020. However, this could be a gross over estimate.

A significant land is allocated for tourism purposes in Phase 2. Therefore, with the development of Phase 2, more tourism operations will be in place.

3.8 Hazard Vulnerability

Maldives in general does not experience natural disasters and hazards on a frequent basis. The major natural hazards are due to swells and/or due to storm surges. However, the Indian Ocean Tsunami in 2004 was a historic reminder on potential hazardous threats the country faces. The islands across Maldives face similar type of threats and hazards to varying degrees and magnitude depending on several factors.

The vulnerability of islands to natural hazards depends on geological and more importantly geographic aspects of the island. As such, the location of the island, with respect to the country and atoll is quite important. Likewise, the level of protection the island is offered from neighbouring islands, the house reef, shape and orientation of the island are also important factors.

Based on the UNDP Disaster Risk Assessment Report of Maldives in 2006, Hulhumale’ is located in an area that has been designated as a low-risk hazard zone. However, as stated in the report, sea level rise due to climate change is a uniform hazard throughout the country, and will have high impact on Hulhumale’ as well. Figure profiling the Maldives based on the hazard zones are given in the following Figure 10.

The proposed buildings located south of the Phase II area, and virtually center of the entire Hulhumale’ land area. There may be flooding at the project site in the event of a Tsunami or major swell surges, which would be the case for majority of the island. As there is no residential area in the ground floor, impact to residents will be minimal under such circumstances.
Figure 10 Disaster risk profile of the Maldives (UNDP, 2006)
The legislative and regulatory consideration the project adheres to is mostly at a national level, since it takes place on a local scale within the Maldivian environment. The extent to which the project conforms to existing plans, policies, guidelines, regulations and laws of the Maldives are considered in this Section. Some of the more important regulations are stated within the context of this project scope. The regulatory context in which the project activities take place and the legal and policy aspects relevant to those activities will be discussed in the Section.

4.1 Environmental Protection and Preservation Act (Law No. 4/93)

The major legal instrument relating 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, and Energy before implementing any development project that may have a potentially detrimental impact on the environment.

Clause 5b: The Ministry of Environment, and Energy 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, and Energy 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, and Energy 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.

4.2 Regulation on Aggregate and Sand 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.

This regulation would not have any implication on the project, as manufactured sand and imported sand will be used for the construction works.

4.3 EIA Regulations

The EIA Regulations, which initially came into force in May 2007 has been amended and re-published in May 2012 based on the Environmental Protection and Preservation Act. The EIA Regulations have been the basis for Environmental Impact Assessment in the Maldives and since its inception; it had helped to improve the quality of EIAs undertaken in the country. Today, registered consultants are required to sign EIAs and the reports are subsequently reviewed by two independent reviewers and a final decision is made by EPA based on the reviews. Likewise, this EIA report would also be subject to these requirements and review criteria.
‘Jadhuvalu Raa’ of the new EIA Regulations lists the different environmental projects that require an Environmental Impact Assessment study. High rise building construction works is among this list and thus a full Environmental Impact Assessment was needed to be carried out for this project. It is specifically stated that buildings with foundation deeper than 5ft / 1.5m will require Environment Impact Assessments to be carried out. This project proposes a foundation 2.77m deep.

The EIA Regulations sets out the requirements for the contents of Environmental Impact Assessment reports in ‘Jadhuvalu Baa’ and format for monitoring reports have been given in ‘Jadhuvalu Laamu’. Therefore, these requirements have been taken into consideration in preparing this EIA report.

On 9th April 2013, a further amendment to the EIA Regulation 2012 has been published, which deals with repeated offenders of the regulation. Under Clause 20 of the regulation, the amendment proposes a new Schedule, ‘Jadhuvalu Taviyani, which lists penalties for repeated offenders. Under ‘Jadhuvalu Taviyani’, repeated offenders of the regulation will be fined based on the following criteria

- For Initial offence: 20,000 MVR
- If an offence is repeated for the 2nd time: 60,000 MVR
- If an offence is repeated for the 3rd time: 120,000 MVR
- If an offence is repeated for more than 3 times: 200,000 MVR for each offence.

On 11th August 2016, a third amendment was published, which mainly deals with revised criteria for EIA evaluators, environmental consultants and their performance evaluations.

On 19th January 2017, a 4th amendment to the EIA regulation was published. The amendment lists additional types of project which can be implemented without the need of an EIA, with only a confirmation/assurance from the developer/proponent affirming that mitigation measures required for the project will be undertaken during project implementation. These types of projects include the following

1. Harbour and entrance channel maintenance dredging.
2. Removal of vegetation in plots allocated for housing development by the owner of the plot
3. Removal of vegetation from roads in areas allocated for housing development.
4. Making boreholes for water intake
5. Projects which are undertaken within 3 years in newly reclaimed areas in which the reclamation has been alongside existing natural island.

6. Projects which are undertaken within 5 years in newly reclaimed areas in which the reclamation has been in a lagoon separate from existing island.

The amendment gives an exemption to the types of projects mentioned in 5 and 6, if the project has the following characteristics

1. use of hazardous chemicals
2. any type of fuel storage
3. use of an incinerator
4. release of poisonous emissions
5. involves fibre work

Moreover, it states that if a residential population is established in the reclaimed land, then the exemptions granted for the type of projects as stated in Clause 5 will not be applicable. As fuel storage activities will be undertaken as part of the project, and to fulfil financing requirements of the contractor, an EIA has been undertaken for the project.

### 4.4 Maldives National Building Act

The Maldives National Building Act (4/2017) has been published in the gazette on 23rd April 2017. The building Act discusses compliances issues and procedures, providing disability access, details of procedures for building consent, supervision of buildings, roles and duties of all parties concerned with developments including the regulatory authority, building owners, developers and contractors, occupation of the buildings, licensing of building practitioners, and refers to the Building Code for more detailed guidance on construction procedures and best practice.

The Act also establishes the “Maldives Building and Construction Board” which is responsible for advising the Minister and other relevant actors on matters specified in the Act. The Board is comprised of 7 appointees, from both private and, public sector, who can sit on the board for 2 consecutive 2-year terms.

Some other key areas covered by the Act include the creation of a standardised building code, a fine regime for persons who do not comply with the Act and subsequent Regulations, giving priority to Maldivian workers in the construction sector and, guaranteeing compensation for services rendered. The Act also provides a dispute resolution
mechanism for parties who seek to contest fines and other actions taken against them under this Act. The dispute must be lodged within 14 days of the action and a response to the disputed action must be given within 1 month.

The Act also stresses on the importance of engaging locals in building construction projects and also highlights fines for non-compliance of the various clauses given within the Act.

4.5 **Maldives National Building Code 2008 draft**

Maldives National Building Code is also still at a draft stage, and is awaiting the Building Act to be fully implemented. The Code intends to regulates on the duties of the contractors, It recommends best practices, in addition to regulations to be adhered to during construction work. It covers aspects such as structural stability, fire safety, access, moisture control, durability, services and facilities, and energy efficiency. Once the building act is published, the Coder will be enforced and all contractors will need to adhere to the regulations provided. Currently the contents are followed as a guideline. The proposed development will conform to the guidelines provided in the Building Code draft.

4.6 **Environmental Guidelines for Concrete Batching plants 2014**

The guideline has been prepared by EPA as a guide for developers/contractors regarding installation and operation of batching plants. It is proposed to ensure that the operations are environmentally friendly and has minimum impact on neighbouring communities. Some of the key points outlined in the guideline are as follows:

Generation of wastewater from the plant must be minimised and measures to re-use wastewater should be in place such that it mitigates potential groundwater impacts.

Materials used for the plan such as cement, sand and aggregates should be stored in such a way that they are covered and not exposed to rain or excessive sunshine.

Material dispersal to the natural environment should be minimised during transportation

Noise reduction measures should be in place during plant operations
The plant should be located at the site in such a way as to reduce spread of dust and/or debris by incorporating existing trees, or constructing fences and landforms to maintain a minimum of 100m buffer distance from other sensitive areas.

**4.7 Waste Management Regulation, 2013**

Waste Management Regulation (No. 2013/R-58) came into effect on 6 February 2014. The Regulation was gazetted on 05 August 2013. The regulation provides a set of comprehensive guidelines and on collecting, storing, transporting and managing waste as well as management of hazardous waste. The waste management regulation prohibits dumping of waste on to parks and roads; protected areas under the Environmental Protection and Preservation Act. Moreover, waste management regulation states that those involved in waste management must be permitted by the Environmental Protection Agency.

Clause 11 of the regulation deals with terrestrial wastes and states that waste should be deposited and managed only at sites allocated by the relevant authority.

Clause 26 of the regulation deals with the transportation of wastes.

Clause 34 of the regulation states the procedure for penalties for those that do not abide by the regulation.

Jadhuvalu (annex) Haa 1.1 states the regulation applicable to household wastes.

- Waste should be stored within the household in a container with a lid, such that there is no opening for any leakage. This is the responsibility of the household dwellers.
- There should not be any leakage of waste from waste storage to waste transport vehicle
- Any waste that can potentially leak out liquid should be properly sealed
- Waste should be sealed such that no insect or animal will be able to access the contents of the stored wastes

Jadhuvalu (annex) Haa 1.4 of the regulation states the conditions applicable to building and construction waste. From the clause, the notable points are as given below:

- Construction projects should be planned and managed in such a way to ensure minimum amount of waste is produced.
- Steps should be in place to ensure minimum waste generation during building and construction
- Building and construction waste generated from demolition should be reused as much as possible
- Building and construction waste should be within the site boundary of the project and should not cause any disturbance to the public
- All building and demolition works shall be arranged in such a way to ensure that during the course of the project, there shouldn’t be any disturbances to the neighbouring entities and public due to the generation of wastes

It should be noted that demolition is not part of this project, as there is no structure in the area currently. Moreover, the way the site is setup, it is virtually guaranteed that waste will be contained within the site and will not pose any nuisance to the public or any potential currently residential area.

Jadhuvalu (annex) Haa 2.1 states the conditions applicable to land transport of waste.

- Waste should be properly concealed during transportation such that any waste or smell of waste will not be exposed to the surrounding environment
- Waste transporting vehicle should be properly washed and cleaned regularly
- If waste is to be transported on a wheel burrow, it has to still be ensured that the burrow is able to handle the entire content of the waste and that there is no chance for waste to spill out
- If waste is transported by individuals personally, still the condition as stated in this clause is applicable.

During the operational stage of the project, under the management of HDC, the building will be maintained according to a maintenance agreement which will be termed and agreed between HDC and the tenants or concerned body. In any case, waste management within the building will be outsourced to a third party and waste transfer to transfer station or landfill will be undertaken by WAMCO.
**4.8 Dewatering Regulation, 2013**

A Dewatering Regulation (No. 2013/1697) came into effect in December 2013. The main purpose of the regulation is to protect groundwater resources found in the islands from impacts of dewatering, pollution and protect the environment from release of groundwater by dewatering. As per the regulation, a dewatering permit shall be obtained from EPA prior to any dewatering operations required for all development projects.

Furthermore, the regulation states that 30m radius boundary shall be considered as impact area from all dewatering operations and any entities within the boundary shall be informed 24hrs before the dewatering operation. EPA approved dewatering signage must be placed during the process of dewatering. There are no structures or any development within a 30m radius from the project site.

Dewatering can only be to be carried out, after gaining approval by submitting “the dewatering approval form” in the annex 1 of the Regulation to the enforcing body for approval with all the required documents expressed and with an administrative fee of 500 MVR. Water quality tests results also have to be submitted as one of the required component.

The regulation also guides on where and how the extracted water shall be disposed of, and how it has to be handled. According to the regulation, permission can be granted for dewatering at a stretch for a maximum of 28 days, for which a sum of 500 MVR should be paid per day. This amount can be increased with the increase in number of days.

**4.9 Management, Use and Control of HCFC Substances Regulation, 2010**

The HCFC Regulation was developed under the Environmental Protection and Preservation Act (4/93) towards regulating phasing out of import, use, selling of HCFC substances by 2011 and completely eliminating use of HCFC substances in the Maldives by 2020 through controlling importers, registering importers, establishment of a quota system, control mechanisms for selling, maintenance of import, selling, purchase and service providers statistics. This regulation is more relevant to the operational stage of the project.
4.10 Maldivian Land Act, 2002

The Act governs the allocation of Maldivian land for different purposes and uses and other issues regarding the issuing of land, issuing of state dwellings for residential purposes, conduct regarding state dwellings or private dwellings constructed for residential purposes and the sale, transfer and lease of Maldivian Land.

In accordance with section 3 of this Act, land shall be allocated for the following purposes and uses: for the construction of households and buildings for residential purposes, for commercial use, for social use, for environmental protection and for government use.

Clause 38 of the Act states the conditions for articles discovered during the excavation of land. Sub-clause A states that except for coconut palms owned by the person, all other natural resources and gold, silver, jewellery, money, utensils, historical artefacts and metals that do not have a legal owner shall be a property of the government. Sub-clause B states Any jewellery, vessel or money or artefacts or metal as mentioned in subsection (a) of this section, if found in the soil of Maldives then the party who found the articles. As the project is being undertaken in Hulhumale’, an artificially reclaimed land, it is highly unlikely the clause will come into effect.

4.11 Land Use Plan and Implementation Regulation

Under the Maldivian Land Act of 2002, all lands in the islands under the lands development policy, a Land Use Plan shall be developed and approved from Ministry of Housing and Infrastructure prior to use of the lands. The regulation outlines key aspects that need to considered while preparing land use plans as well as describes guidelines on developing and allocating lands for various purposes. In this regard, various categories of lands are identified under which a government agency shall implement the land use plan.

The project falls under Category D, which are described as islands reclaimed as special projects. The land use plan will be made for such islands by the developer as stated in the regulation, which in this case is HDC.
4.12 Condominium Law 2006

Condominium Law or ‘Emmedhu Imaaraathaa behey Qavaaidhu’ came into effect on 21st May 2006. The law states that a Condominium is defined by buildings in which in different tenants own floor areas/apartments in the same building, as would be the case in this project.

Clause 18 of the law states that Public Spaces and Services in Condominiums will have to be maintained by the tenants.

Clause 19 of the law states that It has to be stated in the contract on how Public Spaces and Services in Condominiums will be monitored and maintained.

Clause 20 of the law states that apartments in condominiums can only be owned by local citizens of the Maldives.

The tenants would need to be contractually obliged to maintain the building.

The law is very brief and is in need up revision considering the many upcoming condominiums projects such as these.

There should be elaboration on the penalties upon tenants if they do not oblige with the predefined maintenance setup, which is unanimously agreed among the tenants, or is predetermined by the developer. This is to ensure that the buildings are maintained properly and is not subject to decisions made by individual tenants. Proper maintenance of the building is key for the project to be sustainable and to ensure the building area is liveable for the long term.

4.13 Permits required for the Project

4.13.1 Design Approval

The floor plans and design has to be currently approved by Housing Development Corporation (HDC). The approval is attached in the Annex 3. There need not be any approvals required from the Ministry of Housing Infrastructure to implement the project. However, detail design would still need to be certified by an Engineer approved by the Ministry.
**4.13.2 Dewatering Permit**

A dewatering permit shall be obtained from EPA prior to undertaking any dewatering works. Before dewatering approval is given, an EIA would need to be done if the project falls under ‘Jadhuvalu R’ of the EIA regulations.

**4.13.3 EIA Decision Statement**

A decision regarding this EIA from the Environmental Protection Agency (EPA) need to be obtained before construction commences. 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 EPA may request for further information or provide a decision if further information is not required.

**4.13.4 Building Use Permit**

A building use permit is required to be obtained from HDC upon completion of the proposed building. HDC projects and/or engineering team will undertake a final inspection of the development to determine if there are any defects and if the building conforms to the development guidelines as provided by HDC.

Prior to commencing living in the apartment units, water connection approval would need to be obtained from MWSC and electricity connection approvals would need to be obtained from STELCO.
5 Identification of Impacts & Significance

This section is based on the potential environmental impacts due to the project components including:

- Excavation and Dewatering
- Material sourcing, transport and storage
- Site setup and establishment of utilities
- Operation of own gensets and RO plants at site
- Fuel handling and storage
- Construction of the foundation
- Super structure construction and masonry works
- Waste management
- Building operation
- Building maintenance
- Long term social issues

The section describes the mitigation measures for each identified impact. Since the components are all building related some impacts are general to all the components of the project, and some are specific. Likewise, the same applies for the mitigation measures. Methods of identification of potential impacts and assessing the significance of the impacts are described in the following sections.

5.1 Identification of Impacts and their Significance

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

- Public consultation with important stakeholders. Including during the scoping of the project and formulation of the Terms of Reference for the EIA.
- Using decision frameworks for assigning significance to impacts
- Existing environmental studies carried out similar developments in other similar environments, especially that 7000 and 2500 housings units project.
- Research data that has been accumulated specific to the Maldivian context.
- Baseline environmental conditions collected.
- Experience of the consultants with similar projects.
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.

The impacts highlighted in the TOR for this EIA has been used as a guideline in identifying important impacts. However, this was not used as a strict instruction for the identification. Once new impacts not highlighted in the TOR were foreseen, they were given equal importance.

Following are the major types of negative impacts that commonly occur due to the implementation of building construction projects in Greater Male’ City.

- Loss of visual amenity during demolition and construction
- Loss of vegetation and impact on terrestrial habitats
- Groundwater degradation
- Mosquito growth
- Noise Pollution
- Air Pollution
- Traffic disruption leading to congestion
- Generation of building and construction waste
- Impact on adjacent structures
- Health and safety of workers and neighbours
- Generation of household waste during operational phase
- Building maintenance issue
- Fire risk hazards

Among these, several impacts do not apply to this project due to the barren undeveloped area this project is proposed to be undertaken.

As such, there is virtually no visual impact during construction, negligible noise pollution, no traffic disruption, no impact on vegetation and no impact on adjacent structures.

The project impact area is the project site as shown in the Figure 2 showing the study area, with no significant impact anticipated beyond the area.
5.2 Description of Impacts

5.2.1 Loss of visual amenity during demolition and construction

There is no existing building at the site and therefore there is no impact from demolition. There are no other receptors near the project site as well. The visual impact would be short in nature and receptors will only be other construction staff. The magnitude of impact will be very low and can be regarded as negligible.

5.2.2 Loss of vegetation and impact on terrestrial habitats

As this project is to be undertaken on a newly reclaimed land, there is no impact on vegetation.

5.2.3 Groundwater degradation

The major cause for concern with regards to groundwater is the water extraction process, dewatering, to lay the foundation. Dewatering would remove a moderate volume of water from the project site. Although the depth is not significant, a large area will be excavated and need to be dewatered to an extent. This water will be disposed towards the lagoon. The impacts of the operation are short term.

The short-term impacts due to dewatering is mainly the impact on the groundwater lens due to saline intrusion resulting from coning and the impact of such sudden increase in salinity on the freshwater lens near the site. As stated previously, there are no mature trees that will undergo an impact from this. The sudden increase in salinity in the area will not have any impact.

Further impacts on ground water may occur due to contamination from spills, mishandling of chemicals, paint and fuel.

Considering the cumulative impact from many other similar developments in the area, it can already be observed that the ground water quality has somewhat deteriorated. However, the freshwater lens will likely regain its shape once the dewatering phase for all the projects are completed.

5.2.4 Seawater degradation

The dewatered water is proposed to be discharged out to the lagoon east of the project site.
There will be sedimentation impacts on the lagoon resulting in poor water quality in the immediate area for the duration of dewatering. However, this impact will be minor especially if only overflow water from a trench made nearby is allowed to be discharged into the sea. Further impact on seawater may occur from brine discharge. However, this will be a very short term and insignificant impact.

5.2.5 Mosquito growth

Mosquito growth has become a significant issue at all major construction sites, due to potential spreading of dengue among other diseases. Mosquito growth at construction sites mostly occur due to negligence. After foundation is laid, and construction takes place at ground floor and beyond, the elevator pit is usually left without any such construction. More significantly, after excavation, if the fresh water lens is left exposed, mosquito growth occurs at dewatering sites as well, especially when the dewatering operation is suspended for some reason after commencement. Any area that water is left to accumulate and left without intervention provides a favourable environment for mosquito growth. As there will be a large land area that will be excavated as part of the project, mosquito growth can be a significant impact and will need to be mitigated.

5.2.6 Noise Pollution

As stated previously under Description of the Environment, ambient noise pollution in the area is low due to lack of consistent activity in the area. However, once all the constructions work commences, noise emission will be high. Even though noise emissions are expected to be high, there will not be any significant receptor of the noise in the barren land. Construction activities will increase the amount of noise, especially during the concrete mixing operations. Also, there will be consistent noise emitted from Stationary equipment such as air compressors, cranes, and generators. They generally run continuously at relatively constant power and speed, although sound levels may vary according to the work cycle (e.g., loading). These types of noises are temporary and are relatively intermittent. As there aren’t much receptors at site, the significance is negligible to minor. As there are not any notable receptors near the project area, the impact will be very low.

There will be a cumulative impact with other similar developments nearby. It is likely that at the peak of construction, the area will emit noise in excess of 65-70 dB(A). The main receptors of this impact will be construction staff. If they follow safety standards, impacts will be low.
5.2.7 Air Pollution

Air pollution is an issue during construction when debris maybe seen accumulating in the project area. Impact of debris on human health is significant. Pollutants will include dust from demolition, excavation, movement of transportation vehicles, loading and unloading of materials, earthwork and during concrete mixing work. Dusts may also be transported to surrounding areas by wind, affecting residents and workers of surrounding areas. The most significant activity would be the operation of the batching plant.

In addition to dusts and debris, harmful gases released by heavy machineries and vehicles and other construction work include carbon monoxide, carbon dioxide, hydrocarbons, and nitrogen oxides. Other harmful gases can be released from vapors of oils, glues, thinners, paints and wood treatment during construction and interior finishing. These are all atmospheric pollutants and can also cause respiratory problems and other detrimental health issues upon repeated inhalation.

The diesel generator at site will emit greenhouse gases to the atmosphere. However, a more notable issue would be if incomplete combustion regularly occurs. Emissions will include carbon dioxide, carbon monoxide, nitrous oxides, of fine particulate matter.

Considering cumulative impact, the area will have higher amount of dust and debris compared to background amounts. However, the only receptors would be construction staff.

5.2.8 Lead based paints

Using lead based paints could have very serious cumulative long-term impacts on the residents of the apartment building during operation stage. Children and Pregnant woman are especially vulnerable to the effects of lead. This is important to consider as families will be occupying the building after construction is completed. Prolonged exposure to lead based solvents also lead to high blood pressure, hypertension, issues with the kidney and reproductive system in healthy adults. Furthermore, the impact on children include mental and growth issues. As lead based paints are unlikely to be used, the impact is low.

5.2.9 Generation of building and construction waste

There will be a significant volume of building and construction waste generated from the construction area. This would result in a negative input to the environment and can be a nuisance to the surrounding areas. Construction waste such as wood, concrete, metals, bricks, plastic and domestic waste will be generated in addition to excavated waste and municipal waste. The impact of the waste will be localised as waste should not be placed
outside the site under any circumstances. Waste will be required to be removed from the site completely before the housing units are to be occupied.

5.2.10 Health and Safety of workers

Health and safety of workers have been discussed to some extent under noise pollution and air pollution. As stated in the preceding sections, the construction site will indeed be a health hazard and care must be taken always while at or near the site. Moreover, in addition to impacts arising from noise and air pollution, there is also the significant possibility of direct impact from accidents from the work area. This has already been discussed under Section 2.4 and Section 2.5. Further accidents could occur due to falling objects, misplaced equipment and materials, temporary structures not properly fixed, etc. For a large scale project such as this, this impact would be significant.

5.2.11 Social Issues due to population concentration

Numerous social issues are envisaged due to the concentration of population in one area. Similar points were highlighted in the 7000 housing units project and 2500 housing units project study. Issues ranging from indecent behaviour, intolerance among community members, conflicts in-between to full-fledged crime are real concerns.

Similar social housing based condominium type projects in Male’ (most notably Senahiya and Male’ hiya) has resulted in such issues getting repeated time and time again. This will have an impact on virtually all the residents living in the apartments once fully operational. The impact will be cumulative and will increase in magnitude with time unless proper intervention is not in place.

5.2.12 Alleviating congestion issues in Male’

Male’ is already among the most densely populated island cities in the world. Based on the 2006 census, the population density of Male’ is 18,000/km². Currently over one third of the total population lives in Male’. It is a widely held belief that projects of these types in Male’ contribute to alleviating the ever increasing population in Male’. More housing has traditionally resulted in more migration to the Male’, and the process has continued to grow exponentially.

Decentralisation is a key policy for all the major government stakeholders and policy makers and this has resulted in reducing the increase in the population density. One of the key actions for this has been the development of Hulhumale’, which has resulted in people moving to the island away from Male’.
Hulhumale’ offers more public spaces, better ventilation, and an overall better environment compared to Male’, and therefore it is a positive impact to offer more housing in the area, albeit with some controls in place to preserve the current environment. From a planning perspective, there are important factors to consider as constructing large buildings in close proximity will lead to congestion issues in Hulhumale’ as well.

### 5.2.13 Fire hazards and impacts

The dangers of fire risks and hazards increases with increasing congestion and poor urban planning and individual developments also largely contribute in the potential of fire incidents as well as risk minimization once a fire breaks out.

The risks posed by potential fires is great in terms of social, economic and environmental impacts. It is a huge threat to health, life, livelihood and possessions of the individuals and community. While there would be losses which are irrecoverable, financial burden associated in the recovery process would be heavy. Furthermore, environmental costs coupled with smoke and toxic fumes that would pollute the air, leachates that would contaminate the soil and water lens and also the loss of resources would be difficult to quantify.

The impacts need to be addressed through prevention, impact minimization measures and efficient responding mechanisms. Awareness and drills also plays a major role in determining the potentials impacts that can be avoided or minimized.
5.3 Impact Significance Assessment

This section provides a summation of the impacts of the project components discussed above. The impacts of the project have been evaluated as per the criteria proposed by Posford Haskoning (2004). The decision framework is given in the following figure.

In order to make the evaluation quantitative, the framework proposed by Haskoning has been modified. Spatial distribution of impact is also added in order to make the significance of the impacts more realistic. Scores are given for each impact once it is identified that the resource is vulnerable to the impact. Scores are based on the following factors.

- Sensitivity of Receptor
- Recoverability of Receptor
- Importance of Receptor
- Spatial Distribution of impact

The scales associated with the above criteria are given in the Table 8.
Step 1
Description of the resource (receptor)

Step 2
Predicted environmental change (impact)

Step 3
Is the Resource vulnerable to the impact

NO
- Not Sensitive
- Low

YES
- Medium
- High
- Positive Effect

High
- (0 – 6 months)

Medium
- (6 months – 5 years)

Low
- (>5 years or not at all)

Not Impact
- Minor Impact
- Moderate Impact
- Major Impact
- Beneficial Impact

Vulnerability of Receptor

Step 4
Sensitivity of Receptor

Step 5
Recoverability of Receptor

Step 6
Importance of Receptor

SIGNIFICANCE
Table 8 Impact Evaluation Criteria

If the impact receives a -1, it deems the impact to have a positive effect on the receptor and the other criteria is then not applied. The impact is referred to as a Beneficial impact as is done by the Haskoning framework.

The significance of the negative impacts will be given based on the following range:

- 1 – 5 : Minor Impact
- 6 – 9 : Moderate Impact
- 10 – 12: Major Impact

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Scale</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>-1</td>
<td>Positive Effect</td>
</tr>
<tr>
<td>How sensitive the receptor is to the impact</td>
<td>0</td>
<td>Not sensitive</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>High</td>
</tr>
<tr>
<td>Recoverability</td>
<td>1</td>
<td>Short</td>
</tr>
<tr>
<td>How long it would take for the receptor to recover from the impact</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Non-recoverable</td>
</tr>
<tr>
<td>Importance</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>The importance of the receptor to the environment</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>High</td>
</tr>
<tr>
<td>Spatial Distribution</td>
<td>1</td>
<td>local scale</td>
</tr>
<tr>
<td>Distribution of impact</td>
<td>2</td>
<td>regional scale</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>global scale</td>
</tr>
</tbody>
</table>
Table 9 Analysis of potential impacts and their significance

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Nature of Impact</th>
<th>Significance Evaluation Criteria</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of visual amenity during demolition and construction</td>
<td>Direct</td>
<td>Immediate &amp; Cumulative</td>
<td>4 (Minor)</td>
</tr>
<tr>
<td>Air pollution during demolition and construction</td>
<td>Indirect</td>
<td>Cumulative</td>
<td>4 (Minor)</td>
</tr>
<tr>
<td>Groundwater degradation during dewatering.</td>
<td>Direct</td>
<td>Immediate &amp; Cumulative</td>
<td>5 (Minor)</td>
</tr>
<tr>
<td>Groundwater degradation due to mishandling of chemicals/paint/fuel</td>
<td>Direct</td>
<td>Immediate &amp; Cumulative</td>
<td>4 (Minor)</td>
</tr>
<tr>
<td>Mosquito growth during dewatering stage, and at locations where structural construction is scheduled</td>
<td>Direct</td>
<td>Cumulative</td>
<td>6 (Moderate)</td>
</tr>
<tr>
<td>Impact</td>
<td>Type</td>
<td>Timing</td>
<td>W1</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>-------</td>
<td>----------------</td>
<td>----</td>
</tr>
<tr>
<td>at a later stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise pollution during construction.</td>
<td>Direct</td>
<td>Immediate</td>
<td>1</td>
</tr>
<tr>
<td>Disruption of regular traffic and traffic congestion</td>
<td>Direct</td>
<td>Immediate</td>
<td>1</td>
</tr>
<tr>
<td>Generation of waste oil and building and construction wastes</td>
<td>Direct</td>
<td>Cumulative</td>
<td>2</td>
</tr>
<tr>
<td>Impact on residents due to use of lead based paints</td>
<td>Direct</td>
<td>Cumulative</td>
<td>1</td>
</tr>
<tr>
<td>Health and safety of workers</td>
<td>Direct</td>
<td>Cumulative</td>
<td>2</td>
</tr>
<tr>
<td>Fire hazards and impacts</td>
<td>Direct</td>
<td>Immediate</td>
<td>3</td>
</tr>
<tr>
<td>Indirect contribution to alleviating congestion in Male’</td>
<td>Indirect</td>
<td>Cumulative</td>
<td>-1</td>
</tr>
<tr>
<td>Social issues due to population concentration</td>
<td>Indirect</td>
<td>Cumulative</td>
<td>3</td>
</tr>
<tr>
<td>Waste Generation during the operational stage of the project</td>
<td>Direct</td>
<td>Cumulative</td>
<td>3</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>--------</td>
<td>------------</td>
<td>---</td>
</tr>
<tr>
<td>Indirect Economic impact on the community, by creating additional jobs for construction, landscaping and building maintenance</td>
<td>Indirect</td>
<td>Cumulative</td>
<td>-1</td>
</tr>
</tbody>
</table>
The potential impacts, their significance and mitigation measures to be undertaken are
given in Section 6 for the construction and operation phase together since the
components of the project are all continuous processes. The significance of the
impacts is similar to the impacts from the 2500 housing units project.

In conclusion, similar to the 7000 and 2500 housing units project, the proposed
project will have minor to moderate impacts on the environment.

Compared to most other developments in Hulhumale’, the proposed construction is in
a relatively remote area. Therefore, impacts during construction will be even less.
While some moderate impacts are important, probability of these impacts occurring
are rather low.

5.4 Uncertainties in Impact Prediction

The impact prediction has been carried out based on literature and tested methods.
However, the prediction relies heavily on the judgement of the consultant, and would
therefore lead to uncertainties. Alternatively, such projects as has been described in
this report has been carried out on numerous occasions in Male’ and Hulhumale’.
Therefore, observing past literature on a local context, the uncertainty would be
reduced. However, the issue is that no long term monitoring exists for such
developments, and therefore there are major unknowns as to the direct impact due to
the project.

Based on this, the level of uncertainty in the case of the proposed project may be
expected to be moderate as similar projects in similar settings is ongoing. The
uncertainty can be further reduced once some of these projects are completed and a
final assessment of the impacts that has occurred is made in a comprehensive
monitoring stage.

Uncertainties will be significantly reduced by undertaking the monitoring program
and re-analysing impacts, after comparing the monitoring data with the baseline data
in this report and previous recent environmental studies done for Hulhumale’.
Mitigation measures are proposed where significant impacts are expected. Once an impact is identified to have ‘moderate’ or ‘major’ impact, appropriate mitigation measures are given for the project, if possible.

Successful implementation of the measures given would lead to a major reduction and/or nullification of the impacts on the environment and thereby ensuring that the project is environmentally sustainable.

As impacts are similar to that assessed in the 2500 housing units project, the mitigation measures are similar as well.

### 6.1 Mosquito growth

As a mitigation measure for mosquito growth some project managers put an oil layer on top to make the area inaccessible for mosquito growth. However, this also leads to groundwater contamination. For small pockets of unavoidable open water areas, it is recommended to put a lid on top of the area. Alternatively, regular monitoring of any water-logged area at the site can be carried out and removed or lidded with immediate effect. Daily inspection of the project site is required and any open stagnated water area should be removed or covered.

Dewatering works should not be suspended, and once started, the area should be entirely dewatered and shoring works completed to ensure that open water will not be present in the area for a long time. As the excavation area, and subsequently the dewatering area is quite large for this project, it has to be ensured that water logged areas are not left unattended. The dewatering should be arranged in such a way that water is completely dewatered in each section before proceeding to the next.

According to HDC, vegetated areas in Hulhumale’ phase 2 are fumigated on frequent intervals as a measure to control mosquitoes. It is recommended that the same is carried out for construction and temporary site on a daily basis.

### 6.2 Water quality degradation

Short term groundwater quality impacts due to dewatering is unavoidable. However, the magnitude of the impact on the groundwater aquifer can be mitigated by dewatering inland rather than towards the lagoon. Likewise, this will mitigate the
sedimentation impact on the lagoon due to dewatering as well. As recommended under the Alternatives section, dewatering should occur in land to a site close to the project area, which is currently vacant.

With regards to mitigating groundwater contamination due to spills, ensure fuel storage and handling areas have concrete floorings and that any water in the area is not designed be drained to the ground.

### 6.3 Noise Pollution

Noise protection gears such as ear muffs are to be used by workers on site. Components that require heavy vehicles such as casting of the slabs and columns are scheduled to be undertaken on weekends. Works emitting noise at high decibels should not be encouraged to be undertaken during night hours. Furthermore, the boundary wall should be able to contain some amount of noise within the project site. Noise barriers could be further used for noisy plants.

### 6.4 Air Pollution

For mitigation, dust screens and regular water spraying and dampening should also be practiced to reduce the spread of dust to surrounding areas. Dust screens should be erected to cover the scaffolding consistent with the increase in elevation of the structure.

All heavy machineries should be inspected and fine-tuned to make sure the harmful gases released to the atmosphere do not exceed allowed standards.

Building materials should be covered or contained during loading, unloading and storage. The boundary wall or fence should also be able to restrict the movement of dusts and debris within the project site.

Construction workers should wear dust masks during dust sensitive work always.

For the operation stage, mitigating air pollution is important. In the building design proper ventilation should be ensured for each housing unit and toilet/bathroom areas. Kitchen areas should be highly ventilated as well. Furthermore, building corridors in each floor should be ventilated either mechanically or preferably naturally.

### 6.5 Lead based paints

Use of lead free paints is recommended. If under any circumstances, lead based paint is used, the tenants should be well informed and the painted surfaced in the housing
units should be inspected and maintained regularly. It is recommended not to use lead based paints altogether.

### 6.6 Generation of building and construction waste

It is recommended to re-use as much construction waste as possible, although this may be difficult to manage. The reusable waste includes wood and blocks. Metals can be recycled, and a recycling group can be contacted to remove such materials. WAMCO will likely provide assistance on this. Reusing formwork material as much as possible is another measure that can be taken to reduce waste. All such recyclable or reusable wastes should be segregated on site.

Waste that cannot be reused or recycled (which will be in the majority) are to be taken away from site for disposal. The contractor has to collect and store the waste at site. These include any waste oil and other hazardous type waste, which all should be collected separately. They are to be transported to Thilafushi on a regular basis; likely weekly, which would be facilitated by HDC.

### 6.7 Health and Safety of workers and neighbours

Awareness of the works on site is the first and foremost mitigation measure that can be taken to reduce any risk of accidents and other minor health impacts. For awareness, the commonly used method is to put up warning signs around the project area. These include:

‘Caution: Construction works in progress!”.

“Warning: No entry beyond this point!”.

“Wear Safety Hats at all times!”’, etc.

Aside from awareness, second method is to encourage wearing safety cloths and equipment at the construction site always. This applies more to construction workers. As such, they should be instructed to wear safety helmets always, dust masks during sensitive work, conspicuous fluorescent cloths, earmuffs, safety shoes, etc.

All loose or semi loose component such as temporary roofing, scaffolding should be made tighter to prevent any harm in surrounding areas especially in an event of storms and strong wind.

The measures given under ‘Safety on site’ section in this report should be followed.
6.8 Fire Hazards and Risks

Fire hazards and risks can be easily mitigated by following standard procedures. Factors such as standard building setbacks, planned road networks and parking itself contribute as important features to minimize fire risks and also shall facilitate in responding to emergency situations more efficiently to minimize the loss. Furthermore, fire hydrants are expected to be integrated into Hulhumale’ phase 2, which will be a major mitigation measure.

Individual developments also have a crucial role to play in ensuring the fire safety and risk minimization. It needs to be addressed in the planning, design, construction and operation stages of the development. Building materials and design perform a central role in providing the optimum fire safety. However, it is also important that due care is taken not to either neglect sufficient and necessary features in the design for risk minimization or on the other hand grossly over design where neither would be sustainable. Risk assessments to determine the level necessary measures would contribute in reaching a balance in addressing the matter.

Some of the key measures include:

- Integration of dry riser and wet riser systems into the setup at each floor.
- It is important to ensure all firefighting equipment including fire alarms and fire extinguishers are present and in working condition in each apartment.
- It is also recommended to equip each floor with built-in sprinkler systems.
- Fire prone material or material with low fire rating should not be used as building materials, and especially for building cladding
- Common areas of buildings should be ventilated in each floor.
- Fire drills are also recommended to be undertaken on a frequent basis, at least annually.
6.9 Social issues due to population concentration

Social issues may be the most difficult to mitigate on the long term.

Interventions can be put in place from the start to prevent exasperating social issues. These ranges from legislative implementations, social interventions, to strict enforcement. As suggested in the 7000 housing units EIA study, it is recommended to undertake the following

- Have in place a community police setup within the project area.
- In addition to professional police presence, it is important to give part of the role to the community. This can be done by selecting members of the community as neighbourhood watchmen.
- Also, CCTV should be in place to ensure security of all residents.
- Likewise, any alleyways or pathways in both inside the buildings and in the land area should be lit at all times from sunset to sun rise.
- Programs can be held frequently which involves the apartment blocks community, creating awareness to social issues and how to prevent them. Troubling tenants can be penalised, while good behaviour can be encouraged by various reward systems targeted for tenants.
- It is very important to have a corporate management system established specifically for the project area from the start, which will provide an outlet for tenants to reach out at all times. Moreover, and even more importantly, such a body shall ensure that the buildings are properly maintained at all times.

6.10 Waste Management

Waste management is the main issue during the operational stage of the project. A large number of wastes will be generated from 5000 apartments in a concentrated area.

Currently the proponent has stated that this is a service that would be provided to the tenants free of additional costs, and assured that daily collection and disposal services will be offered by the developer and they will be fully overseeing operations.
However, this may not be the case on a long-term basis as it may not be regarded as economically feasible.

In addition to the general waste management methods, the following should be in place:

- Recyclables from non-recyclables should be segregated at the source.
- Tenants should be informed on the type of waste that are regarded as recyclables and non-recyclables.
- They should be informed on how the waste are to be collected in their units. The waste should be collected on a daily basis and transported to the waste management area in the ground floor, and placed in appropriately labelled bins for recyclables and non-recyclables.
- This will reduce the total no. of waste produced and the system will be easier to manage ensuring sustainability.
- The enclosed garbage collection area in each floor of the buildings shall be closely maintained at a daily basis.
- Garbage collection area shall be closed in such a way that odour is not present in the common areas.
- The developer is required to put in place a system for hazardous wastes such as batteries and also large waste collection. It is important to inform tenants to not dispose hazardous wastes including batteries along with normal household wastes.
- It is recommended to collect large wastes on a quarterly basis and upon demand. The developer/operator would need to coordinate with WAMCO to schedule to remove such waste as per the generation volume.
- Options should always be available to tenants of disposing any type of waste without having to dump them.

Table 10 Mitigation management plan summary

<table>
<thead>
<tr>
<th>Mitigation measures</th>
<th>Implementing Responsibility</th>
<th>Implementing Stage</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground water degradation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispose water to site as shown by HDC for ground water recharge</td>
<td>Project Engineer</td>
<td>Construction</td>
<td>65,000 MVR</td>
</tr>
<tr>
<td>Regular monitoring of groundwater condition on site</td>
<td>Project Engineer</td>
<td>Construction</td>
<td>750 MVR/test</td>
</tr>
<tr>
<td>Ensure concrete flooring in all areas where fuel</td>
<td>Project Engineer</td>
<td>Construction</td>
<td>Approx. 45,000</td>
</tr>
<tr>
<td>Storage and Handling Practices</td>
<td>Project Manager</td>
<td>Design</td>
<td>Construction</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------</td>
<td>--------</td>
<td>--------------</td>
</tr>
<tr>
<td>Mosquito Growth</td>
<td>Site Supervisor</td>
<td>Construction</td>
<td>na</td>
</tr>
<tr>
<td>Ensure still water does not remain on site</td>
<td>Site Supervisor</td>
<td>Construction</td>
<td>10,000 MVR</td>
</tr>
<tr>
<td>Put lids or pump out water from areas prone to water accumulation</td>
<td>Site Supervisor</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Ensure dewatering process does not get suspended midway and fully complete dewatering</td>
<td>Project Manager</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Ensure daily fumigation of both construction site and temporary site</td>
<td>Site Supervisor</td>
<td>Construction</td>
<td>8,000 MVR per month</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Noise Pollution</th>
<th>Project Manager</th>
<th>Design</th>
<th>Construction</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>For workers, use of earmuffs at construction site.</td>
<td>Project Manager</td>
<td>Design and Construction</td>
<td>In Project Cost</td>
<td></td>
</tr>
<tr>
<td>Construction to be scheduled in such a way that noise pollution will be at a minimum to the public.</td>
<td>Project Manager &amp; Site supervisor</td>
<td>Design and Construction</td>
<td>In Project Cost</td>
<td></td>
</tr>
<tr>
<td>Ensure proper site demarcation and boundary wall condition before commencing such work</td>
<td>Site supervisor</td>
<td>Construction</td>
<td>In Project Cost</td>
<td></td>
</tr>
<tr>
<td>Place noise barriers around noisy plants including batching plant.</td>
<td>Site Supervisor</td>
<td>Construction</td>
<td>350,000 MVR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air Pollution</th>
<th>Project Manager</th>
<th>Construction</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers should be made to wear dust marks during dust sensitive work.</td>
<td>Project Manager</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Place dust screens demarking the concrete mixer</td>
<td>Project Manager</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Daily water spraying and dampening to reduce spread of dust to surrounding areas.</td>
<td>Site Supervisor</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Inspect and fine-tune all machinery and vehicles before work commencement to ensure harmful gases released to atmosphere are at a minimum.</td>
<td>Site Engineer</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Cover building materials such as cement and sand, and should be contained during loading, unloading and storage.</td>
<td>Site Engineer</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Surfaces in the housing units should be painted with lead free paints.</td>
<td>Project Manager</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
<tr>
<td>Ensure ventilation throughout each building, including common areas and corridors</td>
<td>Project Engineer</td>
<td>Design and Construction</td>
<td>In Project Cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water Quality Degradation</th>
<th>Project Manager</th>
<th>Construction</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undertake all dewatering inland rather than towards the lagoon. Ensure water gets percolated to the ground</td>
<td>Project Manager</td>
<td>Construction</td>
<td>In Project Cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traffic Congestion</th>
<th>Project Manager</th>
<th>Construction</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Schedule transport of heavy-duty vehicles to site during off-peak hours such as the morning. | Project Manager | Construction | 0

**Generation of building and construction waste**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible</th>
<th>Department</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-use construction waste where possible.</td>
<td>Project Engineer</td>
<td>Construction</td>
<td>0</td>
</tr>
<tr>
<td>Metals are to be collected separately and handed over or sold to a metal recycling group.</td>
<td>Site supervisor</td>
<td>Construction</td>
<td>0</td>
</tr>
<tr>
<td>All waste should be segregated on site.</td>
<td>Site supervisor</td>
<td>Construction</td>
<td>5,000</td>
</tr>
<tr>
<td>During and straight after demolition works, all waste that cannot be recycled or reused, are to be transported daily to the waste disposal site in Thilafushi.</td>
<td>Site supervisor</td>
<td>Construction</td>
<td>In Project cost</td>
</tr>
<tr>
<td>Reusing formwork material as much as possible.</td>
<td>Site supervisor</td>
<td>Construction</td>
<td>0</td>
</tr>
</tbody>
</table>

**Health and safety of workers and neighbors**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible</th>
<th>Department</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undertake health and safety training for workers before project commencement.</td>
<td>Project Manager</td>
<td>Pre-Construction</td>
<td>In Project cost</td>
</tr>
<tr>
<td>Put up warning signs around the project area including signs indicating ongoing works, and restricting entry into the project area, and signs reminding the use of safety gear at site.</td>
<td>Project Manager</td>
<td>Construction</td>
<td>In Project cost</td>
</tr>
<tr>
<td>Encourage use of safety cloths and equipment at the site at all times. These include safety helmets, dust masks, conspicuous fluorescent cloths, earmuffs, safety shoes, etc.</td>
<td>Project Manager</td>
<td>Construction</td>
<td>In Project cost</td>
</tr>
<tr>
<td>Ensure there are no loose materials or loose components of the temporary or permanent structure</td>
<td>Site Supervisor</td>
<td>Construction</td>
<td>0</td>
</tr>
</tbody>
</table>

**Social issues due to population concentration**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible</th>
<th>Department</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure CCTV cameras in place to cover all areas within the area.</td>
<td>Project Manager</td>
<td>Construction</td>
<td>n/a</td>
</tr>
<tr>
<td>Establish neighborhood watch and/or community policing setup</td>
<td>Developer</td>
<td>Operation</td>
<td>n/a</td>
</tr>
<tr>
<td>Ensure project area is properly lit at all times</td>
<td>Developer</td>
<td>Operation</td>
<td>n/a</td>
</tr>
<tr>
<td>Setup a property management body with the responsibility of maintaining the building quality</td>
<td>Developer</td>
<td>Operation</td>
<td>n/a</td>
</tr>
<tr>
<td>Setup a reward and penalizing system for tenants to encourage good behaviour</td>
<td>Developer</td>
<td>Operation</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**Fire risks and hazards**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible</th>
<th>Department</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure fire hydrants and alarm systems are present and in working condition</td>
<td>Project Manager</td>
<td>Construction &amp; Operation</td>
<td>In Project cost</td>
</tr>
<tr>
<td>Undertake fire drills</td>
<td>Project Manager</td>
<td>Operation</td>
<td>In Project cost</td>
</tr>
<tr>
<td>Task</td>
<td>Responsible</td>
<td>Department</td>
<td>Project costs</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------------------------</td>
<td>--------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Put in place sprinkler systems in each floor.</td>
<td>Project Manager</td>
<td>Construction</td>
<td></td>
</tr>
<tr>
<td><strong>Generation of household wastes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate collection of recyclables and non-recyclables at the building and transport the waste</td>
<td>Maintenance officer</td>
<td>Operation</td>
<td>In Project cost</td>
</tr>
<tr>
<td>Put in place awareness notices in each floor regarding waste collection and management in the building, and ensure they are maintained on a monthly basis</td>
<td>Developer</td>
<td>Operations</td>
<td></td>
</tr>
<tr>
<td>Collect hazardous wastes in separate containers.</td>
<td>Maintenance officer</td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Undertake regular cleanup of common areas at least 2–3 times weekly</td>
<td>Maintenance officer</td>
<td>Operations</td>
<td></td>
</tr>
<tr>
<td>Have a quarterly large waste collection schedule in place</td>
<td>Maintenance officer</td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Monitor and record waste generation and collection information daily</td>
<td>Maintenance officer</td>
<td>Operation</td>
<td></td>
</tr>
</tbody>
</table>
7 Alternatives

This section looks at different alternatives for the proposed project. The main alternative is the no project option. After discussion of this alternative, options for the project components are investigated. Alternatives are given for each component based on location and design. Each alternative is discussed based on economic, social, and environmental factors.

These alternatives are not as intensively investigated as the original scope of the project. However, investigating and discussing alternatives is important so that it is ensured that the best available option(s) is/are chosen to solve particular project issues.

7.1 No project option

Initially the no project option is discussed to hypothesise whether a necessity for the project exists. This is an important exercise to ensure that undertaking this project at this stage makes good socio-economic sense without any significant impact on the environment. The discussion on no project option is similar to all other similar developments in Hulhumale’, especially to the 7000 housing units development project.

The no project option is analysed on the basis that no such project is to take place in Male’ City, and not specifically for this development. As this development is part of a larger program, discussing no project option for this specific project alone will not make much sense. The no project option is therefore not very much applicable as the project has been given the go ahead in the planning stage, and the decision does not seem reversible at this stage.

Nevertheless, the advantages and disadvantages of not undertaking the project is given below.

Table 11 Advantages and Disadvantages of the no project option

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will not lead to health and safety concerns at project site during construction</td>
<td>Will not be able to alleviate the issue of large number of people living in small crowded places in Male’</td>
</tr>
</tbody>
</table>
Will not cause any traffic issues and noise and air pollution at project location

Will decrease economic opportunities for construction companies and their employees

The land can be used for other alternative uses such as public open area, commercial area, or tourist areas, which will all result greater revenue for the developer.

Will leave a large area of land unutilized in a land scarce area.

Other commercial uses of the land will deprive the opportunity to provide housing options to a large population living in Male’ who has been deprived of housing opportunities for generations.

Other commercial uses for the land will increase the economic activity of Hulhumale’, which is currently quite stagnant.

Will hinder the development of Hulhumale’, and especially Phase 2

Will prevent social issues that may arise from a large population living in the same area

Social issues that currently exists in the heavily densely populated Male’ will remain.

Will not lead to production of waste at a concentrated site as the proposed area

Easier to collect waste from a single point source rather than housing units dispersed over a wide land area.

A comparison of the no project option with the project going ahead as proposed, indicate that the no-project option is possible, but involves losses to the developers if no other activity is undertaken in the land. If in the event, alternative uses are proposed and developed in the land, it may be a more profitable option for the developer. However, one of the key issues of the country which the project aims to resolve, will be left unresolved in such a case.

There are a few advantages of the no project option from an environmental perspective, although they are not strong as impact from the project is minor. Local environmental impact from this project is small in nature, and the advantages stated is not significant, since most of the environmental impacts can be properly mitigated.
7.2 Project Alternatives

Alternative options; mainly based on design and methodology for the construction are given below.

7.2.1 Project Location

Alternative locations are not as important for this project, as the location cannot be changed under any circumstances. The plot had been decided by HDC at the planning stage aligns with the Land Use Plan for Hulhumale’ Phase II which has been previously provided. Even if location can be changed at this stage, there are no particularly better alternative locations apart from the currently vast empty lands in Hulhumale’ Phase II.

7.2.2 Building Height

Building height has also been approved at the planning stage like all other similar developments. While it will lead to congestion of population at a point source, there are advantages such as easy management of housing units. As an example, waste management will be more convenient for the municipal service provider as collection from the point source would be easier than collecting waste from dispersed housing units. However, there are social issues that will arise from a large number of people living together as well. These will need to be properly managed by the developer.

Presently the maximum height of buildings in the Maldives is at 25 storeys. However, height restrictions exists for the area this project is proposed. Therefore, further increase in height is not possible for the proposed location. Nevertheless, increasing height is not desirable as it would lead to even greater number of people living together in the same area.

7.2.3 Project design

Several components of the project design can be changed, taking the community more into consideration, such as:

Making space for a mini mall or office space for the first 4 or 5 floors so that it would provide activities in the area. Vertical development is important since it would encourage shop/office goers to get concentrated to particular areas, rather than spread out into the streets as the case in Male’ thereby making them crowded & disrupting traffic. Providing more of such amenities in the building will have further advantages.
Provide a larger parking space within the building. The current parking space proposed will likely be sufficient for the tenants of the building. But a larger public parking space or visitor parking space would alleviate potential parking issues for Hulhumale’. Providing such a space in the building will therefore be an important service to the community.

Design for a rooftop garden area and incorporate green walls, which will contribute to making the city greener, while improving the natural aesthetics of the area while also continuing with the infrastructure development in the given area.

Energy generation and usage is another important factor that can be considered in design. Currently it is proposed to only depend on power generated by STELCO. However, a more efficient system would be to incorporate solar panels within the building. The solar power generated can be used to power the utilities and appliances in the common areas at least. Furthermore, energy efficient lighting and water saving shower heads can be incorporated as part of the project to make the building more energy and water efficient.

These project designs are given as suggestions, the feasibility of which the developer should take into consideration before implementation.

### 7.2.4 Building maintenance

For a social housing project such as this, it can be foreseen that some issues may arise if responsibility for collecting fees and undertaking maintenance is given to the tenants. It will be more efficient and more sustainable if a maintenance figure is ‘built into’ monthly payments by each tenant. As HDC is currently already undertaking such maintenance work, HDC can carry out the fee collecting and maintenance works. Alternatively, HDC can hire a property management company to oversee the process. It will be a more sustainable model if fee is collected by HDC and maintenance works are handed over to a property manager for a monthly fee.

### 7.2.5 Foundation

A deep pile foundation can be constructed, which will likely provide more stability to the structure in the long term. The issue with piling is generally vibration impacts at nearby areas leading to tremors and cracks in nearby buildings especially old ones. The methodology has endured negative reception in Male’, most notably that of the Traders building (formerly Holiday Inn) at Athireege Aage. For the structure, metal
load bearing piles were driven to depths of 30 to 40 metres. The deep piling, lead to several neighbours complaining of tremors and cracks in their walls. Due to the close proximity of buildings structures, use of deep pile technology may not be ideal for high rise buildings in Male’, but the case is different for Hulhumale’, especially the Phase II area.

As there are no structures at the project area, this issue is virtually negligible for the proposed project. Furthermore, with only 14 storeys developed over a large enough land area, the impact shall be much moderated.

Moreover, using bored piles would expedite the foundation process and reduce the impacts that may occur due to the project getting prolonged. It will also reduce impacts due to prolonged dewatering processes such as ground water impacts and facilitating a medium for mosquito growth in the area.

Due to the remoteness of the area, one particular method is not necessarily recommended over the other on environmental ground. It is recommended to finalise foundation methodology after a geotechnical assessment is undertaken at the project location such that the best method for engineering purposes is chosen.

### 7.2.6 Dewatering

The project proposes to dewater to the lagoon east of the project site. This is very straight forward, and is easy to implement for the contractor and prevents any flooding issues that may occur in land. However, this also means that a large amount of water will be lost from the groundwater aquifer which has formed over months after reclamation.

As Phase II is largely barren land, any potential flooding can be mitigated easily. It is therefore recommended to dewater inland to an empty land close to the project site after excavating the area about 1.0-2.0m deep. This will ensure that water is contained in the allocated area, and sufficient time should be given for the water to seep into the groundwater aquifer.
7.2.7 Parking

The project proposes to allocate one parking spot for each apartment. In the similar but larger 7,000 housing unit project, it was reported that 2 parking spots were allocated for each housing unit. Based on the average motorcycle use in the greater Male’ area, this is the bare minimum amount of parking that is recommended for such buildings. Allocating one spot will only lead to more cycles being parked on public roads creating both nuisance and traffic issues.

Therefore, it is recommended that 2 parking spots are allocated for each unit and ensure the design is revised to accommodate this. Moreover, it is favourable to establish a limited number of car parking areas at the project site as well.

7.2.8 Additional amenities

The proposed buildings are within a social housing project and therefore bare minimum has been offered for future residents of the area. The building area does not consist of any sites allocated for recreational purposes and any significant public areas appear to be absent. The currently proposed design may lead to significant socio-economic issues with a large population being secluded in an area without sufficient space for entertainment and relaxation. It is important to ensure the socio economic environmental issues that we had faced in Male’ is not repeated in future projects. And as such congestion is one of the major issues in Male’ and to prevent it, additional open spaces are recommended.
8 Stakeholder Consultations

Stakeholder consultations were carried out with the Project Manager for the project, and other stakeholders such as STELCO, WAMCO, MWSC, HPA, MEE and MNDF. General discussions relevant to all similar developments that are currently being undertaken in Hulhumale’ were discussed previously in face to face meetings and through phone consultations. The project specific information was also shared via email requesting for any specific concern or other relevant input from the stakeholders.

Table 12 Important stakeholders met during the consultation process

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Office</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminath Shaufa</td>
<td>Public Health Program Cordinator</td>
<td>HPA</td>
<td><a href="mailto:shaufa@health.gov.mv">shaufa@health.gov.mv</a></td>
</tr>
<tr>
<td>Ahmed Asif</td>
<td>-</td>
<td>MWSC</td>
<td><a href="mailto:ahmed.asif@mwsc.com.mv">ahmed.asif@mwsc.com.mv</a>, <a href="mailto:ahmed.rabeeu@mwsc.com.mv">ahmed.rabeeu@mwsc.com.mv</a></td>
</tr>
<tr>
<td>Ahmed Rabeeu</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Azzam Ibrahim</td>
<td>Senior Engineer</td>
<td>STELCO</td>
<td>+960 7782574</td>
</tr>
<tr>
<td>Ismail Ubaid</td>
<td>Facilities Manager</td>
<td>WAMCO</td>
<td><a href="mailto:ismail.ubaid@wamco.com.mv">ismail.ubaid@wamco.com.mv</a></td>
</tr>
<tr>
<td>Col. Abdulla Zuhury</td>
<td>Commander fire</td>
<td>MNDF</td>
<td><a href="mailto:admin@defence.gov.mv">admin@defence.gov.mv</a></td>
</tr>
<tr>
<td>Warrant Officer 1 Muanmar</td>
<td>Prevention Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seargent Mohamed Ashraf</td>
<td>Design and Enforcement Incharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muawiyath Shareef</td>
<td>Director</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maldives Energy Authority</td>
<td><a href="mailto:muawiyath.shareef@energy.gov.mv">muawiyath.shareef@energy.gov.mv</a></td>
<td></td>
</tr>
</tbody>
</table>

**8.1 Consultations with the Developer**

Meeting with the developer was initially held in early November 2017 and regular collaboration had occurred since then.

The developer informed that concerns with regards to a large population residing in the same area will be attended by providing means for open spaces, commercial areas and educational institution allocations in the same area as the proposed buildings. The developer had previously informed that the distance between the buildings have also been increased to make the area less dense.

The developer further informed that they expect financing for all upcoming housing projects to settle soon and expect construction to commence early as well.

The developer had informed that the maintenance arrangement of the project following construction is currently under the management of HDC. Hence the developer’s management team will undertake necessary maintenance as per a maintenance agreement between tenants and HDC. The scope of maintenance services will be termed and agreed upon after the construction of the building.

The developer also ensured that the quality of the building construction will be maintained. The structure will be checked and approved by a government certified structural consultant before the construction of the building. After the structure has been approved, the construction will be closely monitored by a team of experienced civil engineers and construction officers managed by an assigned project manager. The project manager and assigned team will ensure that the works are carried out in accordance to the approved detail design and construction is maintained within
acceptable standards as per the specifications. For any concrete works to be carried out, contractor is required to submit requests for inspection, after which the developers team will carry out inspection and give approval if the works are in accordance to the design and specifications. The contractor would also require to submit specifications/sample of any material used during construction and get approval from HDC.

8.2 State Electric Company (STELCO)

STELCO was met face to face previously for similar project and email was sent inquiring about further concerns on 24th December 2017 and extensive discussions had been undertaken since then.

STELCO was consulted as the main power supplier for Hulhumale’ for residential, industrial and commercial areas as well. STELCO had informed that they had currently suspended all works in Hulhumale’ Phase II. They informed that as things stand, all contractors in Phase II area will need to provide power themselves. HDC is undertaking all civil works to setup power infrastructure in Hulhumale’ Phase II currently.

STELCO assured that they will be the power service provider during the operational stage.

8.3 Male’ Water and Sewerage Company (MWSC)

Project specific details have been shared with MWSC on 24th December 2017. Although any additional points were not brought up by MWSC for this specific project, general issues in relevance to similar developments have been recently consulted with the Company.

MWSC provides water and sewerage services to the whole of Hulhumale’. However, MWSC does not provide dewatering services.

MWSC has not initiated operations in Hulhumale’ Phase II as of yet. They had informed that the project for provision of water and sewerage services in Hulhumale’ Phase II is ongoing as per the agreed timeline with HDC. The water and sewer services will be provided to the developers/tenants as per the Phase II development plan they had received from HDC.
The main issue is with regards to providing water to high rise buildings. Currently MWSC can provide water services to 4 storey buildings at the normal pressure maintained by the company. If the buildings are 4 storey and above, developers are required to use booster pumps in order to obtain required water pressure level. Furthermore, MWSC is in a process of formulating a guideline for provision of water to high rise buildings and currently the guideline is in approving stage.

8.4 Health Protection Agency (HPA)

HPA was notified of the project on 24th December 2017 with project specific information provided. HPA had informed on 26th December 2017 that they do not have any specific concerns.

They had previously informed that information regarding upcoming projects were not shared with them. The main concern from HPA side had been with respect to workers health and safety on site, and issues with respect to hygiene. However, they mentioned that there were no local regulations or guidelines currently specifying the standards for health and safety of workers.

The other main concern from HPA had been regarding mosquito control at construction sites. They informed that a survey had been undertaken recently in Male’ and the condition was quite bad at most site and they had notified numerous developers on the issue of mosquito growth at their sites. HPA informed that they do carry out inspections at site, and that some work had already been undertaken in Hulhumale’ as well. Although no inspections in Hulhumale’ Phase II has been reported.

HPA had previously that they are currently in the process of making regulations and guidelines which would enforce certain standards within construction sites with respect to both mosquito control and worker health and safety. However, this has not been published up to this date.

8.5 Waste Management Corporation ltd. (WAMCO)

WAMCO was met on 24th September 2017 regarding Hulhumale’ phase 2 projects. Specific information with regards to this project was shared with WAMCO on 24th
December 2017. They informed that all waste management in greater Male’ area has been handed over to them starting from January 2017. This includes waste collection, pickup and sorting, management of the waste site, and transporting waste to Thilafushi. However, they informed that specific arrangement related to waste management in Hulhumale’ Phase II has not been finalised yet. However, WAMCO has started operating in Phase II now.

Regarding waste generated post construction, WAMCO informed that they will likely have a good setup running in Hulhumale’ Phase II at that stage. They are currently planning to pick up waste from sites on a daily basis. However, the main issue noted by WAMCO is that a waste transfer site has not been designated in Hulhumale’ Phase II. Moreover, the transfer site given in Phase I is also not sufficient. Therefore, there is great need to expand the waste management area in Phase I or alternatively designate another area in Phase II.

For the proposed project, during the construction stage, it was reported that the contractor will transfer the waste to Thilafushi at their own costs. They will use their own quay wall in Hulhumale’ Phase II.

**8.6 Maldives National Defence Force (MNDF)**

Fire Department of Maldives National Defence Force was initially met with on 2nd October 2017 regarding both 1394 housing units and 5000 housing units project. The important points noted by the department in relevance to the high-rise buildings as proposed are summarised below.

MNDF fire highlighted that the more planned nature of Hulhumale' development in itself would contribute in the fire risk minimization. For example, the space left between buildings, parking spaces and planned roads shall influence the potential damage of the fire and speed of firefighting response.

It was also noted that fire hydrants were being integrated into the phase 2 of Hulhumale' in collaboration with HDC.

MNDF fire department conducts awareness every year regarding fire safety and risk minimization and this year so far, over 20,000 participants have been covered through various programmes.
While drills are conducted for public sectors such as the schools and offices, drills are also accommodated upon request.

It was recommended that it is very important to maintain compliance to regulations and best practice standards by all stakeholders especially at individual levels.

High-rise buildings need to pay additional attention to fire risks with special provisions incorporated in design for fire risk reduction and also facilitate internal response.

8.7 Maldives Energy Authority (MEA)

Project specific details were shared with MEA via email on 24th December 2017.

According to MEA all electricity relevant works shall be carried out by a licensed power engineer and they did not have any further requirements. Further response specific to this project was not given at the time of report compilation.
9 Environmental Monitoring

This section deals with the Environmental Management and Monitoring plan for the proposed building construction project with respect to the developments proposed in this EIA. The proposed monitoring plan is for the construction and operation phase of the project. The data collected for this assessment will be used as baseline data while undertaking the monitoring plan. Undertaking environmental monitoring is essential for several reasons including:

- To ensure that potential impacts are minimized and to mitigate unanticipated impacts.
- To aid in impact management,
- To improve impact prediction for future projects
- To identify the effectiveness of the proposed mitigation measures
- To improve mitigation measures for the next phases of this project and for future projects
- To gather long term data to minimise uncertainty
- To ensure sustainable development

The proposed monitoring programme will yield beneficial results if it is undertaken for a long period. The monitoring is to take place during the construction phase once every 3 months until the end of the construction period, and then on an annual basis for 2 years. Further monitoring is recommended to ensure the building standards are maintained. However, this is not obligated by this EIA.

The proponent expressed their full commitment to carry out the monitoring program outlined in this report. The proponent’s commitment to undertake the environmental monitoring and mitigation measures is given in Annex 4.

For a project such as this, it is vitally important to have arrangements with the building maintenance office to undertake regular monitoring of the building including monitoring waste generation as outlined in this program.

9.1 Monitoring Methodology and Costs

The methodology used for monitoring will be similar if not the same as those used in this environmental assessment. However, field water quality testing equipment can be employed to decrease the uncertainties of the results as they can be compared to those obtained from the Laboratory from MWSC.
The costs given in Table 13 and Table 14 are calculated for monitoring to be undertaken by hiring environmental consultants for each monitoring program. However, field data collected for the proposed environmental monitoring program can be carried out by an in-house maintenance team since most of the parameters are to be investigated monthly and quarterly, and therefore hiring a consultant for each occasion may not be feasible. Moreover, majority of the monitoring, such as waste monitoring can be undertaken by an in-house team as being based at the site is important to get the required data. If the developer does not employ environmental experts among its staff, it is highly recommended that an arrangement is made with an environmental consultant on a long-term basis to carry out and supervise the execution of the monitoring program.

The waste generation data must be undertaken by the maintenance team setup at the site.

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

- Ground water quality
- Generation of wastes
- Noise pollution
- Health and safety issues
- Traffic congestion
9.2 Recommended Monitoring Programme

As instructed in the TOR, the monitoring programme will be divided into 2 stages.

**Stage 1**

Ground water quality for pH, temperature, electronic conductivity, total hydrocarbon, and total coliform at 2 sites within the project area.

Determine number, type and respective quantity of waste produced within the past quarter. Data from the contractor’s project management team will be required. Project team is required to take a log of daily waste and give an estimate on quantities. Waste types and respective quantities present at site during inspection should be noted at each visit.

Observe and monitor any open water-logged areas at the construction site and determine area.

Noise measurement. Measure noise at the locations as was studied in the EIA.

Survey the traffic within the same area as undertaken for this EIA.

Inspect the use of health and safety equipment on site. Take a head count on the number of staff at site not using proper health and safety equipment including safety shoes, fluorescent vest, safety helmets during monthly inspection. Record any accidents that had occurred during the past quarter.

Determine complaints or issues raised by any neighbouring development or from developer side.

**Stage 2**

Ground water quality for pH, temperature, electronic conductivity, total hydrocarbon, and total coliform at project site.

Determine number, type and respective quantity of waste produced (on daily basis, extrapolated to monthly data). Long term data can be taken in coordination with the maintenance office set up at the building area. It is very important such
an arrangement is made and is included in the contract. During monitoring, general inspection of the building common areas should take place to take note of any loose wastes in the common areas. Will have to depend on secondary data collected by building monitoring officers based at the site. Building monitoring office is required to maintain a log of daily waste generation at site.

Noise measurement. Noise should be measures at the southern and northern end of the project area and at the center of the project area.

Survey the traffic around the project area. Traffic survey was not undertaken for the project due to the area being vacant. However, once operation begins, this will be an important parameter and needs to be measured and assessed. Traffic survey should be undertaken at the southern, northern end, and at the center of the project site at 3 different times (09:00am – 10:00am, 04:00pm – 05:00pm, 0830pm – 0930pm) both on a weekday and a weekend.

Record any major social issue or conflict that had occurred. This can be determined by randomly consulting with tenants and also by consultation with the management office or HDC.

Record any significant accident that had occurred, including any fire related incidents. Data to be obtained by the management office or HDC.

9.3 Cost of monitoring

The following tables outline the cost estimate for each stage of the monitoring plan given. The costs are calculated assuming the monitoring will be undertaken by hiring environmental consultants on a project basis. Since this monitoring is in Hulhumale’ and does not involve expensive surveying equipment, and most are based on visual observation and consultation, the overall cost is low relative to most monitoring programs.

Table 13 Estimated costs of Stage 1 Monitoring Programme

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Details</th>
<th>Unit cost (US$)</th>
<th>Frequency</th>
<th>Total (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Details</th>
<th>Unit cost (US$)</th>
<th>Frequency</th>
<th>Total (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Field allowance for 1 consultants for 2 days to collect data</td>
<td>150.00</td>
<td>2</td>
<td>300.00</td>
</tr>
<tr>
<td>2</td>
<td>Surveying and monitoring equipment depreciation</td>
<td>50.00</td>
<td>2</td>
<td>100.00</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory charges</td>
<td>110.00</td>
<td>2</td>
<td>220.00</td>
</tr>
<tr>
<td>4</td>
<td>Compliance reporting (annual report)</td>
<td>1000.00</td>
<td>2</td>
<td>2000.00</td>
</tr>
<tr>
<td><strong>Total for 5 years</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>2620.00</strong></td>
</tr>
</tbody>
</table>

This monitoring is for a period of 2 years, where data is collected annually. Therefore, for each year the cost will be approximately USD 1310.00, not taking into account any effects of inflation and other such economic scenarios.
Considering the 2 stages of monitoring, monitoring costs in the construction stage would be approximately **USD 7,430.00**. The proponent has to endure the greatest cost during stage 1 monitoring, as frequency of monitoring is greater.

### 9.4 Monitoring Report

Monitoring report should be compiled based on the baseline data collected. This report should be submitted to the EPA and any other relevant government agencies for compliance annually or at a greater frequency, if requested. The report structure may include but not limited to;

- Introduction
- Details of the site at the time of investigation,
- Data collection and analysis,
- Details of methodologies and protocols followed
- Quality control measures,
- Sampling frequency and monitoring analysis
- Conclusion and recommendations

The report should include details of all those who participated in undertaking the analysis and formulating the report, including those from the property management/maintenance office.
10 Conclusion

There have been numerous mixed residential projects based in Hulhumale’ recently of which the environmental impact assessments are quite similar. This project proposes mixed social residential buildings in Hulhumale’ Phase II, which is largely barren land and has not been populated yet. Therefore, in general the impacts are much less than those being undertaken in the populated Phase I. Due to the virgin nature of the land area, there is not much site investigations to be carried out. Additional impacts from the proposed project compared to a typical building project is due to the generating own power and water production at the site. There are regulations and best practice guidelines for these including fuel storage, which should be adhered to ensure sustainability. The nature of the project is very similar to the 7000 housing units and 2500 housing units development in Hulhumale’ Phase II.

More serious impacts are of planning nature, and is not project specific. These include social impacts due to large number of people living in close proximity in the same area. To mitigate this impact, it has been recommended to incorporate CCTVs and community police setup within the project area, in addition to providing more public open areas. Moreover, concerns regarding fire safety exits and standard fire safety measures are very important to be established as well as additional features such as sprinkler systems in each floor. Proper ventilation should be ensured in both housing units and in common areas.

The project complements the larger program by Housing Development Corporation to establish more residential buildings in Greater Male’ area. The project will contribute to the grand plan of reducing congestion in Male’ by providing more housing opportunities in Hulhumale’. With the proposed building providing opportunities for those seeking their first own housing options, it is intended that this will remove the low-income generators from the mid range market, thus allowing more competitive prices in the market. The eventual plan is to provide a wide range of accommodation option to all members of the community living in greater Male’ area.

The existing environment at the project site does not consist of any significant vegetation and the water test result shows normal water quality. There are no
residents living near the site and there is no other structure currently at the site as well. There are other buildings that are proposed to be developed in the area.

Regarding alternatives, there are no viable alternatives available for the project with respect to location. The no project option is also not plausible at this stage and possibilities are outside the scope of this study, as the non-development of this building is a question to be considered at the planning stage. However, when considering the population density issue in the proposed area, it can still be regarded to be a better alternative to go ahead with the project as it will offer less dense environment than the current situation in Male’. Increase in building height would however further worsen the situation and it is recommended to proceed with the proposed building height. Other alternatives including material, foundation type, construction methodology are not necessarily recommended. Recommendations had been made to change dewatering methodology. It is recommended to dewater inland to an empty land close to the project site after excavating the area to ensure that water is contained in the allocated area, and will not have any negative impact on the groundwater aquifer. It is also recommended to proceed with piling as foundation type for the buildings considering the barren land.

In general, as was stated for other similar projects, proper planning and stronger legislation is required to ensure sustainability of such projects and to ensure maximum benefits are reaped from them. Legislation needs to be strengthened to ensure such projects provide the maximum benefits to the community with minimum risks. This is the opportune time to bring in such legislation as numerous similar projects are being developed and will be occupied by tenants in about 2 years time. The building code needs to be strengthened and widely followed. Currently condominium law is very brief and is in need for revision considering the many upcoming similar projects. There should be elaboration on the penalties upon tenants if they do not oblige with the predefined maintenance setup, which is unanimously agreed among the tenants. Maintenance of the buildings are of utmost importance to ensure sustainability of the housing units.
Acknowledgement

I would like to acknowledge all major contributors to this study and other similar studies. The proponent was supporting throughout the study, which is highly appreciated and made our work a lot easier. Technical information was provided by the contractor China Nantong Sanjian Construction Group Co. Ltd, for which I am very grateful. I would also like to thank all stakeholders for the cooperation they gave throughout.
12 References

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Terms of Reference for Environmental Impact Assessment for Proposed Design and Construction of 5000 Social Housing Units in Hulhumale’ Phase II.

The following is the Terms of Reference (ToR) issued for undertaking the EIA of the Proposed Design and Construction of 5000 Social Housing Units in Hulhumale’ Phase II. The proponent of the Project is Housing Development Cooperation.

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 EIA report.

1. **Introduction to the project** – Describe the purpose of the project and, if applicable, the background of the project and the tasks already completed. Clearly identify the rationale and objectives to enable the formulation of alternatives. Define the arrangements required for the environmental assessment and if relevant, including how work carried out under this contract is linked and sequenced with other projects executed by other consultants, and how coordination between other consultants, contractors and government institutions will be carried out. List the donors and the institutions the consultant will be coordinating with and the methodologies used.

2. **Study area** – Submit an A3 size scaled plan with indications of all the proposed land infrastructures. Specify the boundaries of the study area for the environmental impact assessment highlighting the location and size of the proposed construction. The study area should include nearby environmentally sensitive areas. Justification for site selection is required. Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – Identify and number tasks of the project including site preparation, construction and decommissioning phases.

   **Task 1 Description of the proposed project** – Provide a full description and justification of the relevant parts of the project, using maps at appropriate scales where necessary. All inputs and outputs related to the proposed activities shall be justified.

   1. Provide a clearly labeled concept design and scaled site plan of the project boundary.
   2. Submit a detailed description of the components of the project and how the project activities will be undertaken.
   3. A project schedule should be included.
   4. A matrix of inputs and outputs related to the proposed activities shall be included.
   5. Need and justification for the proposed project.
   6. Waste management during construction period including construction waste, and demolition waste.
   7. Dewatering plan.
   8. Description of any underground structures such as basement or wells.
   10. Details of vegetation clearance if any.
11. Use of any energy conserving utilities
12. Details of the backup generator to be installed, if any
13. Estimated consumption of water and electricity and their sources

Project management: Include communication of construction details, progress, target dates and duration of works, construction/operation/closure of labor camps, access to site, safety, equipment and material storage, water supply, waste management from construction operations, power and fuel supply for backup generators;

Building design details:
- Description of residential building designs including the type of accommodation and facilities offered
- Layout of various building floors
- Parking capacity and building access
- Description of office complex design

Site clearance:
- Number and types of vegetation removal required
- Green waste disposal methods

Excavation and dewatering:
- Area, depth and volume required for excavation
- Excavated earth disposal method and location
- Estimated no of days required for dewatering
- Dewatered water disposal method and location(s)
- Shoring methods for excavated particularly on sides with adjacent buildings
- Details of methodology used for dewatering including machinery specifications

Construction work:
- Scheduling and workforce inclusive of workforce accommodation logistics
- Construction materials and machinery to be used (quantified)
- Construction methodology; inclusive of low energy ventures and concepts to be used during construction and operation phases

Foundation and piling works:
- Pile specifications, including type, dimensions and max driving length
- Pile driving method

Foundations and concrete works:
- Type of foundation and foundation depth;
- Geotechnical calculations regarding the building weight
- Concrete batching process and transportation method (if required)
- Project site office and temporary storage area details

Utilities
- Type, number and capacity of backup power plant
- Capacity, construction method and binding details of any fuel storage tanks
- Sewerage connection plan to Hulhumale's main network
- Water connection plan and water storage tank(s) details
- Waste management plan during operations

Building operations
- Traffic management plan outline
- Re-vegetation plan outline

Task 2. Descriptions of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the project (e.g. monsoon season). Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that data collected is suitable for use as a baseline. As such all baseline data must be presented in such a way that they will be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized.

The baseline data will be collected before construction and from at least two benchmarks. All survey locations shall be referenced including water-sampling points.

All data must be collected as per the requirements of the EPA Data Collection Guidelines (published on www.epa.gov.mv). The report should outline detailed methodology of data collection utilized.

Climate
Temperature, rainfall, wind, waves

Physical and Biological Environment
Noise levels in the vicinity of the site including any noise sensitive location
Water quality of groundwater wells in project site. Following parameters are to be tested: Conductivity, pH, Salinity, Temperature, TDS, Turbidity

Built Environment
Nature of adjacent or upcoming buildings if any
Condition of the roads
Existing structure/uses of the proposed site
Proposed land use plan especially with a focus on the public facilities nearby

Socio-economic Environment
Demographic data for greater Hulhumale’ area.
Brief description of social environment of Hulhumale’ in general and adjacent residential units in particular
Identify types of vehicles and peak traffic hours in or near the project site

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Legal requirements:
Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages – The EIA report should identify all the impacts, direct and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

- Loss of vegetation if any
- Loss of visual amenity
- Land preparation and piling works if any
- Impacts on ground water table and water quality
- Impacts related to construction works on land including materials sourcing, transport and storage, building construction methodology and piling.
- Mosquito growth
- Impacts due to generation of waste
- Potential impacts of the development, post construction, on proposed residential areas, especially sensitive areas like schools, pre-schools and mosques.
- Safety and security of the building
- Risk of accidents to workers and public
- Impacts on employment and income such as job opportunities
- Disturbances to residents and public facilities/activities nearby post construction

The methods used to identify the significance of the impacts shall be outlined. One or more of the following methods must be utilized in determining impacts: checklists, matrices, overlays, networks, expert systems and professional judgment. Justification must be provided to the selected methodologies. The report should outline the uncertainties in impact prediction and also outline all positive and negative/short and long-term impacts. Identify impacts that are cumulative and unavoidable.

Task 5. Alternatives to proposed project – Describe alternatives including the "no action option" should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the “no action alternative”. All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options should be specified for each component of the proposed project.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. An Environmental management plan for the proposed project, identifying responsible persons, their duties and commitments shall also be given. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan (see appendix) – Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for ground water as well as defects in neighbouring structures. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.
Task 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders. Housing Development Corporation, engineers/designers, development managers, staff and members of the general public. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes. Major stakeholder consultation shall include:

- STELCO
- MWSC
- MNDF Fire
- HPA
- Maldives Energy Authority

**Presentation** - The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will 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, 2012 and relevant amendments.

**Relevant documentation, references for consultants** – Include publicly available studies or references relevant to the current project to be used by the consultant.

**Timeframe for submitting the EIA report** – The developer must submit the completed EIA report within 6 months from the date of this Term of Reference.

21st December 2012
Annex 2 – Approved Concept Drawings
FRAMEWORK AGREEMENT
TO DESIGN, FINANCE AND CONSTRUCT 5000 SOCIAL HOUSING UNITS IN HULHUMALE', PHASE 2

BETWEEN

HOUSING DEVELOPMENT CORPORATION LIMITED
(“HDC”)

AND

JIANGSU NANTONG SANJIAN CONSTRUCTION GROUP CO. LTD
(“CNTC”)

Agreement number: HDC/OHR/2017/13
Date: 13th April 2017
This Framework Agreement (the "Agreement") is made on 11th April 2017, between

Housing Development Corporation Limited, a company duly incorporated and existing under the laws of the Republic of Maldives bearing Registration No: C-793/2008 and having its registered address and principal place of business at 3rd floor, HDC Building, Hulhumale, Republic of Maldives (hereinafter referred to as "HDC"); which expression shall include its successors-in-title, liquidators, administrators and lawful assigns where the context so requires or admits); and

JIANGSU NANTONG SANJIAN CONSTRUCTION GROUP CO. LTD, a corporation created and duly incorporated and existing under the laws of the People's Republic of China bearing Registration number 9132068413876017K and having its address at 131 Shishan Road, Haimen City, Jiangsu Province, People's Republic of China (hereinafter referred to as the "CNTC"); which expression shall include successors-in-title, liquidators, administrators and assigns where the context so requires or admits);

The HDC and CNTC are hereinafter, collectively referred to as the "Parties" and individually referred as a "Party".

WHEREAS,

2.1 The HDC, in line with the effects of the Government of the Republic of Maldives to address the problem of housing deficit in Maldives, is desirous of carrying out infrastructural and housing developments of 5,000 Social Housing Units in Hulhumale' Phase 2.

2.2 The CNTC, along with its implementation partners is in the business of developing housing projects and has proven track record and well-recognized experience in good quality construction of integrated housing solutions in China and abroad; has made a proposal to carry out the infrastructural and Social housing development for the HDC.

2.3 In pursuance of the above, CNTC having been highly skilled and resourceful in the business of project development, design and construction, shall coordinate to arrange funds that will provide the facility to finance up to 100% (one hundred percent) which 85% (Eighty-Five Percent) from a Chinese Bank and 15% (Fifteen Percent) on Buyer's Credit Facility subject to facility of financing agreements to be included.

2.4 CNTC is interested in undertaking the Design and Build of 5000 Social Housing Units in Hulhumale' Phase 2 (hereinafter referred to as the "Project") with proper support and assistance to source of finance from a Bank to the full amount of the Project.

2.5 The President's Office of the Maldives requested HDC to enter into an Agreement with CNTC to define the minimum requirements of the Project, via letter no 1-ED/161/2017/12 dated 5th February 2017; (Copy of this letter is attached hereto in Schedule 1).

2.6 Further to the discussions between CNTC and HDC, the Parties agree to enter into this Agreement to formalize the understanding between the Parties prior to entering into an official Commercial Contract (hereinafter referred to as the "Contract") to implement the Project.
SIGNATORIES TO THE AGREEMENT

SIGNED FOR AND ON BEHALF OF HOUSING DEVELOPMENT CORPORATION LIMITED

AUTHORIZED SIGNATORY:  IN THE PRESENCE OF:
Name: Mohamed Saiman  Name: Ali Shareef
Designation: Managing Director  Designation: Director
Date: 13th April 2017  Passport/ID no: A0208412
                                      Date: 13th April 2017

SIGNED FOR AND ON BEHALF OF JIANGSU NANTONG SANJIAN CONSTRUCTION GROUP CO., LTD

AUTHORIZED SIGNATORY:  IN THE PRESENCE OF:
Name: Sun Difei  Name: Zhang Wei
Designation: Executive President  Designation: Vice General Manager
Date: 13th April 2017  Passport/ID no: E17695293
                                      Date: 13th April 2017
COMMERCIAL AND PARKING AREA
FINISHING STANDARDS

GROUND FLOOR PLAN
- PARKING AREA
- COMMERCIAL AREA

PARKING
- WALLS & CEILING FINISH: PAINT FINISH W/ WALL SEALER
- FLOOR FINISH: INDUSTRIAL GRADE FLOOR PAINT WITH MARKINGS
- DOORS & ACCESS CONTROL: TEMPERED GLASS DOOR W/ ACCESS CONTROL
- LIGHTS & VENTILATION: LED LIGHTS (WARM LIGHTS)
- FIRE FIGHTING: PROVIDED
- SECURITY: CCTV CAMERA PROVIDED
- SIGNAGE: PROVIDED

COMMERCIAL
- WALLS & CEILING FINISH: PAINT FINISH W/ WALL SEALER OR GLASS PARTITION WALLS
- FLOOR FINISH: 600X600 HOMOGENEOUS NON-SKID FLOOR TILES
- DOORS & ACCESS CONTROL: TEMPERED GLASS DOOR W/ ACCESS CONTROL
- LIGHTS & VENTILATION: LED LIGHTS (WARM LIGHTS)
- FIRE FIGHTING: PROVIDED
- SECURITY: CCTV CAMERA PROVIDED
- SIGNAGE: PROVIDED IF NECESSARY
TOTAL = 5040 UNITS
36 x 4 = 144 SQFT
27 x 4 = 108 SQFT
18 x 4 = 72 SQFT
9 x 4 = 36 SQFT
SITE LOCATION PLAN
SCALE: NTS

CONCEPTUAL DESIGN FOR FIRE APPROVAL

DEVELOPMENT OF 5000 SOCIAL HOUSING UNITS BY CNTC
[HULHULMALE PHASE II]

DATE: 16-OCT-2017

DRAWN: SAAIF MOHAMED
BDR2017116A

CHECKED:

PREMIA CONSULTING PVT LTD
2nd Floor, Gulfaamuge,Maafannu,
Fareedhee Magu, Male', 20191, Maldives.
Phone: +960 331-0910, Email: info@premia.mv
www.premia.mv

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LEGEND

- ALARM BELL (85 db)
- MANUAL CALL POINT (RESET-ABLE)
- JUNCTION BOX
- FIRE BLANKET
- SMOKE DETECTOR
- EXTINGUISHER WATER (9 Ltr)
- EXTINGUISHER CO2 (2 Kg)
- WET CHEMICAL (6 Ltr)
- DRY CHEMICAL POWDER (6 Kg)

NOTE:
HOSE REEL PIPE Ø75MM
SCHEDULE 40 BOTH SIDE GALVANIZED

WET RISER PIPE Ø100MM
SCHEDULE 40 BOTH SIDE GALVANIZED

PUMP DETAILS:
2,000 LPM, 80M HEAD
JOCKEY, DUTY, STAND-BY (DIESEL)
LEGEND

• ALARM BELL (85 db)
• MANUAL CALL POINT (RESET-ABLE)
• JUNCTION BOX
• FIRE BLANKET
• SMOKE DETECTOR
• EXTINGUISHER WATER (9 Ltr)
• EXTINGUISHER CO2 (2 Kg)
• WET CHEMICAL (6 Ltr)
• DRY CHEMICAL POWDER (6 Kg)

EXIT

2-WAY BREACHING INLET

WET RISER LANDING VALVE

FIRE HOSE REEL 30M

HEAT DETECTOR

2 HOUR FIRE RATED DOOR

FIRE RETURN CABLE 1.5M

AUTOMATIC AIR RELIEF VALVE

NOTE:

HOSE REEL PIPE Ø75MM
SCHEDULE 40 BOTH SIDE GALVANIZED

WET RISER PIPE Ø100MM
SCHEDULE 40 BOTH SIDE GALVANIZED

PUMP DETAILS:

2,000 LPM, 80M HEAD

JOCKEY, DUTY, STAND-BY (DIESEL)
Annex 3 – Water test results
WATER QUALITY TEST REPORT
Report No: 500178149

Customer Information:
Amir Mushafa
Flat 11-02-03
Hulhumale', Maldives

Sample Information:

<table>
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<tr>
<th>Sample Description</th>
<th>Site 1 5000 housing units, Hulhumale'</th>
<th>Site 2 5000 housing units, Hulhumale’</th>
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<tr>
<td>Sample Type</td>
<td>Ground Water</td>
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<td>Sample No</td>
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</tr>
<tr>
<td>Sample Date</td>
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TEST METHOD

<table>
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<tr>
<th>PARAMETER</th>
<th>ANALYSIS RESULT</th>
<th>UNIT</th>
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</thead>
<tbody>
<tr>
<td>Physical Appearance</td>
<td>Pale yellow with particles</td>
<td>Pale yellow with particles</td>
</tr>
<tr>
<td>Conductivity</td>
<td>975</td>
<td>836</td>
</tr>
<tr>
<td>pH</td>
<td>8.23</td>
<td>8.22</td>
</tr>
<tr>
<td>Salinity</td>
<td>0.48</td>
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</tr>
<tr>
<td>Temperature</td>
<td>24.6</td>
<td>25.1</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>489</td>
<td>418</td>
</tr>
<tr>
<td>Turbidity</td>
<td>2.20</td>
<td>1.98</td>
</tr>
<tr>
<td>Total Petroleum Hydrocarbon (TPH)</td>
<td>&lt;0.036 (LoQ 0.036 mg/L)</td>
<td>&lt;0.036 (LoQ 0.036 mg/L)</td>
</tr>
</tbody>
</table>

Keys: μS/cm : Micro Siemens per Centimeter, % : Parts Per Thousand, °C : Degree Celsius, mg/L : Milligram Per Liter, NTU : Nephelometric Turbidity Unit

Checked by

Aminath Sofia
Assistant Laboratory Executive

Approved by

Mohamed Eyman
Assistant Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory
This report shall not be reproduced except in full, without written approval of MWSC
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer

*************** END OF REPORT ***************
Construction Schedule of Development of 5040 Social Housing Units in Hulhumale' phase II

**Construction Duration**: 730 d

- **Start**: 3/1 2018
- **Finish**: 3/6 2020

**Design and Temporary Facilities Construction Stage**: 61 d

- **Start**: 3/1 2018
- **Finish**: 4/30 2018

**Construction Stage**: 699 d

- **Start**: 4/1 2018
- **Finish**: 3/6 2020

**Ground and Foundation Work**: 250 d

- **Start**: 4/1 2018
- **Finish**: 12/6 2018

**First Area (Buildings 1#–7#)**: 180 d

- **Start**: 4/1 2018
- **Finish**: 9/27 2018

**Second Area (Buildings 8#–13#)**: 170 d

- **Start**: 5/11 2018
- **Finish**: 10/27 2018

**Completion of Ground and Foundation Work**: 1 d

- **Start**: 6/1 2018
- **Finish**: 6/1 2018

**Main Work**: 454 d

- **Start**: 6/1 2019
- **Finish**: 9/4 2019

**First Area (Buildings 1#–7#)**: 412 d

- **Start**: 6/1 2019
- **Finish**: 7/24 2019

**Second Area (Buildings 8#–13#)**: 378 d

- **Start**: 7/10 2019
- **Finish**: 7/29 2019

**Third Area (Buildings 14#–20#)**: 385 d

- **Start**: 8/9 2019
- **Finish**: 9/4 2019

**Completion of Main Work**: 1 d

- **Start**: 9/4 2019
- **Finish**: 9/4 2019

**Decorating Work**: 516 d

- **Start**: 10/1 2018
- **Finish**: 3/6 2020

**Mechanical and Electrical Work**: 581 d

- **Start**: 7/28 2018
- **Finish**: 3/6 2020

**Facilities Installation & Testing and Acceptance**: 30 d

- **Start**: 2/26 2020
- **Finish**: 3/6 2020

---

*P.S. 1. The estimated commence date is 1st March 2018; 2. After one month of design work started, the ground and foundation work will start in the following month; 3. There are three construction areas as we planned.*
Annex 5 – Proponents Commitment for Monitoring and Mitigation
Letter No.: HDC(161)-PM/203/2018/2

16 January 2018

Ibrahim Naeem
Director General
Environmental Protection Agency,
Ministry of Environment and Energy,
Male',
Republic of Maldives

Dear Sir,

PROJECT: HULHUMALÉ PHASE 2, 5040 SOCIAL HOUSING UNITS PROJECT - 2017
SUBJECT: PROPOINENTS COMMITMENT FOR MONITORING AND MITIGATION

As the proponent of the project, we would like confirm our financial commitment to undertake all mitigation measures and give our commitment to finance the environmental monitoring program to the costs given and as outlined in this EIA.

Thank You.

Yours faithfully,

Nawaz Shaugee.
Director