ENVIRONMENTAL IMPACT ASSESSMENT

Proposed Mixed Residential Apartment Building Development 'FITRON Residence' in Plot C4-2, Hulhumale', Maldives

Proponent:

MUNI Enterprises Pvt. Ltd.

Consultant:

Amir Musthafa (EIA01/13)

October 2017

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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

Amir Musthafa (EIA 01/13)

29th October 2017

Proponents Declaration

(attached in the following page)

بسم الله الرحمن الرحيم

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Enhance your life

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

29th October 2017

Dear Mr. Ibrahim Naeem,

Project: EIA for the proposed mixed residential apartment building development project at Hulhumale', Plot C4-2

Sub: Proponents 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.

Thanking you

Yours sincerely,

Ahmed Shiham
Director of Business Development

Non Technical Summary

This report is based on the proposed mixed residential building construction in Plot No. C4-2, Hulhumale'. It is proposed to build two 10 storey towers, of which 2 storeys will be allocated for commercial purposes. The project is being developed by MUNI Enterprises Pvt. Ltd. The proponent is to oversee the development and project management including managing the EIA process. The contractor has not yet been decided.

An Environmental Impact Assessment was necessary for the works as per the requirements of the signed agreement between MUNI Enterprises Pvt. Ltd. and Housing Development Corporation (HDC). 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 government entity being given the responsibility to set guidelines and oversee all developments in Hulhumale'.

The project is part of larger program by HDC to establish mixed residential buildings in Hulhumale'. Therefore, many similar EIAs have been done recently. Apartments in these buildings can generally be regarded as being targeted towards middle to upper class members of the community. The project will contribute to the grand plan by the government of reducing congestion in Male' by providing more housing opportunities in Hulhumale'. By 2019, it is projected that there will be over 1000 such housing units built in Hulhumale'.

The existing environment at the project site does not consist of any significant vegetation and the water test result shows deteriorating water quality. There are no residents living in close proximity to the site and there is no other structure at the site as well. However, there are numerous similar developments including Rainbow Oceanfront building development in Plot D2-3 and other developments by ENSIS, APOLLO holdings, DAMAS, etc along the same road. The proposed site also directly faces the Hulhumale' western shoreline.

During the construction stage, health and safety standards of the workers at site, and waste generation are the major areas of concern as is the case for all similar developments. With proper planning and project management, this can be easily mitigated. Waste is the main concern during the operational stage of the project as well. 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 manage the waste in addition to maintaining the building. Further impacts to the adjacent construction site are foreseen. However, this can be mitigated with proper communication and planning before project implementation.

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. Other alternatives including material, foundation type, maintenance methodology, construction methodology are not necessarily recommended. Recommendations had been made to proceed with the project as planned.

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.

All the impacts as highlighted in the project can be mitigated. The socio-economic benefits to Greater Male' City from projects such as these is high. It also provides 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.

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ދ ތިލުގެ، ކުލަދަށ ހުންނަ 2-4 ގަ 10 ވަނި ތިމާގެ ހުރިހާ ގަދަ ގަސްތަކާ ހަމައަށ ކަނޑައަޅާ ހުންނަ ތަނަށ ކިޔާ ކަމަށ ވާ ތަނަށ ކިޔާ ކަމަށ ވާ ތަނަށ ކިޔާ ކަމަށ ވާ

އަސަރުތައް ކުޑަކުރަން މިޕްރޮޖެކްޓުގައި ހުށަހަޅާފައިވާ ފިޔަވަޅުތަކަށް ރިޢާޔަތްކޮށް މަޝްރޫޢު ކުރިއަށްގެންދިއުމުން، މިމަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ އަސަރު ވަރަށް ބޮޑަށް ކުޑަވެގެންދާނެއެވެ. މިފިޔަވަޅުތަކުގެ ތެރޭގައި ކުނި މެނޭޖް ކުރުމާއި، ޑީވޯޓަރ ކުރުމުގައި ވިސްނަންޖެހޭ ކަންކަމާއި، ކޮންސްޓްރަކްޝަން މަސައްކަތު ކުރަން ބޭނުން ކުރާ މެޝިނަރީ އަދި ވެހިކަލްތަކުން ވޯކަރުން ގެއްލުން ނުވާނެހެން މޮނިޓަރ ކުރުމާއި، ޕްރޮޖެކްޓް ސައިޓްގެ ރައްކާތެރި ފިޔަވަޅުތައް ނުވަތަ 'ސޭފްޓީ ސްޓޭންޑަރޑްސް' ދެމެހެއްޓުން ހިމެނެއެވެ. އަދި އަވަށްޓެރިންގެ ނުރައްކަލުން ސަލާމަތްކަން އެޔަރޕްލަގް ދޫކުރުމާއި ހިމެނެއެވެ. މިގޮތުން ބޭނުންކުރާ އެއްވެސް މެޝިނަރީއެއް މަޝްރޫޢުގެ ސަރަހައްދުން ބޭރުގައި ނުބަހައްޓުމަށްވެސް އިލްތިމާސްކުރެވިފައެވެ. އަދި އިމާރާތުގެ ހަރަކާތްތަކުގައި ސްކެފޯލްޑިންގ ޖެހު ރަނގަޅަށް ބެލެހެއްޓުމާއި ބައިގަނޑުތަކުގެ ވީޓް ތަކެތި ބެލެހެއްޓުމަށް ވަކި ތަނެއް ހާއްސަކޮށްދިނުމަށްވެސް ލަފާދެވިފައެވެ.

މިޕްރޮޖެކްޓުގައި ތިމާވެށްޓަށް އަސަރުކުރާ މިންވަރު ކުރިމަތިލާ ހަރަކާތަށް 'އެންވަޔަރަމަންޓަލް މޮނިޓަރިންގ ޕްރޮގްރާމް' އެކުލެވިގެންވާނެއެވެ. މި ޕްރޮގްރާމް ބައިތަކުގެ ކޮންސްޓްރަކްޝަން މަސައްކަތުގެ ކުރިންނާއި މަސައްކަތުގެ ނިމުމަށްފަހު 2 އަހަރު ވަންދެންނެވެ. މިމޮނިޓަރިންގެ މަސައްކަތަކީ ދުވަހުންދުވަހަށް ގޮތެއްގައި މިމަޝްރޫޢު ތަރައްޤީ ކުރުމަށް އޮތް ވަރަށް މުހިއްމު މަސްއޫލިއްޔަތެކެވެ.

ހުށަހެޅިފައިވާ ތަރައްޤީ ކުރުމުން މިފަދަ އެހެނިހެން މަޝްރޫޢުތަކާވެސް އެއްފަދައިން، މި މަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ވަގުތީ ނިސްބަތުން ކުޑަ ގެއްލުންތަކެއް ލިބިދާނެ ކަމުގައިވިޔަސް މަސައްކަތްތަކުގެ ސަބަބުން ލިބޭނެ އިޖުތިމާޢީ އަދި އިޤްތިޞާދީ ފައިދާތަކެއްވެސް ދިމާވާނެއެވެ. މިސަރަހައްދަށް އިޖުތިމާޢީ ގޮތުން ދިމާވާ މަސައްކަތްތަކާއި އިޤްތިޞާދީ ފައިދާތައް ހޯދުމަށް ކުރިއަށް ގެންދެވޭނެއެވެ. ނަމަވެސް މިއިޖްތިމާޢީ މުހިއްމު ބަދަލުތައް ތިމާވެށްޓާ ގުޅުންހުރި ސިޔާސަތުތަކާއި، މިޤާނޫނުތަކާ ޢަމަލުކުރެވޭ ގޮތަށް ކަމެވެ. މިޕްރޮޖެކްޓާ ކަނޑައެޅިގެން ބަލައިލުމުގައި ފަރުގެ ސަރަހައްދަށް ހުރި ފިޔަވަޅުތައް ދަށުން، ސަރަހައްދުގެ މޮނިޓަރިންގ ޕްރޮގްރާމުން ކުރިއަށް ގެންދިޔުމަށް އެދިފައިވެއެވެ. މި މަޝްރޫޢުން ތިމާވެށްޓަށް ފޯރާ ނޭދެވޭ އަސަރުތައް ނުފެނެއެވެ. ވީމާ ތިމާވެށީގެ ހާލަތު ރަނގަޅު ކުރުމާއި ސަރަހައްދުގެ މީހުން ދިރިއުޅޭ ސަރަހައްދުގެ ނުވާފަދަ މަޝްރޫޢުގެ ސަބަބުން ފޯރާ އަސަރުތައް ކުޑަކުރެވޭނެއެވެ. އެހެންކަމުން މިޕްރޮޖެކްޓް ތަރައްޤީކުރުމަށް މި މަޝްރޫޢު މިޕްރޮޖެކްޓް ފޯރާ ކުރުމާއި ގޮތަށް، ތިމާވެށްޓަށް ދިމާވާ ގެއްލުން އެންމެ ކުޑަ ކުރެވޭ ގޮތަށް ކުރިއަށްގެންދިއުމެވެ.

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 mixed residential building construction in Plot C4-2 titled 'FITRON Residence'.

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 June 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

This report 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 a numerous years of experience in Environmental Impact Assessment in the Maldives and has been actively involved in numerous coastal protection projects and building construction undertaken 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 May 2017. 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 May 2017 to collect baseline data.

The following investigations were carried out on site.

- Groundwater quality parameters
- Existing noise levels on site
- Traffic flow at the project site
- Socio-economic conditions in the area

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 3 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. Noise measurements undertaken for similar projects recently has also been referred to and analyzed together.

1.4.3 Traffic flow

Traffic flow was measured by visual observation of traffic within a predetermined area at the project location within a specified period of time using a stop-watch. The no. of heavy duty vehicles, cars, motor-cycles, and pedestrians at the area in a 15 minute period were noted down by visual inspection using a multi-counter, and extrapolated to 60 minutes. Traffic surveys were undertaken at different times and due to the low traffic flow in the area, the maximum flow is presented in the report.

Traffic survey undertaken for similar projects has also been referred to and analysed together.

1.4.4 Stakeholder consultations

Stakeholder consultations were initially carried out in the EIA scoping meeting. The EIA scoping meeting gave the opportunity to consult with the Environmental Protection Agency, project developer and contractor, and Housing Development Corporation (HDC) in one sitting. Additionally, consultation with the Ministry of Housing and Infrastructure, STELCO, MWSC, HPA, MNDF, WAMCO and Project engineer, were carried out before this particular study was commenced. However, 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.

1.4.5 Built Environment

An overview of the built environment around the project site was undertaken by visual inspection with the aid of photographs. A structural defect inspection study is not recommended as is the case for structures usually built in high congestion areas in Male'.

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 11 Storey building construction in M. Thulhaadhooge, 2015 (Zuhair 2015)
- EIA for 14 Storey building construction in G. Hudhukoka, 2014 (Musthafa 2014)
- 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)

The Rainbow Oceanfront project study was of particular use for this study, as the project is near the proposed project location.

1.6 The Proponent

The project is being proposed by MUNI Enterprises Pvt. Ltd.

MUNI Enterprises Pvt. Ltd. is the holding company for the many MUNI group businesses in the Maldives. The business was originally initiated in the year 1983. The group has been involved in numerous tourism related ventures. Moreover there is a thriving furniture business under MUNI homecare. The proposed project is the group's first major real estate development.

1.7 The Project Location

The project is based in Hulhumale', near the western shoreline. Location coordinates are at around 4°13'15.59"N, 73°32'21.79"E.

There are no buildings in the direct vicinity of the proposed site. However, other similar developments are proposed in the neighbourhood including similar buildings by Apollo Holdings, Rainbow Construction, ENSIS, DAMAS.

The precise location is shown in the following image (Figure 1). A more detailed site plan is given in Annex.

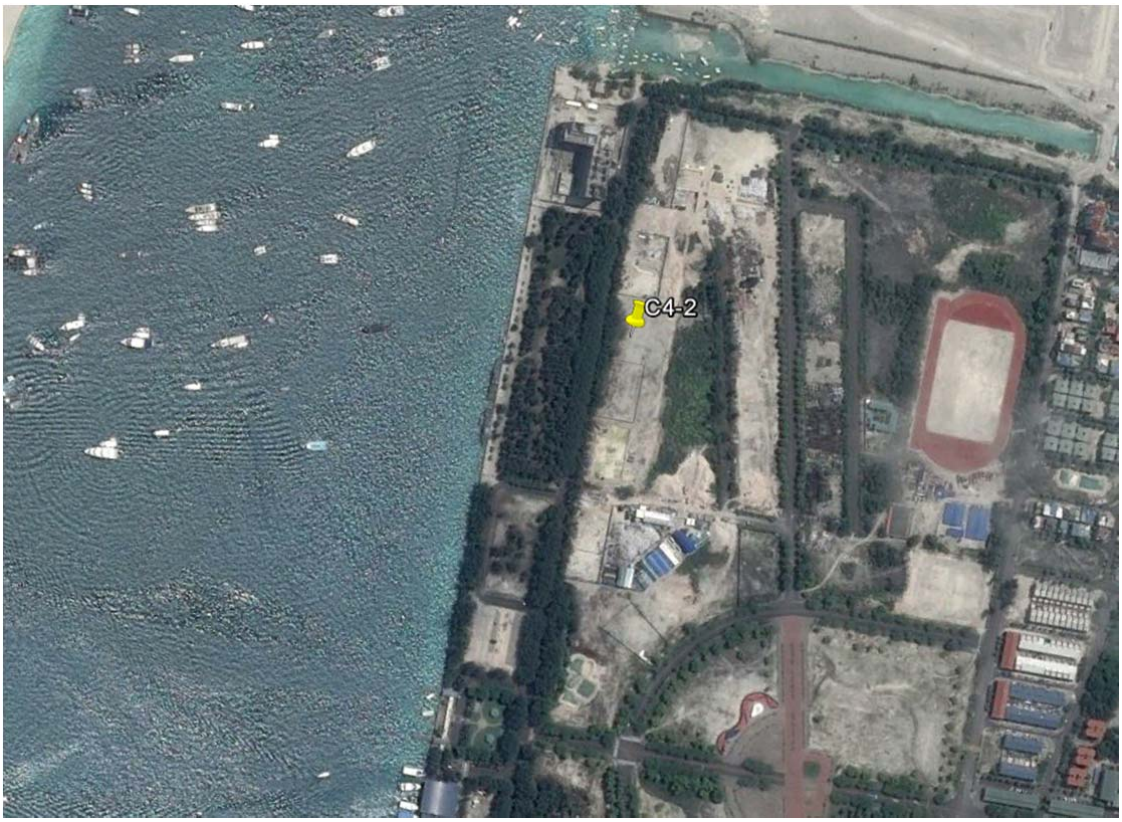


Figure 1 Location of proposed site in Hulhumaale'

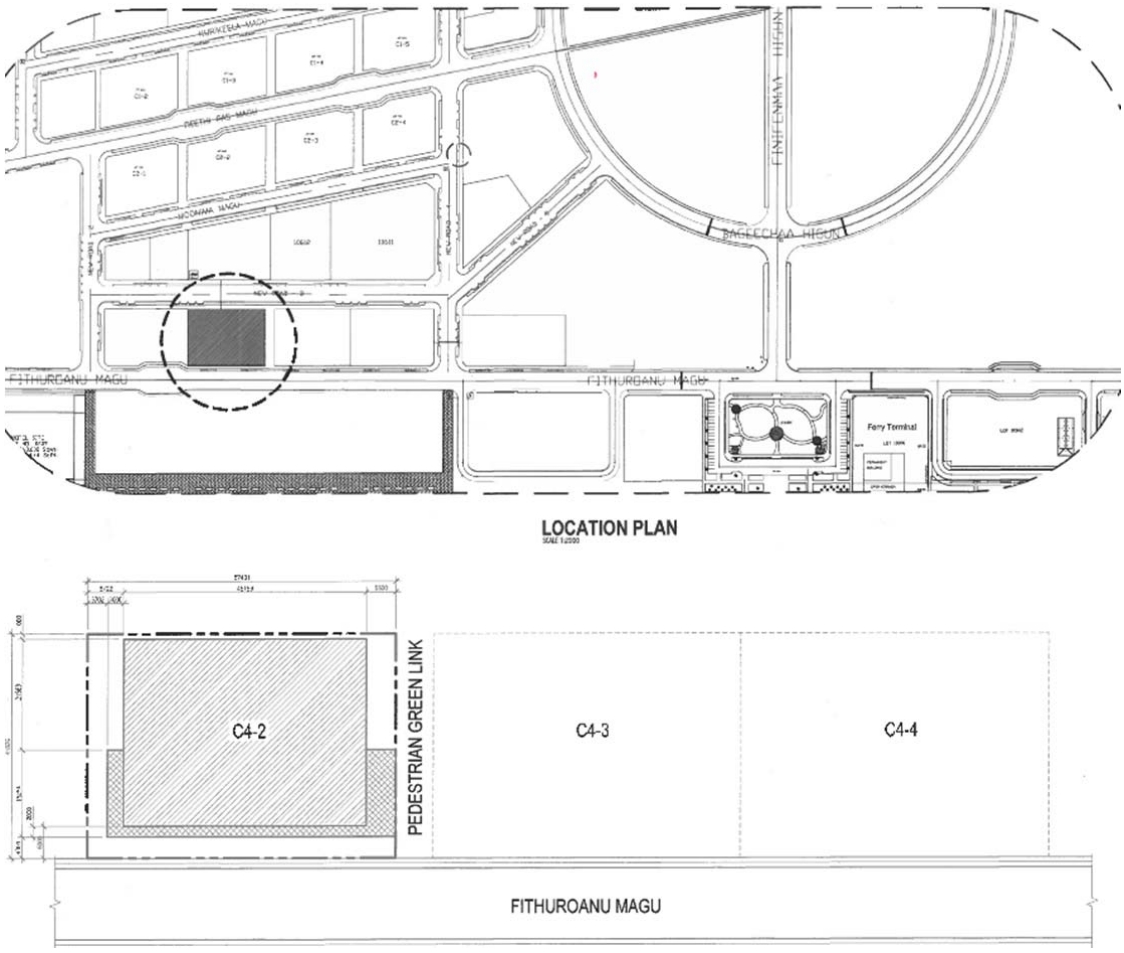


Figure 2 Location of Plot C4-2 Building in Hulhumale'

Figure 3 Impact Area and Study area for the project including the traffic and noise survey regions.

The figure above illustrates the study area and impact area of the project. The direct impact area is the plot in which building construction takes place. Indirect impact area is the road area facing the project site.

1.8 Need and Justification

The need and justification for the project is the same as other recent mixed residential apartment buildings in Hulhumale'. The main justification is to increase housing options in Male' area to alleviate congestion issues 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. All these developments are believed to generate several employment opportunities and therefore will attract additional migration to the area.

With the development of Hulhumale' Phase 2, it appears that there is an urgency to complete the entire Phase 1, and as such there has been a flurry of housing projects proposed. The proposed project in this study has been proposed earlier than the recent developments. 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 ¼ of the total population was residing in Male', which increased to 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 given up to 2006. However, the trend has continued up to the present year.

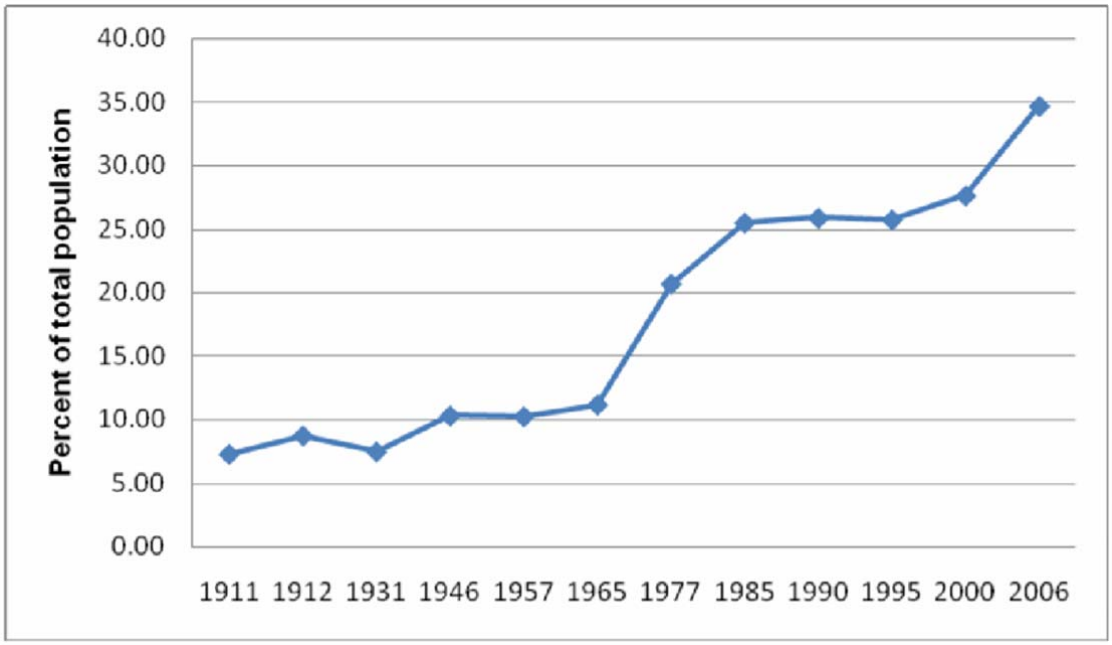


Figure 4 Percentage of people living in Male with respect to total population

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 recipients of the scheme are targeted to 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. Therefore, it appeared there was not much housing opportunities for the middle class. Developments such as proposed building in Plot C2-4 provides these opportunities to the middle to upper class. Therefore, the developments are intended to alleviate the housing issues among the working middle class Maldivians living in Male' City.

2. Project Description

The project proposes to develop a building with 10 storeys, with the top floor used as a multi- purpose terrace equipped with a swimming pool.

In addition to housing units the buildings will have the following amenities.

- Fully equipped gym
- Multi purpose hall
- Kids play area
- Commercial Area
- Waste management area
- Basement parking

The building will also have a dedicated convenience store and restaurant/café which will be accessible to the public.

The drawings are including the floor layouts, elevation plans are given in the Annex.

2.1 Site setup

HDC has allocated a plot facing Hulhumale' port area for FITRON project temporary site. The plot is near Renaatus and Batch construction project site. Material storage will be undertaken on this land plot. The layout of the plot and location map is given below. A 20,000 sqft area has been allocated for this purpose. The temporary site will be demarcated and fenced.

The site is quite far away from the project site and therefore regular transport would need to occur from the project site to the temporary site. Material will be transported in bulk and temporarily stored at the project site. Labourers would move towards the project site in the morning daily from the temporary site. This would not cause any notable traffic disruptions.

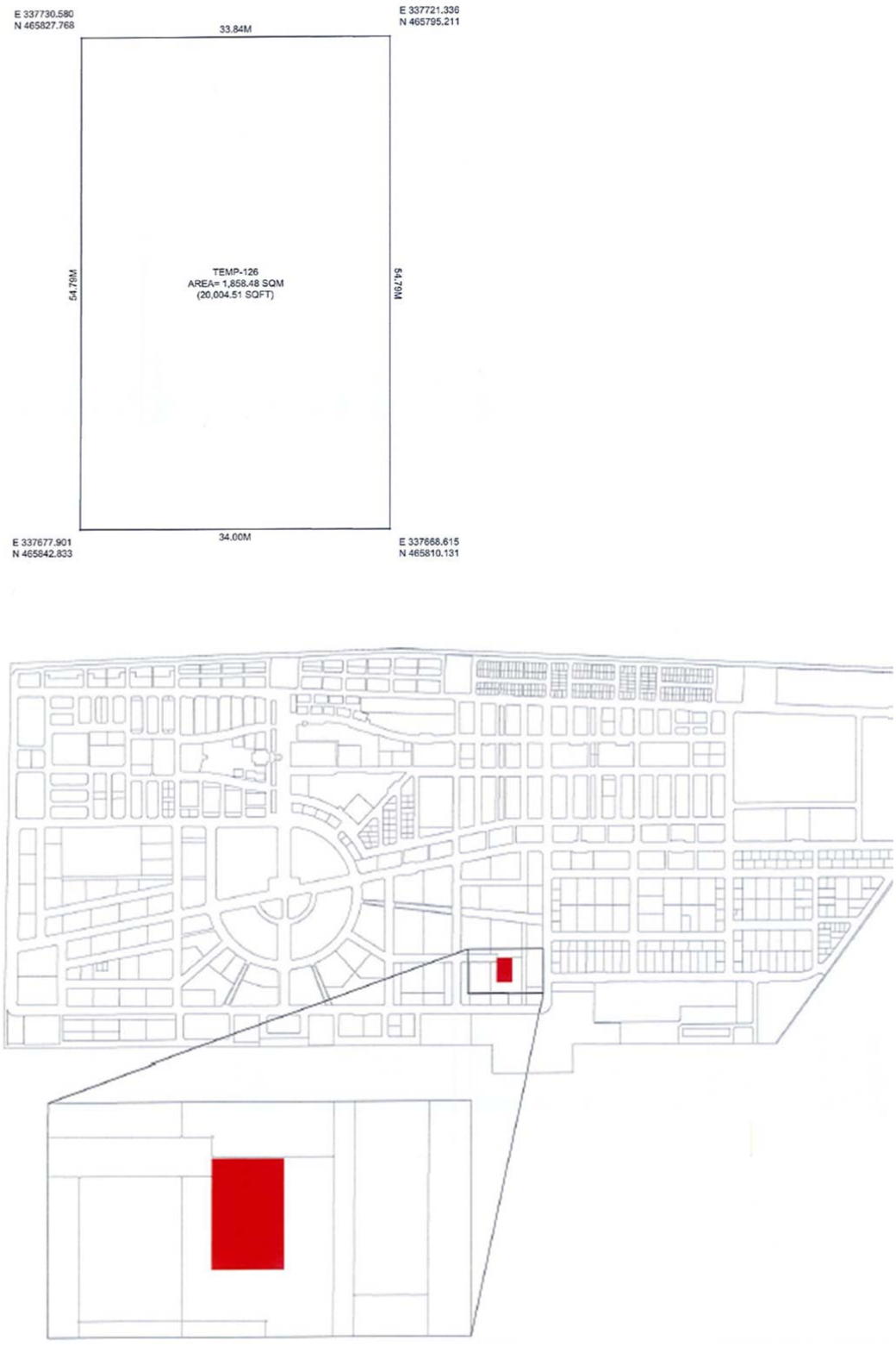


Figure 5 Temporary site location

2.2 Excavation works and Foundation Protection

It has been established that the depth of foundation with basement will be over 2.0m below the existing ground level. The estimated depth of water table in the area is 1.40 from ground level. Dewatering will have to be continuous until casting of the foundation. Excavation will be undertaken with multiple excavators. Total excavation quantity is approximately 4,000.00 cbm. Part of this this will be used for back filling.

Maximum width of the foundation would be 35m. When all the necessary excavation is complete, a 50 mm thick lean concrete (Grade C15, 15MPa) layer will be laid to provide a level surface to assemble the reinforcement of foundation raft slab and beams.

The lateral pressure on the material adjacent to the excavation could be prevented materially by MS sheet piles. This will be to protect road way around the land and adjacent land.

Onsite close observation, frequent measurements and recording of the vertical and lateral movements and behaviours of the sheeting and bracing will be done to provide early warning of unfavourable development which might cause settlement of the adjacent road/property.

2.3 Dewatering

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. It is estimated that 2500 cbm of water will be dewatered.

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 land near the site. The dewatering works will be done entirely by the contractor.

Two options are given by HDC for dewatering site. Option 1 is to dewater in land, to the empty land between the shoreline and the project site. Option 2 is to dewater straight to the lagoon. Both locations are approved by HDC and is illustrated below.

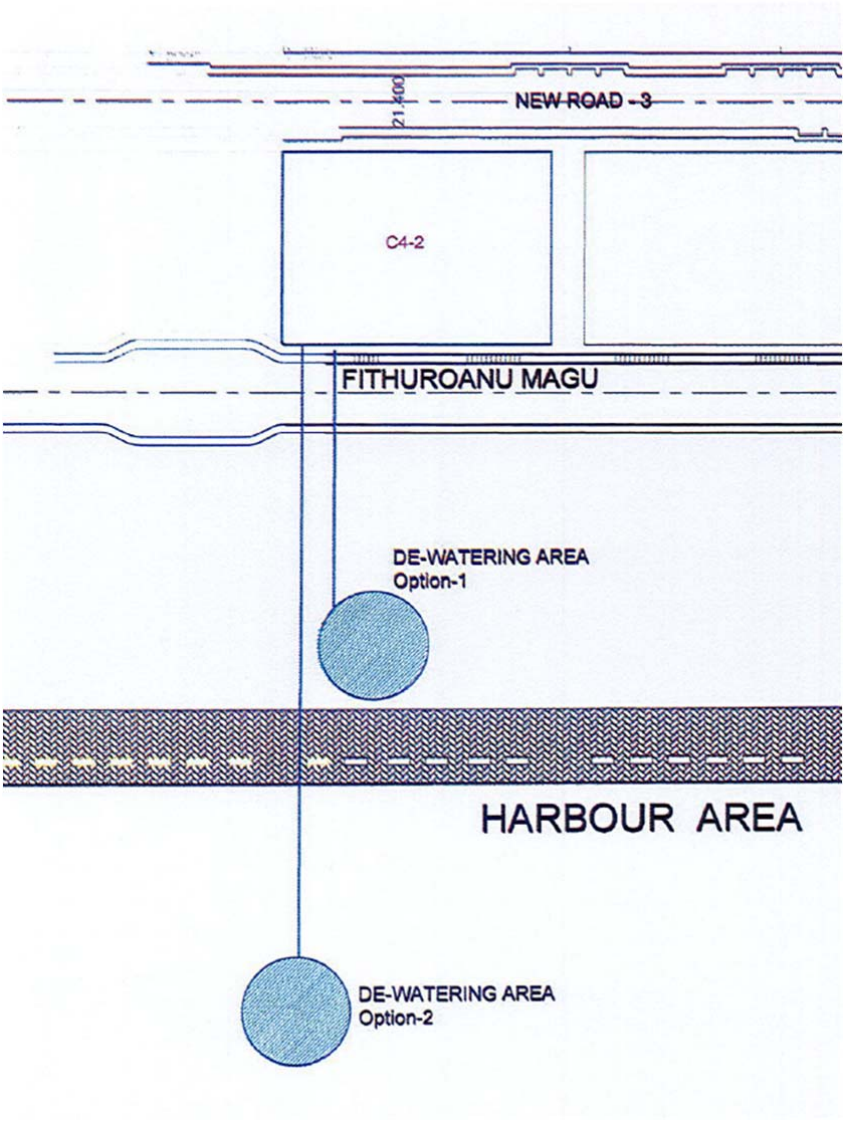


Figure 6 Dewatering location

Option 2 is the more likely scenario for this project. Option 1 may result in flooding in the area to an extent which may cause further issues. This can be prevented by excavating a large pit and dewatering to the area. However, it would involve removing a large number of vegetation and will also have to face mosquito growth issues in the vegetated area.

While undertaking option 2, of dewatering straight to the lagoon, a trench or catch pit will be made in the adjacent land initially, and only overflow will be allowed to be discharged to the lagoon. This is to prevent sedimentation as much as possible. A schematic of the methodology is given below.

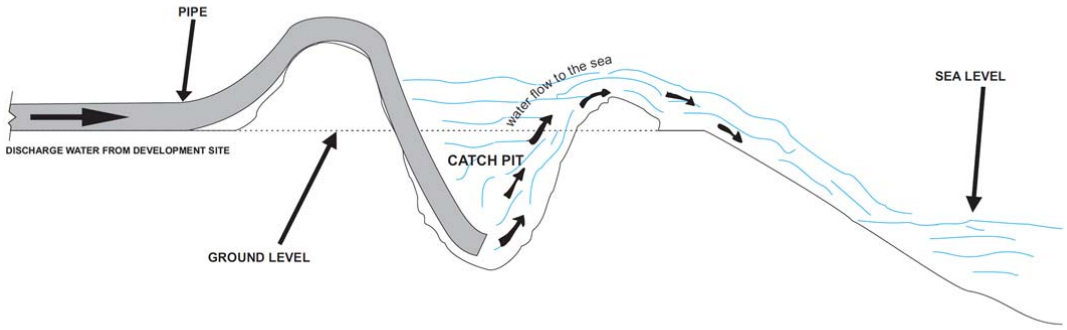


Figure 7 Dewatering methodology schematic

While laying the dewatering pipes, a concrete speed breakwater structure will be built as cover for the pipes that will be laid across the road. A similar structure built in Hulhumale' is illustrated in the figure below.

Figure 8 Speed breaker as protection for dewatering pipes

2.4 Building Foundation

For the foundation works, a raft foundation 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 stiffen 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.

2.5 Construction materials and machinery

The heavy construction materials to be used are

- 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 be prefabricated at company work yard or given to sub-contractors and transported to site. 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 public activities.

2.6 Utilities

Water and sewerage facilities will be provided by the MWSC water and sewerage network. Therefore, water will be desalinated water from the main supply. And sewage will be disposed untreated along the main water outfall.

Electricity will be provided by STELCO. STELCO has assured that they will be able to provide up to the requirements of the site. Backup generator will be placed on site during construction activities. A Sound Proof Diesel Generator, with specifications of 100 KW, 125/140 kva will likely be in place.

It is anticipated that the project site will require approximately 30 kW of power during the construction phase, while 25 m3 per day of desalinated water in anticipated during the construction stage of the development. It is expected that water will be drawn from the MWSC supply lines and stored at site to be used in large quantities for concrete works.

During the construction, the amount of wastewater generated would be relatively low compared to its generation during the operation phase of the development.

2.7 Project Management

The project is managed by the developer Muni Enterprises Pvt. Ltd. Laborers will mostly consist of expatriates from Bangladesh and India, who are already established with the contractor for previous construction projects. All labourers will be accommodated at company labour quarters at the allocated temporary site. There will be a consulting engineer hired in addition to an in-house site engineer and site supervisor to manage the project.

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, 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. Upon completion of foundation works, sand will be reused for back filling. Excess sand can be transported to a stockpile as instructed by HDC, likely to be in the northern areas of the newly reclaimed Phase 2.

It is estimated that during the construction phase, the project will generate wastes around 4 – 5 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 and temporary site demarcated area.

All waste generated during concrete works phase and finishing phase will be collected at the end of each work day and temporarily stored in the ground floor. 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 EPA. 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, waste chute will be made with space allocated in each floor with a dedicated 10 sqft area. Waste collection bins will be kept at ground floor waste collection area. About 115 sqft area will be dedicated for waste collection and sorting in the first floor. Waste will be transported to the first floor waste collection area from all the other floors via garbage chute. The chute will be mechanically cleaned and maintained.

The waste will be eventually collected by WAMCO vehicles daily and transported to the waste management site in Hulhumale'

2.9 Road closure and traffic re-routing

Road closure and traffic rerouting will not be necessary as part of this project, as there will not be any significant obstruction to the main road. The temporary site will be further away from the project site and therefore there will be some disruption during material transport. The tower crane will be fixed at the site. Batching plant will be at the site as well. Therefore, there will not be any need for road closures. There is ample land to work in the area without any road closures. Under any circumstances that the road needs to be closed, traffic can be diverted easily without causing any major disruption to the traffic flow.

Road closure or any significant traffic re-routing will not be necessary during dewatering works either as dewatering will occur at a site near the project location.

2.10 Work Schedule

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

Initially the architectural and structural design works had been completed and approved before undertaking the EIA. The is already been 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.

2.11 Safety on site

All precautions will be taken for safety of workers during the construction stage. Barricades, warning signs or devices will be placed on the road during casting or road works (connection of water lines and sewer lines) for safety of pedestrians and vehicles.

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.

Personal protective equipment will be available for all the workers, for falling objects, hazardous dust or chemicals, or high working areas. 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 9 Some safety signboards to be used on site

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 1 highlights the main inputs, while Table 2 highlights the major outputs.

Table 1 Main inputs from the proposed project

Input resource(s)	Estimated Quantity	Main sources of resource
Construction workers	Management staff – 2 Technical supervision – 4 Quality Control – 3 Design and supervision and development of shop drawing - 2 Labor – 100 Security Staff - 2	Contractor's permanent staff. Project staff. Labourers mostly registered workers from Bangladesh, India.
Machinery and equipment	Tower crane – 1nos Excavator – 20 tons Batching plant – 1nos Transit mixtures – 2nos Dewatering pumps – as per the requirement Power generators – 100kW 2nos Soil boring machine – 1nos Skid loader – 2nos 1.5 cube tipper 1nos Crane truck 1nos Scaffoldings – as per the requirement about 400 sets GI Pipes 50mm – 1000nos Arco jacks and based (U Formwork system Concrete stationary	Sourced from contractor's own equipment/machinery. If new machinery required, sourced from local rentals.

	pump with required length of pipe1 Material and passenger hoist – 2nos Bar bending machine – 4nos Pre stressing jacks – 4nos Grout pumps – 2nos Compressive testing machine – 1nos CBR testing apparatus – 1nos Rebound hammer – 2nos Water proofing membrane wielding machine – 2nos Arc wielding plants – 2nos Lighting generators – 2nos Silent hammer – 1nos Mobile crane 1nos Backhoe loader – 2nos Plastering Machine – 2nos Small concrete mixture – 4nos Mobile concrete pump (as per the requirement)	
Energy supply (during construction)	~30kW	From STELCO mains. Backup: Sound Proof Diesel

		Generator, with specifications of 100 KW, 125/140 kva
Cement (Ordinary Portland cement)	+2,000 bags	Procured from local supplier
Water	25 cbm/day	From MWSC pubic supply
Sand	+6,000 bags	Imported from abroad
Aggregates	+15,000 bags	Imported from abroad
Ply wood (12mm thick),	+1000 No.	Procured from local supplier
Timber (Hard wood)	+75000 No.	Procured from local supplier
Steel	+75 tons	Procured from local supplier
Painting Exterior (Seamaster, or Equivalent Emulsion) Interior (Seamaster or Equivalent Emulsion)	Not yet determined	Procured from local supplier
Masonry Blocks (300x150x150)	+50,000 No.	Developers material sourced from abroad
Hydraulics and Drainages	All the UPVC pipes and fittings shall be used high pressure pipes.	Procured from abroad

Table 2 Major outputs from the proposed project

Products and waste materials	Anticipated quantities	Method of disposal
Waste generated during construction	2-3 tons per day	Collected and sorted at site, and taken to Thilafushi waste collection area.
Waste water	30 litres/second	Water flow towards the lagoon on the west of hulhumale' via established MWSC system
Waste oil and grease	Minute quantities	Collected in used containers and transported to waste site
Air pollution	Debris in minute quantities	External influence minimised by site demarcation temporary boundary walls.
Noise pollution	>75 db(A)	Minimised by site demarcation barriers. Ear muffs and safety equipment for workers on site.
Waste generated during operations	2 – 5 tons per day	Collected on site and transported to waste collection site in Hulhumale'
Waste water generated during operations	165 tons per day	Via MWSC sewerage network

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 the project under consideration 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.

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.

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 per cent to 85 per cent. The country receives an annual average rainfall of 1,924.7mm in the central parts of Maldives, 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 4.

Table 3 Four Seasons of the Maldives

Seasons	Duration
South West Transition	March to April
South West	May to September
North East Transition	October to November
South West Transition	December to February

3.1.1 Wind

Wind is an important indirect process 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'. Wind is an important indirect process affecting the formation, development and seasonal dynamics of the Maldivian islands. 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 lose 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 easterly winds twice during the project cycle, in which the project site will be sufficiently sheltered.

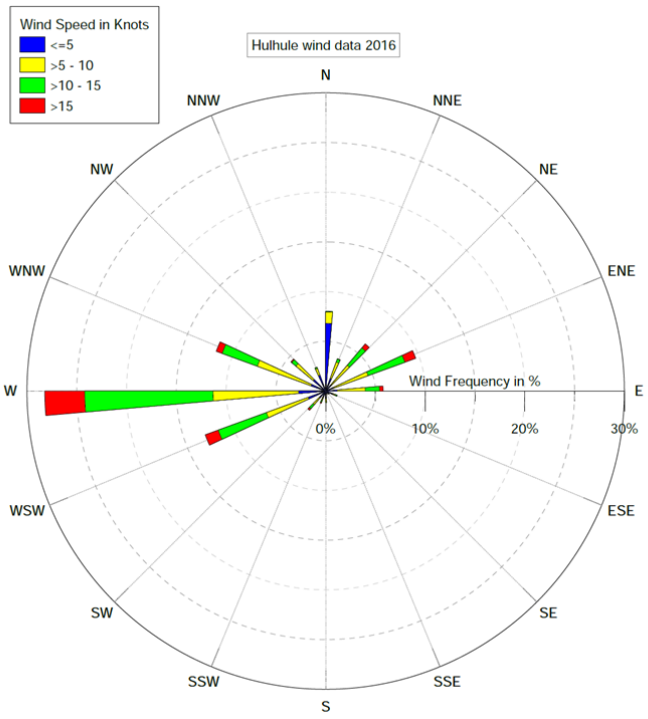


Figure 10 Wind rose diagram from Hulhule' weather station for 2016 (MMS, 2016)

3.1.2 Waves

Wave climate for the proposed site is not as important for a structure situated directly 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 near the west coastline, there is not expected to be any impacts due to easterly waves. However, during the project duration, westerly waves would occur. This will also not have any notable impact at the project site as it is situated at a sufficient distance away.

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. However, during the early stages of the project, this may be an issue and care should be taken during the dewatering process which may fall under the south west monsoon.

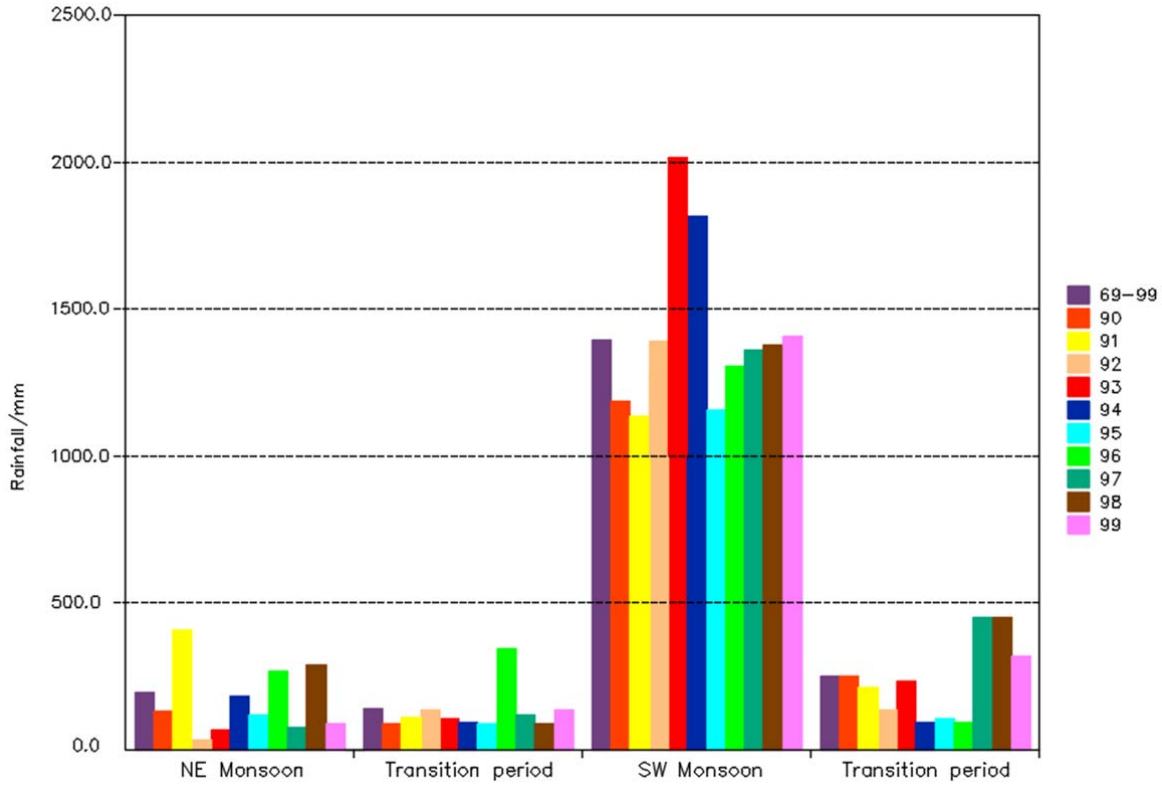


Figure 11 Annual Seasonal rainfall variation in Hulhule'

3.2 Roads and Existing structures

There are no other existing buildings on the same block as Lot C4-2. However there are proposed buildings in the area as previously stated. Similar buildings are proposed to be constructed on the right and left side of the building. The entire area will be a construction site for the next 2 years.

Condition of the road near the project location was observed to be good as is the general case for Hulhumale' roads. There were no significant cracks are defects that could be observed near the site, and none that could be an issue for or due to the proposed project. Speed breakers had been constructed to conceal the dewatering pipes which are laid across the road, which are also in good condition. The general conditions of the roads are shown in the following images.

Figure 12 General condition of the road near the project site

3.3 Vegetation

This is a site that has not been used for any purpose. The vegetation that was planted after reclamation of the island, has being cleared from this area by HDC and therefore there is no vegetation of note to be found at the site, except for grass and few bushes, and some *Fithuroanu* trees. Seven such trees are found at the site, which will be removed, and treated as waste as part of the project.

Roadside vegetation as seen from the following image will not be removed. The vegetation belt between the main road on the site is proposed to remain.

Figure 13 Vegetation within project area

Figure 14 Road side Vegetation near the project site

3.4 Traffic Survey

Traffic load at Fithuroanu Magu, where the proposed building is located was expected to be low to moderate relative to the busier roads of Hulhumale'.

There is generally very limited traffic going towards north from the ferry terminal along Fithuroanu Magu. Taking the Ferry terminal as a reference point, majority of the traffic flow directly towards east, while some traffic goes towards the south. Therefore, the no. and

frequency of vehicles in this area is low to moderate with respect to general Hulhumale' traffic. It is significantly low compared to general Male' traffic.

A traffic survey was undertaken on Fithuroanu Magu of the project site. The survey results can be seen below.

Throughout the survey, the traffic in the area was low with spikes when a ferry arrives.

The results of the survey are given below. In this regard traffic counts were carried out on 27th October 2017 from, 15:00 – 16:00 and 18:00 – 19:00 respectively. Summary of data recorded is provided in the following figure, alongside traffic survey results from Rainbow Oceanfront EIA, which was carried out on October 2016

Figure 15 Traffic flow from 15:00 – 16:00 (top) and 18:00 - 19:00 (bottom) in front of project site. (Red – Oceanfront, Green – FITRON)

As the results demonstrate, the traffic in the area can be regarded to be moderate to low. Motorcyles are the predominant mode of transport, as is the case in most of the areas in Greater Male'. There has been about a 40%increase in traffic from Octber 2016 to October 2017, i.e within an year. However, qualitatively, it can be regarded a roughly the same. The increase in construction activities in the area has resulted in some traffic.

3.5 Noise Pollution

Noise pollution can be an environmental and health hazard. However, there are 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 70dBA.

Figure 18 gives the noise levels measured at the selected sites in the vicinity of the project area. These measurements were taken during evening to include ambient noise from traffic that is present in the vicinity in general. As stated in the traffic flow section, this area undergoes low traffic throughout the day and especially during afternoon. Background noise pollution in the area is generally moderate.

Figure 16 Noise values near the project area

Generally, the average noise level was about 57 dB, and the lowest go down to 35 dB, which is very low. Spike maximum goes to about 80dB. Noise levels were almost entirely determined by traffic and construction works nearby, with the spikes occurring during loud occasional motorcycle or heavy vehicle transport. Seaplane noise was also a factor. During the quietest period of early morning and late night, noise levels are at below 40 dBA.

3.6 Water quality

Ground water in the location was sampled and sent for testing to MWSC in May 2017, Results of this test are shown in Table 5 below (see Annex 4 for results sheet).

It is noted that the groundwater quality of Hulhumale' has deteriorated slightly over the past several years due to extraction of groundwater for several building development projects such as buildings. However, the quality is much better relative to that of Male'.

Table 4 Groundwater quality

	Unit	Proposed Jausa site D2-1A	Proposed Oceanfront site C1-1	Proposed Muni building site C4-2
GPS Location	-	4°13'6.59"N, 73°32'22.36"E	4°13'17.93"N, 73°32'28.33"E	4°13'15.59"N 73°32'21.79"E.
Electronic Conductivity	µs/cm	2240	451	26800
pH	-	7.43	8.17	7.81
Salinity	‰	1.15	0.22	16.40
Temperature	°C	22.2	20.6	22.9
Total Dissolved Solids (TDS)	mg/L	1119	225	13400
Turbidity	NTU	2790	2.99	0.384

As seen from the results, the parameters from the project site shows very high electronic conductivity and salinity values compared to the previous tests in nearby areas. This is mostly due to the area enduring dewatering from other similar projects adjacent to the project site. Electrical Conductivity is a very important parameter with regards to

groundwater over extraction and increase in groundwater salinity. The other parameter values are not of significant concern.

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 island 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 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 the several location 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.

3.7.3 Education

Hulhumale' currently have 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. 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.

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 sometime in 2017. 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.

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.

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, and is not fully operation at the time of this study.

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.

3.8 Hazard Vulnerability

Maldives in general does not experience natural disasters and hazards on a frequent basis. 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, and 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.

Plot C2-4 being located west of the island, any impact at the project site will be moderate compared to those at eastern edges of the island. In an event of a disaster such as a tsunami, where the impact will be felt throughout the island, the project site will also be vulnerable, although it is not expected to be more vulnerable than sites on the eastern edge. It should be considered that the impact from the 2004 Indian Ocean Tsunami, was felt more on the eastern side.

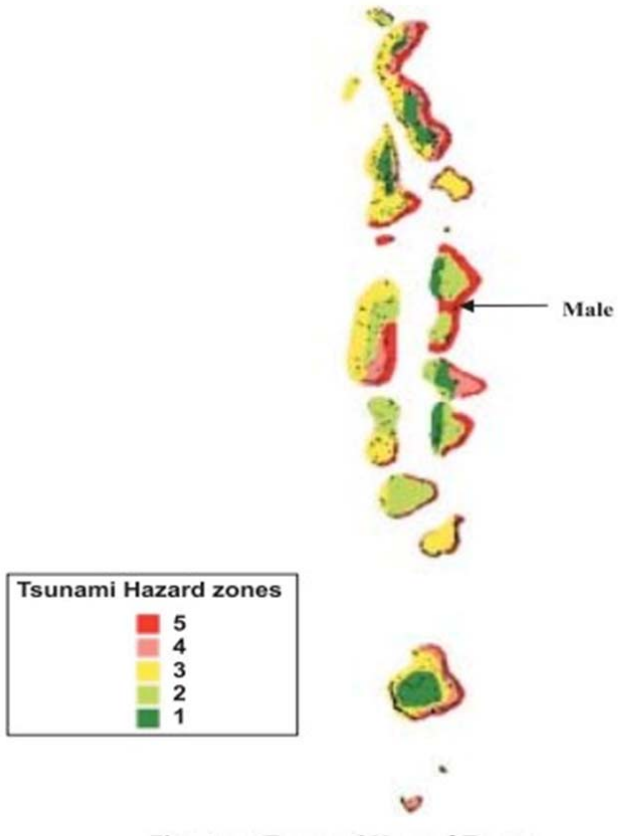


Figure 17 Disaster risk profile of the Maldives (UNDP, 2006)

4 Legislative and Regulatory Considerations

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 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 that are undertaken within 3 years in newly reclaimed areas in which the reclamation has been alongside existing natural island.

6. Projects that 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.

This amendment does not have much impact for this particular project due to the following factors

- The project does not involve any significant vegetation removal.

- The project does not involve construction of boreholes

- It has been well over 5 years since Hulhumale' has been reclaimed.

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 come in place. 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 a 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 sensitive land uses.

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 potentil neighbour.

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, waste management of the building will be handled by the building monitoring board members, whom are unanimously elected among the tenants. Waste management will likely be outsourced to a third party by the board, which is the intended process by the developer.

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.

Further, 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 is 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 found during he excavation of land. Sub-clause A states 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. 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. This is to ensure that the buildings are maintained properly and is not subject to decisions made by individual tenants.

Ministry of Housing and Infrastructure did inform that they are on the verge of drafting a new amendment to the condominium law, which will make it more detailed and thorough.

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.

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 the 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.

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
- Construction of the foundation
- Super structure construction and masonry works
- Waste management
- Establishment of utilities
- Building operation
- Building maintenance

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
- 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
- Traffic accidents due to dewatering pipe
- Generation of building and construction waste
- Impact on adjacent structures
- Health and safety of workers and neighbours
- Fire risks
- Generation of household waste during operational phase
- Building maintenance issue

The project impact area is the project site as shown in the figure 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 only receptors would be the traffic that pass by the site. The visual impact would be short in nature. The magnitude of impact will be very low and can be regarded as minor.

5.2.2 Loss of vegetation and impact on terrestrial habitats

The site has already been cleared by HDC. There is only a few *Fithuroanu* trees at the site, which will be removed. But this is not a notable impact. The rest of the area generally

consists of bushy vegetation. There will thus be no significant impact on vegetation. Care must be taken to avoid harming the roadside vegetation during construction activities.

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. This water will be disposed nearby the project site on land to be used for groundwater recharge. 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. Desalinated water from MWSC water network is widely used by the residents in Hulhumale'. The sudden increase in salinity in the area will not have any impact.

It is not expected that the impact will be significant on the surrounding infrastructure in accordance with the permit given by Environmental Protection Agency.

Considering the cumulative impact from many other similar development in the area, it can already been observed that the ground water quality has somewhat deteriorated with high electronic conductivity and salinity detected in recent tests. However, the freshwater lens will likely regain its shape once the dewatering phase for all the projects are completed.

5.2.4 Mosquito growth

Mosquito growth has become a significant issue at all major construction sites, due to potential spreading of dengue among other reasons. 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. 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.

5.2.5 Noise Pollution

As stated previously under Description of the Environment, ambient noise pollution in the area is low due to low traffic. 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 65dbA. The main receptors of this impact will be pedestrians and traffic that pass the area.

5.2.6 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.

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.

Considering cumulative impact, the area will have higher amount of dust and debris compared to background amounts.

5.2.7 Traffic Congestion

From the nos. obtained during the observation of traffic, and how the project has been planned this project will have low impact in the area. It is not expected that any traffic diversion would be necessary.

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.

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.

5.2.10 Impact on adjacent structures

There are no structures nearby at the time of construction. Therefore there will be no impact. However, other structures are proposed to be developed close to the project site, and some work is currently ongoing The foundation protection method ensures there will not be any significant impact.

5.2.11 Health and Safety of workers and neighbours

Health and safety of workers and neighbours 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 2.11, Section 6.12 and Section 6.13. Further accidents could occur due to falling objects, misplaced equipment and materials, temporary structures not properly fixed, etc.

An issue that has recently been identified is accidents occurring due to dewatering pipes laid across the roads, which would likely be the case for this project as well. Fithuroanu Magu is dimly lit, and when the concrete or steel casing protecting the pipe is not properly designed, it poses a hazard risk especially to motorcyclists.

5.2.12 Impacts during swimming pool operations

There are a range of potential impacts specific to swimming pools in residential buildings. The probability of such impacts would be doubled for this project as 2 swimming pools are

proposed. These broadly include physical impacts due to drowning and other accidents, microbial hazards, and chemical hazards.

Physical impacts include drowning due to poor swimming ability, impact against hard surfaces, extreme exposure to heat and UV, ingestion or inhalation of pathogenic bacteria, viruses, fungi, protozoa due to faecal contamination.

Microbial impacts include those related to both faecal and non-faecal derived micro-organism. There has been numerous viral illnesses. Swimmers may be exposed to bacteria from other swimmers due to excretion, vomit, A number of these bacteria may be shed by bathers or may be accumulated in biofilms on the surfaces of the pool structure

Chemical impacts can arise from malfunction of plant and associated equipment or over doze of chlorine. This hazard can be reduced, or eliminated, through proper installation and effective routine maintenance programmes. The use of gas detection systems and automatic shutdown can also be an effective warning of plant malfunction. If Ozone and UV radiation is used to purify pool water, there may be impacts due to leakages of ozone into the atmosphere from ozone generators and contact tanks. Ozone is a severe respiratory irritant (WHO 2006)

5.2.13 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/km^2. 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 will lead to congestion issues.

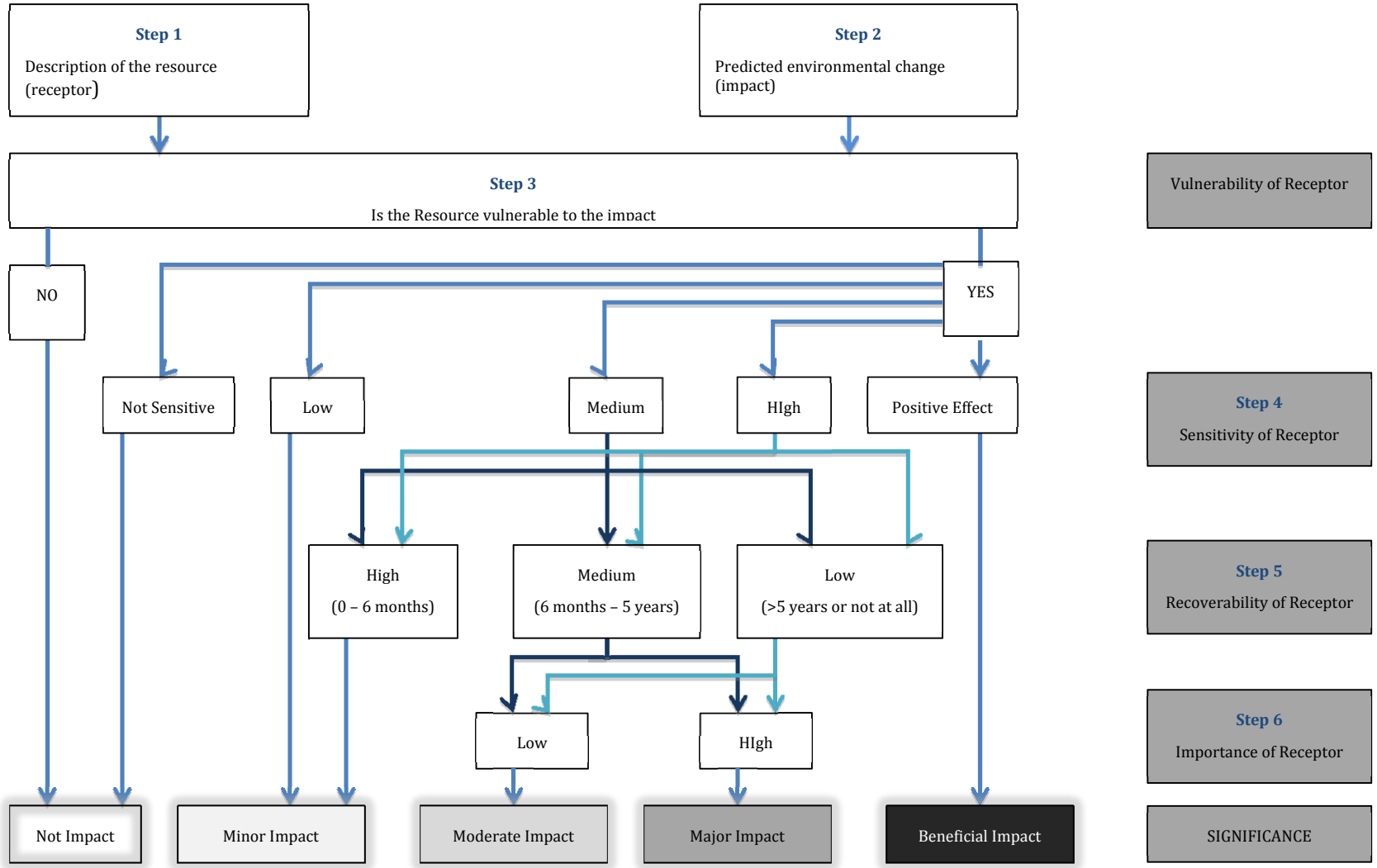
5.3 Impact Significance Assessment

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 6.


Step 1
Description of the resource (receptor)
Step 2
Predicted environmental change (impact)
Step 3
Is the Resource vulnerable to the impact
Vulnerability of Receptor
NO
YES
Not Sensitive
Low
Medium
HIgh
Positive Effect
Step 4
Sensitivity of Receptor
High
(0 – 6 months)
Medium
(6 months – 5 years)
Low
(>5 years or not at all)
Step 5
Recoverability of Receptor
Low
HIgh
Step 6
Importance of Receptor
Not Impact
Minor Impact
Moderate Impact
Major Impact
Beneficial Impact
SIGNIFICANCE

Criteria	Scale	Attribute
Sensitivity *How sensitive the receptor is to the impact*	-1	Positive Effect
	0	Not sensitive
	1	Low
	2	Medium
	3	High
Recoverability *How long it would take for the receptor to recover from the impact*	1	Short
	2	Medium
	3	Non-recoverable
Importance *The importance of the receptor to the environment*	1	Low
	2	Medium
	3	High
Spatial Distribution *Distribution of impact*	1	local scale
	2	regional scale
	3	global scale

Table 5 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 6 Analysis of potential impacts and their significance

	Nature of Impact		**Significance Evaluation Criteria**				
Potential Impact	Direct/Indirect	Immediate/Cumulative	Sensitivity	Recoverability	Importance	Spatial Distribution	Significance
Loss of visual amenity during demolition and construction	Direct	Immediate & Cumulative	1	1	1	1	4 (Minor)
Air pollution during demolition and construction	Indirect	Cumulative	2	1	1	1	5 (Minor)
Groundwater degradation during dewatering.	Direct	Immediate & Cumulative	1	1	2	1	5 (Minor)
Mosquito growth during dewatering stage, and at locations where structural construction is scheduled at a later stage	Direct	Cumulative	1	2	1	2	6 (Moderate)

Noise pollution during construction.	Direct	Immediate	1	1	1	1	4 (Minor)
Disruption of regular traffic and traffic congestion	Direct	Immediate	1	1	1	1	4 (Minor)
Generation of waste oil and building and construction wastes	Direct	Cumulative	2	1	2	2	7 (Moderate)
Impact on residents due to use of lead based paints	Direct	Cumulative	1	2	3	1	7 (Moderate)
Structural impact on adjacent structures	-	-	0	-	-	-	No impact
Health and safety of workers	Direct	Cumulative	2	3	2	1	6 (Moderate)
Health and safety of neighbours	Indirect	Cumulative	2	2	2	1	7 (Moderate)
Impacts from swimming pool operations	Direct/Indirect	Immediate/Cumulative	2	2	2	1	7 (Moderate)
Indirect contribution to alleviating congestion in Male'	Indirect	Cumulative	-1				Beneficial

Waste Generation during the operational stage of the project	Direct	Cumulative	3	2	2	1	8 (Moderate)
Indirect Economic impact on the community, by creating additional jobs for construction, landscaping and building maintenance	Indirect	Cumulative	-1				Beneficial

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.

In conclusion, the project will have minor to moderate impacts on the environment.

Compared to similar other developments in Hulhumale', the proposed construction is in a relatively remote area with very limited traffic. 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'.

6 Environmental Management and Mitigation Measures

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 there has been numerous similar developments in the same neighbourhood, similar mitigation measures are provided in this Section.

6.1 Loss of visual amenity during demolition and construction

Some impacts from demolition and construction generally arises due to poor project planning. To avoid loss of visual amenity and other such minor impacts, it is recommended that the project site be hidden to the public by means of a temporary boundary wall as soon as possible. Warning signs should be placed which states that only staff is allowed within the boundary wall. The wall height should not be less than 10ft, and it could be made of wood or roofing materials. More consumer friendly designs on the fencing/boundary wall could be used to reduce aesthetic impact, however is not necessarily recommended. It must be ensured that absolutely no waste or temporary storage of materials occur outside the project boundary.

6.2 Mosquito growth

As a mitigation measure, 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. This practice is already carried out by some contractors. 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.

Daily fumigation of the construction area is also recommended.

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 term.

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, during morning or at noon as to minimize the impact of noise to the park, shops, mosque. Works emitting noise at high decibels should not 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.

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 Impact on upcoming structures

For potential mitigation, soft/silent piling can be used, which would be approximately 6m of piles at regular intervals around the land plot for retaining the earth to a depth of 10 metres below the ground level. The piles would be driven into the ground to hold the boundary wall that would be constructed for the shoring of the foundation. As added horizontal protection, the compacted soil should be placed along the periphery of the construction area, preferably in gunny bags, to minimize stress and risk of overturning. The construction methodology adopted for the proposed project has been decided in order to minimise the impact on any upcoming buildings nearby. Unlike the deep pile foundation, the raft foundation is shallow and does not require deep piling.

Furthermore, it is recommended that dewatering will be timed when rainfall is less or there is no rainfall. This is to avoid rainwater percolating into the soil beneath the foundations. If rain does occur, measures should be taken to reduce the amount of water to the site, as the water particles may loosen the soil reducing its shear strength. Any impact on structures would be less as currently there is no other built structure in the area.

6.8 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.

With regards to protecting casing for dewatering pipes which acts as a breakwater, it is recommended to follow the engineering best practices when designing the covers. As such, it is recommended to maintain a ratio of 1:18 from height to width. Therefore, if a 12 inch pipe (0.3m) is to be laid, a width of 2.7m should be maintained in the speed breaker. This is to ensure cyclists can go pass the speed breaker without risks of an accident occurring. Moreover, the pipe area should be well lit using flood lights at night time, and the cover should be painted using reflective paint.

Further health and safety measures are given in Section 6.12 and 6.13.

6.9 Impacts from swimming pool operations

Impacts specific to swimming pool can be mitigated with proper maintenance and monitoring program in place. Some of the important things to consider include those listed below:

Ensure the swimming pool area is properly fenced, and children cannot enter the area without adult supervision.

- Keep the surrounding areas dry when pool is not in use.
- Ensure the depths are clearly marked.
- Put up warning signs near the pool area.
- To prevent entrapment, it is recommended that the velocity of water flowing from the pool through outlets should not exceed 0.5 m/s.
- There should be a minimum of 2 outlets to each suction line and should be sized and located such that they cannot be blocked by a bather's body.
- If there is a pool cover, better to have it strong enough to hold a child's weight and transparent so that any accident will be noticed.

- Maintenance officers should be trained for life guard duty and should be able to provide cardiopulmonary resuscitation (CPR).
- Limit pool users at any given time to cover less than 1/3 of the pool area.
- Pool maintenance and appropriate disinfection levels are easily overwhelmed by accidental faecal releases or sewage intrusion; therefore, the only possible response to this condition, once it has occurred, is to prevent use of the pool and physically remove the oocysts by draining or by applying a long period of filtration, as inactivation in the water volume
- Regular cleaning and maintenance of the pool, especially the surfaces. This include toilets, showers, pipe works changing facilities and pool surroundings.
- Bathers should be encouraged to shower before entering the water
- Using high levels of chlorine (up to 20 mg/l) as a shock dose as a preventive measure or to correct specific problems periodically. While it should not be used to compensate for inadequacies of other management practices, periodic shock dosing can be an effective tool to maintain microbial quality of water and to minimize build-up of biofilms and chloramines.
- Use Chlorine on a regular basis to disinfect water. Chlorine in solution at the concentrations recommended is considered to be toxicologically acceptable even for drinking-water; the WHO health-based guideline value for chlorine in drinking-water is 5 mg/l (WHO, 2004).
- No child (or adult) with a recent history of diarrhoea should swim.
- Parents should be encouraged to make sure their children use the toilet before they swim, and babies and toddlers that have not been toilet trained should wear waterproof nappies or specially designed bathing wear.
- Young children *should whenever possible* be confined to pools small enough to rain in the event of an accidental release of faeces or vomit.
- Lifeguards or maintenance officers should be made responsible for looking out for and acting on accidental faecal release/vomit incidents. (WHO 2006)

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 over 70 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 for one year. It is likely that the developer in operation afterwards as well. But the decision will be made by the steering committee selected among the tenants. A separate waste management plan should be made for the operations and submitted to EPA.

In addition to the general waste management method, 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. Images such as given in the Figure below could be used. This will reduce the total no. of waste produced and the system will be easier to manage ensuring sustainability.

Figure 18 Indicative image for recyclables and non recyclables (source: http://www.huonvalley.tas.gov.au/services/waste-2/)

Furthermore, it is recommended for the developer to put in place a system for hazardous wastes such as batteries and 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.

6.11 Summary of General mitigation management plan

Table 7 Mitigation management plan summary

Mitigation measures	Implementing Responsibility	Implementing Stage	Cost
Ground water degradation			
Dispose water to site as shown by HDC for ground water recharge	Project Engineer	Construction	65,000 MVR
Regular monitoring of groundwater condition on site	Project Engineer	Construction	750 MVR/test
Mosquito Growth			
Ensure still water does not remain on site	Site Supervisor	Construction	na
Put lids or pump out water from areas prone to water accumulation	Site Supervisor	Construction	10,000
Ensure dewatering process does not get suspended midway and fully complete dewatering	Project Manager	Construction	In project cost
Noise Pollution			
For workers, use of earmuffs at construction site.	Project Manager	Design	In project cost
Construction to be scheduled in such a way that noise pollution will be at a minimum to the public.	Project Manager & Site supervisor	Design and Construction	In Project cost
Ensure proper site demarcation and boundary wall condition before commencing such work	Site supervisor	Construction	In Project cost
Place noise barriers around noisy plants	Site Supervisor	Construction	15,000 MVR
Air Pollution			
Workers should be made to wear dust marks during dust sensitive work.	Project Manager	Construction	In Project cost
Place dust screens demarking the concrete mixer	Project Manager	Construction	In project cost
Daily water spraying and dampening to reduce spread of dust	Site Supervisor	Construction	In Project

to surrounding areas.			cost
Inspect and fine-tune all machinery and vehicles before work commencement to ensure harmful gases released to atmosphere are at a minimum.	Site Engineer	Construction	In Project cost
Cover building materials such as cement and sand, and should be contained during loading, unloading and storage.	Site Engineer	Construction	In project cost
Surfaces in the housing units should be painted with lead free paints.	Project Manager	Construction	In Project cost
Traffic Congestion			
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			
Re-use construction waste where possible.	Project Engineer	Construction	0
Metals are to be collected separately and handed over or sold to a metal recycling group.	Site supervisor	Construction	0
All waste should be segregated on site.	Site supervisor	Construction	5,000
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.	Site supervisor	Construction	In Project cost
Reusing formwork material as much as possible.	Site supervisor	Construction	0
Impacts due to swimming pool			
Keep the surrounding areas dry when pool is not in use.	Maintenance officer	Operations	Maintenance officer wages
Ensure the depths are clearly marked. Put up warning signs near the pool area.	Project Engineer	Design	In Project cost
To prevent entrapment, it is recommended that the velocity of water flowing from the pool through outlets should not exceed 0.5 m/s. There should be a minimum of 2 outlets to each suction line and should be sized and located such that they cannot be blocked by a bather's body.	Project Engineer	Design	In Project cost
If there is a pool cover, have it strong enough to hold a child's weight and transparent so that any accident will be noticed	Project Engineer	Design	In Project cost
Maintenance officers should be trained for life guard duty and should be able to provide cardiopulmonary resuscitation	Project Manager	Operations	Staff training costs

(CPR).			
Limit pool users at any given time to cover less than 1/3 of the pool area.	Maintenance officer	Operations	0
prevent use of the pool and physically remove the oocysts by draining or by applying a long period of filtration in events of accidental faecal release.	Maintenance officer	Operations	~1,000 usd
Regular cleaning and maintenance of the pool, especially the surfaces. This include toilets, showers, pipe works changing facilities and pool surroundings.	Maintenance officer	Operations	~500 usd
Bathers should be encouraged to shower before entering the water	Maintenance officer	Operations	0
Use Chlorine on a regular basis to disinfect water	Maintenance officer	Operations	~500 usd
Parents should be encouraged to make sure their children use the toilet before they swim, and babies and toddlers that have not been toilet trained should wear waterproof nappies or specially designed bathing wear.	Maintenance officer	Operations	0
Young children *should whenever possible* be confined to pools small enough to rain in the event of an accidental release of faeces or vomit.	Maintenance officer	Operations	0
Lifeguards or maintenance officers should be made responsible for looking out for and acting on accidental faecal release/vomit incidents. (WHO 2006)	Maintenance officer	Operations	Maintenance officer wages
Health and safety of workers and neighbors			
Undertake health and safety training for workers before project commencement.	Project Manager	Pre-Construction	In Project cost
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.	Project Manager	Construction	In Project cost
Encourage use of safety cloth and equipment at the site at all times. These include safety helmets, dust masks, conspicuous fluorescent cloths, earmuffs, safety shoes, etc.	Project Manager	Construction	In Project cost
Ensure there are no loose materials or loose components of the temporary or permenant structure	Site Supervisor	Construction	0
Ensure dewatering pipe cover area is well lit and painted using reflective paint. Ensure design of the cover does not pose a threat to motorcyclists.	Project Manager	Construction	25,000 MVR

Generation of household wastes			
Separate collection of recyclables and non-recyclables at the building and transport the waste	Maintenance officer	Operation	In Project cost
Collect hazardous wastes in separate containers.	Maintenance officer	Operation	In Project cost
Have a quarterly large waste collection schedule in place	Maintenance officer	Operation	In Project cost

6.12 Management of risk from accidents and hazards

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 8 Accident and Hazard Risks

Performance Consideration	**Risk Level**	**Risk Probability**	**Responsible Personnel**
Presence of hazardous substances, which impact on construction work eg: asbestos, SMF, hydrogen chloride, etc.	High	Low	Project manager, Site Supervisor
Sufficient access / space around new section or building for use of cranes, scaffolding during construction	Moderate	Moderate	Project Engineer
Construction workers will be protected from / proximity to HV electrical, high risk energy sources	High	Moderate	Site Supervisor
Traffic / pedestrian risks are minimised for planned loading & unloading for construction vehicles	High	Moderate	Site Supervisor, Project Manager
Neighborhood construction considerations eg:, school vicinity, site	Low	Low	Project Manager,

location			HDC
Roof design will reduce /eliminate the risk of falls from height during construction	Moderate	Moderate	Project Engineer
Sufficient space is planned for access & to install / major fixed plant or equipment or specialised equipment, plant rooms	Low	Moderate	Project Engineer
Floor loading design has been assessed by engineer to be able to accommodate heavy equipment / plant to be installed in future	Moderate	Moderate	Project Engineer
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	Moderate	High	Project Engineer
Stairs and balcony – edge delineation, slip resistant (SR) stair nosing, construction / design suitable for intended use, handrails, non-horizontal railings in balcony	Moderate	High	Project Engineer
Window positioning and solar glare	Low	High	Project Engineer
Safe Access to lighting fixtures to change fitting, bulbs	Low	Moderate	Project Engineer
Safe Access to plant rooms – locked, lighting.	Low	High	Project Engineer
Access to roof tops – safe access to within safety zone, minimised manual handling of material, equipment tools.	Low	Moderate	Project Engineer

Accessible window cleaning methods	Low	High	Project Engineer
Accessible roof cleaning methods	Low	High	Project Engineer
Accessible dirt or rubbish collection points	Moderate	Moderate	Project Engineer Maintenance Officer

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.
- **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.
- **Traffic / pedestrian risks are minimised for planned loading & unloading for construction vehicles.** While the risk level is high, the probability is given as moderate. It can be argued that the probability can even be low in this case as there were not much pedestrians using the area. As a mitigation measure to prevent any harm to the few pedestrians using the area, loading and unloading is recommended to take place using inner roads and not the main ring road. Signboards and barricades should be placed to discourage any pedestrians or traffic nearing the project site

6.13 Management of risk from fire

Risk of fire can be assessed using the following evaluation guide and assessment table

Severity	Likelihood	Fire risk rating
H – major fire involving loss of life	H – certain	3 – high risk

M – fire involving injuries to personnel and some damages to building	M – reasonably likely	2 – medium risk
L – any event of fire	L – very unlikely or never	1 – low risk

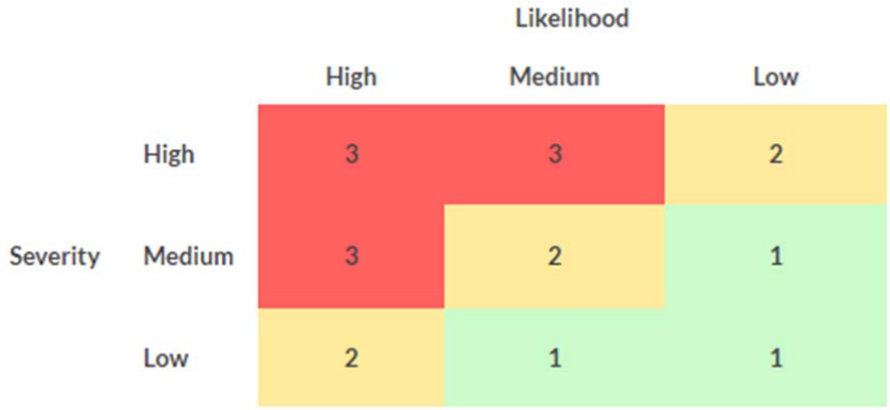


Table 9 Fire risk assessment

Description	Severity	Likelihood	Rating	Mitigation
Presence of highly flammable substances in premises. Eg. Paints, thinners, flammable gases, etc	M	H	3	Keep such materials in fire resistance containers Separate them from heat sources Keep minimum quantity at site Ensure all the containers are sealed or closed at all times Regularly monitor the area
Flammable liquids or gases stored in areas without adequate ventilation	M	M	2	Improve mechanical ventilation of storage area
Combustible materials stored, on display on in use in the area eg: paper, cardboard, packaging, fabrics, wood	L	H	2	Replace materials with safer alternatives. Store them in fire resisting stores Separate from heat sources

Combustible waste allowed to accumulate in the area such as paper, cardboard, wood shavings, dust	L	M	1	Ensure waste is removed on a daily basis Improve general housekeeping and removal of waste from units Train maintenance staff accordingly
Units contain foam filled furniture or is worn to the point that foam interior is exposed	L	L	1	Highly unlikely due to luxury nature of development.
Areas of walls or ceilings covered with combustible linings eg: carpet tiles, polysterne tiles.	L	L	1	Treat with fire resisting solutions or cover such areas
Combustible decorations such as seasonal decoration, artificial foliage or plants in use	M	L	2	Replace with non-combustible materials where possible Ensure such decorations do not remain on site after event is finished.
Storage of oxygen such as oxidising chemicals, oxygen cylinders, or piped systems	M	L	2	Will not be stored at site
Any work involving hot work processes such as welding or flame cutting, sparks, etc.	H	L	2	Ensure combustible materials are not present in work area Make arrangements such that hotel metal and sparks are safely contained Impose fire safety conditions on outside contractors
Any incineration or cooking being undertaken	M	M	2	Large scale incineration should not take place. Cooking areas should be cleaned regularly Ensure food cooking is not left unattended Make sure smoke detectors and fire extinguishers are placed in units

Smoking within the premises	M	L	1	Ensure no smoking within apartment units Enforce prohibition of matches and lighters near combustibles
Presence of light fittings near combustible materials	M	L	1	Give preference to fluorescent tubes or LED in place of tungsten or halogen bulbs
Electrical equipment and wiring issues	H	M	3	Repair or replace faulty or damaged equipment Fixed installations periodically tests Ensure all fuses are the correct rating. Ensure independent supervision of wiring
Electrical extension leads	M	M	2	Ensure extension leads are fully uncoiled Limit extension leads and adaptors Ensure extension leads are not overloaded Ensure flexible power cables are kept as short as possible and safety routed
Fire due to arson	H	M	3	Improve safety measures such as improving lighting, place CCTV cameras. Put up notice saying CCTV in operation Ensure areas of combustible materials (likely to be basement) is properly locked and secure. Ensure that all occupants are aware of alternative exits
Fire due to lightening	H	L	2	Install lightning protection system Extend fire detection to cover roof void Incorporate measures in emergency plan
Walls, cladding and ceilings of sufficient fire resistance	M	M	2	Approve materials from fire protection experts/authority Ensure use of fire resistant materials

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 the project should be taking place first of all. This is an important exercise to avoid such a scenario and 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' and the congested Greater Male' region as a whole.

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 10 Advantages and Disadvantages of the no project option

Advantages	Disadvantages
Will not lead to health and safety concerns at project site	Will not be able to alleviate the issue of people living in small crowded places in Male'

Will not cause any noise and air pollution at project location	Will decrease economic opportunities for construction companies and their employees
Will not cause any traffic disruptions	Will be a missed opportunity for upper class still looking for their individual housing options in Male' City.
Will offer greener quasi-natural public areas without built areas	Will hinder the development of Hulhumale'
Will leave some space in an area which may get congested in the future	Will lead to similar type of developments being dispersed around the island, against the established planning
Will not lead to production of waste at a concentrated site as the apartment building.	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 practicable, but involves losses to the developers and to the development of Greater Male' City and especially Hulhumale' in general.

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. Alternatives for components of the project are discussed further.

7.2 Project Alternatives

The Proponent initially decided that the best option not encompassing excessive costs would be adopted after evaluating different options. Therefore, the different alternatives for the project components were considered before finalising an option. Alternative options; mainly based on design and methodology for the construction are given below.

7.2.1 Project Location

Alternative locations are viable for this project, as the location cannot be changed under any circumstances. The plot was awarded to the developers by HDC, and at this stage changing the plot would not be an option.

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.

7.2.3 Project design

Several component 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 pubic parking space or visitor parking space would alleviate potential parking issues for Hulhumale', and especially in this area which could potentially be heavily dense during public events in the Central Park. Providing such a space in the building will therefore be an important service to the community. However, these will not be advantageous to the developer as potential space that could be sold will need to be used for other purposes. Such changes can only brought from a regulatory side based on the overall master plan for Hulhumale'.

Design for a rooftop garden area and incorporate green walls, which will contribute to making the city greener will be aesthetically pleasing while also providing additional insulation from heat, thereby reducing electricity costs. It will be a more environmentally friendly option. However, managing and maintaining such areas

would be difficult and costly. This would in turn increase the monthly maintenance cost of the building.

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. Incorporating such new appliances will increase the initial cost of the project. However, on a long term costs will significantly reduce. This may not be particularly advantageous to the developer. Rather the benefits will be to the tenants and will in general make the development more sustainable.

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

7.2.4 Building maintenance

Currently the proposed plan is to lease out space from within the building area for a convenience store and restaurant/café, and finance maintenance works from the revenue generated from leasing out these areas. This is an innovative method in Hulhumale', which only one other developer is pursuing and would free the tenants from the burden of having to pay extra charges each month. More importantly, this ensures consistent maintenance can be undertaken and will not depend on the tenant's compliance.

The alternative is to follow the general process of taking monthly fee from the tenants and utilising this total amount for monthly maintenance works. This is the usual system. However, it carries with it the risks of non-compliance by some tenants leading to the process being unsustainable.

7.2.5 Foundation

A deep pile foundation is an alternative to the raft foundation proposed, which will likely provide more stability to the 12 storey structure in the long term, and can be argued to withstand to more extreme environmental conditions. However, the methodology have 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'. However, it can be considered for this development, although with 12 storeys over a large land area it is not a necessity. Moreover, due to ongoing and upcoming buildings closeby, the proposed foundation method is recommended.

8 Stakeholder Consultations

Stakeholder consultations were carried out with the construction management team of MUNI Enterprises Pvt. Ltd. Officials from the Environmental Protection Agency were met for consultation during the stakeholder meeting.

Further consultations were carried out with the Project Manager for the project, and other stakeholders such as STELCO, WAMCO, MWSC, HPA, Ministry of Housing and Infrastructure. General discussions relevant to all similar developments that are currently being undertaken in Hulhumale' were discussed previously in face to face meetings and specific information on this project was also shared via email.

Table 11 Important stakeholders met during the consultation process

Name	Office	Contact	Designation
Ali Shaathir	Muni Enterprises Pvt. Ltd.	shaathir@muni.com.mv	Project Manager
Zeeniya Ahmed	MHI	zeeniya.ahmed@housing.gov.mv	Deputy Director General

Aminath Shaufa	HPA	shaufa@health.gov.mv	Public Health Program Cordinator
Aminath Rifqa	MWSC	aminath.rifga@mwsc.com.mv	Business Development Officer
Azzam Ibrahim	STELCO	+960 7782574	Senior Engineer
Ismail Ubaid	WAMCO	Ismail.ubaid@wamco.com.mv	Facilities Manager

8.1 Consultations with the Developer

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

The developer informed that since they are among the last parties in the wider mixed residential building program, they have considered various means to make the apartments attractive to the market. As such, one significant step they have taken is measures to reduce maintenance fees taken from tenants. The developer intends to lease out some space from within the building to raise money to significantly offset the fees that would otherwise need to be taken from tenants.

Additionally, the developer intends to provide affordable housing to middle class through this development. The developer stated that they do realise that the surrounding area is a full construction area and that they will be concentrating all their equipment and machinery to their project site and temporary site at all times. The developer had not finalised a contractor at this stage.

8.2 Ministry of Housing and Infrastructure

Consultation with the Ministry personnel was held at a more general level discussing all the developments in Hulhumale' and the regulation and guidelines for such development, which had occurred in October-December 2016. With regards to this specific project, discussion was held on 15th May 2017.

The Ministry had previously informed that under recent changes, Male' City Council currently has no role to play in infrastructure developments in Male'. The unit that was undertaking building and land approvals now come under the Land and Building Department under the Ministry of Housing and Infrastructure. The structure and architectural works for the project are to be undertaken by consultants registered at the Ministry. The foundation protection method along with other structures will need to be certified by these registered licenced consultants.

The Ministry had also informed that they do not have any further concerns if the necessary approvals for the project have been obtained. They also further informed that the Ministry does not give approvals for such projects undertaken in Hulhumale'. HDC is solely responsible for giving planning approvals and detail drawing approvals. It was informed that Hulhumale development falls under 'Binaaveshi Qavaaidh' Clause 2.2.4, which refers to islands that are developed as a special project. Clause 3.1.3 of the Regulation states Planning for such islands will be carried out by the developer of the island, which in this case is HDC. It was further informed that Hulhumale' is also by law regarded as a land owned by HDC.

The Ministry informed that the Building Act has now been published. However, the building code will be published at a later stage. Then building standards for buildings in Hulhumale' would still be set up by HDC, with HDC required to follow the clauses in the Code.

8.3 State Electric Company (STELCO)

All similar projects being undertaken within the same timeline were discussed with STELCO in a face to face meeting held during October 2016. Project specific details were initially communicated on 15th May 2017. Feedback from STELCO was received on 11th June 2017

STELCO was consulted as the main power supplier for Hulhumale' for residential, industrial and commercial areas as well. The company had previously informed that they are not regularly updated on the upcoming projects, although they are aware of the proposed project.

STELCO had informed that they can provide the electricity connection up to 300A. For more than 300A, the owner or developer has to install a transformer at site with his/her own cost, whether it is a temporary or permanent connection. The transformer should be kept at a secure location. But should be accessible to STELCO staff at all times.

STELCO informed that connection can easily be made to the site as it has already been provided to similar developments nearby.

8.4 Male' Water and Sewerage Company (MWSC)

Meeting with MWSC was held to discuss all similar developments in Hulhumale' on 4th December 2016. The specific project was informed via email as was agreed in the meeting. Status of water and sewerage line was informed by MWSC via email on 15th May 2017. MWSC had provided feedback on 21st May 2017

MWSC provides water and sewerage services to the whole of Hulhumale'. MWSC also provides dewatering services to similar developments in Male'. However, it was informed that for such developments based in Hulhumale', currently MWSC does not provide any such services.

It was previously informed on the difficulty in obtaining valid information in a timely manner on the new developments in Hulhumale'. MWSC team had shared a map where the most immediate new developments were noted.

With regards to the proposed site MWSC informed that sewer network and water network both exist in the propose project location area.

8.5 Health Protection Agency (HPA)

HPA was initially met concerning all similar developments in November 2016. Project specific information was provided and discussed as previously agreed along with other similar developments on 15th May 2017.

HPA had informed that information regarding upcoming projects was not shared with them previously. 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 was regarding mosquito control at construction sites. They informed that a survey had been undertaken recently in Male' and the condition were quite bad at most site and they had notified numerous developers on the issue of mosquito growth at their sites. Details of the survey have not been published at the time. HPA informed that they do carry out inspections at site, and that some work had already been undertaken in Hulhumale' as well.

HPA further stated 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.

HPA informed that they did not have any further recommendations specific to this project as was informed on 15th May 2017.

8.6 Waste Management Corporation ltd. (WAMCO)

WAMCO was initially met on 9th February 2017. They informed that all waste management 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 they were at the very early stages then and had not resumed full operations in Hulhumale'. Currently WAMCO operations have initiated. Specific information regarding this project was given to WAMCO on 15th May 2017.

Regarding construction waste, WAMCO advised to undertake the same process as had been carried out thus far. For the contractor to collect and sort waste at their site and transfer to Thilafushi on a regular basis. Organic household type wastes can be transported to the waste center in Hulhumale'.

Regarding waste generated post construction, WAMCO informed that they will likely have a good setup running in Hulhumale' at that stage. They are currently planning to pick up waste from sites on a daily basis. At this stage, WAMCO is inviting residents to sign up for their waste collection services.

The waste collection nodes in the residential area that currently exists will be removed soon and all waste will be collected in the vehicles as per the time table that will be formulated soon. They informed that waste have to be sorted at the buildings to at least recyclable and non-recyclable wastes. Separate bins must be in place at the waste collection area in the buildings. Large bulky wastes will be removed on demand. A call and pickup service will be provided to collect such wastes. There are also plans to have a scheduled monthly or quarterly round of picking up bulky wastes from households and apartment buildings such as these. WAMCO did not have any additional comments specific to this project.

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 and mitigation methods.
- 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. As required in the TOR, the monitoring is to take place during the construction phase once every 3 months, and then on an annual basis for 2 years. Further monitoring will be undertaken by the developer as long as building monitoring and maintenance is under their control. 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 the Annex 5.

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. To carry out field water testing, especially for swimming pool water quality, such equipment should be built into the system or procured.

The costs given in Table 11 and Table 12 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

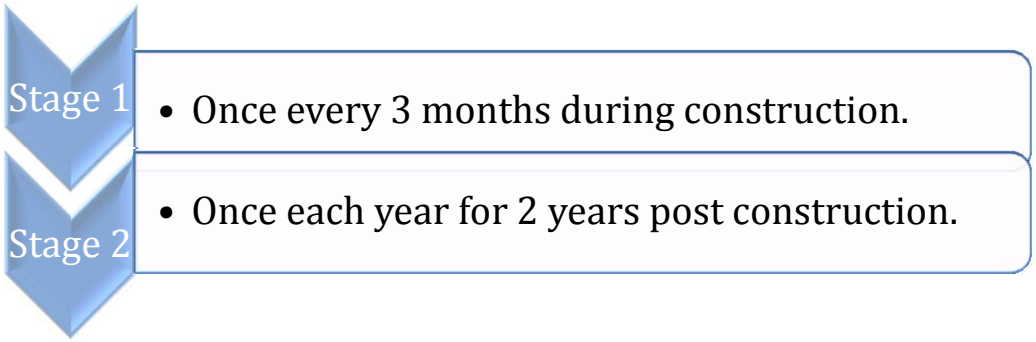
investigated monthly and quarterly and therefore hiring a consultant for each occasion may not be feasible and practical.

Waste monitoring and accident monitoring will only be possible to be undertaken by in house maintenance team. 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
- 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 salinity at project site
- Determine number, type and respective quantity of waste produced within the past quarter. Assistance from the contractor's project management team will

be required. Waste types and respective quantities present at site during inspection should be noted at each quarterly 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 during the same times.
- 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.
- Determine complaints or issues raised by the neighbouring development.

Stage 2

- Ground water quality for pH, temperature, electronic conductivity, total hydrocarbon and salinity at project site
- Water quality at the pool for pH, temperature, electronic conductivity, chlorine, total coliform and faecal coliform. It should be coordinated with the maintenance office to log the parameter values on a daily basis.
- 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. 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.
- Noise measurement
- Survey the traffic within the same area as undertaken for this EIA

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 12 Estimated costs of Stage 1 Monitoring Programme

Item No.	Details	Unit cost (US$)	Frequency	Total (US$)
1	Field allowance for 1 consultants for 1 day	75.0	8	600.00
2	Surveying and monitoring equipment depreciation	50.00	8	400.00
3	Laboratory charges	110.00	8	880.00
4	Compliance reporting (annual report)	800.00	2	1600.00
	Total			**7,430.00**

The monitoring is for a period of 2 years (duration of construction phase), where data is collected quarterly.

Table 13 Estimated costs of Stage 2 Monitoring Programme

Item No.	Details	Unit cost (US$)	Frequency	Total (US$)
1	Field allowance for 1 consultants for 1 day	150.00	2	300.00
2	Surveying and monitoring equipment depreciation	50.00	2	100.00
3	Laboratory charges	110.00	2	220.00
4	Compliance reporting (annual report)	1000.00	2	2000.00
	Total for 5 years			**2620.00**

This monitoring is for a period of 2 years, where data is collected annually. Therefore for each year the cost will be approximately USD 1,310.00 not taking into account any effects of inflation and other such economic scenarios.

Considering the 2 stages of monitoring, monitoring costs in the first year would be approximately **USD 3,715.00**. 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

10 Conclusion

There have been numerous such projects based in Hulhumale' recently of which the environmental impact assessments are quite similar. As the existing environments are similar, the expected impacts and mitigations are comparable as well. The development areas generally do not have any significant vegetation and there are virtually no residences nearby that will endure direct impacts from the project during the construction stage. Therefore, this study shares many traits and contents with similar EIAs that have recently been done.

The project can be regarded to complement the larger program by Housing Development Corporation to establish mixed residential buildings in Hulhumale'. Apartments in the proposed building are generally targeted towards higher income market. 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 mid to luxury options, it is intended that this will remove the high-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 deteriorating water quality, very likely due to recent extraction of water in nearby sites. 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 in the near future, with some of those sites already commencing excavation and dewatering works.

During the construction stage, which takes about 2 years, health and safety standards of the workers at site, and waste generation is the only major areas of concern. With proper planning and project management, this can be easily mitigated. Waste is the main concern during the operational stage of the project as well, in addition to impacts from swimming pool usage and general fire risks. Although this will be developed as a condominium with multiple tenants owning the rights of the building, it is arranged in such a way that the developer will initially take the responsibility of maintaining the building. The proposed development intends to reduce monthly maintenance fees from tenants by raising finances by leasing out space from within the building. This is a much more progressive and sustainable method which ensure that building maintenance would not be hindered as tenants are more likely to pay small maintenance figures. However, with regards to legislation, the condominium

law needs an urgent update to ensure the proposed building and many other similar structures currently being built are maintained and the projects sustainable for the long term.

Regarding alternatives, there are no viable alternatives available for the project with respect to location. The proposed location is in an area already designated for such mixed residential apartment building complexes. 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. The same applies to the height of the building. Other alternatives including material, foundation type, and construction methodology are not necessarily recommended. Recommendations had been made to proceed with the project as planned.

Generally, the impacts from this project is low as it is being undertaken in a currently rarely used area in Hulhumale'. Therefore, there isn't much receptors of any potential impact. Any impact as highlighted in the project can be mitigated. The socio-economic benefits to Greater Male' City from projects such as these is high. It also provides additional housing opportunities, which would contribute to alleviating the housing issues in Male' City. The area designated for the project was always going to endure general developmental impacts, and it was always the intention that the area will be developed, as per the masterplan for Hulhumale'. Additional impacts that pass through the area has been highlighted in the report and mitigation measures are given. Therefore, after consideration of all these viewpoints, it is recommended for the project to proceed as planned after incorporating the mitigation measures given in this study with the commitment to implementing the monitoring plan.

11 References

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Annex 1 – Terms of Reference

No: 203-EIARES/PRIV/2017/711

Extended Terms of Reference for Environmental Impact Assessment for the Proposed Mixed Residential Apartment Building Development Project at Hulhumale', Plot C4-2

The following is the Terms of Reference (ToR) (Extended) following the scoping meeting held on for undertaking the EIA of the Proposed Mixed Residential Apartment Building in Plot C4-2, Hulhumale. The proponent of the project is Muni Enterprises Private Limited.

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, demolition waste, and green waste where applicable.

7. Dewatering plan
8. Description of any underground structures such as basement or wells.
9. Plans for road closures during construction
10. Details of vegetation clearance if any
11. Use of any energy conserving utilities
12. Details of the backup generator to be installed
13. Estimated consumption of water and electricity and their sources
14. Fire Emergency Evacuation Plan

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;

Task 2. Description 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.

Physical and Biological Environment
Noise levels in the vicinity of the site including any noise sensitive location
Traffic flow (size and direction) around the project site
Vegetation in the project site and major trees around it, if any
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 buildings if any
Condition of the surrounding roads
Existing structure/uses of the proposed site
Public facilities nearby

Socio-economic Environment
Demographic data for greater Male' 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:

- Approval from the Housing Development Corporation

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
- Noise, fugitive dust, traffic obstruction and other impacts related to traffic due to the project
- Impacts due to generation of waste
- Potential impacts of the development on adjacent properties and 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

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, The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes. Consultations must be done with

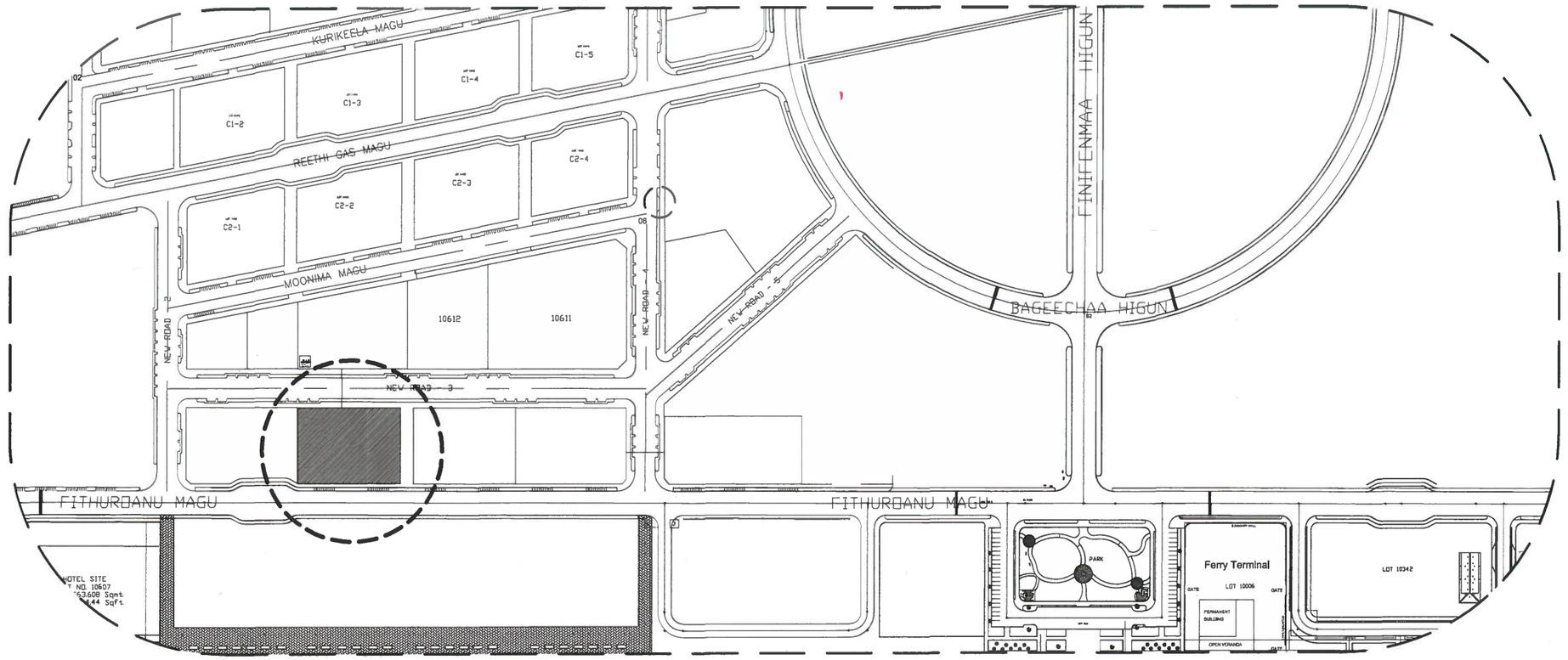
1. MWSC
2. STELCO
3. WAMCO
4. Housing Development Corporation
5. Maldives Energy Authority

<u>Presentation</u>- 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 f or 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

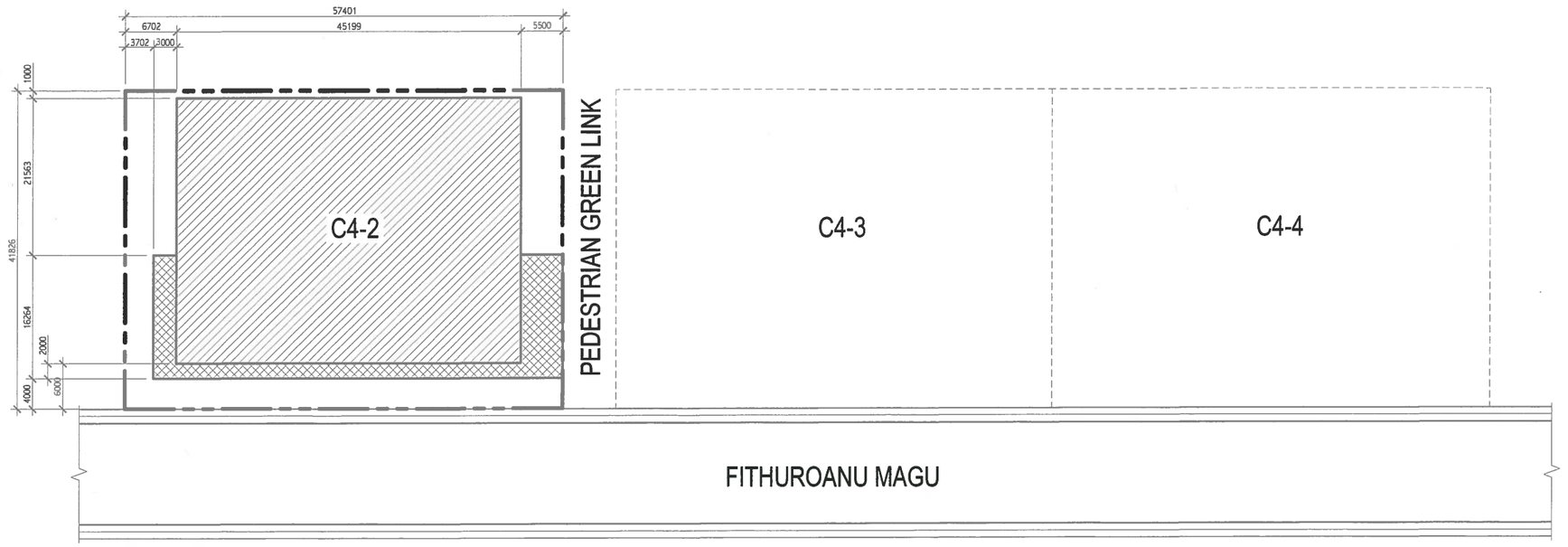
<u>Timeframe for submitting the EIA report</u> – The developer must submit the completed EIA report within 3 months from the date of this Term of Reference.

17th August 2017

Annex 2 –Approved Site layout and Concept



LOCATION PLAN
SCALE 1:2000



SITE PLAN
SCALE 1:500

APPROVED
Housing Development Corporation Ltd.
Date: 05/04/17
Name: Ismail Shan Rasheed.
Sign:

Revision	Date	Drawn By	Checked By
-	-	-	-

Client :
MUNI ENTERPRISES PVT LTD

Project Title :
MIX RESIDENTIAL DEVELOPMENT

Building Name :
C4-2

Drawing Title :
SITE PLAN

Scale :
1:500

Discipline :
ARCHITECTURAL

Stage :
DETAILED DESIGN

Drawn By : JAY-AR
Checked By : IMRAN
Date : 17 OCTOBER 2016
Design By : SHAMMA

Drawing Number :
11-101

Revision Number :
R01

File Name :
C42-11-101R01.dwg

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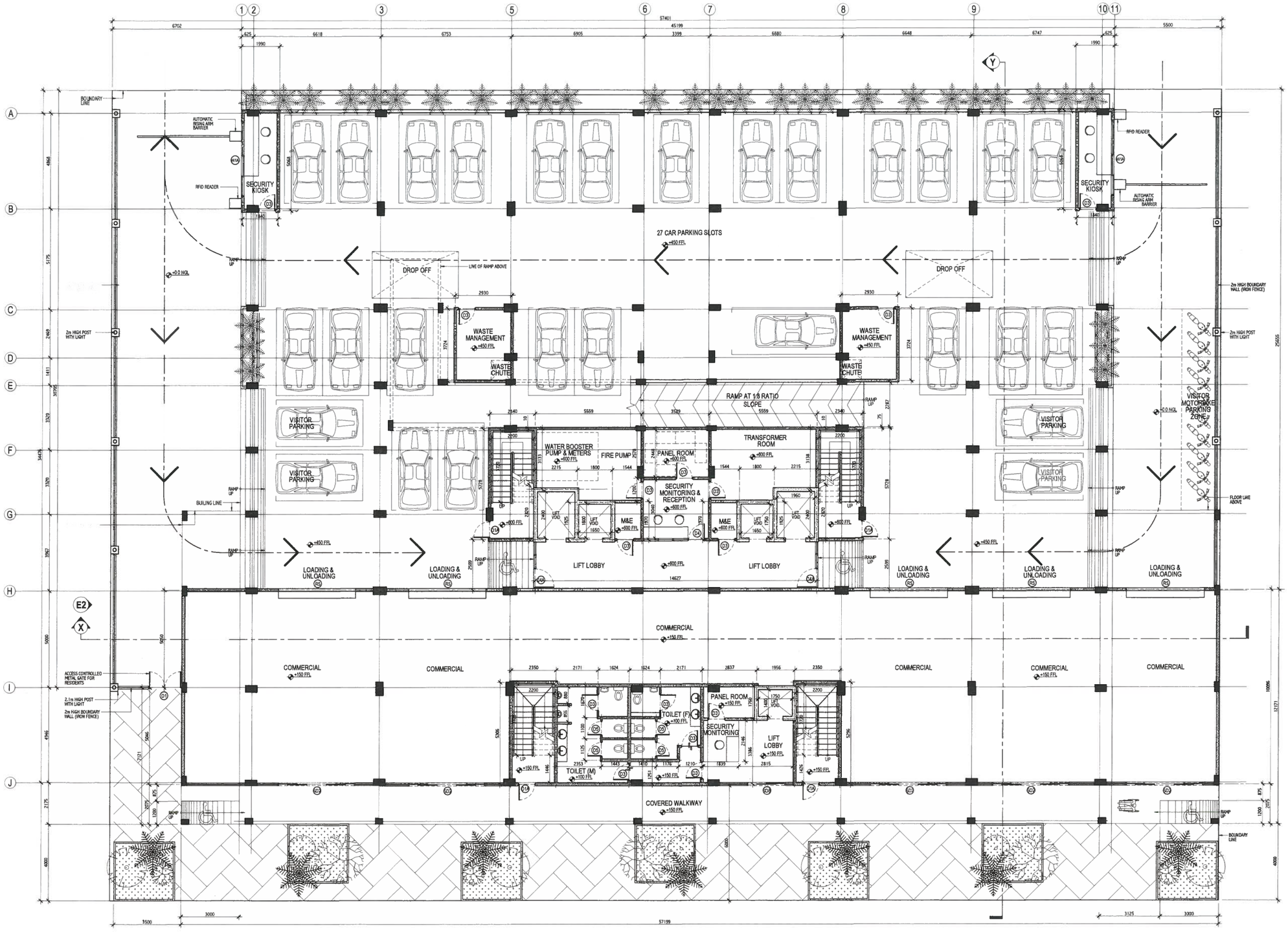

LEVEL-01 FLOOR PLAN
SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

NOTE:
ALL TOILETS WILL HAVE MECHANICAL VENTILATION

Revision	Date	Drawn By	Checked By

Client
MUNI ENTERPRISES PVT LTD

Project Title
MIX RESIDENTIAL DEVELOPMENT

Building Name
C4-2

Drawing Title
LEVEL-01 FLOOR PLAN

Scale
1:100

Discipline
ARCHITECTURAL

Stage
DETAILED DESIGN

Original Drawn By: JEFF
Checked By: ISIRAN
Date: 17 OCTOBER 2016
Design By: SHAMMA

Drawing Number
11-102

Revision Number
R06

File Name
C42-11-102R06.dwg

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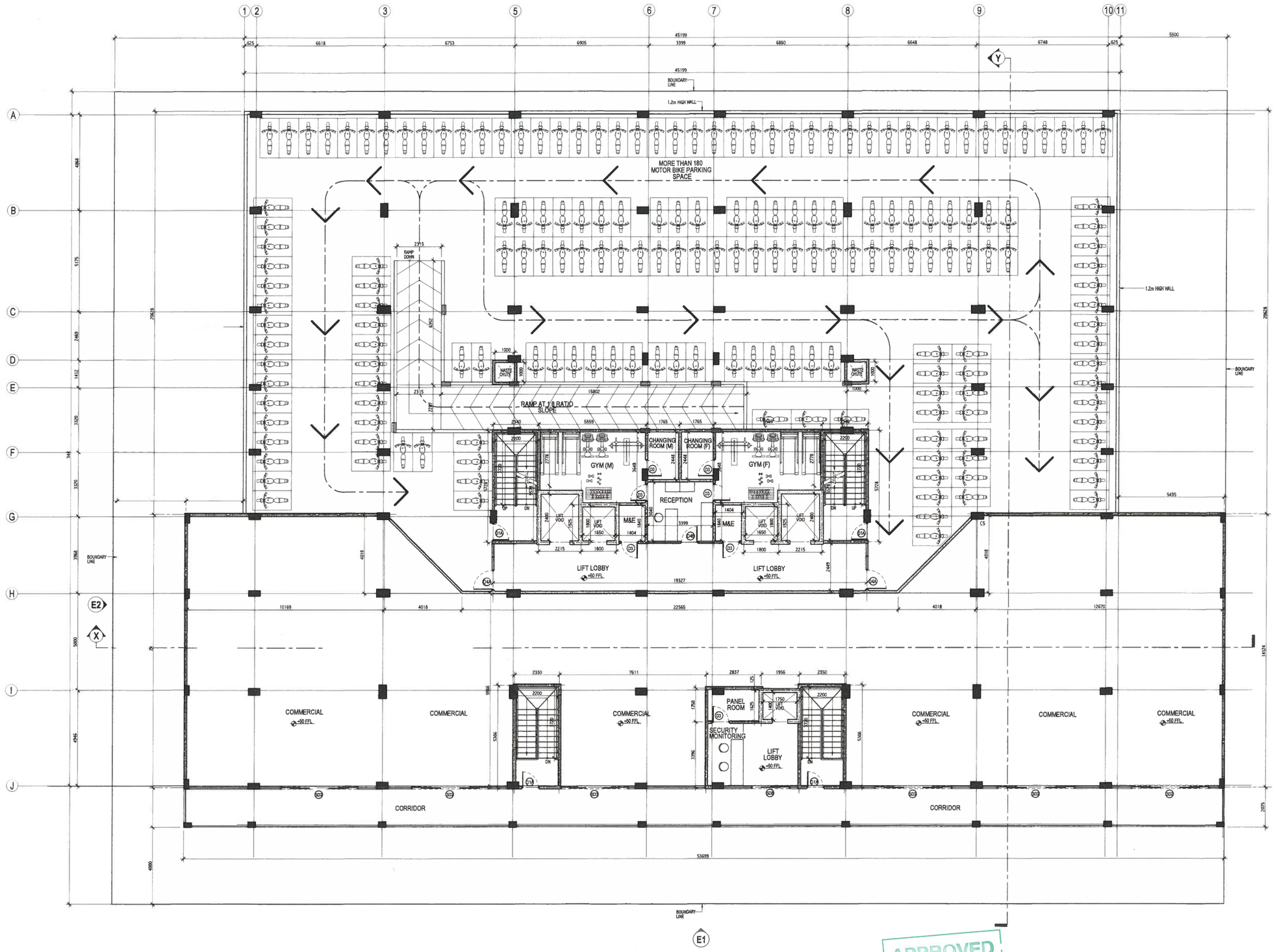

LEVEL-02 FLOOR PLAN
SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By
-	-	-	-

Client
MUNI ENTERPRISES PVT LTD

Project Title
MIX RESIDENTIAL DEVELOPMENT

Building Name
C4-2

Drawing Title
LEVEL-02 FLOOR PLAN

Scale
1:100

Discipline
ARCHITECTURAL

Stage
DETAILED DESIGN

Original Drawn By: JEFF
Checked By: IMRAN
Date: 17 OCTOBER 2018
Design By: SHAMMA

Drawing Number
11-103

Revision Number
R01

File Name
C42-11-103R01.dwg

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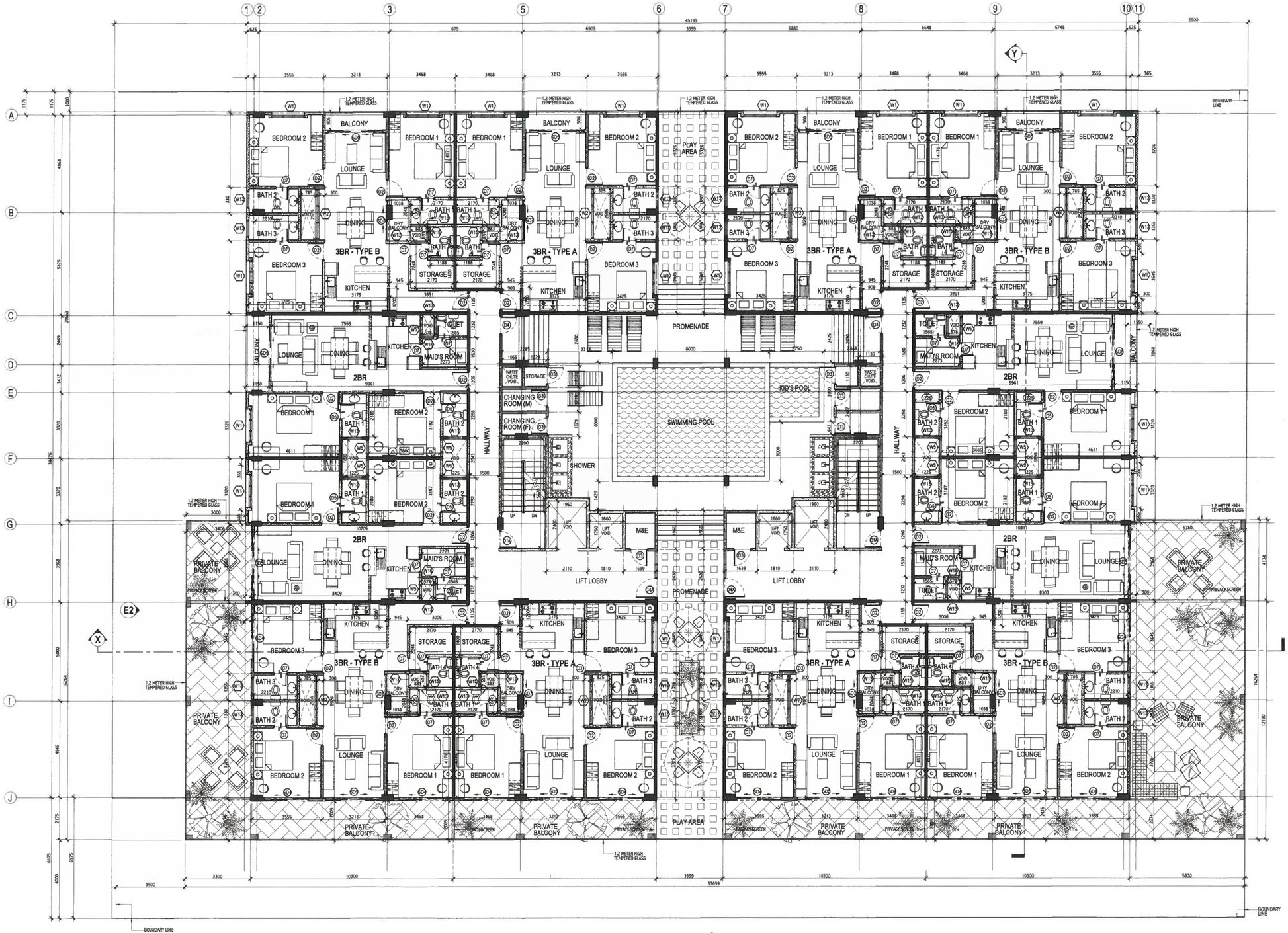
GEDAR CONSULTING (P) LTD



LEVEL-03 FLOOR PLAN
SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By

Client
MUNI ENTERPRISES PVT LTD

Project Title
MIX RESIDENTIAL DEVELOPMENT

Building Name
C4-2

Drawing Title
LEVEL-03 FLOOR PLAN

Scale
1:100

Discipline
ARCHITECTURAL

Stage
DETAILED DESIGN

Original Drawn By : BONJ
Checked By : IMRAN
Date : 17 OCTOBER 2018
Design By : SHASMIA

Drawing Number
11-104

Revision Number
R01

File Name
C42-11-104R01.dwg

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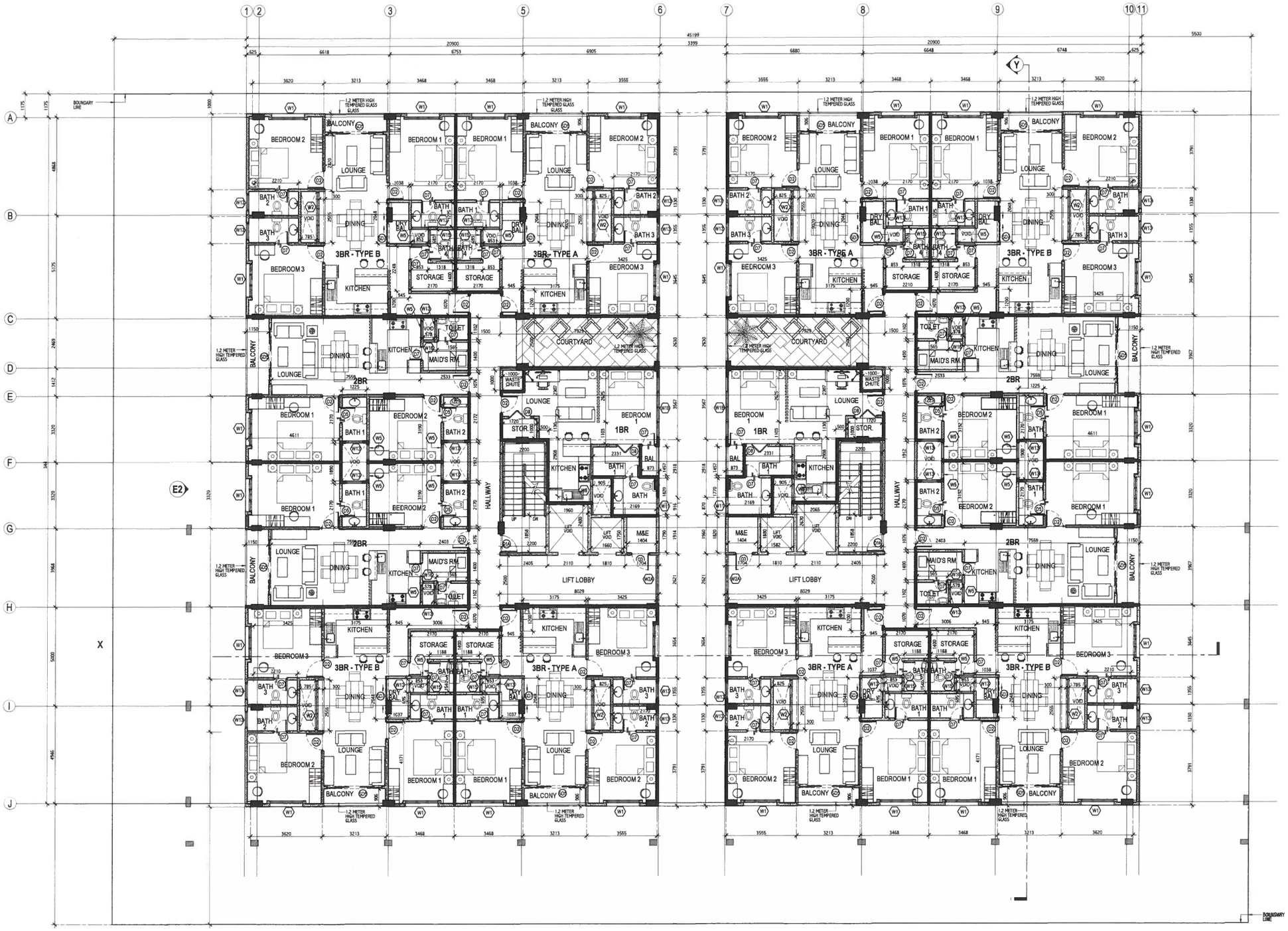

E1

LEVEL-04 TO LEVEL-08 FLOOR PLAN

SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By

Client
MUNI ENTERPRISES PVT LTD

Project Title
MIX RESIDENTIAL DEVELOPMENT

Building Name
C4-2

Drawing Title
LEVEL-04 TO LEVEL-08 FLOOR PLAN

Scale
1:100

Discipline
ARCHITECTURAL

Stage
DETAILED DESIGN

Original Drawn By : IMYY
Checked By : IMRAN
Date : 17 OCTOBER 2018
Design By : SHAHMA

Drawing Number
11-105

Revision Number
R01

File Name
C42-11-105R01.dwg

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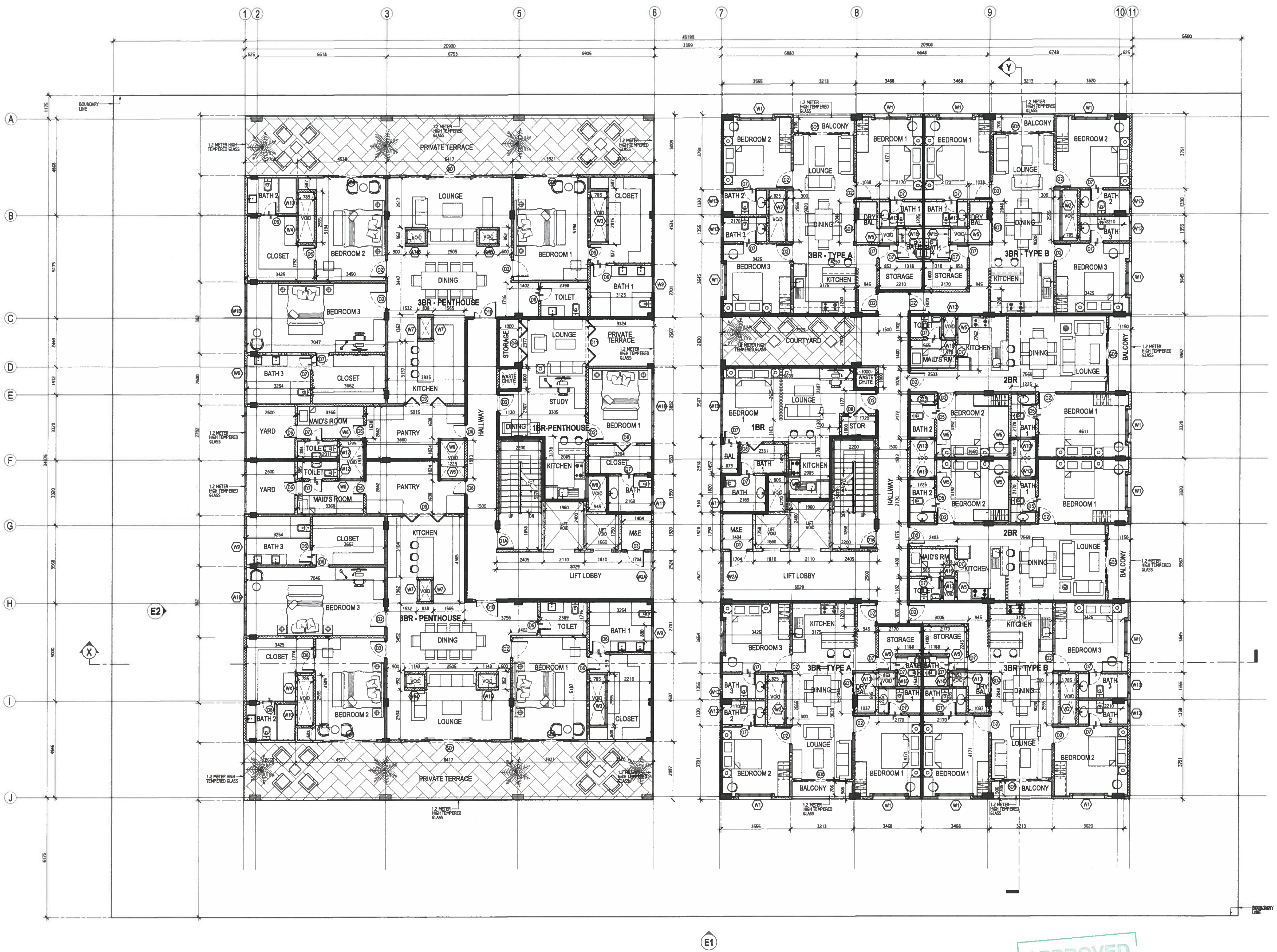
GEDAR CONSULTING PVT. LTD



LEVEL-09 FLOOR PLAN

SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By

Client: MUNI ENTERPRISES PVT LTD

Project Title: MIX RESIDENTIAL DEVELOPMENT

Building Name: C4-2

Drawing Title: LEVEL-09 FLOOR PLAN

Scale: 1:100

Discipline: ARCHITECTURAL

Stage: DETAILED DESIGN

Original Drawn By: MHY
Date: OCTOBER 20, 2016
Checked By: IMRAN
Design By: SHAMMA

Drawing Number: 11-106

Revision Number: R01

File Name: C42-11-106R01.dwg

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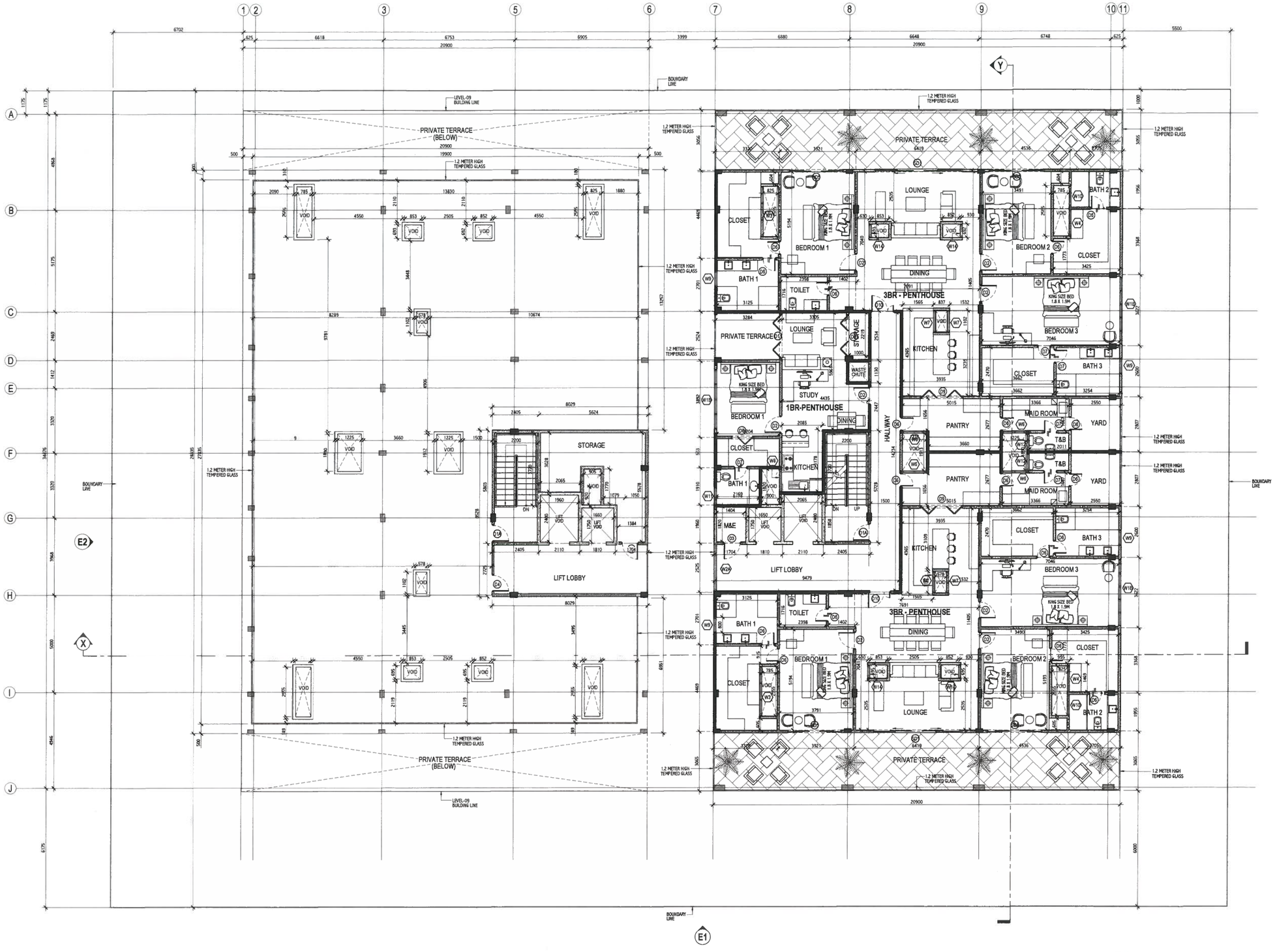
GEDOR CONSULTING PVT. LTD.

All dimensions to be checked on site.



LEVEL-10 FLOOR PLAN

SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By
-	-	-	-

Client :
MUNI ENTERPRISES PVT LTD

Project Title :
MIX RESIDENTIAL DEVELOPMENT

Sheet Name :
C4-2

Drawing Title :
LEVEL-10 FLOOR PLAN

Scale
1:100

Discipline
ARCHITECTURAL

Stage
DETAILED DESIGN

Original Drawn By : JEFF
Date : 17 OCTOBER 2018
Checked By : IMRAN
Design By : SHAMMA

Drawing Number :
11-107

Revision Number :
R01

File Name :
C42-11-107R01.dwg

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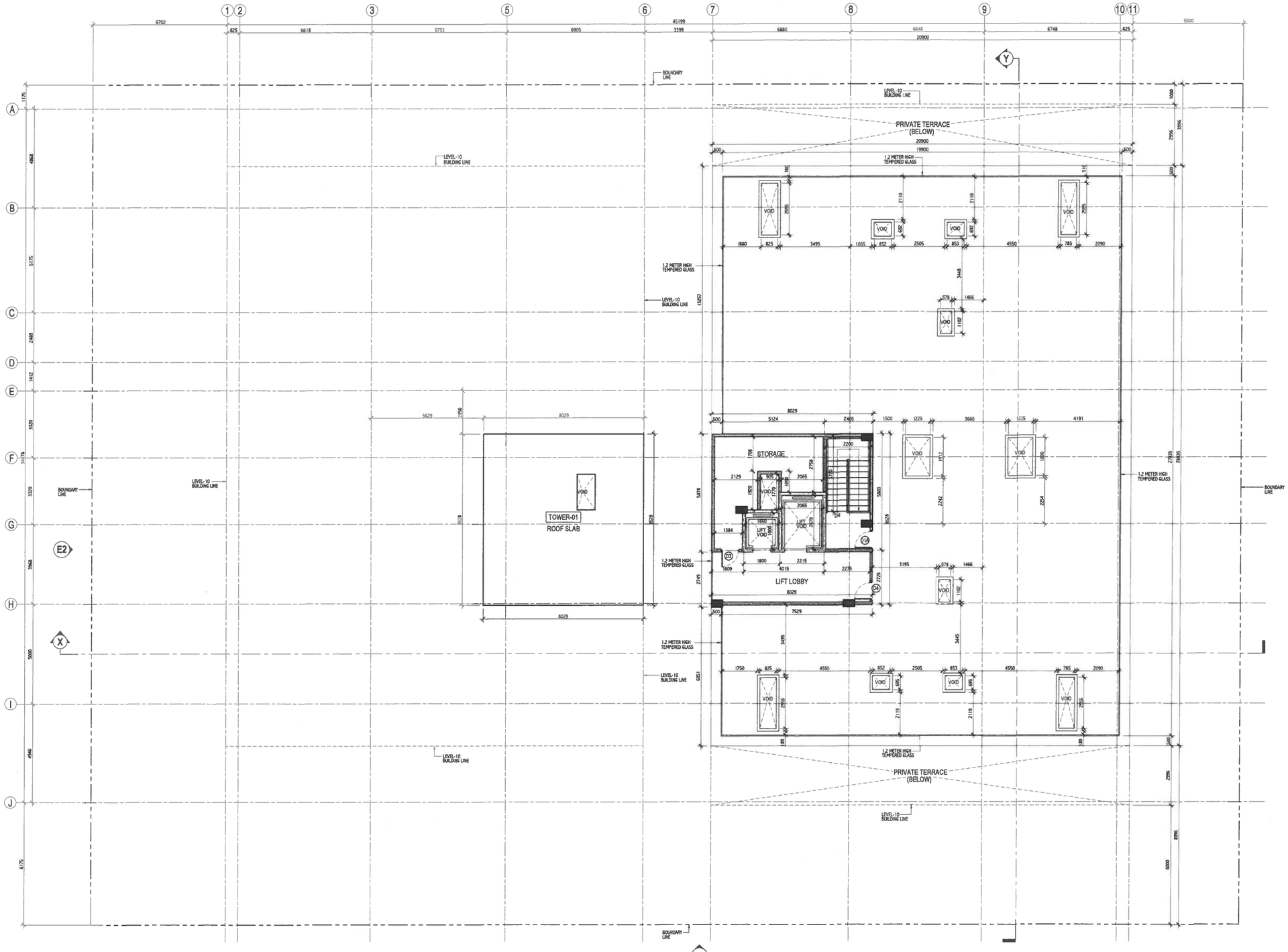
GARDAR CONSULTING PVT. LTD



LEVEL-11 (TERRACE) FLOOR PLAN
SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By
-	-	-	-

Client
MUNI ENTERPRISES PVT LTD

Project Title
MIX RESIDENTIAL DEVELOPMENT

Building Name
C4-2

Drawing Title
LEVEL-11 (TERRACE) FLOOR PLAN

Scale
1:100

Discipline
ARCHITECTURAL

Stage
DETAILED DESIGN

Original Drawn By: ASFF
Date: 17 OCTOBER 2018
Checked By: IMRAN
Design By: SHAMMA

Drawing Number
11-108

Revision Number
R01

File Name
C42-11-10BR01.dwg

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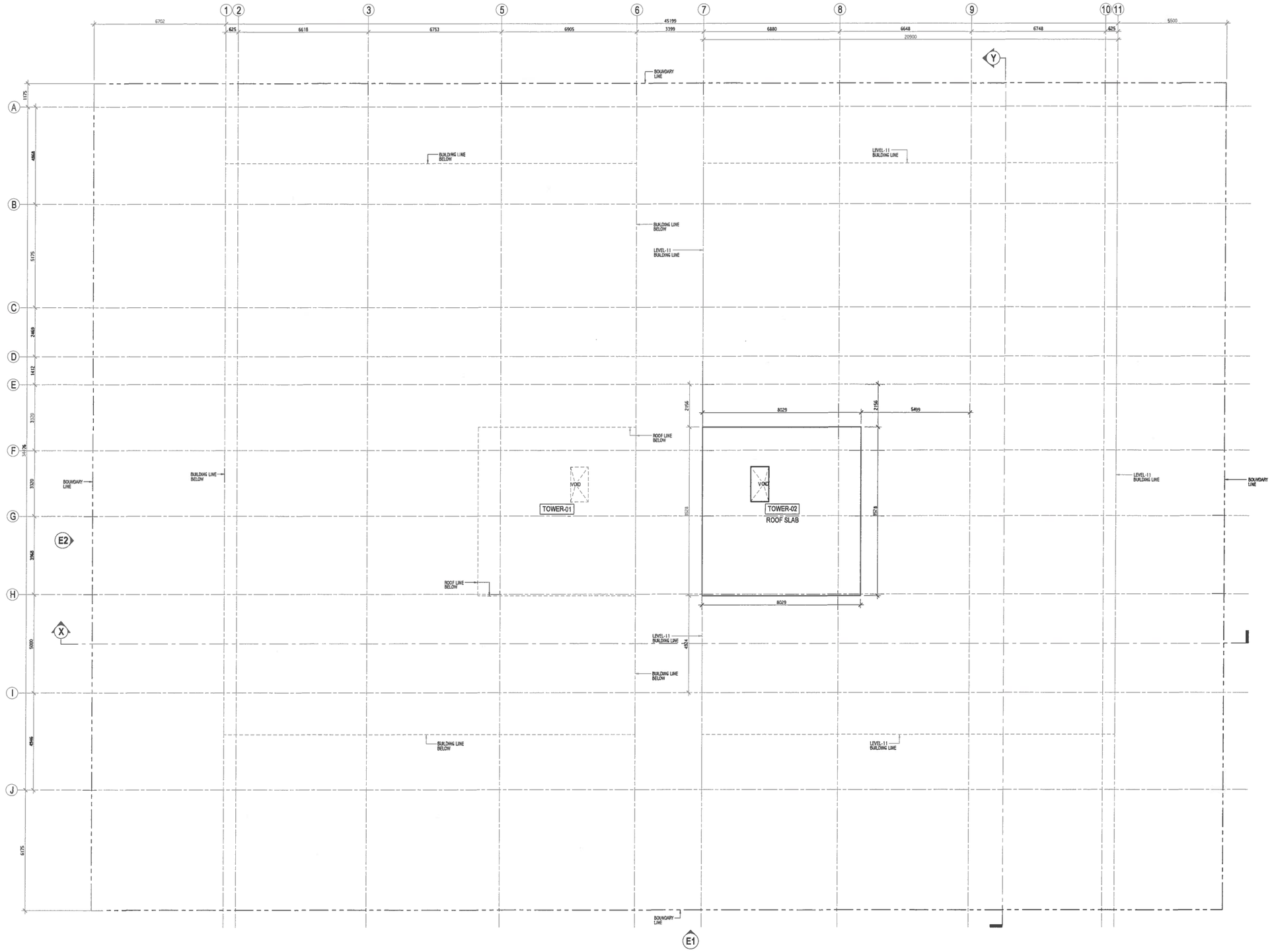

LEVEL-12 (ROOF) PLAN
SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By
-	-	-	-

Client:
MUNI ENTERPRISES PVT LTD

Project Title:
MIX RESIDENTIAL DEVELOPMENT

Building Name:
C4-2

Drawing Title:
LEVEL-12 (ROOF) PLAN

Scale:
1:100

Discipline:
ARCHITECTURAL

Stage:
DETAILED DESIGN

Original Drawn By: JEFF
Date: 17 OCTOBER 2018
Checked By: IMRAN
Design By: SHAMMA

Drawing Number:
11-109

Revision Number:
R01

File Name:
C42-11-109R01.dwg

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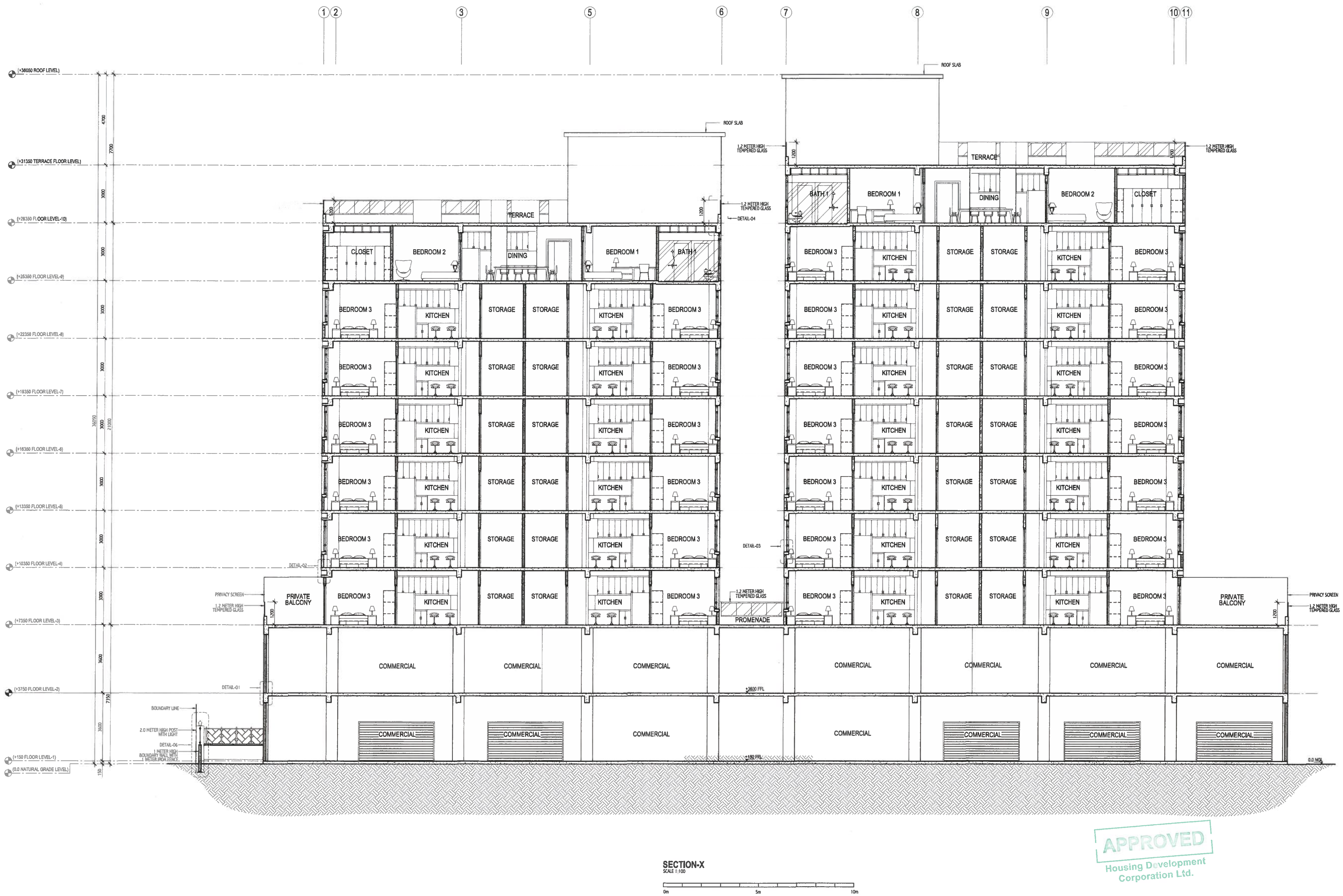

SECTION-X
SCALE 1:100

APPROVED
Housing Development Corporation Ltd.

Client :
MUNI ENTERPRISES PVT LTD

Project Title :
MIX RESIDENTIAL DEVELOPMENT

Building Name :
C4-2

Drawing Title :
SECTION-X

Scale :
1:100

Discipline :
ARCHITECTURAL

Stage :
DETAILED DESIGN

Drawn By :
SHAMMA
Date :
17 OCTOBER 2016
Checked By :
IMRAN
Design By :
SHAMMA

Drawing Number :
11-201

Revision Number :
R00

File Name :
C42-11-201R00.dwg

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GEDOR CONSULTING PVT LTD

SECTION-Y
SCALE 1:100

Revision	Date	Drawn By	Checked By

Client:
MUNI ENTERPRISES PVT LTD

Project Title:
MIX RESIDENTIAL DEVELOPMENT

Building Name:
C4-2

Drawing Title:
SECTION-Y

Scale:
1:100

Discipline:
ARCHITECTURAL

Stage:
DETAILED DESIGN

Drawn By: SHAMMA
Date: 17 OCTOBER 2016
Checked By: IMRAN
Design By: SHAMMA

Drawing Number: 11-202

Revision Number: R00

File Name: C42-11-202R00.dwg

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FRONT ELEVATION ELEVATION - E1
SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Client :
MUNI ENTERPRISES PVT LTD

Project Title :
MIX RESIDENTIAL DEVELOPMENT

Building Name :
C4-2

Drawing Title :
FRONT ELEVATION-E1

Scale :
1:100

Discipline :
ARCHITECTURAL

Stage :
DETAILED DESIGN

Drawn By : SHAMMA
Date : 17 OCTOBER 2016
Checked By : IMRAN
Design By : SHAMMA

Drawing Number : 11-301

Revision Number : R00

File Name : C42-11-301R00.dwg

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GEDOR CONSULTING PVT LTD

SIDE ELEVATION - E2
SCALE 1:100

0m 5m 10m

APPROVED
Housing Development Corporation Ltd.

Revision	Date	Drawn By	Checked By

Client :
MUNI ENTERPRISES PVT LTD

Project Title :
MIX RESIDENTIAL DEVELOPMENT

Building Name :
C4-2

Drawing Title :
SIDE ELEVATION - E2

Scale :
1:100

Discipline :
ARCHITECTURAL

Stage :
DETAILED DESIGN

Drawn By : SHAMMA
Date : 17 OCTOBER 2016
Checked By : IMRAN
Design By : SHAMMA

Drawing Number : 11-302

Revision Number : R00

File Name : C42-11-302R00.dwg

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GEDOR CONSULTING PVT LTD

Annex 3 – Water test results

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
FEN Building 5th Floor, Machangoalhi, Ameenee Magu, Male', Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

WATER QUALITY TEST REPORT

Report No: 500173923

Customer Information:
Amir Musthafa
Flat 11-02-03

Hulhumale', Maldives

Report date: **18/06/2017**
Test Requisition Form No: **900175750**
Sample(s) Recieved Date: **15/06/2017**
Date of Analysis: **15/06/2017 - 18/06/2017**

Sample Description	PLOT C4-Z HULHUMALE	**TEST METHOD**	**UNIT**
Sample Type	Ground Water		
Sample No	83187061		
Sampled Date	14/06/2017		
PARAMETER	**ANALYSIS RESULT**		
Physical Appearance	Clear with particles		
Conductivity	26800	Method 2510 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	µS/cm
pH	7.81	Method 4500-H+ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
Salinity	16.40	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
Temperature	22.9	Electrometry	°C
Total Dissolved Solids	13400	Electrometry	mg/L
Total Suspended Solids	10	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Turbidity	0.384	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

Keys: µS/cm : Micro Seimen per Centimeter, **‰** : Parts Per Thousand, **°C** : Degree Celcius, **mg/L** : Milligram Per Liter, **NTU** : Nephelometric Turbidity Unit

Checked by

Afnan Farooq
Laboratory Executive Gr.1

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 **********

Annex 4 – Project Work Schedule

FITRON Building construction - WORK SCHEDULE

		Months																														
Task	**Duration (days)**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**	**M12**	**M13**	**M14**	**M15**	**M16**	**M17**	**M18**	**M19**	**M20**	**M21**	**M22**	**M23**	**M24**	**M25**	**M26**	**M27**	**M28**	**M29**	**M30**
FITRON Building construction	**900**																															
Mobilisation	30																															
Site setup	30																															
Ground works	60																															
Foundation works	60																															
Ground floor works	90																															
1st floor concrete works	15																															
2nd floor concrete works	15																															
3rd floor concrete works	15																															
4th floor concrete works	15																															
5th floor concrete works	15																															
6th floor concrete works	15																															
7th floor concrete works	15																															
8th floor concrete works	15																															
9th floor concrete works	15																															
10th floor concrete works	15																															
Terrace concrete works	15																															
Lift machine room level works	15																															
Masonry works	240																															
Electrical and plumbing	120																															
Door and window fixing	120																															
Tiles works	90																															
Ceiling and carpentry works	60																															
Painting and finishing	150																															
Site handover	30																															

Annex 5 – Proponents Commitment for Monitoring and Mitigation

بسم الله الرحمن الرحيم

MUNI ENTERPRISES PVT LTD
Muni Building 5th Floor, M. Loobiyaa-20319
Ameenee Magu, Male' Rep of Maldives
Tel: 960 333 1512 / 334 2741 Fax: 960 333 1513
E-mail: info@muni.com.mv

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

29th October 2017

Dear Mr. Ibrahim Naeem,

Project: EIA for the proposed mixed residential apartment building development project at Hulhumale', Plot C4-2

Sub: Proponents 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.

Thanking you

Yours Sincerely,

Ahmed Shiham
Director of Business Development