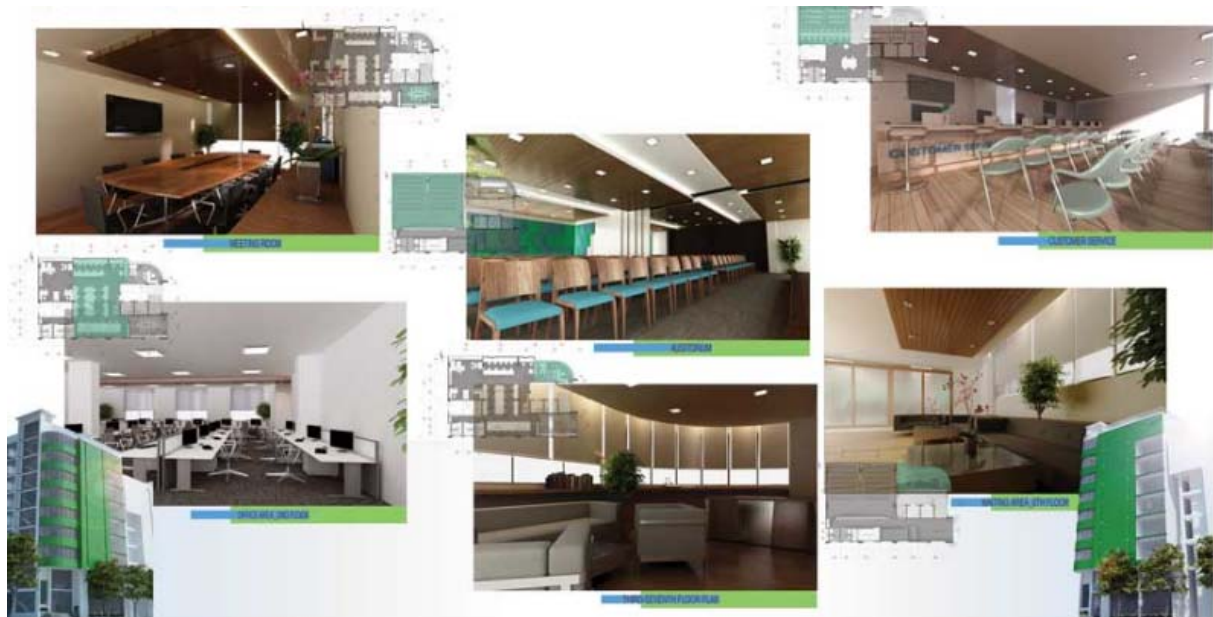


ENVIRONMENTAL IMPACT ASSESSMENT

MWSC Customer Service Building Development Project

Proponent: Male' Water and Sewerage Company



Sandcays

October 2016

Table of Contents

TABLE OF CONTENTS.....	I
TABLE OF FIGURES.....	V
TABLE OF TABLES.....	V
LIST OF ABBREVIATIONS.....	VI
CONSULTANTS DECLARATION.....	VII
PROPONENT’S DECLARATION	VIII
EXECUTIVE SUMMARY.....	IX
1 INTRODUCTION.....	1
1.1 INTRODUCTION.....	1
1.1 BACKGROUND TO THE EIA.....	2
1.2 SCOPE OF THE EIA AND APPROACH	2
1.3 RELEVANT STUDIES	3
1.4 AIMS AND OBJECTIVES OF THE EIA	4
1.5 EIA IMPLEMENTATION AND METHODOLOGIES.....	4
2 PROJECT DESCRIPTION	6
2.1 PROJECT PROPONENT	6
2.2 THE PROJECT.....	6
2.2.1 Proposed works	6
2.2.2 Project Location	7
2.3 RELEVANT PROJECT COMPONENTS	8
2.3.1 Protection and safety	8
2.3.2 Scaffolding	8
2.3.3 Excavation and protection to adjacent structures	8
2.3.4 Foundation	8
2.3.5 Dewatering	9
2.3.6 Backfill.....	10
2.4 IMPLEMENTATION PHASE ACTIVITIES	11
2.4.1 Site Preparation	11
2.4.2 Mobilization of Equipment and Materials.....	12
2.4.3 Workforce and Services	12

2.4.4	Utilities.....	13
2.4.5	Waste Management.....	13
2.4.6	Road Closure.....	13
2.4.7	Health and Safety	14
2.5	OPERATIONAL PHASE ACTIVITIES	15
2.5.1	Energy conservation.....	15
2.5.2	Water conservation.....	15
2.5.3	Solid waste	15
2.5.4	Maintenance	16
2.6	SOCIAL AND ENVIRONMENTAL DESIGN CONSIDERATIONS.....	16
2.7	PROJECT DURATION	16
2.8	PROJECT INPUTS AND OUTPUTS.....	17
2.9	NEED AND JUSTIFICATION	17
3	POLICY, ADMINISTRATIVE AND REGULATORY FRAMEWORK	19
3.1	NATIONAL POLICY GUIDANCE	19
3.1.1	Third National Environment Action Plan.....	19
3.1.2	Waste Management Policy.....	20
3.2	APPLICABLE LAWS AND REGULATIONS OF THE MALDIVES	20
3.2.1	Environmental Protection and Preservation Act	20
3.2.2	Environmental Impact Assessment Regulation.....	21
3.2.3	Regulation on Landuse Planning and Management	21
3.2.4	Malé Planning Regulation.....	21
3.2.5	Maldives Building Act and Building Code	22
3.2.6	Dewatering Regulation.....	23
3.2.7	Regulation on Environmental Liability	24
3.2.8	Waste Management Regulation.....	24
3.2.9	General considerations	25
3.3	ADMINISTRATIVE ARRANGEMENTS	26
3.3.1	Ministry of Environment and Energy.....	26
3.3.2	Environmental Protection Agency (EPA)	27
3.3.3	Ministry of Housing and Infrastructure	27
3.3.4	Atoll/City Councils and Island Councils.....	27
3.4	INTERNATIONAL CONVENTIONS, TREATIES AND PROTOCOLS	28
4	EXISTING ENVIRONMENT	30
4.1	INTRODUCTION.....	30
4.2	METHODOLOGIES	30

4.2.1	Location identification	31
4.2.2	Air quality	31
4.2.3	Background noise and traffic	31
4.2.4	Water quality	31
4.2.5	Condition Assessment	31
4.3	NATURAL HAZARD VULNERABILITY	31
4.4	GEOLOGY, TOPOGRAPHY AND UTILITIES	36
4.4.1	Groundwater	37
4.4.2	Water and Sewerage	38
4.4.3	Waste management	39
4.4.4	Electricity	40
4.4.5	Other utilities	41
4.5	AIR QUALITY	41
4.6	AMBIENT NOISE	42
4.7	TRAFFIC	43
4.8	ECOLOGY	44
4.9	VISUAL INSPECTION OF THE NEARBY BUILDINGS	44
5	STAKEHOLDER CONSULTATIONS	48
6	ENVIRONMENTAL IMPACTS	49
6.1	IMPACT IDENTIFICATION	49
6.2	OVERALL IMPACTS OF THE PROPOSED PROJECT	51
6.3	PROJECT SPECIFIC IMPACTS DURING CONSTRUCTION	55
6.3.1	Water Quality	55
6.3.2	Hazard to nearby buildings	56
6.3.3	Impacts due to material transport	56
6.3.4	Impacts on land	57
6.3.5	Ambient Air	58
6.3.6	Ambient Noise	60
6.3.7	Ecology	60
6.3.8	Cultural Property	61
6.3.9	Impacts on Utilities	61
6.3.10	Socio-Economic Environment	61
6.4	PROJECT SPECIFIC IMPACTS DURING OPERATIONAL PHASE	62
6.4.1	Land	62
6.4.2	Energy	62
6.4.3	Ambient Noise	62
6.4.4	Ecology	63

6.4.5	Socio-economic impacts	63
6.4.6	Utilities.....	63
6.5	UNCERTAINTIES IN IMPACT PREDICTION	63
7	ALTERNATIVES	64
7.1	NO PROJECT OPTION	64
7.2	TYPE OF FOUNDATION.....	64
8	IMPACT MITIGATION AND MANAGEMENT	66
8.1	INTRODUCTION.....	66
8.2	MITIGATION MEASURES.....	66
8.2.1	Groundwater Quality.....	66
8.2.2	Air Quality	67
8.2.3	Ambient Noise	68
8.2.4	Marine Ecology	68
8.2.5	Hazard to nearby buildings	68
8.2.6	Health and Safety	69
8.2.7	Traffic Disruptions	70
8.2.8	Utilities.....	70
8.3	SUMMARY OF MITIGATION MEASURES	71
	Utilities 78	
9	MONITORING	79
9.1	INTRODUCTION.....	79
9.2	RESPONSIBILITIES.....	79
9.3	PROJECT SPECIFIC MONITORING REQUIREMENTS	79
9.4	MONITORING REPORT	81
9.4.1	Monitoring report submission format and schedule	81
10	CONCLUSIONS.....	82
11	ACKNOWLEDGEMENTS.....	83
12	REFERENCES	84
13	APPENDICES	86

Table of Figures

Figure 2-1 Location of MWSC Customer Service Building.....	7
Figure 4-1: Tsunami hazard zones	33
Figure 4-2: Tracks of Cyclones affecting Maldives, 1877-2004	34
Figure 4-3: Regions to capture Cyclones passing through Maldives for Hazard Zoning.....	34
Figure 4-4: Storm Surge Hazard Zones with Cyclones Affected.....	35
Figure 4-5: Maldives Seismic Hazard Zones	36
Figure 4-6: Conceptual Illustration of freshwater lens in a small coral island (after Falkland)	38
Figure 4-7 Traffic count at project site.....	44
Figure 4-8: Visual assessment of neighbouring buildings	46
Figure 4-9: Photographic illustration of the project site and vicinity	47

Table of Tables

Table 2-1: Matrix of key inputs.....	17
Table 2-2: Matrix of major outputs	17
Table 3-1: Project specific aspects under the EHS Guidelines	26
Table 4-1: Groundwater quality at and around the project site.....	38
Table 4-2: Air quality at the project site	42
Table 4-3: Noise levels in the project area	43
Table 6-1: Environmental impacts to be considered during project construction phase	49
Table 6-2: Environmental Impacts to be considered during project operation phase.....	50
Table 6-3: Impact evaluation scale.....	51
Table 6-4: Summary of potential impacts	53
Table 6-5: Impact matrix for the proposed project	54
Table 6-6: Impact potential indices for the proposed project.....	55
Table 7-1 Comparative analysis of project and 'no project' option.....	64
Table 8-1: Summary table of environmental impacts and mitigation measures	72
Table 9-1: Proposed environmental monitoring programme for construction phase.....	80

List of Abbreviations

BATNEEC	Best Available Technology Not Entailing Excessive Costs
BPEO	Best Practice Environmental Option
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
H ₂ S	Hydrogen sulphide
l/d	litres per day
MCC	Malé City Council
MEE	Ministry of Environment and Energy
MHI	Ministry of Housing and Infrastructure
MVR	Maldivian Rufiyaa
MRDC	Maldives Road Development Corporation
MWSC	Malé Water and Sewerage Company
NBSAP	National Biodiversity Strategy and Action Plan
NEAP	National Environment Action Plan
NEAP	National Environment Action Plan
NO ₂	Nitrogen dioxide
NSSD	National Strategy for Sustainable Development
PM	Particulate Matter
RF	Rufiyaa (same as MVR)
SO ₂	Sulphur dioxide
STELCO	State Electric Company
TOR	Terms of Reference
UNDP	United Nations Development Programme

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.



Ahmed Zahid

Consultant Registration No. EIA08/07

Proponent's Declaration

I declare that I have read the report thoroughly and that to the best of my knowledge all information provided here is accurate and complete.

For Malé Water and Sewerage Company Ltd.



Mohamed Ali
Project Engineer



Mohamed Imran Adnan
Engineering Manager



Executive Summary

This report discusses the findings of an Environmental Impact Assessment (EIA) carried out for the proposed 10-storey customer service building of Male' Water and Sewerage Company (MWSC). The project is proposed by the MWSC, the contract for construction phase has been awarded to Amin Construction. This project requires EIA as the building has a basement, under EIA regulations 2012 buildings with basement require EIA clearance.

The main objective of the EIA is to identify potential impacts of excavation, construction of foundation and dewatering and consider mitigation measures that can be adopted. In addition, the EIA would also consider other construction phase and operational phase activities such as waste management, energy and water supply although they are not directly related to the scope of the EIA.

The project is to commence as soon as the EIA is approved and the duration of the project is estimated to be completed by December 2017. Substructure works, which is considered to be the most sensitive component (socially and environmentally), is expected to be completed within two months. The critical elements of excavation and dewatering are expected to be completed within 80 days. Therefore, the project has a critical impact timeframe of less than 4 months.

Currently MWSC does not have dedicated customer service centre, where all services can be attained from one stop. The proposed project ensures such a service base to the customers are provided, thus meeting this existing need of the company. This improved service also means that additional jobs will be created thus contributing positively to the economy.

Looking at the existing environment of the site, the site is devoid of any significant flora or fauna. The traffic is considerably high in Ameen Magu during peak office and school hours and majority of the structures within close radius of the site is structurally sound. The groundwater quality is not very saline when compared to some other parts of Male'.

Almost all of the negative impacts envisioned for the project occurs during construction phase and as highlighted previously most of these impacts are associated with substructure works. However, almost all these impacts are minor and can be reduced to negligible levels with the mitigation measures proposed in this report. In this regard, the potential negative impacts

associated with this project can be summarised as impacts related to groundwater quality and quantity, impacts on nearby buildings in terms of structural damage, impacts on air quality, impact on ambient noise, impacts on utility services, impacts on traffic and impacts on health and safety. Mitigation measures proposed for the project like minimizing dewatering to the shortest possible time, ensuring proper storage and transport of construction material and waste, restricting noisy activities to day time, undertaking works by experienced operators and supervisors, avoiding closure of roads during peak rush hours and implementing international best practice health and safety standards will help to reduce the influence of most of the envisioned impacts to negligible levels.

The EIA report proposes a monitoring program that will help to identify the actual impacts and to identify the effectiveness of the implemented mitigation measures. In this regard monitoring will include, monitoring of groundwater quality, monitoring of dust and noise, visual assessment of nearby buildings and monitoring of traffic condition. The monitoring reports will be submitted to EPA every two months during construction phase and once thereafter to meet the requirements of the EIA regulations. The reports will be submitted in the format specified in the EIA regulations.

Overall, this project is a positive project and the negative impacts envisioned are only for the construction phase and all these impacts can be easily mitigated.

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1 Introduction

1.1 Introduction

This report addresses the social and environmental impacts associated with the development of MWSC customer service centre building in Malé City. The development is a 10-storey building as a result of which Environmental Impact Assessment (EIA) is required under the EIA Regulations of the Maldives. The primary objective of environmental assessment for buildings is to minimize structural damage to neighbouring structures when undertaking foundation works. However, in the process, the whole building process is placed within the scrutiny of the EIA process.

Infrastructure projects that require impact assessment under Schedule (Jadhuvalu) Raa of the EIA Regulations of the Maldives include:

1. Buildings that are higher than 31 m;
2. Buildings that are constructed with a foundation that is required for a building of 31m or higher;
3. Buildings that are constructed with pile foundation;
4. Buildings with foundations that go below 6 m in depth;
5. Buildings with basement (If the basement is of a depth of more than 1m or if the area of the basement is bigger than 172 m²)

The basement parking space of MWSC service building is 221 m² and the basement depth is 1.7 m hence under condition 5 above the project requires EIA under the EIA regulations.

This report will identify potential impacts and suitable mitigation options to address these impacts for the project of construction of 10 storey customer service building by MWSC. Moreover, the report will explore alternatives for various project components including the no project option. Moreover, a monitoring program is proposed to determine the actual impacts of the project and to see whether the proposed mitigation measures are effective.

The findings of this report are based on assessments undertaken during a site visit made to the project site in October 2016 as well as professional judgment. The development concept prepared by the project architect and engineering protocols developed by the project engineer has been utilized in order to understand and present the project. The impact assessment

methodology has been restricted to field data collected, professional judgement and experience of similar building projects in Male’.

1.1 Background to the EIA

This EIA is prepared in accordance with the Terms of Reference (TOR) approved by the Environmental Protection Agency (EPA) on October 2016. It is a legal requirement that new projects having potential for environmental impacts gain environmental clearance or approval prior to construction and operation of such projects. Environmental clearance is obtained through submission and approval of EIA report by the Environmental Protection Agency (EPA) under the Ministry of Environment and Energy.

The principal environmental institution that implements EIA process in the country is Environmental Protection Agency. Additionally, since April 2015, the Ministry of Tourism has taken the authority of EIA process for tourism sector projects.

1.2 Scope of the EIA and Approach

The main scope of this EIA report as per the approved TOR is to broadly assess, identify, predict and document potential environmental impacts from the proposed 10 storey customer service building, located next to Fen Building. The primary focus of the report is on the impacts associated with foundation aspects as this is the main reason for requiring EIAs for such projects. In this regard, this report investigates existing environmental condition of the project site and its surrounding and foresees the ways in which potential environmental impacts will be managed, mitigated, reduced and monitored.

Hence the key aims of the report are to;

- Describe in detail the proposed project;
- Identify the need and justification for the proposed development;
- Describe the biophysical status of the existing environmental condition of the project area based on the findings undertaken during the site visits;
- Assess, identify and predict potential environmental impacts;
- Evaluate the significance and magnitude of impacts that will be generated; and identify and predict ways in which these environmental impacts will be prevented and removed through appropriate environmental management and mitigation measures;

- Develop a mechanism to closely monitor and understand the long-term effects and changes of the proposed development on the environment with respect to the available baseline information, mostly from field assessments;
- Provide legal protection with regards to the proposed development activities; and
- Review the predictions and assessments made on environmental impacts that are associated with the proposed development activities.

In general, the EIA report has been based upon the following sources of information:

- Review of available project documentation including concept plans;
- Discussions with involved key personnel;
- Field visits to site;
- Baseline environmental assessments;
- Maldives Environmental Protection and Preservation Act No. 4/93;
- Environmental Impact Assessment Regulation;
- Other Environmental Regulations;
- Sandcay's previous experience of undertaking EIAs for building projects in Malé; and
- Other EIAs for similar development projects that have been carried out for Malé.

1.3 Relevant Studies

In order to prepare this EIA, relevant EIA reports for multi-storey buildings in Malé has been carefully studied. These include;

- EIA for H. Del Rio multi-storey building
- EIA for H. Point Villa multi-storey building
- EIA for H. Marvel multi-storey building
- EIA for 13-storey Parliament Building Extension Project.
- EIA for the development of 10-storey building at H. Campus.
- EIA for the development of 10-storey building at Umar Shopping Arcade.
- EIA for the development of a 14-storey building at G. Hudhukokaa.
- EIA for the construction of a 10-storey building with basement at G. Javaahiru Asseyri
- EIA for the construction of 11-storey building at Ma. Jambugasdhoshuge
- EIA for the construction of 13-storey building at H. Blue Haven.

In addition the following monitoring reports submitted to EPA were used in predicting impacts and mitigation measures associated with the project:

- Environmental monitoring report for the 11-storey building at Ma. Jambugasdhoshuge.
- Environmental monitoring report for the 11-storey residential building at Husham Residence.

1.4 Aims and Objectives of the EIA

This report helps to achieve the following key objectives.

- Allow better project planning through identification of key impacts and measures for mitigating these impacts.
- Ensure efficient resource use and minimize irreversible damage to the environment.
- Ensure and allow informed and environmentally-sound decision making.
- To demonstrate the commitment by the proponent on the importance of environmental protection and preservation.

1.5 EIA Implementation and Methodologies

This study was based mainly on assessment and monitoring data from similar projects, data collected during field investigations undertaken in October 2016 by a team from Sandcays and published literature on similar projects. The EIA report was compiled by Ahmed Zahid, who is a registered EIA consultant with over 19 years of experience in this field. He was assisted by Mohamed Hamdhaan Zuhair, who has been working in the environment sector mostly in the regulatory side for the past 09 years.

Established and widely accepted methods have been applied in this EIA study. Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. The field assessment methodologies are described in Section 4.2 of this report.

The methods used to identify, predict and assess impacts are based on matrices that have been established by the Consultants over a long period. In the matrix, the consultants assign a likert-scale number to represent the magnitude, significance, duration and spatial extent of the potential impact for each project activity against the key environmental and socio-economic components that the specific project activity may have an impact on. The product of the

magnitude, significance, duration and spatial extent for each activity and component is summed up to measure the exact nature of the impacts by each activity and the overall impact of the proposed project is the sum of all activities.

2 Project Description

2.1 Project Proponent

The proponent of the proposed project is Male' Water and Sewerage Company. Established on the 1st of April 1995, Male' Water and Sewerage Company is the pioneer organization in the Maldives to institute a water production and wastewater management system. Since then, the Company has worked diligently to provide the people of Male' with potable water and manage wastewater sustainably, and at present serves approximately more than 50% of the Maldivian population.

2.2 The Project

MWSC signed a contract with Amin Construction Pvt Ltd on 01st September 2016 for the construction of the new customer service building. The new Customer Service Building will be a contemporary 10-storey structure accommodating modern facilities for customers, including:

- Bill Payment Office accommodating 48 customers at once
- Application Office accommodating 28 customers at once
- Modern Call Center providing an enhanced customer experience
- Contemporary Auditorium Hall to accommodate large audiences with a capacity of 126 people

In addition, the new customer service building will have dedicated parking space at the basement level of the building. The construction of the building is estimated to be completed by the end of 2017.

2.2.1 Proposed works

The following is a list of significant works that will be carried under this project;

- Excavation to achieve required depth
- De-watering during the foundation concrete works
- Mixing and application of concrete
- Storage and handling of cement and other raw materials
- Use of heavy machinery and equipment for construction

- Roofing part of the terrace
- Plumbing
- Tiling and railing
- Plastering, painting and finishing

2.2.2 Project Location

The proposed MWSC customer service building is located within the MWSC plot (plot numbers 375 and 376, a total area of 7984.82m²) immediately east of Fen building in the Ameenee Magu and Amina Rani Hingun junction. The built up area of the proposed building is 272.43 m². To the east of the proposed building is the university building and many government offices and schools are located within walking distance. Moreover, many new developments are envisioned to come to this location including the 25 storey office building proposed at the site of finance Ministry. Such a setting ensures ease of access for many customers during business hours. Furthermore, since it is located within the MWSC plot, it ensures that all major operations of the company are run smoothly from one location.

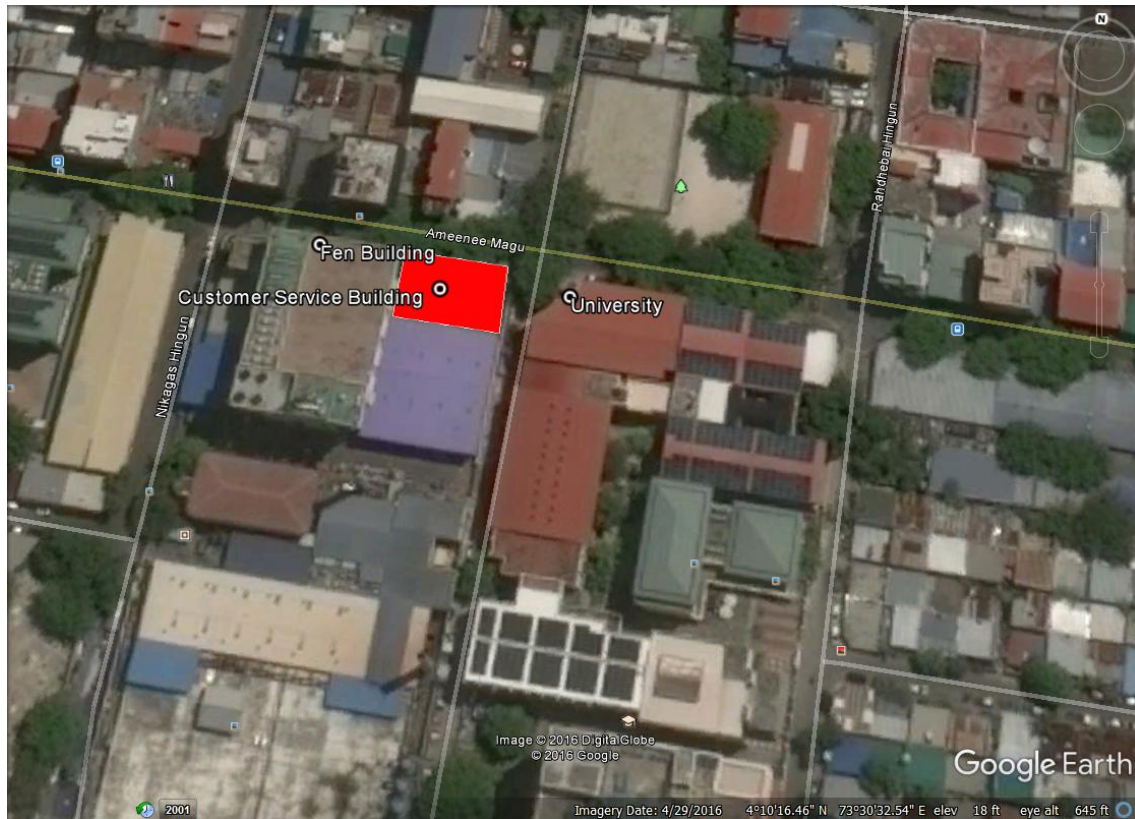


Figure 2-1 Location of MWSC Customer Service Building

2.3 Relevant project components

2.3.1 *Protection and safety*

The Proponent will ensure that the Contractor would have the works and adjoining properties protected from inclement weather. The Contractor would be required to provide all necessary dustsheets, barriers and guardrails during construction period.

2.3.2 *Scaffolding*

The Contractor will provide, erect, maintain, dismantle and clear away at completion proper and adequate scaffolding required for construction activities. Putlog holes shall be made good to match the adjacent surface as the scaffolding is dismantled.

It will be the Contractor's responsibility to have all safety precautions in connection with the scaffolding including the provision of all bracing, scaffold boards and toe boards.

2.3.3 *Excavation and protection to adjacent structures*

The proposed depth of excavation for the MWSC customer service building is about 3.4 m below the existing ground level. Buildings with a basement normally tend to have slightly deeper foundation. In order to minimize slumping of excavated area due to dewatering and to keep the edges plumb, 6mm GI sheets (2.4m long, 1.2m wide) may be inserted to a depth of 200mm below the proposed excavation depth with GI angle bracing.

The excavation will be done using a back hoe excavator. Part of the excavated black sand will be later used for backfilling and the remaining excavated material will be transported to the disposal area allocated on the south of Malé.

2.3.4 *Foundation*

For the foundation works, a raft or mat foundation will be used. This is the most commonly adopted method of laying foundations in the Maldives. Raft foundations help to spread the load from a structure over the entire area of the structure, minimizing the pressure exerted on the base.

When all the necessary excavation is complete, a 50mm thick lean concrete (Grade C15) layer will be laid to provide a level surface to assemble the reinforcement of foundation raft slab

and beams. Once the lean concrete layer has hardened, the raft foundation works will be carried out starting with steel work. The concrete works for the raft foundation will be done using C30 Grade concrete. An anti-separation additive would be used to promote bonding of the concrete mix, since the concrete works will be done underwater. There will be a water proof membrane around the basement concrete to prevent water from getting in.

For foundation protection, trench protection method will be utilised. This method involves the following steps:

1. Excavate the plot area to 800 mm
2. Start dewatering especially from the sides.
3. Drive the Mild Steel (MS) angle (65 x 65 x 6mm thick) the maximum amount possible.
4. Plunge the 9mm thick MS sheet to the maximum possible amount behind the MS angle.
5. Excavate the plot area further more to 1400mm.
6. Drive the MS angle further more in the excavated area.
7. Plunge the MS sheet to the maximum possible amount behind the MS angle.
8. Repeat the process until 3400 mm has been achieved.
9. Weld the MS sheet to get the maximum depth of 3400 mm and weld the adjacent MS sheet to attain the necessary length of the plot.
10. To avoid the sheet from collapsing, support the sheets using props at the maximum angle to get the strength.
11. Once the supports are in place, brace the complete structure in a grid using 100 mm pipes.
12. Continue dewatering until the necessary process is done.

2.3.5 *Dewatering*

Dewatering will be carried out throughout the foundation works until the casting of the foundation has been completed. The general practice in Malé today is to pump the water to a

temporary catchpit/junction provided by Malé Water and Sewerage Company (MWSC) or dispose to sea via a pipeline along the roads provided by Maldives Road Development Corporation (MRDC). One of these methods will be practiced based on the most suitable for the time and location. Details of the selected method will be shared with EPA, when making the dewatering application through the Dewatering Regulations. In order to improve efficiency and minimize the impact of drawdown on a single point, several pumps will be used. Several pumps each with a flow rate of 30 litres per second is recommended to be located at specific locations to pump out the water. The dewatering works will be done in accordance to Dewatering Regulations.

Engineers often recommend as follows.

- Where the excavation level is below the natural water table and it is necessary to pump continuously from the excavation or to install a specialist type of dewatering equipment around the perimeter of the site or excavation, the Contractor will be responsible for ensuring the safety and stability of all adjoining structures and services or utilities above or below ground level.
- It will also be the responsibility of the Contractor that the equipment installed shall ensure that the excavation and subsequent construction is carried out in dry conditions.
- Continuous or permanent de-watering of the excavation or site may not be undertaken without the written approval of the Consultant and the methods to be employed shall also comply with Codes of Practice and EPA requirements.
- The water pumped from the excavations or well points shall be pumped to disposal points or sumps approved by the Consultant and the EPA/Council/MWSC and, if so required, be passed through settling tanks before disposal.
- Unless prior approval has been obtained no water must be disposed of in the sewerage system or storm water sewers.

During the dewatering process, any important or mature trees near the project site that may be adversely affected due to dewatering would be watered daily to prevent water shortages. Complaints received from neighbouring households and buildings regarding water quality and availability will be resolved through negotiation and if required through compensation.

2.3.6 Backfill

Engineers often recommend as follows.

- All earth used for filling shall unless otherwise stated, be selected hard dry material from the excavation. The maximum dry density of the fill material shall be not less than 1600 kg/m³.
- The backfill of excavations shall be placed in horizontal layers not exceeding 300mm in thickness. Each layer shall be compacted by hand or other mechanical means to the required density before the next layer is added.
- Care shall be taken when filling or back-filling to avoid any wedging action or eccentric action upon or against the structure of the work.
- Before placing of fill, the surface of the sub-grade shall be compacted at optimum water content to the same percentage of maximum dry density required of subsequent lay.
- The Consultant will inspect all compacting devices that the Contractor proposes and shall have the right to reject any device which he feels is unsuitable for the job.
- Heavy equipment for spreading and compacting fill and backfill shall not be operated closer to walls than a distance to the difference in height between the top of the footings and the layer being compacted.
- When back-filling behind retaining walls, basement walls and the like the said structures shall be kept propped during the complete operation. The hydraulic compaction of fill shall not be permitted and the back filling shall be carried out in layers not exceeding 150mm thick.
- Each layer shall be compacted to 90% of the modified compaction. No back filling shall be carried out until the wall concrete has achieved its full works cube strength and care shall be exercised so as not to damage the external tanking membrane and its protection.

2.4 Implementation Phase Activities

2.4.1 Site Preparation

Site preparation works are underway. Site preparation is one of the key elements of any such project which include fixing of secure place (container) for material storage and administrative work or build a site office attached to material storage facility in an appropriate location. Other important preparation work includes:

1. Appoint staff for site management and material stock control.

2. Clear and make access to areas where work will be carried out.

2.4.2 *Mobilization of Equipment and Materials*

Site mobilization involves mobilization of workforce, machineries/equipment and construction materials to the sites to begin physical work. Materials, equipment/machineries and all other related items will be transported to site by dhoni from Thilafushi to Male and by pickup truck from harbour to construction site. Necessary measures will be taken to ensure that no spillage of construction materials occur when transporting the material. In this regard the necessary safety requirements as per the transport regulations and guidelines will be met. Since the project takes place in Malé, which is the primary location for sourcing materials in the Maldives, there will be fewer complications in material mobilisation as well as human resource for the project. However, the Contractor would be expected to plan the entire works to minimize the number of mobilisations that would in turn minimize the cost of the project/increase profits and also minimize the time frame.

For the foundation and each slab, materials will be placed on the road side in a manner approved by the City Ministry of Housing and Infrastructure with necessary signboards and safety measures on the day of the concrete works.

Materials for masonry and other works would be kept inside the premise.

2.4.3 *Workforce and Services*

This is one of the key components that need appropriate management on site during the construction phase. In the proposed project an estimated 50 staff including labourers, engineers, consultants and supervisors will be sited working on the project. It is expected that the workforce would comprise mainly of foreign labour, as with other similar projects. Prevalent labour laws and regulations shall be adhered to.

The workforce would comprise of Contractor's staff. They would be provided with adequate and reasonable accommodation, water, sanitation and meals. Foreign labour employed specifically for the project will be provided either with labour camps on the same site or elsewhere with reasonable facilities and services. Temporary toilets may be set up for the workers at the construction site and connected to MWSC sewer network to provide proper sanitation facilities.

2.4.4 Utilities

Water and sewerage services for the building will be provided by the MWSC. Therefore, the main water supply will be desalinated water. However, there will be underground tanks for the collection of groundwater for flushing. As per the usual practice in Malé, MWSC will provide the water supply and sewerage connections up to the building and all internal plumbing has to be done by the Proponent, which also MWSC in this case. Therefore, the Proponent would ensure that there will be no cross-connection of desalinated water supplied by MWSC with the ground and rainwater collected and supplied within the building. The Proponent will also make provisions for easy cleaning and maintenance of internal sewer lines.

Electricity will be provided by State Electric Company (STELCO). STELCO will provide temporary electricity during construction and permanent electrical connection to the entire building during the operational phase. STELCO has existing capacity to provide the service to the proposed building.

Backup generator may be considered by the Proponent. A 100kVA backup genset may be considered for the operation of the lift and lighting in public or common spaces within the building in case of failure of main power from STELCO. Especially since the proposed building acts as a customer service hub for the company, back-up power will be vital.

2.4.5 Waste Management

Excess sand excavated during foundation works will also be transported to this landfill site. All waste generated during concrete works phase and finishing phase will be collected at the end of each work day and temporarily stored in closed containers on a designated location at site. Hazardous waste such as empty paint cans will be kept separate and disposed according to the standards established by relevant government authority. All waste will be transported in vehicles approved for waste transportation under waste management regulation, meeting the required standards of the regulation. Special attention should be made to ensure that no spillage of waste into roads occur during waste transport.

2.4.6 Road Closure

Prior to casting of foundation and slabs permit will be taken from MHI/Malé City Council for road blocks as determined by the Ministry/City Council. There are well established

procedures followed by Contractors and MHI/City Council for road blockages for building concrete works. These procedures will ensure that the works are carried out with minimal disturbance to pedestrians, traffic and neighbours. Often, concrete works are undertaken in the night time after *Isha* prayer, to minimize disturbance and interruptions. Special consideration will be given to undertake any road closures during low traffic hours and as requested by the University (described in detail in Chapter 5) during off peak hours of the university. In fact, road closures would be approved by the Ministry/City Council depending on the prevailing circumstances including other projects in the vicinity.

The foundation work is estimated to take around 18-24 hours while the concrete slabs for the rest of the floors will be around 12-15 hours. Information will be provided to neighbors before undertaking works during night time.

2.4.7 Health and Safety

Workers' health and safety is also an important aspect that needs careful consideration during the implementation from beginning till end. Protection of employees from likely adverse effects will be one of the core duties of the Proponent or Contractor. All machineries and equipment must be operated by trained and experienced personnel wearing necessary safety gears. If there is any need for an employee to work on a different work site, he/she must be given appropriate training before the work. Noisy or dusty works would be minimized or stopped during peak hours and prayers times to reduce dust and noise related pollution for pedestrians, traffic and people in the mosque. Moreover, as the proposed building site is next to the University building, efforts will be made to ensure that noisy activities are not undertaken during main teaching hours.

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 works involving the use of roads such as power, water and sewer connections. Safety of pedestrians and vehicles will be ensured by appropriate signage, safe scaffolding and netting.

Workers would be informed of local values, respect for religion and culture in addition to health and safety issues at site. Engineers and/or supervisors will brief workers as and when necessary and ensure safety precautions are in place. Personal protective equipment will be made available to all workers. First aid will be available at site for minor injuries.

2.5 Operational Phase Activities

Key activities identified throughout the operational phase of the proposed buildings would be building maintenance, maintenance of fire-fighting equipment, monitoring the adequacy of the proposed structures for their intended purpose and health and safety issues.

2.5.1 *Energy conservation*

The proposed building will be powered by STELCO power station in Malé. Capacity of diesel powered engines in Malé have been rising rapidly due to growing demand. The Fourth Power Project, which was recently completed, would be able to meet the rising demand for a number of years with foreseen expansion in the coming years under the Fifth Power Development Project. Also, in order to minimize the demand for power from diesel gensets, the Government of Maldives has initiated several solar energy programmes, which may be considered by the Proponent during the operational phase of the project.

The proposed building will be fitted with energy-efficient fittings, including light bulbs and air-conditioners with inverters. Solar water heating would also be considered.

2.5.2 *Water conservation*

Water to the proposed building will be supplied by Malé Water and Sewerage Company (MWSC). Booster pumps will be used for supplying water to the top floors. There are two options for boosting; one is to use in-line booster pumps provided by MWSC and the other would be to collect the water in an underground tank and use a booster pump to pump from the tank. Both options are acceptable, however, it may be ideal to use an in-line booster system.

The option to use groundwater for flushing has always been an option that needs to be evaluated in terms of the cost of pumping the groundwater to the top floors as well as the nuisance of smell in the building, especially toilets, due to the use of smelly groundwater in toilets. This may be considered during the operational phase or during the design/implementation phase.

2.5.3 *Solid waste*

During the operational phase of the building, waste chutes and/or waste bins will be provided in designated area(s) for use of staff and the public. Daily collection and transport of waste to collection points will be undertaken.

2.5.4 Maintenance

Maintenance is a subject of little interest in the Maldives. Buildings are not generally maintained once built. However, the proposed building would be maintained to acceptable standards. The proponent will undertake regular maintenance activities of the building both structurally and internally.

Regular maintenance often involves dealing with cracks, especially during the early stages of the development, when the building settles or due to poor workmanship. Maintenance will also involve maintenance of sewerage network within the premise, HACV systems and general repairs, changing of lights, interior maintenance and exterior painting.

2.6 Social and Environmental Design Considerations

In terms of planning and design, the most important and pressing issues to consider are:

- Structural safety over the design period
- Good natural ventilation and lighting for greater energy efficiency
- Use of energy saving and environmental friendly resources such as energy saving or LED lights, eco air conditioning, etc.
- Provisions for uninterrupted power and water supply
- Fire safety
- Adequate waste management facilities
- Adequate drainage and drainage facilities
- Landscaping for improved aesthetics
- Avoid sick-building syndrome

2.7 Project Duration

The implementation of the proposed project is expected to be started as soon as the EIA is approved. The duration of the project is estimated to be 420 days with the project completion targeted to end of December 2017. Substructure works, which is considered to be the most sensitive component (socially and environmentally), is expected to be completed within three months. The critical elements of excavation and dewatering are expected to be completed within 80 days.

The proposed tentative project schedule is given in the Appendix.

2.8 Project Inputs and Outputs

The project has inputs in terms of human resources, and natural resources and machinery. The main output of the project is improvement in living conditions and standard of living in the capital city. The inputs and outputs are summarised in Table 2-1 and Table 2-2.

Table 2-1: Matrix of key inputs

Input resource(s)	<i>How to obtain resources</i>
Construction workers	Contractor's responsibility
Management and supervisory staff	Appointed by proponent/Contractor
Construction materials: timber, sand, cement, aggregate, reinforcing steel bars, electrical cables, circuit boards, PVC pipes, HDPE pipes, diesel, petrol, etc.	Imported and/or purchased at competitive prices where locally available– Contractor's responsibility
Water supply	Piped desalinated water supply from MWSC Piped groundwater for flushing (optional)
Electricity/Energy	Diesel-based electricity from STELCO Solar energy from roof installations (optional)
Telecommunication and cable TV	Existing service providers (Dhiraagu/Wataniyya/Medianet/ROL)
Machinery and equipment (concrete mixer, trucks, loaders, forklifts, cranes and general construction equipment and machineries)	Contractor's responsibility
Paints, thinners and other solvents	Imported or locally purchased
Doors, windows and furnishings	Imported or locally purchased

Table 2-2: Matrix of major outputs

Products and waste materials	Anticipated quantities	<i>Method of disposal</i>
Demolition waste	Small to moderate	Sent to designated landfill site in Malé
Waste oils from machinery	Minute	Re-used for other applications
Timber, cardboard, gunny bags and scrap metals (construction site waste)	Small	Recovered, reused , recycled
Used oil (waste oil), grease and paint	minute	Reused/appropriately disposed
Waste (kitchen waste, domestic waste)	Small to moderate	Taken for disposal through Malé waste management system
Sewage effluent	Small	Disposed through existing sewerage network via catchpits and oil traps in the building premise

2.9 Need and Justification

Currently there is difficulty in providing efficient customer service by the company, as there is no dedicated one stop for providing this service. Thus, MWSC has been lagging some other similar service oriented companies. This project will help to address this issue. Moreover, some floors of the 10-storey building could be commercially leased acting as a source of revenue for the company. The location is a prime hot spot for office space with the new major

government 25 storey office building being built in the finance ministry complex. Moreover the location provides MWSC opportunity to rent out space for meetings and events.

In addition, this project opens job opportunities to the local community, as additional staff will need to be hired to provide this dedicated customer service experience. Furthermore, the basement level of the building provides parking space, thus reducing parking pressure on the already congested Ameeney Magu. Thus, overall this is a positive project for the company, its customers and the community in general.

3 Policy, Administrative and Regulatory Framework

This chapter will 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. The proposed project is expected to conform to all the policy and regulatory aspects outlined in this Chapter. Specific compliance requirements are discussed within the relevant section.

3.1 National Policy Guidance

3.1.1 Third National Environment Action Plan

NEAP 3 sets out the agenda for environmental protection and management in the Maldives for the five-year period 2009-2013. This plan is targeted to achieve measurable environmental results that matter to the people of the Maldives.

The aim of developing NEAP 3 is to protect and preserve country's environment and properly manage natural resources for sustainable development of the country and encompasses ten principles, six strategic results with targeted goals to be achieved under each result.

The key principles of the NEAP 3 are:

Principle 1: Environmental protection is the responsibility of every individual

Principle 2: Achieve results

Principle 3: Promote and practice sustainable development

Principle 4: Ensure local democracy

Principle 5: Inter-sectoral co-ordination and co-operation

Principle 6: Informed decision making

Principle 7: Precaution first

Principle 8: Continuous learning and improvement

Principle 9: Right to information and participation

Principle 10: Environmental protection complements development

The six strategic results of NEAP3 are: resilient islands; rich ecosystems; healthy communities; safe water; environmental stewardship; and a carbon neutral nation with 30 result oriented environmental goals that will be achieved in the span of the NEAP 3.

3.1.2 Waste Management Policy

As waste management has been identified as a key environmental issue in the Maldives, a National Solid Waste Management Policy for the Maldives was first developed in 2007 and updated in 2015 as an important step towards mainstreaming waste management in the country. The key strategic principles outlined in the document include; establishing polluter pay principles, integrated solid waste management, best practice environmental option (BPEO), best available technology not entailing excessive costs (BATNEEC), proximity principle and private sector participation. It is an important priority of the Government of Maldives as identified in the policy document to setup regional waste management facilities and island waste management centres and decentralizing waste management administration.

3.2 Applicable Laws and Regulations of the Maldives

3.2.1 Environmental Protection and Preservation Act

The Articles of the Environmental Protection and Preservation Act (Law No. 4/93) addresses the following aspects of environmental management, which are relevant, understood and adhered to in the proposed project.

- An EIA shall be submitted to EPA before implementing any developing project that may have a potential impact to the environment.
- Project that has any undesirable impact on the environment can be terminated without compensation.
- Disposal of waste, oil, poisonous substances and other harmful substances within the territory of the Maldives is prohibited. Waste shall be disposed only in the areas designated for the purpose by the government.
- The Penalty for Breaking the Law and Damaging the Environment are specified in the Law.

- 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.

3.2.2 Environmental Impact Assessment Regulation

The EIA Regulation, which came into force in 2007, has been recently revised and the revised EIA Regulation 2012 is currently in force since May 2012. This EIA is subjected to the EIA Regulations 2012. Further revisions/improvements to the regulation are underway.

The EIA Regulation 2012 is currently only in Dhivehi and an official translation is awaited. The Regulation sets out the criteria to determine whether a development proposal is likely to significantly affect the environment and is therefore subject to an EIA. Schedule D of the EIA Regulations defines the type of projects that would be subject to Environmental Impact Assessment. Infrastructure projects that require impact assessment under Schedule D of the EIA Regulations of the Maldives include:

1. Buildings that have a footprint of over 4000square feet
2. Buildings that that are higher than 31m or over 10 storeys
3. Buildings with foundations that can support over 10 stories
4. Buildings with basement
5. Buildings with foundations below 5m from ground level or with foundations that is different from normal foundations.

3.2.3 Regulation on Landuse Planning and Management

This Regulation, which sets out the regulatory framework for land use planning and land management in the Maldives, has no specific relevance to the project. However, with the advent of the Regulation, land for residential and institutional areas is located away from industrial zones. However, in some of the islands, poor zoning or land use planning has a negative impact on schools and other noise, dust or smell sensitive environments.

3.2.4 Malé Planning Regulation

The Planning Regulation for Malé has been developed in relation to the Regulation on Land Use Planning and Management in Maldives discussed above. This regulation has been developed

specifically for the 5 wards of Malé, with the first part of the Regulation focussing on the four wards on the island of Malé namely Henveiru, Mahchangolhi, Galolhu and Maafannu and the second part focusing on VilliMalé, which exists as a separate island. The regulation looks at the different aspects relating to construction of high rise buildings focusing on minimizing congested living conditions and related health and safety aspects. The regulation specifies the different conditions for building design, requirements for design approval, height of buildings and ventilation, lighting, fire and safety requirements and other requirements for building safety and occupants' health and well-being.

The regulation specifies requirements for dewatering, demolition, sighting of open toilets/bathrooms near the building, scaffolding, height restrictions, setback limits, ventilation, railing, mezzanine floor and parking.

3.2.5 Maldives Building Act and Building Code

This is possibly the most relevant legislation for the project under consideration. The first draft of the Maldives Building Act was published for public comments in May 2009 and second draft published in 2010. The final draft was published in early 2014 in Dhivehi with some differences from the drafts in English entitled Maldives Building and Infrastructure Bill. This Act has been passed by the Majlis and ratified by the President in 2014.

The Act sets out the importance of adhering to the Building Code, building consents, application procedures, performance standards/requirements including access and facilities for persons with disability, define specific roles and responsibilities of different parties involved in the building process and means to avoid hazards or dangers during construction or use. Clause 46 and 53 of this Act are important for aspects relating to building safety and assurance that the Building and Infrastructure Act has been followed during the building process. Clause 46 states that the certified/registered building practitioner and design checkers shall be responsible for the design. Clause 53 states that the permit to use the building would be issued based on the Building Inspector's report. Clause 60 and 61 refers to Building Code. Clause 64 states that the building works should be supervised by a Building Inspector appointed by the Developer and who is not associated with the Client/Developer or the Contractor. The responsibilities of the Developer as well as the Contractor are also stated in the (draft) Act.

The proposed project will follow existing design requirements, which are in line with the requirements set out in the Building and Infrastructure Act as well as the Building Code. The designs have already been approved by the concerned government agency. The designs have been done by licensed engineers. Clause 94 refers to place or article of importance/special interest that is found in the building site, which should be immediately notified to concerned parties.

3.2.6 *Dewatering Regulation*

Dewatering regulation (2013/R-1697) was published on 31 December 2013 and was effective from 1 February 2014. The Regulation covers the following:

- Exceptions under the Regulation including dewatering for cleaning household wells and extraction for agricultural purposes.
- Application for dewatering permits including application form, information required such as size, water quality, work schedule, method of dewatering and disposal location.
- Fees for dewatering permits including MVR500.00 for administrative fees, MVR500 per day for the first 28 days, MVR1000 per day for first extension, MVR1500 per day for second extension and MVR 2000 per day for third extension.
- Water quality testing requirements including parameters that has to be tested
- Provision of information (in writing) regarding dewatering to entities within 30m from the dewatering location and ensuring that in case of difficulty in getting water from neighbouring wells, providing 250litres or RF30 as compensation for each household.
- Provisions for disposal of dewatering effluent.
- Reporting requirements.
- Procedures for termination of work and fines levied.

This regulation is of relevance in the proposed building where dewatering would be required. The foundation for the building is expected to be below the groundwater lens; therefore, dewatering would be required. Hence this regulation will be strictly adhered to and dewatering would be undertaken in a planned manner to avoid inconveniences as well as cost minimization.

3.2.7 Regulation on Environmental Liability

The Environmental Liability Regulation (Regulation 2011/R-9) came into force on 17 February 2011 and covers a wide range of issues which enable charging penalties and compensation due to environmental pollution and environmental damages. Apparently, the key objective of the environmental liability regulation is to practice polluter pay principles in the Maldives. The proposed project will cut down on environmental liabilities and polluting practices will be almost completely abandoned.

3.2.8 Waste Management Regulation

The Waste Management Regulation (Regulation No. 2013/R-58) came into effect in August 2013. The objective of Waste Management Regulation is to implement the National Waste Management Policy; through which it aims to protect the environment by minimizing the impact of waste on the environment, including the impact of waste on human health, establishing an integrated framework for minimizing and managing waste in a sustainable manner and establishing uniform measures to reduce the amount of waste generated. The regulation also ensures waste is reused, recycled and recovered in an environmentally sound manner before being safely treated and disposed. The regulation covers the management of general, hazardous and special waste. Wastes arising from paints and chemical solvents are considered as special waste.

Clause 1.4 of this regulation is of relevance to the projects under consideration. This clause is for construction waste and it states that;

- a. Building construction works shall be planned and organized in a manner that there is minimal waste
- b. Measures shall be in place to minimize construction waste
- c. Reusable or recyclable waste among demolition/construction waste shall be reused or recycled
- d. Construction waste shall be kept at the demolition site until demolition is completed
- e. Demolition of buildings shall be done with minimal disturbance due to dust and emissions to the environment and people living in the vicinity.

Clause 11(e) states that waste management at household level would not require any permits under the regulation.

This regulation was effective from 6 January 2014 and EPA would be responsible for the implementation this regulation. This regulation has little relevance to the project under consideration.

3.2.9 *General considerations*

All building construction and renovation will adhere to the existing building and other applicable codes of practice in the Maldives and any other standard construction specifications approved by the country. In addition, the contractor is expected to pay attention to and address the following in the Environmental Management Plan:

- Air and noise pollution during construction activities
- Preservation of culturally significant buildings
- Preservation of ecological features of the sites
- Good planning in terms of transport and access to site
- Overshadowing and access to daylight and sunlight, with possible options for passive solar design and its effect on site layouts
- Structural integrity of buildings
- External appearance (aesthetics)
- Floodwater protection provisions
- Designing appropriate landscaping
- Energy conservation and efficiency
- Waste disposal, salvage, re-use and recycling of materials
- Avoidance of hazardous materials
- Health, safety, security and fire
- Potential for sick building syndrome

For building projects, General EHS Guidelines of the World Bank Group may be adopted since the EHS risks are low for these projects. The following table presents the specific areas of focus when the EHS Guidelines are considered.

Table 3-1: Project specific aspects under the EHS Guidelines

Areas identified in the Guideline	Project specific considerations	Responsible party
1. Environmental • Dust and air emissions • Energy conservation • Waste management • Noise	• Energy conservation (good lighting and ventilation) in the design • Constructional waste management • Air and noise emissions minimized	Designer/ Engineer Contractor/ Developer
2. Occupational Health and Safety • General facility design and operation • Communication and training • Physical hazards • Chemical hazards • Biological hazards • Personal Protective Equipment (PPE) • Special hazard environments • Monitoring	• Contractors and supervisors shall be obliged to implement all reasonable precautions to protect the health and safety of workers • Workers should be made of special hazard envts including confined spaces and lone/isolated events • Use appropriate signs and PPE during construction works as well as maintenance works during operational phase	Designer /Engineer Contractor/ Developer
3. Community Health and Safety • Water quality and availability • Structural safety of infrastructure • Life and fire safety • Traffic safety • Disease prevention • Emergency preparedness and response	• Ensure healthy and safe use of the buildings during the design • Ensure structural integrity and use safe and appropriate chemicals and other materials in the construction • Promote health and safety in the use of buildings by appropriate signage • Use appropriate signs and PPE during construction works as well as maintenance works during operational phase	Designer /Engineer Contractor/ Developer
4. Construction and decommissioning • Environment • Occupational Health and Safety • Community Health and Safety	• Project engineers shall outline health and safety measures in the design and incorporate those in the BoQ. • Contractors shall follow good engineering principles and health and safety measures such as leaving the work area clean and levelled prior to demobilization.	Designer /Engineer Contractor/ Developer

3.3 Administrative arrangements

This EIA falls within the jurisdiction of environmental regulatory bodies in the Maldives. Therefore, their roles have been defined as follows.

3.3.1 Ministry of Environment and Energy

The primary environmental institution in the Maldives is Ministry of Environment and Energy (MEE). It is mandated with formulating policies, strategies, laws and regulations concerning environmental management, protection, conservation and sustainable development. The Minister of Environment or a designate gives the environmental approval or clearance to EIA by an Environmental Decision Statement. Additionally, MEE is responsible for formulating

relevant laws and regulations, policies and strategies concerning energy, water and sanitation, waste and infrastructure.

3.3.2 Environmental Protection Agency (EPA)

EPA is the key regulatory body on environment, which is an autonomous body formed under the umbrella of MEE. It is mandated with implementing the EIA process in the Maldives, implementing the Environment Act and subsequent regulations on behalf of MEE, regulating water and sanitation, biodiversity conservation, waste management and coastal zone management. Also, it is responsible for developing environmental standards and guidelines in the country.

3.3.3 Ministry of Housing and Infrastructure

The Ministry of Housing and Infrastructure (MHI) is the government agency responsible for the provision of housing and infrastructure such as harbours. The Ministry, therefore, regulates housing and infrastructure developments in the country. The Land Act and recent Housing and Infrastructure Act are implemented by the Ministry.

MHI is also the government agency responsible for licensing or registering engineers, architects and other building practitioners including building inspectors.

3.3.4 Atoll/City Councils and Island Councils

Under the Maldives Decentralization Law, elected Atoll Councils, City Councils and Island Councils have been formed as regulatory bodies dealing directly with atoll, cities and island issues. In this regard, some of the development projects are subject to approval of these councils through a public consultation process.

For the proposed project, the Ministry of Housing and Infrastructure will take the role of Malé City Council in approving the concept and detailed drawings based on Malé Planning Regulation, provide approvals for construction and monitor/supervise the works during construction with assistance from relevant government authorities including traffic police. EPA requires that a copy of the final draft of the EIA Report be submitted to the relevant Council and receipt provided to EPA or attached to the EIA report. In the case of Malé, the receipt is provided by the Ministry of Housing and Infrastructure.

3.4 International conventions, treaties and protocols

The major global issue facing the Maldives is climate change, global warming and subsequent sea-level rise. The small size of the islands and their low elevation above MSL makes possible impacts of it very serious. Consequently, the country plays a prominent role in forefronting environmental issues faced by many other small islands developing states including the Maldives in the international arena. The Maldives is therefore, a party and signatory to various international conventions and declarations. These include:

- UN Convention on the Law of the Sea – UNCLOS (1982)
- International Convention for the Prevention of Pollution of the Sea by Oil (1982)
- Vienna Convention for the Protection of the Ozone Layer (1985)
- Montreal Protocol on Substances that Deplete the Ozone Layer (1987)
- Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal (1989)
- The London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1990)
- Agenda 21 and the Rio Declaration of the United Nations Conference on Environment and Development (1992)
- Convention on Biological Diversity (1992)
- United Nations Framework Convention on Climate Change (1992)
- The Copenhagen Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1992)
- The Montreal Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1997)
- The Beijing Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (1999)
- Washington Declaration on Protection of the Marine Environment from Land-Based Activities
- Kyoto Protocol to the United Nations Framework Convention on Climate Change (1998)
- Cartagena Protocol on Biosafety (Maldives acceded on 2 September 2002)
- United Nation Convention to Combat Desertification (2002)

The Maldives is also a key player in formulating and adopting various regional plans and programmes to protect the environment by continuously participating in various activities organized by regional bodies such as SACEP, ESCAP and SAARC.

Some of the international conventions, treaties and protocols of relevance to the proposed project may be identified as follows:

- United Nations Convention on Climate Change (UNFCCC) and the Kyoto Protocol which aims at minimizing greenhouse gases to reduce or combat potential impacts of global climate change, global warming and associated effects such as sea level rise, which are thought to have devastating impacts on the Maldives, a fragile small island nation. The aspects of the proposed project that apply to this convention are the use of diesel-based power, possible use of small excavators, especially their emissions as well as the use of pumps which consume electricity. These are inevitable impacts; however, efforts should and have been made to minimize all such impacts.
- The Montreal Protocol on Substances that depletes the Ozone Layer is also of concern. The Maldives has an accelerated HCFC phase-out schedule as agreed in the Montreal Protocol. Hence, the proposed project will meet such criteria in the area of cooling and refrigeration.

4 Existing Environment

4.1 Introduction

This chapter will provide the data and information relating to the existing project site conditions or environmental and social baseline conditions. Understanding baseline conditions is an important element of an EIA, as baseline conditions are essential for comparative analysis during monitoring. For the proposed 10-storey customer service building of MWSC, the baseline data and information has been divided into following three categories:

- 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;
 - Trees in the project site and major trees around it;
 - Water quality of groundwater wells in the vicinity;
 - Indoor and outdoor air quality in the project vicinity.
- Structural environment
 - State of adjacent buildings including photographic records of existing damages as baseline reference;
 - Condition of the surrounding roads;
 - Existing structures/uses of the proposed site;
- Socio-economic environment
 - Demographic data for Malé and population of adjacent buildings;
 - Brief description of social environment of Malé in general and adjacent residential units in particular;
 - Identify types of vehicles and peak traffic hours in or near the project site.

4.2 Methodologies

Conditions of the existing environment of the study areas were analysed by using appropriate scientific methods. The following site data were collected and the methods of collection are described here.

4.2.1 *Location identification*

The location of data collection sites has been marked using handheld differential Trimble GeoXH GPS. Sampling locations as well as site boundaries were also done. Figure 4-9 shows the data collection and sampling locations.

4.2.2 *Air quality*

Air quality was measured for different locations at the project site. The results are given in

4.2.3 *Background noise and traffic*

Noise was measured using a Type-2 noise meter (handheld). Noise levels were measured at four intervals, morning between 10:00 am – 12:00 pm, afternoon between 1:00 pm and 2:00 pm and evening 4:00 pm – 6:00 pm. Readings were taken each hour in each of these two hour intervals and the average noise level calculated. Traffic count were also undertaken during these times intervals. The locations from which noise and traffic readings were taken are provided in the map below. Two readings were taken from Ameene Magu and one from Falhumathee Magu.

4.2.4 *Water quality*

Groundwater quality was assessed in-situ at selected buildings nearby the project site. A handheld YSI water quality logger was used to measure temperature, pH, electrical conductivity, TDS and dissolved oxygen. Samples were taken from some of the locations to understand the hydrogen sulphide content as well as nitrates for sewage contamination in water.

4.2.5 *Condition Assessment*

Visual inspection of the nearby buildings were undertaken and large cracks were noted and photographed.

4.3 *Natural hazard vulnerability*

The worst natural hazard that was faced by Malé was that of the tidal wave in 1987 and the tsunami. When the tidal wave hit the Maldives on 11 April 1987, Malé had poorly built breakwaters around it and about a third of Malé was affected by severe flooding resulting in

severe damage to the breakwater and retaining walls around the island. A number of houses were damaged or destroyed and several people evacuated and became homeless although no loss of life was reported. Following this incident, under a grant aid from the Government of Japan, the entire perimeter of Malé was protected by revetments and breakwaters that stood the test of time when the tsunami hit the island on 26 December 2004. On that day, several islands on the eastern coast of Maldives were badly damaged by the tsunami but Malé had very little damage due to the breakwater and revetments around it. However, due to the low-lying nature of the island, the peripheral areas have severe flooding during tidal surges.

Natural hazard vulnerability risks related to global warming and subsequent sea level rise remains a cause for concern. The vulnerability is further aggravated by the fact that rainfall in the region is of high intensity but short duration, which may be affected due to changes in global precipitation patterns related to climate change. The project location is at a location which gets flooded often during high rainfall events due to improper drainage at the road. The Male' road development project is expected to address this concern.

In Developing a Disaster Risk Profile for Maldives by UNDP (2006), the natural vulnerability of the islands and atolls of the country to potential hazards have been modelled to understand the risk factors of the country. In that report, the disaster risk scenario for Maldives was described as moderate in general.

Figure 4-1 show that Maldives faces tsunami threat largely from the east and relatively low threat from the north and south. Islands along the western fringe experience a relatively low tsunami hazard. This map is produced based on the experience of the tsunami in 2004 and also occurrence of historic tsunami events in the greater region where most of the events have identified to have occurred from the Sumatra Region (UNDP 2006). For Malé, the wave was stopped largely by the breakwater surrounding Malé but water rushed inside. There were no reports of damage to structures or structural failures although there is a possibility it there was any lesser degree of coastal protection. Under such circumstances, there is some possibility of unloading of soil depending on the speed of travel of the water. However, it is low due to low porosity of the soil.

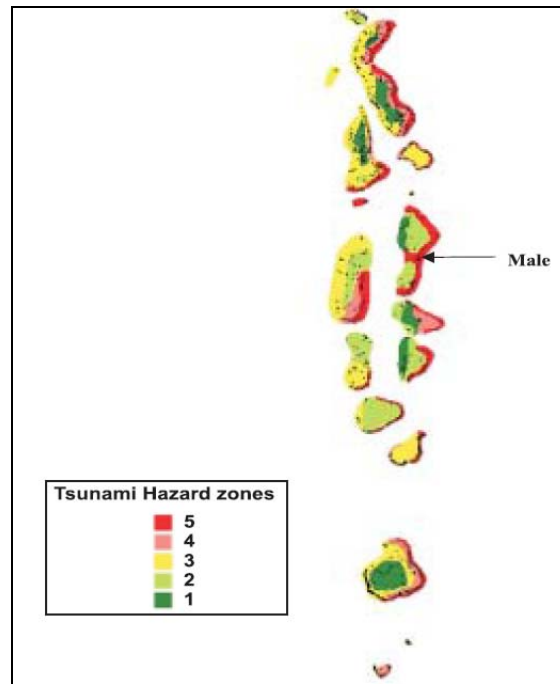


Figure 4-1: Tsunami hazard zones

Besides heavy rains and strong winds during monsoons, hazardous weather events which regularly affect Maldives are tropical storms or ‘tropical cyclones’, and severe local storms. At times, tropical cyclones hitting Maldives are destructive due to associated strong winds that exceed a speed of 150 kilometres per hour, rainfall of above 30 to 40cm in 24 hours and storm tides that often exceed four to five meters (UNDP 2006).

Cyclonic winds sometimes can cause a sudden rise in sea-level along the coast, leading to a storm surge. The combined effect of surge and tide is known as ‘storm tide’. Storm tides can cause catastrophe in low-lying areas, flat coasts and islands such as Maldives.

Maldives is also affected by severe local storms- thunder storms/ thunder squalls. Hazards associated with thunder storms are strong winds, often exceeding a speed of 100 kilometres per hour, heavy rainfall, lightning and hail; they also give rise to tornadoes in some regions. In general, thunderstorms are more frequent in the equatorial region than elsewhere, and land areas are more frequently hit by thunderstorms as compared to open oceans. However, thunder storms close to the equator are less violent when compared with those in the tropical regions and beyond. Maldives being close to the equator, thunder storms are quite frequent but less violent. Strong winds generated by severe local storms generate large wind-driven waves which are hazardous for Maldives (UNDP 2006).

The islands of Maldives are less prone to tropical cyclones. The northern islands of the country were affected by weak cyclones that formed in the southern part of the Bay of Bengal and the Arabian Sea. Figure 4-2 shows the tracks of cyclones affecting Maldives during the period 1877-2004. The number of cyclones directly crossing Maldives is small. Only 11 cyclones crossed the islands over the entire span of 128 years. Most of the cyclones crossed Maldives north of 6.0°N and none of them crossed south of 2.7°N during the period (UNDP 2006).

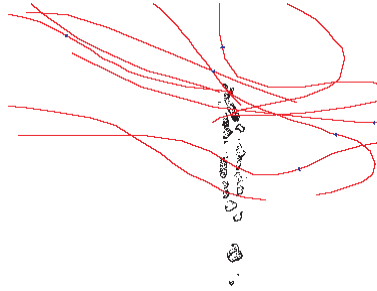


Figure 4-2: Tracks of Cyclones affecting Maldives, 1877-2004

UNDP (2006) stated that there were 21 cyclonic disturbances within the 500km radius during 1877-2004, of which 15 were depressions with an average wind speed of about 28 knots. The highest wind speed due to cyclonic disturbances that affected the islands during that time was about 65 knots.

Based on the above information, Maldives is divided into zones with varying scales of cyclone hazards based on a qualitative judgment based on the gradient of the storm tracks from north to south.

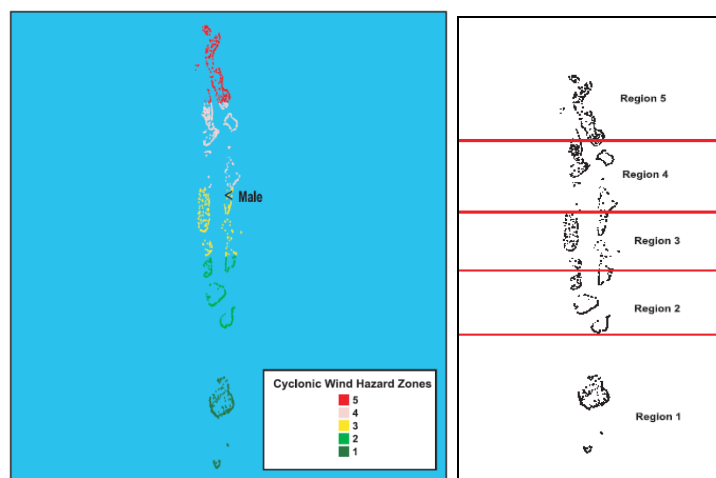


Figure 4-3: Regions to capture Cyclones passing through Maldives for Hazard Zoning

Figure 4-3 shows the regions used to compute the highest wind speed of each cyclone captured within the region. Majority of the cyclonic disturbances crossed the northern region. The frequency and wind speed decreases from northern region to southern region. Region 1 is not affected by any storm. Thus, Maldives can be divided into three cyclone hazard zones – the northern zone with high cyclone hazard, central zone with moderate cyclone hazard and the southern zone with very little cyclone hazard. The proposed project location in the central zone with moderate cyclone hazard risk.

With regards to the storm surge potential, the bathymetry around the Maldives shows that the ocean slope close to the east coast is steeper than the west coast, hence it can be generalized that the eastern islands of the Maldives are vulnerable to higher surge hazard compared to the western islands. Figure 4-5 shows storm surge hazard zones based on computed model with maximum pressure drops for 100 year return period and with historical data (UNDP 2006).

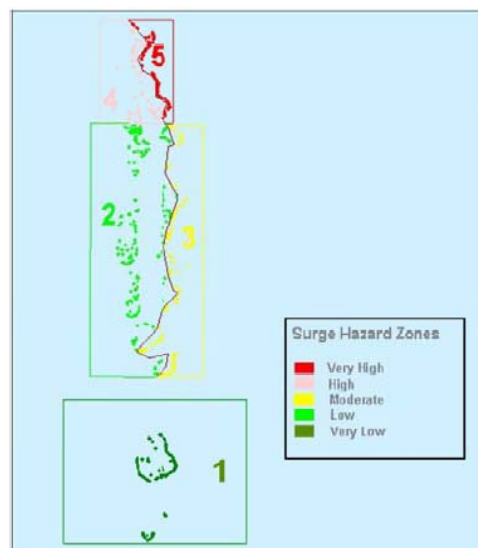


Figure 4-4: Storm Surge Hazard Zones with Cyclones Affected

Based on the above figure, it can be said that the north-eastern parts of the country are very vulnerable to storm surges.

Based on historical catalogues of earthquakes in the region, identifying seismic sources based on this historical information and based on numerical models, it was found that except for Seenu, Gnaviyani and Gaafu Dhaalu and Gaafu Alifu Atolls, earthquake hazard is low across the country. The probable maximum Modified Mercalli Intensity (MMI) is estimated between 7-8 in Zone 5 (Figure 4-4). This level of MMI can cause moderate to high damages (UNDP 2006).

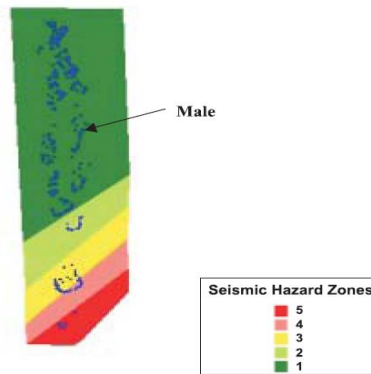


Figure 4-5: Maldives Seismic Hazard Zones

It can be summarized that the northern parts of the country are vulnerable to cyclones and storm surges while southern parts of the country are vulnerable to seismic activity. The eastern side of the country is more exposed to potential tsunamis and surges. The proposed project area in Male' have medium cyclone risk and most of the flooding Male' experiences is due to inappropriate drainage of the roads.

4.4 Geology, topography and utilities

The geology of the islands of Maldives is largely sandy soil. The soil is a mixture of coral dust which has been transformed into sand that is highly alkaline with pH varying from 8.0 to 8.8 at the top with calcium carbonate formations beneath the sand. About a meter of sand layer shall be expected. Along the coastline, the soil is white and very fine resulting from the wave action whereas the soil is darker in colour inland. The soil in the project area has been modified over the years, however, darker soil exists. Typical estimate of sand porosity in the islands of Maldives is 30% (Falkland 2001, Carpenter 2006). Soil in Malé is fairly uniform and therefore highly permeable and subsequently easily susceptible to pollution.

The topography of Malé is almost flat and the relative variation in ground level in different parts of Malé with the western side of Malé being slightly lower than the eastern side. This is because the eastern side is directly facing the eastern rim of the atoll and prone to strong oceanic swells.

The roads in Malé including those around the project site are paved using pavement blocks. The roads are sufficiently wide enough to cater for vehicle movements with Ameene Magu being the main road at the project site allowing bi-directional flow. The number of

motorcycles in Malé had grown rapidly over the years and motorcycles are parked on all roads on the parking spaces allocated on the side of narrow pavements. This is of primary concern and the project aims to address this concern by providing basement parking space.

The underground utilities present on the roads include the power, telephone and cable TV cables as well as water and sewerage pipes. The main sewerage pipes run in the middle of the road and so does the manholes while other utilities are on the side of the road.

4.4.1 Groundwater

The fresh groundwater aquifers generally are formed as freshwater lenses floating on salt water which depends on island width, recharge rate and the ease of transmission of freshwater through soil (Falkland *et al* 2007). According to the USGCRP team (Carter *et al* 2001), “the size of the groundwater lens is directly related to the size of the island also related to the normal amount and type of precipitation (e.g., heavy downpours recharge lenses, while light rain generally does not)”. Therefore, the type of rainfall that occurs in the Maldives with high intensity-high duration-low frequency rainfall is useful for the development of groundwater lenses in low-lying islands. This argument also supports the belief held by the consultants that aquifer recharge is not easily possible by grey water recharge. However, while heavy downpours help to recharge the lens, it also aids flooding of roads, which have been hardened over time, resulting in poor permeability/percolation.

The water lens in small islands is illustrated in Figure 4-6.

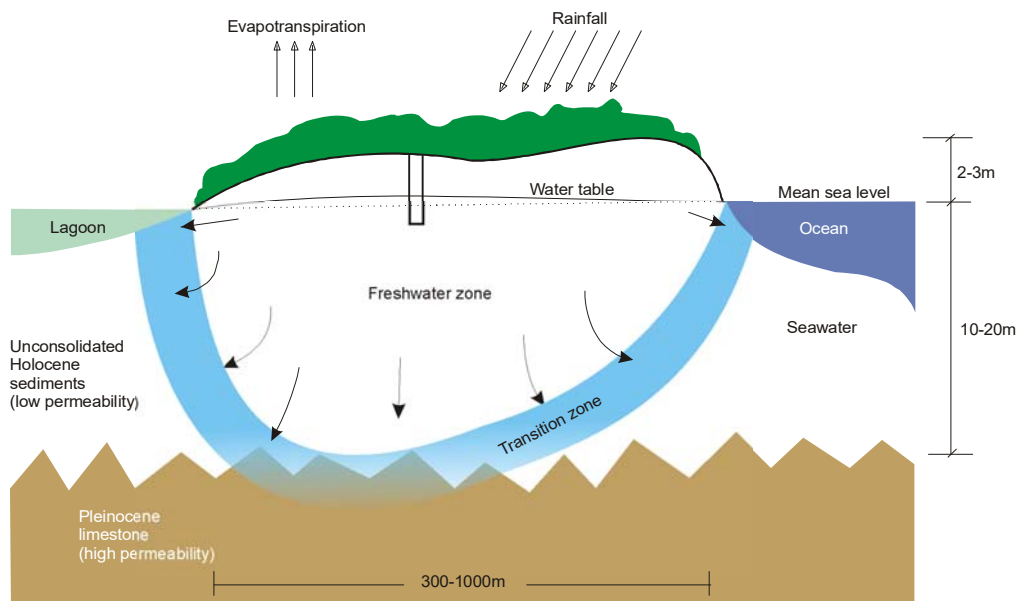


Figure 4-6: Conceptual Illustration of freshwater lens in a small coral island (after Falkland)

The above illustration is typical of most of the islands. Like other islands in the Maldives, Malé is also small, low-lying and flat with thin, superficial groundwater lenses. The groundwater lens in Malé has been severely deteriorated due to congestion and subsequent over-abstraction and sewage contamination. The fresh water lens has dwindled from over 20m in the early 1970s to less than 2m below the water table in 2000 as a result of the rapid urbanization over the years. There are high levels of faecal and total coliforms everywhere with high levels of hydrogen sulphide and nitrates in the water. The salinity in the project area is considerably good when compared to some other parts of Male' with 0.89 ppt and 1.10 ppt (Table 4-1), however is still high compared to fresh water levels of less than 0.5 ppt. The generally high salinity levels in ground water in Male' is due to excessive abstraction, however with the increase in use of desalinated water for most of the domestic purposes in most households, the salinity levels of groundwater in Male' has decreased in recent times.

The water table in the project site is approximately 1.5m below the ground surface. The water table was believed to fluctuate with tides. However, recent findings of Sandcays indicate that there is very little or no variation of water table with tides in larger islands.

Table 4-1: Groundwater quality at and around the project site

	Unit	Burger Point	Ameen Building (University)
GPS Coordinates of location		4°10'18.22"N 73°30'28.20"E	4°10'17.15"N 73°30'32.53"E
Temperature	°C	27.92	26.86
pH		8.83	8.87
Total Dissolved Solids	mg/l	1150	1409
Salinity	ppt	0.89	1.10
Dissolved Oxygen	mg/l	1.80	1.66

4.4.2 Water and Sewerage

Since its incorporation in 1995, Malé Water and Sewerage Company Ltd. has been providing water and sewerage services in Malé. The service was previously provided by the Government under the mandate of Maldives Water and Sanitation Authority.

In Malé, a comprehensive sewerage system with about 9 pump stations disposing wastewater into the ocean via six ocean outfalls had been installed in the late 80s. Untreated wastewater is discharged via these ocean outfalls. This was done following epidemics of cholera in the late 70s and typhoid and shigella in 80s. At the same time a proper water scheme depending on rainwater collection was also introduced. The result was a dramatic improvement in sewage

disposal and water-borne disease prevalence. However, sewage and wastewater leaked into the ground via household catchpits made from cement and kept contaminating the groundwater aquifer. As a result, hydrogen sulphide or sewer gas was present in extremely high levels until the whole system was ventilated in 2000 following an incident of hydrogen sulphide poisoning which caused two deaths in 1997. Due to the smelly groundwater emanating hydrogen sulphide inside toilets, some of the new buildings in Malé are almost entirely dependent on desalinated water.

The entire Malé is supplied with desalinated water produced by reverse osmosis, which is an energy-intensive process. From the first plant of 200tons in 1988 to a current production of over 10,000tons in the greater Malé region, desalinated water is heavily depended upon. However, even today, groundwater is being used in Malé for flushing. Nonetheless, the trend is to avoid use of groundwater even for flushing to avoid smell in toilets as well as the building. Some argue that the use of desalinated water sets-off the cost of pumping groundwater to flush tanks and provides a living environment free from poisonous gases such as hydrogen sulphide. Rainwater tanks are also installed in some buildings as backup and for domestic uses including watering plants.

4.4.3 *Waste management*

Waste may be considered as the main environmental problem facing Malé and the rest of the Maldives today. Waste management is an important municipal service that has been mismanaged in Malé for a long time. With the advent of Malé City Council with elected members in 2009 and the Decentralization Act passed in 2011, Councils have been entitled to manage waste although clear roles and responsibilities were not defined. However, for Malé City, the central government has taken the decision to allocated this responsibility to Waste Management Corporation under the guidance of Ministry of Environment and Energy.

In Malé, waste collection at household level is undertaken by individuals, mainly as a part time job by the large number of foreign labourers working in the government, private companies and households. They collect waste and transport the waste to the designated waste collection site. The waste collection yard was cleaned up in 2012, following which waste that is taken to the site is regularly ferried to Thilafushi to avoid smell and other inconveniences related to rotting waste and overflow of waste from the collection area. A few local

companies are also involved in the waste collection business. Currently there are plans to start systemic waste collection by Waste Management Corporation.

Since the clean-up of Malé waste collection yard in 2012, waste is taken to Thilafushi on a regular basis without letting any waste to stand on the island. However, a greater problem remains to be addressed at its ultimate disposal location at Thilafushi. Open burning of tons of waste from Malé and the rest of the Maldives received in Thilafushi on the west of Malé has been a critical environmental health issue for a long time. The thick cloud of smoke from the burning carried with it carcinogens due to burning all sorts of waste at low temperature in the open. The southwest monsoon winds blow the cloud over the greater Malé region (populated by over a third of the entire population of Maldives) covering Gulhifalhu, VilliMalé, Malé, Hulhulé and Hulhumalé. In addition, Thilafushi is the host to a number of important commercial and industrial activities and home of the large foreign workforce who are directly impacted by the smoke from burning waste. Nuisances associated with rotting garbage including smell and flies in the neighbouring inhabited islands as well as resorts have been a long due environmental and health concern that remains to be addressed. In order to address this long overdue social and environmental disaster, the government through assistance from development banks are developing plans for waste management in the greater Male' region.

The recently introduced Waste Management Regulation requires that licensed parties undertake waste collection, disposal and management. However, the means to implement the regulation yet remains to be discovered.

4.4.4 Electricity

Electricity is provided in Malé City by State Electric Company (STELCO), wholly owned by the Government of Maldives. STELCO has a total installed capacity of 61.42MW powered by diesel of which 40MW is utilized at peak load. Therefore, STELCO is currently capable of providing uninterrupted electricity service to the growing demand in Malé. Therefore, there will be no need for a backup facility. However, the ever-increasing population and growth in the economic sector appears to have effected recent power cuts in Malé City and the ongoing Fifth Power Project is expected to address the concerns. When the issue was discussed in the Scoping Meeting, STELCO responded that they would be able to cater to the several projects currently underway in Malé City.

4.4.5 Other utilities

Telephone lines are installed throughout Malé by Dhiraagu while Dhiraagu and Ooredoo provide telecommunication services to Malé and the rest of the Maldives. ROL (Raajje Online) also provides internet services separately.

Cable TV is provided in Malé by MediaNet. There is a possibility that the above-named telecommunication service providers may also start live TV services with all local channels being live-streamed now by Dhiraagu in association with Schwack Maldives.

Natural gas/cooking gas, which is imported and stored at Thilafushi by Villa Hakatha and Maldives Gas is distributed in cylinders by several parties including Villa Gas and Maldives Gas.

4.5 Air Quality

In the Maldives, air quality is generally good with few sources of air pollution in the islands although Malé has several air pollution concerns due to open burning of waste at Thilafushi, congestion, ever-increasing construction works and high number of vehicles and vehicular movements.

Visible air pollution can be seen to vary across the Maldives with poor visibility in the north and good visibility in the south below the equator, especially during the northeast monsoon. This was observed during recent field visits to HA Atoll and Seenu Atoll. It was observed during the northeast monsoon that the skyline of the north of Maldives is grey with low visibility of nearby islands whereas the skyline of the southern atolls is blue with good visibility. This is a result of the Indo-Chinese pollution spreading over the Maldives with the onset of the northeast monsoon. However, there are no existing studies to quantify this observation.

Maldives EPA has established a few Air Quality Monitoring Stations in the capital, Malé, in December 2012, which measures PM10 and the results published on www.epa.gov.mv. According to EPA (personal communication with former Deputy Director General, Mr. Ibrahim Mohamed), only one sample has been tested during the initial phase and further tests could not be done due to financial constraints since samples have to be sent to foreign

laboratory. The 5-day average for 10 to 15 Dec 2011 was 20 $\mu\text{g}/\text{m}^3$ (24-hourly interval), which is well within acceptable international standards.

Detailed laboratory tests were also undertaken for the EIA for modernizing and expansion of Malé International Airport (AECOM and WS 2010). The results of this study are based on air quality readings over 2 weeks, the results of which are given below (adapted).

Parameter	Skai Lodge, Malé	Site Office, Hulhulé	Central Store, Hulhulé	HDC Building, Hulhumalé	WHO guidelines
PM ₁₀ ($\mu\text{g}/\text{m}^3$)	29	24	22.8	15	50 (24-hourly)
PM _{2.5} ($\mu\text{g}/\text{m}^3$)	8.5	4.3	4.8	4.1	25 (24-hourly)
SO ₂ ($\mu\text{g}/\text{m}^3$)	6.5	4.5	4.5	4.1	
NO _x ($\mu\text{g}/\text{m}^3$)	8.5	6.8	6.2	5.8	20 (24-hourly)
CO ($\mu\text{g}/\text{m}^3$)	138	47	48	35	

The air quality results from the air quality measurements undertaken at the project site are given in the table below. The results indicate that the air quality is within permissible limits.

Table 4-2: Air quality at the project site

Parameter	MWSC Site	Reference values
Temperature (°C)	32.7	
Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$)	1.5	200 $\mu\text{g}/\text{m}^3$ (averaging time 1 hour)
Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)	136.0	500 $\mu\text{g}/\text{m}^3$ (averaging time 10 minutes)
Ozone ($\mu\text{g}/\text{m}^3$)	0.0	235 $\mu\text{g}/\text{m}^3$ (averaging time 1 hour)
Hydrogen Sulfide ($\mu\text{g}/\text{m}^3$)	0.0	15,000 $\mu\text{g}/\text{m}^3$ (averaging time 10 minutes)

4.6 Ambient Noise

As highlighted in the methodology ambient noise levels were measured from three different locations in four different time intervals. As can be seen from table 4-3 the average noise reading is above 85db(A) for all locations at all time intervals at which the reading was taken. In general terms, a noise reading of more than 65db(A) is considered as a nuisance. Thus, this area with the every busy Ameen Magu and many new construction activities going on in the vicinity can be considered as a high noise area. As the ambient noise in the area is already high the contribution of the project in terms of increasing ambient noise levels will be insignificant.

Table 4-3: Noise levels in the project area

Time Interval	Location	Average dB(A)
10:00 am – 12:00 pm (Morning)	1 (Ameenee Magu/Nikagas Magu junction)	87.1
	2 (Ameenee Magu/Aamina Rani Hingun junction)	89.2
	3(Falhumathee Magu)	87.6
1:00 pm – 3:00 pm (afternoon)	1 (Ameenee Magu/Nikagas Magu junction)	88.1
	2 (Ameenee Magu/Aamina Rani Hingun junction)	90
	3(Falhumathee Magu)	86
4:00 pm – 6:00 pm (Evening)	1 (Ameenee Magu/Nikagas Magu junction)	89.7
	2 (Ameenee Magu/Aamina Rani Hingun junction)	90.7
	3(Falhumathee Magu)	85
8:00 pm – 10:00 pm (Night)	1 (Ameenee Magu/Nikagas Magu junction)	88.8
	2 (Ameenee Magu/Aamina Rani Hingun junction)	89.6
	3(Falhumathee Magu)	87

4.7 Traffic

One of the main contributors to air and noise pollution is traffic. Traffic is also an increasing social and environmental concern in Malé, which has the largest proportion of traffic in the Maldives. With over 50,000 motorbikes, over 5,000 cars and several heavy traffic including lorries/trucks, Malé is congested with traffic. With slow moving traffic during peak hours and frequenting traffic jams, getting around in vehicles is not easy. Bus service, which started in 2010, also suffers due to congestion and the service has stopped. Since Malé is not a pedestrian-friendly city, vehicles are still preferable over walking.

Traffic in the area was considered important and was assessed to be similar to other similar high traffic areas of Malé. At the time intervals investigated it was Traffic flow in the project area was assessed on an average day to provide an insight into the traffic flow pattern in the area and understand peak hours. As can be seen from the Figure 4-9 below it was found that the traffic flow is high in all investigated timeframes, particularly in the afternoon and at night. In terms of location the traffic flow is highest in location 1, that is Ameenee Magu and Nikagas Magu junction. This junction will not require closure as a result of the project, the

closure will occur in the location 2 junction, where the traffic is generally less when compared to location.

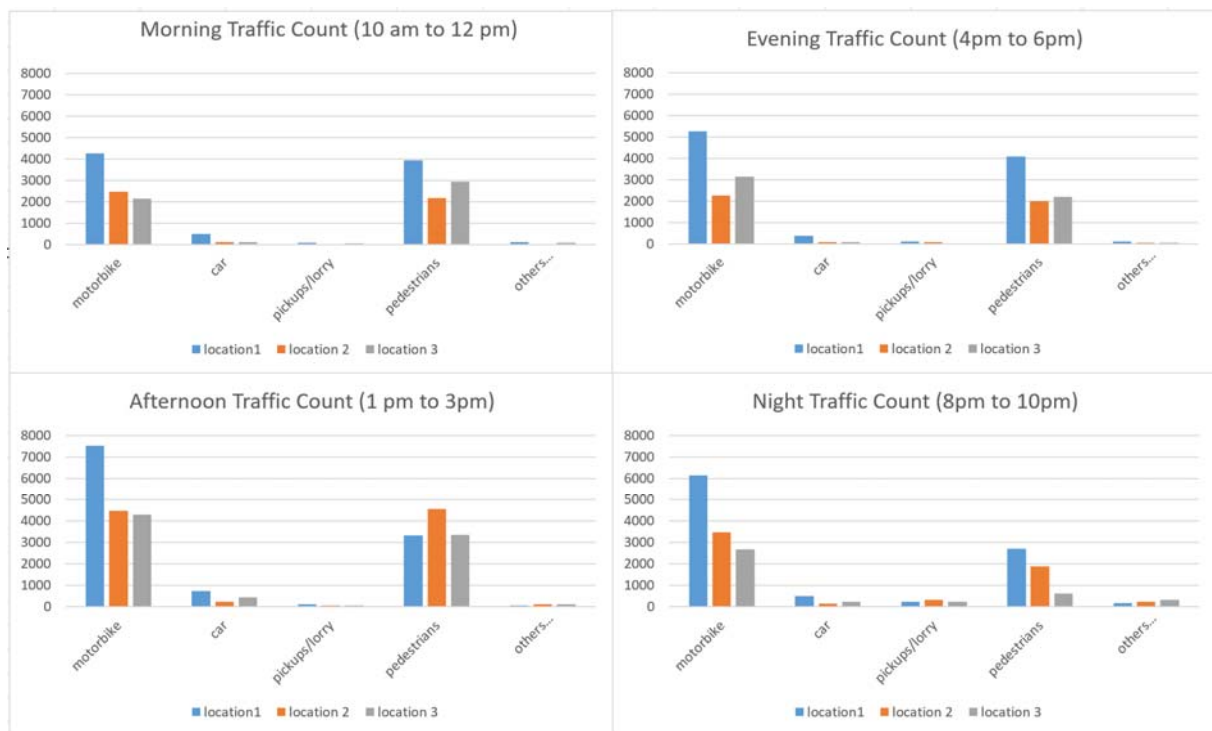


Figure 4-7 Traffic count at project site

4.8 Ecology

Ecologically no flora or fauna are found in the proposed building location. Thus no clearances will be required as part of this project.

4.9 Visual Inspection of the nearby buildings

A brief visual inspection of the existing buildings nearby were undertaken. The results of which are represented in the photo representations (Figure 4.9 and 4.10). This is a brief inspection and visual inspection by licensed engineer will be undertaken prior to construction commencing and after project completion as highlighted under monitoring.

Generally, as highlighted in the description accompanied in the photo representation no major damages were observed in the buildings surrounding the area. Only some minor tile cracks were observed in the Ameenee Building. Also, it is notable that many other construction activities are ongoing nearby including the 25 storey office building development project in

the finance ministry complex. Which can act to exaggerate the impacts of this project through cumulative effects. However, it is important to note that Male' being the urban hub of the Maldives, there are many areas in Maldives where multiple construction activities are undertaken and hence these cumulative effects are not likely to be any major concern.

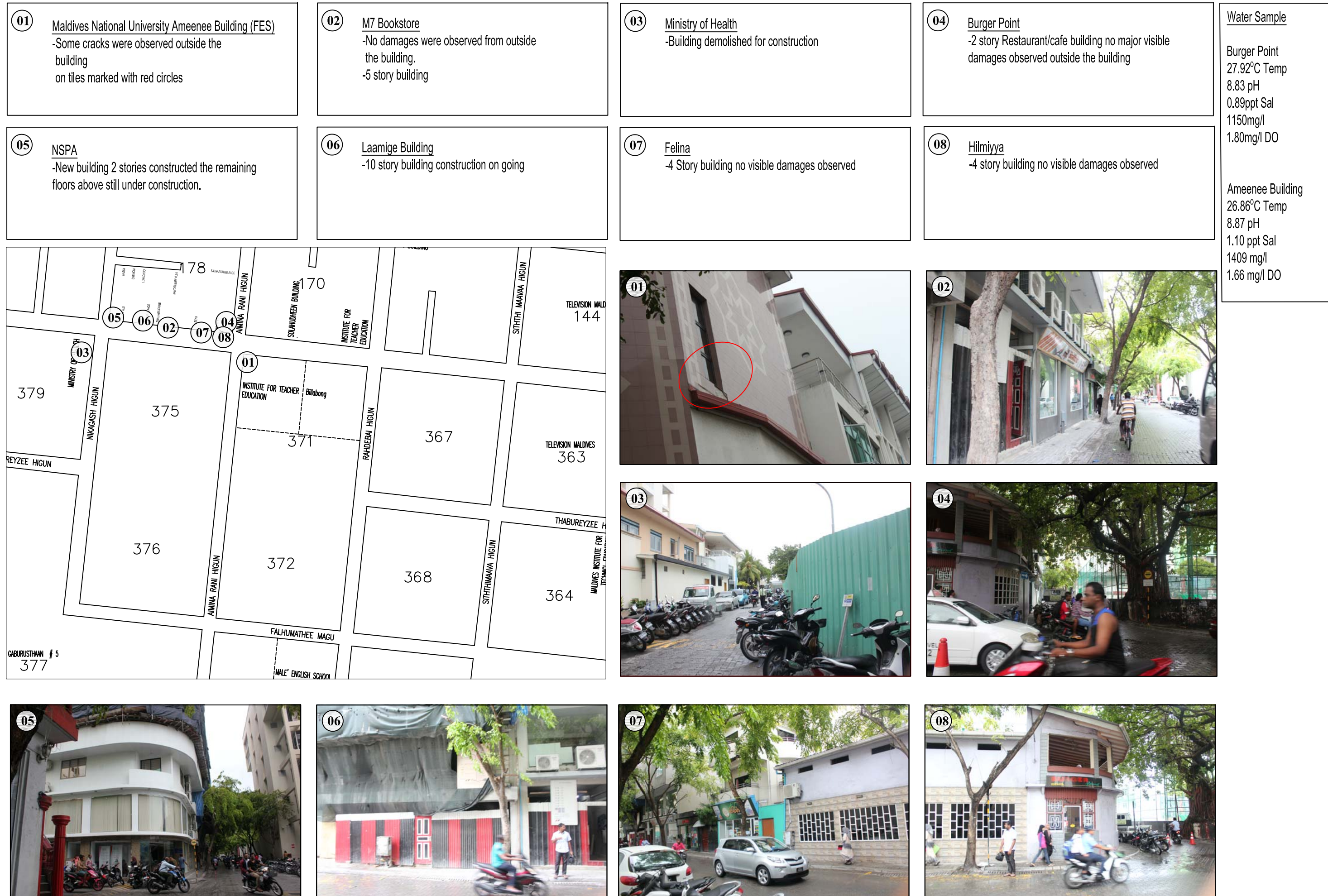
Figure 4-8: Visual assessment of neighboring buildings

Figure 4-9: Photographic illustration of the project site and vicinity



5 Stakeholder Consultations

The only building in the immediate vicinity of the construction site is the Fen Building belonging to the proponent. The other building close-by is the University building (Ameenee building). However, this building is also separated by a road. The remaining buildings are in opposite side in Ameenee Magu, one of the widest roads in Male', and hence any impacts will be negligible. Thus, in terms of stakeholder consultation, the only important stakeholder to consult is the Maldives National University. Particularly Faculty of Education which is housed in the building.

In this regard, consultation was undertaken with Deputy Director, Ahmed Khaleel on 20 October 2016 at the Faculty of Education. In the meeting, the consultant explained the project and the timeframe of implementation of the project and asked Mr. Khaleel regarding the concerns from the University side regarding the project. The prime concern raised was regarding closure of roads during university operating hours. It was highlighted that the faculty undertakes teaching activities during weekends as well with block mode subjects being undertaken during the weekends. Moreover, it was highlighted that the exam period is from 1st November 2016 to 8th December 2016 for this year and hence was requested to avoid any loud noise generating activities during university exam hours.

The proponent is committed to meet these requirements of the university, as highlighted in the mitigation measures in Chapter 8, the road closures will occur predominantly during late night, thus avoiding university operating peak hours and noisy activities will be avoided during exam time. Nonetheless, there will be road closures during the day and every effort will be made to address and minimize related inconveniences as there are several institutional buildings in the area including University, schools, MIRA and other government offices.

6 Environmental Impacts

This Chapter addresses the basic concepts and methodological approach for conducting a scientifically based analysis of the potential impacts likely to accrue as a result of the proposed project. Environmental Impact Assessment (EIA) for quite a few disciplines is subjective in nature and cannot be quantified. Wherever possible, the impacts have been quantified and otherwise, qualitative assessment has been undertaken. This Chapter deals with the anticipated positive as well as negative impacts due to construction of the proposed infrastructure including the operational phase.

6.1 Impact Identification

Environmental and social impacts from various activities of the proposed development have been identified through:

- Consultation with Proponent and other relevant parties
- Purpose-built checklists and matrices
- Existing literature and reports on similar developments in the Maldives
- Baseline environmental conditions
- Consultant's experience of projects of similar nature and similar settings

The impacts on various aspects of Environment shall be assessed for construction as well as operation phases of Environment. The impacts proposed to be covered for assessment during construction and operation phases is given in Table 6-1 and Table 6-2 respectively.

Table 6-1: Environmental impacts to be considered during project construction phase

Aspect	Key Issues to be covered
Water Environment	Sewage generation from labour force
	Pollution due to disposal of effluent with high suspended solids from construction site
	Temporary salinization and possibility of reduced water flow due to dewatering activities
Air Environment	Emissions due to operation of construction equipment
	Increased fugitive emissions from stock piles of construction materials and construction waste.
Noise Environment	Noise due to operation of construction equipment and workforce
Land Environment	Risks to adjacent building due to deep excavation
	Impacts on waste collection yard(s)
	Solid waste generation from labour force
	Pollution due to runoff from construction sites
Biodiversity (flora and fauna)	Increased human interferences for meeting fuel wood and timber requirements
	Impacts on aquatic ecology due to disposal of effluents with high suspended solids/turbidity

Aspect	Key Issues to be covered
Public Health	Respiratory infections due to dust emissions Risk of incidence of illness/diseases from workers
Socio-Economic Environment	Increased employment potential during project construction phase Pressure on existing utilities. Impacts related to health and safety Pressure on traffic due to road-closure during casting of foundation and slabs

Table 6-2: Environmental Impacts to be considered during project operation phase

Aspect	Key Issues to be covered
Socio-Economic Environment	Ease of service to customers. Reduced parking load on the roads due to dedicated parking. Fast efficient one stop service.

A purpose built matrix has been used to evaluate the overall impacts of the proposed project. The impacts of the project have been evaluated according to the following criteria:

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

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

Table 6-3: Impact evaluation scale

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

Based on the above scale, an impact matrix was developed for the proposed development to determine the overall impact of the proposed project. This matrix is given in Table 6-5.

An impact potential index was then developed from Table 6-5. The impact potential index table represents a product of the magnitude (M), significance (S), duration (D) and extent/spatial distribution (E) given in the above table. The sum of all key component specific indexes for one activity (i.e. sum by rows) provides the Activity Potential Impact Index (API) and the sum of all activity specific indexes for one key component (i.e. sum by column) provides the Component Potential Vulnerability Index (CPVI) which gives an indication of the vulnerability of each key component to activity related impacts. Table 6-6 represent the impact potential indices for the proposed project.

6.2 Overall Impacts of the Proposed Project

The overall impact of the proposed project is greatly positive resulting mainly from ease of access to services provided by MWSC to the customers. There would also be direct and indirect employment opportunities in the planning/design phase, construction phase as well as operational phase of the project. The socio-economic benefits of the project may be

considered to outweigh the negative impacts of the project. In fact, the project has minor negative impacts, mainly during construction phase, which could be appropriately mitigated by implementing the mitigation measures proposed in this report.

There are a few negative impacts of the project including mainly impacts related to excavation and dewatering. Excavation has the potential to loosen subsoil, which is the foundation on which the neighbouring buildings are built. Since the MWSC plot is separated from neighbouring buildings belonging to other parties by road, there is little or no concern with reference to damages to neighbouring premises, as the foundation is a raft foundation and vibration impacts would be negligible. All the buildings located within the plot belong to MWSC, hence any negative impacts can be easily managed without much social conflict. There will also be little or no horizontal movement of sand due to excavation given that sandy carbonate soils have heterogeneous material that will adhere to each other and lock into place, providing additional stability. While the impact potential is low for this project, it is still important to provide protective measures as proposed in this EIA to ensure protection and stability. Dewatering may also cumulatively add to the loosening of sand under adjacent buildings. Therefore, it is necessary to provide soft/silent piling to a depth of no more than 1m below the proposed foundation depth around the periphery to mitigate potential impacts of subsoil movement. This has been proposed and included in the project.

There are no notable vegetation that require clearance at the proposed site, hence the impacts on flora and fauna are non-existent.

In addition, human habitat would be burdened during the construction phase. These impacts include noise and dust during construction as well as sanding and tiling works. These impacts are inevitable but can be minimized through appropriate mitigation measures.

The summary of impacts is given in Table 6-4 followed by simple quantification matrices of the overall impacts given in Table 6-5 and Table 6-6.

Table 6-4: Summary of potential impacts

No.	Component	Significance	Remarks
Socio-Economic Environment			
1	Economic activities	Minor	Minor impacts on economic activities may occur due to road closures. However these will be negligible, as the road closures will occur outside the peak working hours.
2	Cultural property	None	No impact is envisaged.
3	Water rights / rights of common	Minor	Dewatering may impact neighbouring well water levels. However this is only a minor temporary impact and not significant since groundwater is not currently widely used.
4	Public health condition	Minor	Increased noise, fumes and dust in the area due to machinery, dusty processes and construction material.
5	Waste	Minor	The construction waste and excavation material will be suitably disposed.
6	Hazard	Minor	No significant impact. Scale of facilities is small.
Natural Environment			
7	Topography & geology	Minor	No significant Impact. Scale of facilities is small
8	Groundwater	Minor	There may be some negative impact in an unlikely event of damage to existing sewerage facilities or dewatering to lay foundation Additionally, dewatering will induce salinization around the project area, but groundwater use is restricted due to current status of the groundwater lens. Hence, minor impacts.
9	Flora	None	No flora.
10	Fauna	None	No fauna.
9	Hydrological situation	Minor	Dewatering may impact neighbouring well water levels. However this is only a minor temporary impact and not significant since groundwater is not currently widely used.
10	Meteorology	None	No impact.
11	Landscape	None	The landscape is already a built landscape hence no impact in terms of landscape.
Environmental Pollution			
12	Air Pollution	Minor	No significant impact but some degree of dust due to vehicular movement to and from site, dusty operation, etc.
13	Soil contamination	Minor	No significant impact but potential for contamination due to accidental spills of paint and other chemicals etc.
14	Noise and vibration	Minor	Some noise and vibration during demolition and construction period is expected. Considering it is Male' high background noise levels offsets the impacts of noise from site.

KEY:

Major: Significant negative impact anticipated

Moderate: Moderate negative impact anticipated

Minor: Negative impact is almost negligible

None: No impact anticipated

Positive: Positive impact is anticipated

Table 6-5: Impact matrix for the proposed project

	KEY COMPONENTS									
	Environment					Socio-Economic				
	Terrestrial flora & fauna	Soil and groundwater	Topography/roads	Landscape	Air/Noise	Services and Infrastructure	Health and Safety	Employment	Property Value	Costs to consumer/tax payer
PROJECT ACTIVITIES										
Construction										
Temporary facilities, machinery and workforce	0	-1 1 1 1	0	0	-1 1 1 1	1 1 1 2	-1 1 1 1	1 1 1 2	0	0
Transport of materials to the site	-1 0 1 2	-1 0 1 2	-1 1 1 2	-1 0 1 2	-1 1 1 2	1 1 1 2	-1 1 1 1	1 1 1 3	0	0
Concrete works and finishing of the building	0	-1 1 1 1	-1 1 1 1	-1 1 1 1	-2 1 1 1	1 1 1 2	-1 -1 1 1	1 1 1 2	0	0
Utilities and services	-1 0 1 1	-1 1 1 1	0	0	0	1 1 1 2	-1 0 1 1	1 1 1 2	0	0
Operation										
Use of building	0	0	0	1 1 3 1	0	3 3 3 3	3 3 3 3	3 3 3 3	3 2 3 2	0
Waste and wastewater disposal	-1 0 1 1	-1 0 3 1	0	0	0	-1 0 3 2	-1 0 3 2	2 2 3 2	0	0
Power and water consumption	0	0	0	0	-1 0 3 3	1 1 3 1	1 1 3 1	1 0 3 2	0	0
KEY:	M S			Magnitude		Significance				
	D E			Duration		Extent (spatial)				

Table 6-6: Impact potential indices for the proposed project

PROJECT ACTIVITIES	Terrestrial flora & fauna	Soil and groundwater	Topography/roads	Landscape	Air/Noise	Services and Infrastructure	Health and Safety	Employment	Property Value	Costs to consumer/tax payer	TOTAL API
Construction											
Temporary facilities, machinery and workforce	0	-0.01	0	0	-0.01	0.02	-0.01	0.02	0	0	0.01
Transport of materials to the site	0	0	-0.02	0	-0.02	0.02	-0.01	0.04	0	0	0.01
Concrete works and finishing of the building	0	-0.01	-0.01	-0.01	-0.02	0.02	0.01	0.02	0	0	0
Utilities and services	0	-0.01	0	0	0	0.02	0	0.02	0	0	0.03
Operation											
Use of building	0	0	0	0.04	0	1	1	1	0.44	0	3.48
Waste and wastewater disposal	0	0	0	0	0	0	0	0.3	0	0	0.3
Power and water consumption	0	0	0	0	0	0.04	0.04	0	0	0	0.08
TOTAL CPVI	0	-0.03	-0.03	0.03	-0.05	1.12	1.03	1.4	0.44	0	3.91
API = Activity Potential Impact Index											
CPVI = Component Potential Vulnerability Index											

The table above indicates that the project has few negative environmental impacts and these impacts occur exclusively during the construction phase. All of these are temporary, minor impacts and hence can be managed easily through proper mitigation measures. Thus, overall the project is seen as a positive impact with many benefits to MWSC and the customers of the company.

6.3 Project Specific Impacts during Construction

6.3.1 Water Quality

The major source of groundwater pollution during project construction phase will be due to leaks and spillage of chemicals, paints, oils and waste oil and effluent from the construction site. In addition, poor handling and management of diesel and other fuel in fuelling of vehicles often lead to contamination of the aquifer

In addition to groundwater shortages to nearby households, due to high pumping rates of groundwater during dewatering, can lead to temporary salinization of the groundwater lens due to salt water intrusion (Geiben-Hertzberg principle). This will cause inconvenience to

nearby households who use groundwater. Nonetheless, this impact is expected to be short-term and spatially limited. Water test done near the plot shows that groundwater is already quite salty as in many other areas in Malé. Moreover, as highlighted in table 6-4, groundwater is only utilised currently in Male' in most households only for flushing. Hence any temporary impacts due to this are likely to insignificant.

6.3.2 Hazard to nearby buildings

Excavation will be undertaken for laying the concrete foundation. According to Horodecki and Dembicki (2006), there are two types of influences on soil due to deep excavation: changes of stress state in a subsoil and technological influence. Excavation causes unloading and reloading of subsoil and the intensity of these impacts depends on geotechnical parameters of the subsoil and geometry of excavation (depth, width and length). Hence, the unloading effect for small excavations has negligible influence on displacements. The closeness of the excavation to the adjacent building is also a cause for concern. The weight of the adjoining building (height of the structure) is also an important factor. Problems of settlement or structural damage often occur if the adjoining building is a high-rise building.

Method of construction including type of excavation, type of support, dewatering methodology and vibrations due to sheet pile wall installation causes changes in subsoil and impacts adjacent constructions is induced by the excavation and loading by the construction. In recent building works for which EIAs have been undertaken, monitoring reports submitted to EPA as well as other reports have indicated that there have been very few instances of failure of adjoining structures. One incident that was reported in media and the monitoring report is the lateral displacement of sand underneath the adjoining 6-storey building during the excavation for foundation works at Ma. Jambugasdhoshuge. According to the monitoring report, it was the Contractor's fault and could have been avoided. Refilling the area was the mitigation measure that was taken.

6.3.3 Impacts due to material transport

The transport and supply of material, excavator, truck and any other machinery may have impacts that may arise from:

- Accidental spillage of construction materials (e.g. cement, paint).
- Accidental oils, paint and other chemical spills.

- Damages to road surfaces
- Accidental Spillage of waste

Considering the scale of the project, the above impacts are expected to be minor and can be managed through appropriate mitigation actions.

6.3.4 Impacts on land

The major impacts anticipated on land environment during construction phase are as follows:

- Operation of construction equipment
- Soil erosion
- Disposal of construction waste
- Impacts due to temporary closure of roads

Operation of construction equipment

During construction phase, various types of equipment will be brought to the site. These include concrete mixers, earth movers, mixers, graders, etc. The siting of this construction equipment would require significant amount of space. Similarly, space will be required for storing of various types of construction material as well. Efforts must be made for proper siting of these facilities. Efforts must be made to site the contractor's working space in such a way that the adverse impacts on environment are minimal.

Soil erosion

If excavation and foundation works are undertaken during the rainy season, rainwater runoff could cause unloading of the sand, which in turn will weaken structures standing on them. Therefore, it would be necessary to plan foundation works in such a way that soil erosion due to rainwater runoff can be minimized. Thus, ideally the works should be planned at period where there is no significant rain.

The runoff from the construction sites will have a tendency to flow along with natural drainage, and get accumulated in depressions or low lying areas, leading to formation of stagnant pools of water. This can lead to increased proliferation of mosquitoes. Another instance of mosquito proliferation reported in Mustafa (2013) is when the elevator pit is left for mosquitoes to breed. Hence, it is important to ensure that the runoff from construction

sites is properly collected and disposed. Adequate measures need to be implemented to ameliorate the adverse impact on this account to the extent possible.

Disposal of construction waste

The waste material generated during construction phase needs to be appropriately disposed. A part of the construction waste can be used for restoration of the construction site, including excavated soil. The remedial measures have been identified in chapter 8 under mitigation measures.

Due consideration will be given for waste storage at the construction site such that it doesn't cause any hindrance to local movement and daily routine of the workforce within the site. Stockpiles will be covered to protect from dust and erosion.

It would be necessary for the contractor to dispose construction waste at the Construction Waste Disposal Site in the southeast of Malé on a regular basis during demolition as well as construction. Sadly, construction waste disposal site in Malé is a hazard in itself, however, remedial measures for construction waste management at disposal site is beyond the scope of the EIA report.

Impacts due to temporary closure of roads

Temporary closure of roads can cause hindrances to daily activities of the public. Especially since many government offices and a university building is located within the immediate vicinity of the site, any road closure needs to be planned such that it does not impact daily activities. As highlighted in chapter 5, this was the main concern raised by the university as well. Approval for road closure will be attained from Ministry of housing and Infrastructure and the council. Any road closures will not coincide with peak working hours and peak teaching hours at the university. Where possible it will be aimed not to close Ameenee Magu, for long period of time, as it is the one of the busiest roads in Male', as can be seen from the traffic survey in chapter 4.

6.3.5 *Ambient Air*

Dust is a cause for concern in building projects in residential areas and areas with public institutions such as schools. Research has shown that fine dust particles from cement,

aggregate, silicates and wood can cause a variety of illnesses such as allergies, asthma and bronchitis and have also been linked to cancer in case of long term exposure. Sensitive individuals such as those with asthma or sinusitis will be affected most during construction activities. In the Maldives, fine cement dust from finishing works for interior of walls (sanding) is one of the main causes for concern in building projects. Cutting tiles in tiling is another dusty operation. Wet processes are available, however, may be cost-prohibitive.

Like high background noise, high background dust, compared to other islands in the Maldives, is an everyday phenomenon in Malé due to increasing number of construction activities occurring concurrently in a given area at a given time. The dust from the proposed construction work is not going to be any worse than the everyday dust that people may be prone to. However, on-site carpentry or aluminium works and other similar works shall be avoided to the greatest possible extent by installing precast-units. If necessary, such dusty operations shall be undertaken in confined space with appropriate personal protective equipment provided to personnel. Pre-fabricated doors and windows shall be encouraged. Good engineering standards, quality materials and material preservatives as well as paint shall be used in order to avoid release of toxic substances during the operational phase.

Transportation of material to site will also generate sand or silica dust while the operation of construction equipment/machinery on site and vehicles used for transport will generate soot and air pollutants, mainly carbon dioxide, sulphur dioxide and nitrogen dioxide, which contributes to global warming and subsequent climate change. In addition, incomplete combustion can lead to release of carbon monoxide and hydrocarbons. Hydrocarbons can react with oxides of nitrogen to form ozone. Carbon monoxide reduces flow of oxygen in blood stream and ozone is an irritant that can cause respiratory illnesses. However, the proposed projects will use mainly manual labour and use of machinery and vehicles will be limited mainly to concrete works and transport. Therefore, emissions due to the project is considered to be minimal although there will be some cumulative contribution from the project towards overall emissions. Hence overall, no significant impact on ambient air quality is expected. The size of the project being small, the impact due to fuel for energy is not a significant contribution to global warming by itself. However, the cumulative impact shall be considered to be minor to negligible.

6.3.6 *Ambient Noise*

The impacts on ambient noise levels are expected only during the project construction phase, due to demolition works and the operation of construction equipment and electric tools.

Noise levels in the immediate proximity of most work sites are expected to be only slightly higher during construction. This is because of the high background noise levels in Male'. The duration of this exposure will also be relatively brief. This exposure represents temporary, localized, minor adverse residual effect of low significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during construction. Noise levels associated with the operation of construction equipment will be minor as civil works will be confined in relatively small sites and use of machinery is expected to be minimal at all worksites.

Walls of various houses or other structure will attenuate at least 30 dB(A) of noise. In addition, there is noise attenuation due to the following factors.

- Air absorption
- Rain
- Atmospheric inhomogeneities

Thus, no significant increase in noise levels is anticipated, due to already high background noise levels at Male'. As can be seen from the noise data on site the background noise levels are already quiet high at the project site. The Ameene Magu being a busy road and many new construction activities going on in the vicinity.

The effect of high noise levels on the operating personnel may be considered. It is known that continuous exposures to high noise levels above 90dB(A) affects the hearing acuity of the workers/operators and hence, should be avoided. Despite this, during the construction phase the generation of significant noise will be for fairly short periods during operation of certain machinery and equipment, thus the impact is likely to be only minor. Also as requested by the university effort will be made to minimize noise pollution during university exam time.

6.3.7 *Ecology*

No significant impacts are likely to occur as a result of the project from an Ecological sense as the site is completely devoid of any flora and fauna. However ecological impacts may occur during transfer of construction material and waste during construction phase. A degree of sea

transport is likely to be involved as material stored in warehouses in Thilafushi and Hulhumale' are likely to be transported to Male' for construction. This transport if appropriate measures are not taken can lead to spillage into sea and impact on marine life. Thus, as highlighted in chapter 8 appropriate measures needs to be taken to ensure that sea transport vessels have appropriate safety measures in place and all transported materials are sealed and secured such that no spillage into ocean occurs. Spillage can also occur during land transport, however the impact is likely to be much less significant from an ecological point of view, as in terms of land ecology Male' is devoid of any significant flora or fauna.

6.3.8 Cultural Property

There is no impact on any sites or property of religious, historical and/or cultural significance as a result of this project, hence this impact is none existent for this project.

6.3.9 Impacts on Utilities

No significant adverse impact on utilities is envisaged. There will not be a significant change in number of users of utility services during construction phase. However, during excavation if proper precaution is not taken it can lead to damage to existing utility cables and pipes. Moreover, according to Zahir (2010), during dewatering, it is important to monitor toilets of adjacent buildings to ensure that flow rate is not excessive so as to exceed capacity of the sewers since dewatering effluent is direct into the sewerage system. According to some engineers if rate of flow exceeds the capacity of discharge pipes back flow could occur in toilets at nearby plots. Therefore, it would be important to keep track of such incidents and to immediately stop pumping or reduce speed if backflow is observed or reported.

6.3.10 Socio-Economic Environment

There are a few minor negative socio-economic impacts of little or no significance during the construction phase. These include the disturbance to vehicular and pedestrian movements during loading and unloading of materials to site, especially during the concrete works. Moreover, disturbances due to road closures can be a cause of social concern as highlighted earlier. Noise from construction equipment, which has been discussed earlier, poses no potential concerns.

There is also potential for impact due to cultural differences with foreign labour force, which is not a cause for concern due to the small labour requirement for the project as well as the fact that the community is already socially integrated and generally tolerant of people from other cultures. Malé hosts the largest no. of foreign labour force. Therefore, this impact is considered negligible.

It is also believed that there will be several opportunities for locals including direct or indirect employment and provision of goods and services during the project implementation. This is considered as an important positive impact of the project.

6.4 Project Specific Impacts during Operational Phase

6.4.1 Land

No major impacts are anticipated on land environment during project operation phase. However, it is anticipated that the new building will have some landscaping the responsibility of which will be carried on to the operational phase. This is expected to improve the overall aesthetics of the area.

Moreover, as the building has dedicated parking at the basement level this will reduce the parking pressure in Amenee Magu, which is already congested with vehicles during peak working hours.

6.4.2 Energy

The proposed project will have energy uses including air-conditioning, fans, lights and equipment that will be associated with the operational phase. Therefore, the overall electricity demand will increase slightly, however considering the scale of the project this is negligible. Thus, there will not be a need to increase the existing capacity of the diesel generator sets in Malé, as has been mentioned earlier. The impacts of emissions related to burning of fossil fuel due to this increase in energy consumption would be minor.

6.4.3 Ambient Noise

No major impacts are anticipated on noise environment during the operational phase.

6.4.4 *Ecology*

No major adverse impacts are anticipated on ecology during operation phase. However, few trees and some small plants may be planted when undertaking landscaping, which will increase the aesthetic value of the site

6.4.5 *Socio-economic impacts*

The primary objective of the project is to provide an easy one-stop customer service base for MWSC operations in Male'. This will have positive impacts on the public, as waiting time for service is reduced and better quality service is provided to the public. Moreover, the improved call center service through this project means many issues can be resolved easily through phone, thus saving time and effort on the part of the customers.

Moreover, the improved and expanded service center operations of the company will create many jobs, which also positively impact on the local community. Especially considering that the job market in the Male' region is getting more competitive day by day.

6.4.6 *Utilities*

No significant impact on existing water supply, sewerage, power systems and waste management system as the number of users will change little, if any.

6.5 Uncertainties in Impact Prediction

Environmental impact prediction involves a certain degree of uncertainty as the natural and anthropogenic impacts can vary from place to place due to even slight differences in ecological, geomorphological or social conditions in a particular place. However, the level of uncertainty, in the case of the proposed infrastructure project may be expected to be low due to the experience of similar projects in Malé. Given that there may be uncertainties in terms of structural failures of neighbouring structures as well as potential claims of damage or nuisances such as availability of groundwater during the dewatering period, it is important to undertake monitoring as described in the monitoring programme given in this EIA report.

7 Alternatives

The project is of small scale and the project components are of suitable nature to the project. However, an important component of all EIAs is to consider alternative options that are feasible and to come up with the best possible alternative. This includes consideration of no project option as well. As for this project, two aspects are investigated with regards to alternatives, that is the no project option and alternative foundation option.

7.1 No Project Option

The ‘no project’ option investigates the advantages and disadvantages of status quo when compared with the project option. In the case of the proposed project ‘no project’ option means that customer service center is not built and the hence the benefits of the such a dedicated service is lost for the customers and the company. However, this option will prevent the minor negative impacts that are envisioned for the construction phase. Despite this as highlighted in detail below, the overall the project is beneficial and the ‘no project’ option has far more disadvantages than advantages.

Table 7-1 Comparative analysis of project and 'no project' option

Advantages of “no project” option	Disadvantages of “no project” option
Temporary construction related impacts will not occur	Status quo means reduced customer satisfaction for the services provided.
	The increased job opportunities as a result of the project will not be realized.
	Loss of revenue for the company due to customer dissatisfaction.
	Improved aesthetics as a result of the project will not be realized.
	Additional parking spaces as a result of the project will not be realized.

7.2 Type of Foundation

In addition to ‘no project’ option, considering the fact that EIA for building projects are required primarily due to impacts during foundation works, it is important to look into alternative foundation options. The alternative method of foundation would be to opt for deep pile foundation. In this method, metal load-bearing piles are driven to depths of 30 to 40 metres. Deep Pile Foundation was undertaken in Malé for the 15-storey building at Athireege Aage (Currently Hotel Jen). Complaints of small degree tremors and cracks in walls were

observed in neighbouring buildings including Dharumavantha School opposite the building. The piling had already been almost completed by the time the issues were addressed and EIA was undertaken. So, the project was allowed to proceed, based on the outcomes of the project. However, deep pile driving for building foundation has been disregarded in most similar building projects ever since. Only recently this was considered for part of the building works required for the Nasandhura development. However, the method of pile driving used for Nasandhura building is different to that practiced in Athireege Aage, as instead of hammering the piles, piles are placed in pre-drilled holes. Despite this, the drilling involved in the Nasandhura project, has also caused public concern due to vibrations experienced by the nearby buildings. Nevertheless, this method is feasible for foundations in less urban areas and in countries with more compact and stable soil and hence is not recommended for the proposed project.

8 Impact Mitigation and Management

8.1 Introduction

Based on the environmental baseline conditions, planned project activities and impacts assessed earlier, this Chapter outlines the mitigation measures that needs to be adopted in order to minimize the potential negative impacts to a low significance level. As highlighted in in Chapter 6 under impacts, the negative impacts are envisioned to occur almost exclusively during the construction stage. Thus, the focus of impact management and mitigation is on the construction phase of the project. As highlighted in Chapter 6, the main impacts that are likely to occur during construction phase are related to groundwater quality, air quality, noise, marine ecology, hazard to nearby buildings, health and safety, traffic disruptions and utilities. Thus this chapter focuses primarily on mitigation measures for these four aspects. Firstly, the chapter explains the mitigation measures followed by a summary table outlining the impacts, mitigation measures, parties responsible for implementation of mitigation measures and the cost of mitigation.

8.2 Mitigation Measures

This chapter explains mitigation measures in detail. As highlighted above the focus is on construction phase, as no negative impacts are envisioned to occur as a result of this project during operational phase.

8.2.1 Groundwater Quality

As highlighted in Chapter 6 groundwater quality maybe impacted due to spillages, damage to sewer lines and through dewatering. The following mitigation measures will be practiced to minimize the potential impacts on groundwater during construction phase.

- All paints, lubricants and other chemicals will be stored on a hard surface to ensure that any leaks do not impact the groundwater.
- All liquids will be transported in sealed containers.
- All wastes will be transported in vehicles that are covered from all sides to prevent spillage.

- All wastes will be transported in vehicles that are approved for the purpose through the waste regulation.
- All chemical wastes, waste oils and other hazardous waste will be transported in sealed containers.
- Vehicle/machinery and equipment operation, maintenance and refueling will not be undertaken at site.
- Dewatering will be completed in the shortest possible period.
- Providing compensation in terms of water supply, if groundwater runs out from nearby households and buildings during construction phase.
- Location of sewer lines and marking these areas prior to commencement of excavation activities.
- Excavation will be undertaken by experienced operators.

8.2.2 *Air Quality*

As explained in detail in Chapter 6 air quality maybe impacted through dust and to a smaller extent through emissions from the vehicles used in the construction phase. In order to minimize these impacts the following mitigation measures needs to be implemented.

- All vehicles used in the project should have an up to date road worthiness certificate.
- All vehicles and machinery should be well tuned.
- Ensure that construction site is wetted to minimize impact of dust as a result of the project.
- Materials that are stockpiled at the location for long period of time should be covered to minimize impact of dust generation due to windy conditions.
- Use prefabricated doors and windows or undertake these activities at an indoor location at the site to minimize dust generation within the site.

- Undertake activities like tile cutting indoors to minimize dust generation into the surrounding.

8.2.3 *Ambient Noise*

As highlighted in details in chapter 6 the ambient noise level can be impacted during the construction phase through the operation of machinery and vehicles during construction and demolition phase. The following mitigation measures needs to be adhered to minimize impacts on ambient noise:

- Except for foundation and concrete works, other high noise generating activities should be undertaken during day time.
- Avoid undertaking high noise generating activities during prayer times.
- Avoid undertaking high noise generating activities during university exam period.

8.2.4 *Marine Ecology*

As highlighted in the impacts, only impacts envisioned in terms of ecology is impacts on marine ecology that may occur during material transport. The following mitigation measures can be implemented to minimize such impacts:

- All vessels used for transportation will be covered from all sides to prevent any spillage.
- All vessels used for waste transport will be approved through the waste regulation.
- All liquids, oils, paints and waste oil will be transported in sealed containers.
- All transport vessels will be operated by experienced captains.

8.2.5 *Hazard to nearby buildings*

As identified in previous chapters the main reason for requiring EIA for building projects are due to potential structural damage to nearby buildings. The potential for damage to nearby buildings are high during excavation and foundation works. Hence the mitigation measures should focus on these aspects. The following mitigation measures should be implemented to minimize impacts:

- All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized as decided upon beforehand.

- Excavations shall conform to the lines, grades, side slopes and levels shown in the drawings or as directed by the engineer.
- Excavation shall be taken in the presence of the engineer or competent supervising personnel.
- Ensure that visual engineering assessments are done of the nearby adjacent buildings prior to construction commencing to identify existing cracks and share the reports with respective owners of the buildings.

8.2.6 *Health and Safety*

As identified in Chapter 6, health and safety is important, both in terms of public safety and safety of workers, in such construction projects. In this regard, the following mitigation measures need to be considered from a health and safety perspective:

- Necessary barriers, warnings, signs demarcating unsafe areas should be followed according to standard construction practices.
- Where relevant, safety nets should be used to cover buildings and prevent injury to public. Safety paths should be identified for public movements.
- Provide first aid facilities in case of an emergency and safety protocols during such event.
- Aluminum and wood works at site shall be supervised and workers informed of the necessity to take care when using tools such as electric cut-offs.
- Contractor shall be required to comply with all the precautions as required for the safety of the workers as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to the contract.
- Provide necessary safety appliances such as protective footwear, cloth gloves, safety goggles for welders, helmets, masks, ear muffs for operation of noisy machinery etc to the workers and staff.
- Chemical-Liquid protective gloves should be used when handling any chemicals, waste oil or other liquid waste.
- Should install temporary toilet facilities at the construction site for construction workers.
- During construction period, any visitors could enter the site with the approval of the project supervisor. Unauthorized visitors should not be permitted to the project site.

- The construction area should be secured to prevent unauthorized access.
- No open electrical wiring or cables should be kept on site.
- Health and Safety briefing should be given to all construction workers.
- In order to guarantee construction safety, efficient lighting and safety signs shall be installed during construction.
- All temporary structures need to be dismantled once construction is completed.
- Avoid leaving pits, holes open empty containers at the constructions site. As these act as potential locations for mosquito breeding.
- Ensure 24-hour security at the construction site to prevent burglary of nearby buildings.

8.2.7 *Traffic Disruptions*

In order to minimize any disruptions to traffic due to road closure and movement of vehicles the following mitigation measures will be considered:

- As much as possible avoid peak hours of travel to offices and schools, when undertaking material land transport to and from the construction site.
- Road closures should be undertaken as per direction of the city council/housing ministry.
- Avoid closure of Ameene Magu as much as possible.
- All road closures should be to the shortest possible period and should avoid peak hours of travel.
- Avoid peak operating hours of university for road closure.

8.2.8 *Utilities*

As highlighted in chapter 6 utilities can be affected during construction phase as utility lines and pipes maybe damaged during excavation works. Moreover, if dewatering is undertaken through the existing sewer pipes it can lead to backflow in toilets of nearby buildings. In order to prevent these scenarios, the following mitigation measures needs to be realised:

- Excavation works needs to be undertaken by experienced operators.
- All utility lines and pipes needs to be identified prior to excavation.
- Keep track of incidents of backflow from nearby buildings and adjust flow rate during dewatering accordingly.

The primary responsibility of implementing these mitigation measures lie with the proponent and the contractor. However, it is the task of the proponent to ensure that the contractor is fully aware of the mitigation measures and the measures are adequately implemented. Moreover, as per the recent revision to the EIA regulations it is must to have the EIA report and the decision statement at the site with the contractor. Hence the proponent should ensure that this condition is met by the contractor.

The proponent should assign a suitably qualified person to oversee the project implementation by the contractor. This person needs to be thorough with the requirements specified in this EIA report and needs to brief the contractor and its staff on these requirements. Alternatively, the proponent could assign a consultant to undertake this activity.

In addition to implementing these mitigation measures for construction phase, in order to realize the full potential of the positive impacts during operational phase the following aspects needs to be considered by the proponent:

- The additional staff required for sufficient operation of the customer service centre should be sourced locally as much as possible.
- Training of staff on customer care and customer service. Short term and refresher courses needs to be provided to staff on these areas.
- Workshops on good environmental practices targeted to company staffs should be undertaken periodically. This should cover 3R's of waste management, water saving practices and energy saving practices.
- Providing bins within the premise of the building in strategic locations.
- Putting up signs and boards promoting good environmental practices.

8.3 Summary of Mitigation Measures

The table below summarizes the main impacts of the project, proposed mitigation measures, responsible party for implementation of mitigation measures and the cost of mitigation measures.

Table 8-1: Summary table of environmental impacts and mitigation measures

Aspect	Impact	Mitigation Measures	Responsible Party	Cost of Implementation
Ground water Quality	Spillage of construction material at construction site and during transport. Spillage of waste at construction site and during transport. Leaks of fuel and oil into ground during refueling and maintenance of machinery. Dewatering causing groundwater salinization. Dewatering causing temporary loss of water from nearby buildings and households. Damage to sewer lines during excavation leading to sewer leak into ground and thus groundwater.	All paints, lubricants and other chemicals will be stored on a hard surface to ensure that any leaks do not impact the groundwater. All liquids will be transported in sealed containers. All wastes will be transported in vehicles that are covered from all sides to prevent spillage. All wastes will be transported in vehicles that are approved for the purpose through the waste regulation. All chemical wastes, waste oils and other hazardous waste will be transported in sealed containers. Vehicle/machinery and equipment operation, maintenance and refueling will not be undertaken at site. Dewatering will be completed in the shortest possible period. Providing compensation in terms	Proponent/Contractor	No potential costs involved in implementing these measures.

		of water supply, if groundwater runs out from nearby households and buildings during construction phase. Location of sewer lines and marking these areas prior to commencement of excavation activities. Excavation will be undertaken by experienced operators.		
Air Quality	Greenhouse gas emissions from vehicles used in the project. Emission of carbon monoxide and hydrocarbons due to incomplete combustion. Generation of dust from movement of vehicles. Generation of dust from construction material kept in the open. Generation of dust from construction activities.	All vehicles used in the project should have an up to date road worthiness certificate. All vehicles and machinery should be well tuned. Ensure that construction site is wetted to minimize impact of dust as a result of the project. Materials that are stockpiled at the location for long period of time should be covered to minimize impact of dust generation due to windy conditions. Use prefabricated doors and windows or undertake these activities at an indoor location at the site to minimize dust generation within the	Proponent/Contractor	No potential costs associated with implementation of these mitigation measures

		site.Undertake activities like tile cutting indoors to minimize dust generation into the surrounding.		
Ambient Noise	Disturbance to nearby residents from construction noise.	Except for foundation and concrete works, other high noise generating activities should be undertaken during day time. Avoid undertaking high noise generating activities during prayer times. Avoid undertaking high noise generating activities during exam period of the university when exam is in progress.	Proponent/Contractor	No potential costs associated with implementation of these mitigation measures
Marine Ecology	Spillage of construction material and waste during transport to Male' from the sea.	All vessels used for transportation will be covered from all sides to prevent any spillage. All vessels used for waste transport will be approved through the waste regulation. All liquids, oils, paints and waste oil will be transported in sealed containers. All transport vessels will be operated by experienced captains.	Proponent/Contractor	No potential costs associated with implementing these mitigation measures.

Hazard to nearby buildings	Structural damage to nearby buildings during excavation works and foundation works.	All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized as decided upon beforehand. Excavations shall conform to the lines, grades, side slopes and levels shown in the drawings or as directed by the engineer. Excavation shall be taken in the presence of the engineer or competent supervising personnel. Ensure that visual engineering assessments are done of the nearby adjacent buildings prior to construction commencing to identify existing cracks and share the reports with respective owners of the buildings.	Proponent/Contractor	MVR 30,000 for the engineering visual assessment.
Health and Safety	Health and safety of construction staff comprised as appropriate health and safety standards are not followed. Health and safety of the public comprised due to inappropriate safety conditions at the construction site.	Necessary barriers, warnings, signs demarcating unsafe areas should be followed according to standard construction practices. Where relevant, safety nets should be used to cover buildings and prevent injury to public. Safety paths should be identified for public movements. Provide first aid facilities in case of an emergency and safety protocols during such event.	Contractor	No additional costs are envisioned to occur as these are standard safety measures

		Aluminum and wood works at site shall be supervised and workers informed of the necessity to take care when using tools such as electric cut-offs. Contractor shall be required to comply with all the precautions as required for the safety of the workers as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to the contract. Provide necessary safety appliances such as protective footwear, cloth gloves, safety goggles for welders, helmets, masks, ear muffs for operation of noisy machinery etc to the workers and staff. Chemical-Liquid protective gloves should be used when handling any chemicals, waste oil or other liquid waste. Should install temporary toilet facilities at the construction site for construction workers. During construction period, any visitors could enter the site with the approval of the project		
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		supervisor. Unauthorized visitors should not be permitted to the project site. The construction area should be secured to prevent unauthorized access. No open electrical wiring or cables should be kept on site. Health and Safety briefing should be given to all construction workers. In order to guarantee construction safety, efficient lighting and safety signs shall be installed during construction. All temporary structures need to be dismantled once construction is completed. Avoid leaving pits, holes open empty containers at the constructions site. As these act as potential locations for mosquito breeding. Ensure 24-hour security at the construction site to prevent burglary of nearby buildings.		
Traffic Disruptions	Traffic disruption due to road closure	As much as possible avoid peak hours of travel to offices and	Proponent/Contractor	No additional cost likely to occur

		schools, when undertaking material land transport to and from the construction site. Road closures should be undertaken as per direction of the city council/housing ministry. Avoid closure of Ameene Magu as much as possible. All road closures should be to the shortest possible period and should avoid peak hours of travel. Avoid road closure during peak operating hours of university.		
Utilities	Utility pipes, lines maybe damaged during excavation. Backflow of water in toilets nearby due to dewatering.	Excavation works needs to be undertaken by experienced operators. All utility lines and pipes needs to be identified prior to excavation. Keep track of incidents of backflow from nearby buildings and adjust flow rate during dewatering accordingly.	Contractor	No additional cost likely to occur.

9 Monitoring

9.1 Introduction

The main objectives of undertaking monitoring is to understand the actual impacts as a result of the project, the effectiveness of the implemented mitigation measures and identify any unforeseeable impacts that occur as a result of the project. Moreover, the information collected during monitoring acts as a source of information for future projects and helps to improve impacts and mitigation identification for future projects.

Moreover, monitoring would ensure that the proposed activities are undertaken with caution and appropriate care so as to protect and preserve the built environment of the areas in proximity to the site or those areas and environmental aspects affected by the development.

The monitoring programme shall target to determine:

- foundation and structural integrity of adjacent buildings during excavation and dewatering
- changes in groundwater table due to dewatering
- groundwater quality during dewatering
- noise and air quality during construction
- incidents and accidents
- impacts are accurate and mitigation measures taken are effective and
- threshold levels are kept within the baseline limits predicted.

9.2 Responsibilities

Overall monitoring responsibility lies with the Proponent or Contractor assigned by the Proponent. EPA and City Council should also monitor the construction activities.

9.3 Project specific monitoring requirements

A project specific monitoring programme is presented with monitoring and reporting protocols. The environmental and social indicators that need to be monitored and monitoring responsibilities as well as costs are identified.

The Environmental Monitoring Programme for the proposed projects is given in **Error! Reference source not found.** The monitoring programme is given only for the construction phase, as previously identified this project is likely to cause negative impacts only during the construction phase. The total cost of monitoring is estimated to be around MVR 70,000.

Table 9-1: Proposed environmental monitoring programme for construction phase

Parameters to be Monitored	Location/ Parameters	Monitoring Method	Frequency	Monitoring Responsibility	Cost (MVR)
Structural damages and dewatering	30m radius of project site. Complaints of structural damages, groundwater deterioration mainly, vibration, noise and air quality related issues rarely	Records of complaints Structural engineer to inspect excavation and dewatering works and keep logs on site. Records of start and end times of relevant works Assess structural damages to adjacent building by a licensed engineer prior to start of work and upon completion of work	Daily during excavation and dewatering And after completion of foundation works	Licensed Engineer/ Proponent	30,000
Groundwater quality for salinization due to dewatering	2 samples in areas adjacent to project site. Parameters to be monitored include pH, TDS/electrical conductivity/DO, level of water table	In-situ sampling using water quality logger and measurement of level of groundwater wells	Daily during dewatering	Proponent/ Contractor	20,000
Dust and noise nuisance at site	Construction sites and surrounding areas	Assess the situation through visual inspection and interviews with local people. Take noise reading using a noise level meter	Once a month (noise readings should be taken during peak and off peak hours)	Proponent/ Contractor	20,000
Waste removal including excavated sand	Complaints received regarding traffic disruptions. Observation of traffic disruption.	Site observations	During road closure	Proponent/ Contractor	0
Disruption to traffic flow	Roads	Site observations/logs	Weekly	Proponent/ Contractor	0
Ensuring that workers wear Personal Protective Equipment	Project site	Site observation and records	Monthly	Proponent/ Contractor	0

9.4 Monitoring Report

A detailed environmental monitoring report is required to be compiled and submitted to the Environment Protection Agency during and after construction based on the data collected for monitoring the parameters included in the monitoring programme given in this report. EPA may submit the report to the relevant Government agencies in order to demonstrate compliance of the Proponent.

9.4.1 Monitoring report submission format and schedule

The monitoring report shall be submitted in accordance to the requirements of the EIA Regulations 2012. As per Schedule (Jadhuvalu) Laamu of the regulations, summary reports needs to be submitted every two months during construction phase and detailed report or reports after project completion as per the schedule identified in the EIA report. In this regard for this project, it is recommended to submit only one monitoring detailed report following completion of construction as no impacts are envisioned to occur during the operational phase of the project.

The monitoring report will include details of the site, strategy of data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed. It will follow the recommended format under Schedule Laamu of the regulation.

10 Conclusions

The proposed project involves construction of 10-storey customer service building at the MWSC plot east of Fen-building. The project is required to improve the services provided by MWSC to the customer base by providing all customer services from one location. The project is overall beneficial in terms providing an efficient service to the customers and creating increase job opportunities for locals.

The negative impacts envisioned for the project are likely to occur during construction phase and all these impacts are minor in significant. The main impacts identified in this report relate to impacts on nearby buildings, impacts on traffic, impacts on groundwater, impacts on air quality, noise impacts and impacts on utility services. All these impacts can be minimized to negligible levels by adopting the mitigation measures proposed in this report.

The environmental monitoring program proposed in this report will help to identify actual impacts of the project and effectiveness of the proposed mitigation measures. Moreover, it will help to identify potential unforeseeable impacts and help to take corrective measures immediately. The focus of the monitoring program is on the construction phase and monitoring is proposed to aspects that are likely to be impacted as a result of the proposed project; that is groundwater, noise, impact on nearby buildings and traffic.

Overall this is a very small project with only minor negative impacts. Overall the project is a beneficial project that has many benefits for the company and especially the customers of the company.

11 Acknowledgements

The contributions and assistance of the following persons who assisted in data collection, data entry and mapping are highly appreciated.

1. Mohamed Riyaz, Sandcays
2. Mohamed Visham, Sandcays

The assistance provided Mohamed Ali and Shaufa Mohamed of MWSC in timely provision of information and following up with the EIA Consultant is worthy of credit. Thanks are also due to those who attended the Scoping Meeting and those who provided the necessary information.

12 References

- AECOM and Water Solution (2010), *Social and Environmental Impact Assessment for Modernization of Male' International Airport, Male'*, AECOM.
- Horodecki, G.A. and Dembicki, E. (2012), *Impact of deep excavation on nearby urban area*
- Jameel, A. and Aleem, A. (2013), *EIA for 10-storey building at Umar Shopping Arcade, Malé*, Water Solutions
- MEE (2012), *Environmental Impact Assessment Regulations 2012*, Maldives
- MEE (2013), *Dewatering Regulation of the Maldives* (Regulation No. 2013/R-1697)
- MEEW (2006), *Handbook on Compilation of Laws and Regulations on Protecting the Environment of Maldives*, Maldives
- MHE (2010), *Fourth National Report to the Convention on Biological Diversity*, Maldives
- MHI (2014), *Dhivehiraajjeyge imaaraaiy kurumaai umraanee tharaggege bill (Draft Building Act)*, Maldives
- Ministry of Housing, Transport and Environment (2009), *Maldives National Sustainable Development Strategy*, Maldives
- Ministry of Housing, Transport and Environment (2009), *Third National Environment Action Plan - 2009-2013*, Maldives
- Musthafa, A. (2013), *EIA for proposed 14-storey building at G. Hudhukokaa, Malé*
- Naseem, M. R. (2012), *EIA for 10-storey building at H. Campus, Malé, ReetTac*
- Saeed, S. (2010), *EIA for construction of 11-storey residential building at Jambugasdhoshuge, Malé, CDE*
- Saeed, S., *Environmental monitoring report for the 11-storey building at Jambugasdhoshuge, Malé, CDE*
- Saeed, S., *Environmental monitoring report for the 11-storey residential building at Husham Residence, Malé, CDE*

Saeed, S., *Environmental monitoring report for the 11-storey residential building at M. Mulammaage*, Malé, CDE

Sandcays (2015a), *EIA for proposed multi-storey building at H. Del Rio*

Sandcays (2015b), *EIA for proposed multi-storey building at H. Point Villa*

Sandcays (2014), *EIA for proposed multi-storey building at H. Marvel*

Sandcays (2016), *EIA for development of 13-Storey building at H. Blue Haven*

UNDP (2006) *Developing a Disaster Risk Profile of the Maldives*, UNDP, Malé, Maldives

Zahir, H. (2011), *EIA for construction of a 10-storey building with basement at G. Javaahiru Asseyri*, Malé, LaMer

Zahir, H. (2012), *EIA for 13-storey Parliament Building Extension*, Malé, LaMer

13 Appendices

Appendix 1: Approved Terms of Reference

Appendix 2: Proponent's Commitment Letter

Appendix 3: Communication of final draft EIA report

Appendix 4: Approved building design

Appendix 5: CVs of assisting consultants

Appendix 6: Construction Schedule

Terms of Reference

EIA for Proposed Multi-storey building of MWSC Customer Service, Malé, Kaafu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on 17/10/2016 for undertaking the EIA for the proposed Multi-Storey Building of MWSC Customer Service at Male, Kaafu Atoll. The proponent of the project is Male' Water and Sewerage Company.

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 and rationale** – Describe the purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary. Identify the institutional arrangements relevant to this project.
2. **Study area** – Submit a minimum A3-size scaled plan with indications of the entire proposed infrastructure. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent buildings and related infrastructure, nearby environmentally sensitive sites (e.g. mosques and schools). Relevant developments in the areas must also be considered including residential areas, all economic ventures and cultural sites.
3. **Scope of work** – Identify and number tasks of the project including 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. The following should be provided:

- Building size, no. of floors and type of development
- Land clearance methods in brief (if relevant);
- Brief methodology of laying the foundation;
- Provision of electricity, water supply and sewerage services;
- Construction/demolition waste disposal
- Compensation plan for construction and dewatering related damaged
- Construction period with a tentative work plan

Task 2. Description of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area. 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.

All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points, vegetation and noise levels for posterior data comparison. Information should be divided into the categories shown below:

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;
- Trees in the project site and major trees around it (if present);
- Water quality of groundwater wells in the vicinity; parameters; pH, salinity, conductivity, TSS;
- Indoor and outdoor air quality in the project vicinity

Structural environment

- State of adjacent buildings including photographic records of existing damages as baseline reference;
- Condition of the surrounding roads;
- Existing structures/uses of the proposed site;

Socio-economic environment

- Demographic data for Malé and population of adjacent buildings;
- Brief description of social environment of Malé 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. Include permits and approvals in the EIA document.

Task 4. Potential impacts (environmental and socio-cultural) of proposed project – 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:

Impacts on any physical and biological environment

- Impacts on terrestrial flora and fauna from land preparation works, if any;
- Impacts on groundwater table and quality as a result of dewatering and groundwater use;
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment

- Impacts on employment and income such as job opportunities in the constructional and operational phase;
- Disturbances to residents and cultural facilities/activities;
- Impacts on transportation/traffic.

Construction related hazards and risks

- Dust and emissions;
- Impacts due to foundation works;
- Weather related hazards and risks;



MALE' WATER & SEWERAGE COMPANY PVT. LTD.
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25 October 2016

MWSC-C/1/2016/6861

Ibrahim Naeem
Director General
Environmental Protection Agency
Maldives

Dear Sir,

Project: EIA for Proposed MWSC Customer Service Building, Malé City.

This is in reference to the Environmental Impact Assessment (EIA) for the Proposed MWSC Customer Service Building, Malé City.

As the Proponent of the project, we assure you our commitment to undertake the proposed mitigation measures and monitoring programme given in the EIA Report.

Sincerely yours,

Male' Water & Sewerage Company Pvt Ltd.

Mohamed Ali
Project Engineer

Mohamed Imran Adnan
Engineering Manager

★ EIA report of MWSC customer service building

(3.0 M)



azmeel@sandcays.com [azmeel@sandcays.com]

Sent: Wed, 1:18 pm

To: secretariat@housing.gov.mv

Attachments: ▾  [MWSC Customer Service Building EIA.pdf](#)

Dear Sir/Madam,

Please find the attached EIA report for the customer service building of MWSC.

Thank you

Mohamed Azmeel

Project Coordinator

Sandcays Pvt. Ltd.

H. Alihuras

Lonuziyaaraiy Magu

Malé, Maldives

Mobile: (960)7793351

Fax: (960)3009799



Environment specialists

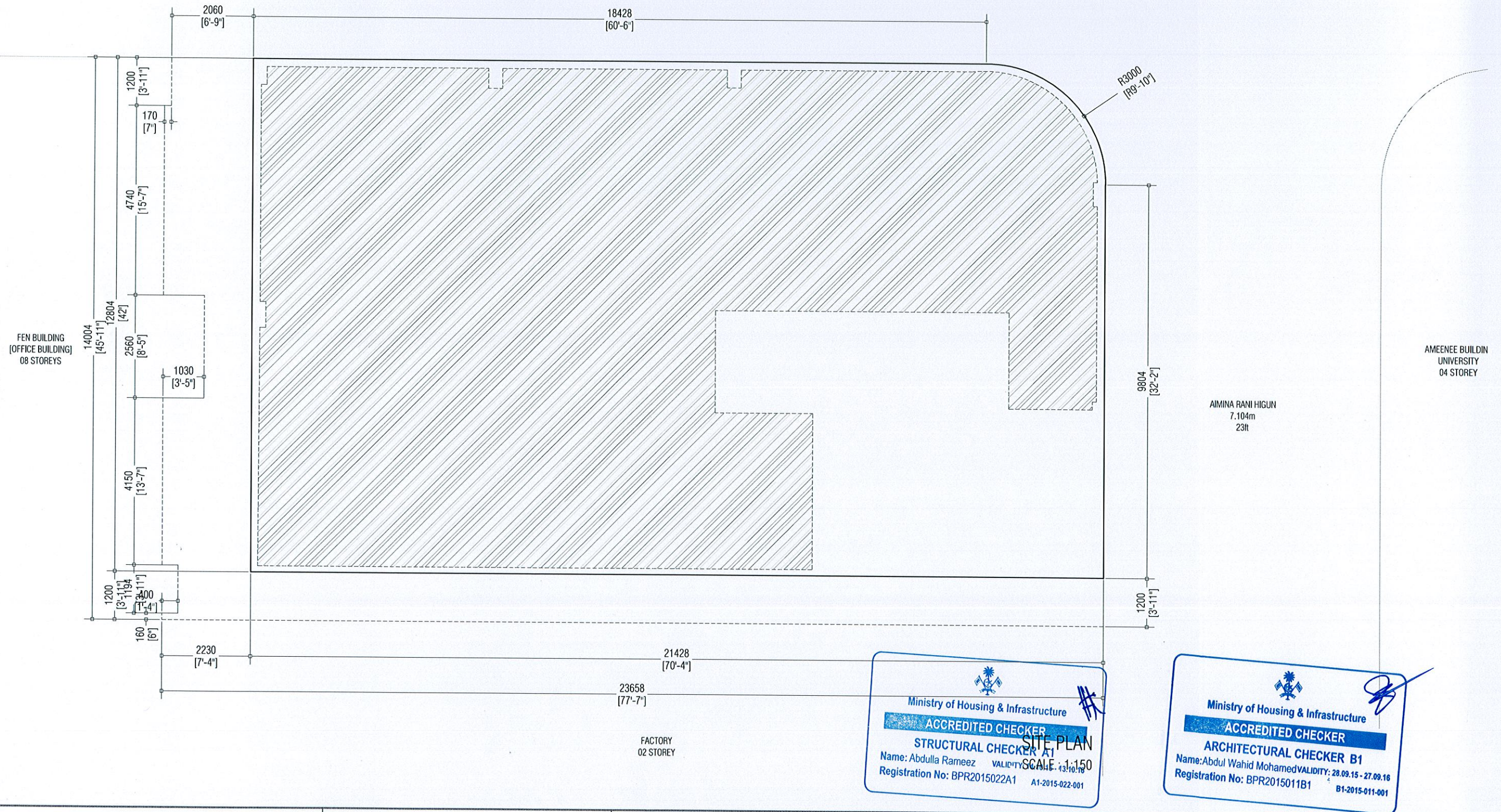
www.sandcays.com



AMEENEE MAGU
9.144m
30ft

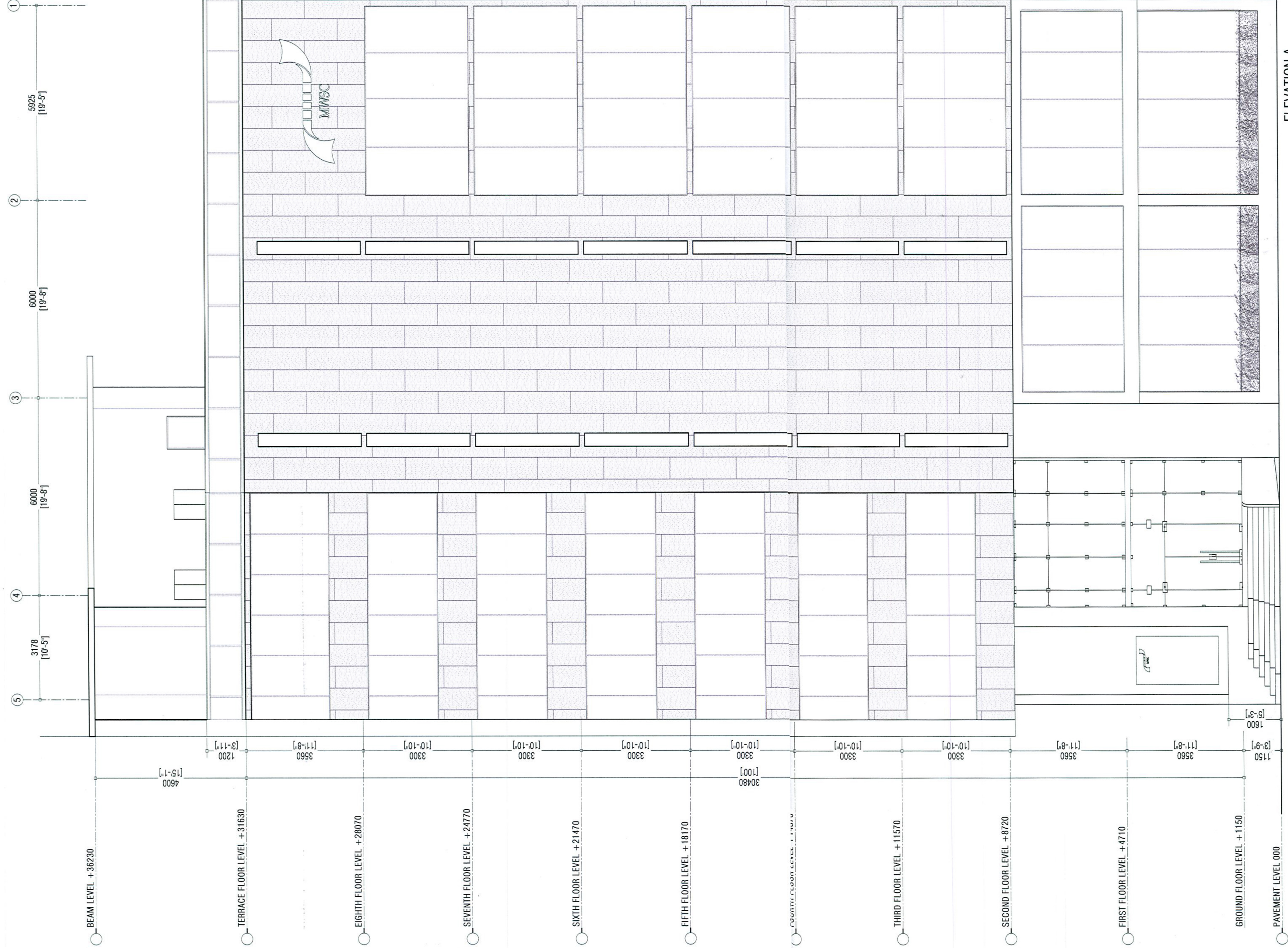
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m ²	7984.82	272.43	53.62	209.27	211.57	m 30.48
ft ²	85947.85	2932.43	577.20	2252.55	2277.28	ft 100.00

 PARKING AREA



AMENDMENTS

AMENDMENTS	PROJECT	ARCHITECTURAL DESIGN BY:	STRUCTURAL DESIGN BY:	CLIENT	SCALE
	NEW CS BUILDING AT MALE'	SHAUFA MOHAMED SAEED [1161]	NASIH JAMAL (DEP)	MWSC	AS GIVEN
	TITLE	DRAWN BY:	CHECKED BY	CHECKED BY	DWG NO.
	SITE PLAN	SHAUFA MOHAMED SAEED [1161]	MOHAMED ALI (PE)	MOHAMED IMRAN ADNAN (CMA)	NCB_A_SP_01
					DATE
					MARCH 2016



ELEVATION A
SCALE : 1:100

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A1
Name: Abdullahi Rameez VALUITY: 14.10.15 - 13.10.16
Registration No: BPR2015022A1 A1-2015-022-001

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Abdul Wahid Mohamed VALUITY: 20.09.15 - 27.09.18
Registration No: BPR2015011B1 B1-2015-011-001

AMENDMENTS		PROJECT	ARCHITECTURAL DESIGN BY:	STRUCTURAL DESIGN BY:	CLIENT	SCALE
		NEW CS BUILDING AT MALE'	SHAUFA MOHAMED SAEED [1161]	NASHI JAMAL (DEP)	MWSC	AS GIVEN
		TITLE	DRAWN BY:	CHECKED BY		DWG NO.
		ELEVATION A	SHAUFA MOHAMED SAEED [1161]	MOHAMED ALI (PE)	MOHAMED IHRAN ADNAN (EN)	NCB_A_ELV01_11
						DATE
						MARCH 2016



MWSC
MALE WATER & SEWERAGE COMPANY PVT. LTD.
REGISTERED OFFICE: KACHCHERIKKAL BUILDING, 3RD FLOOR, CH. RAJENDRAN STREET,
TAL. KACHCHERIKKAL, DIST. KACHCHERIKKAL, COASTAL DISTRICT, MALDIVES
Tel: 9990332000 Fax: 9990332001 E-mail: mwsc@mwsc.mv



MALE' WATER & SEWERAGE COMPANY PVT LTD.
MALE' WATER & SEWERAGE COMPANY PVT LTD.
MALE' WATER & SEWERAGE COMPANY PVT LTD.



SCALE : 1:100




Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A1

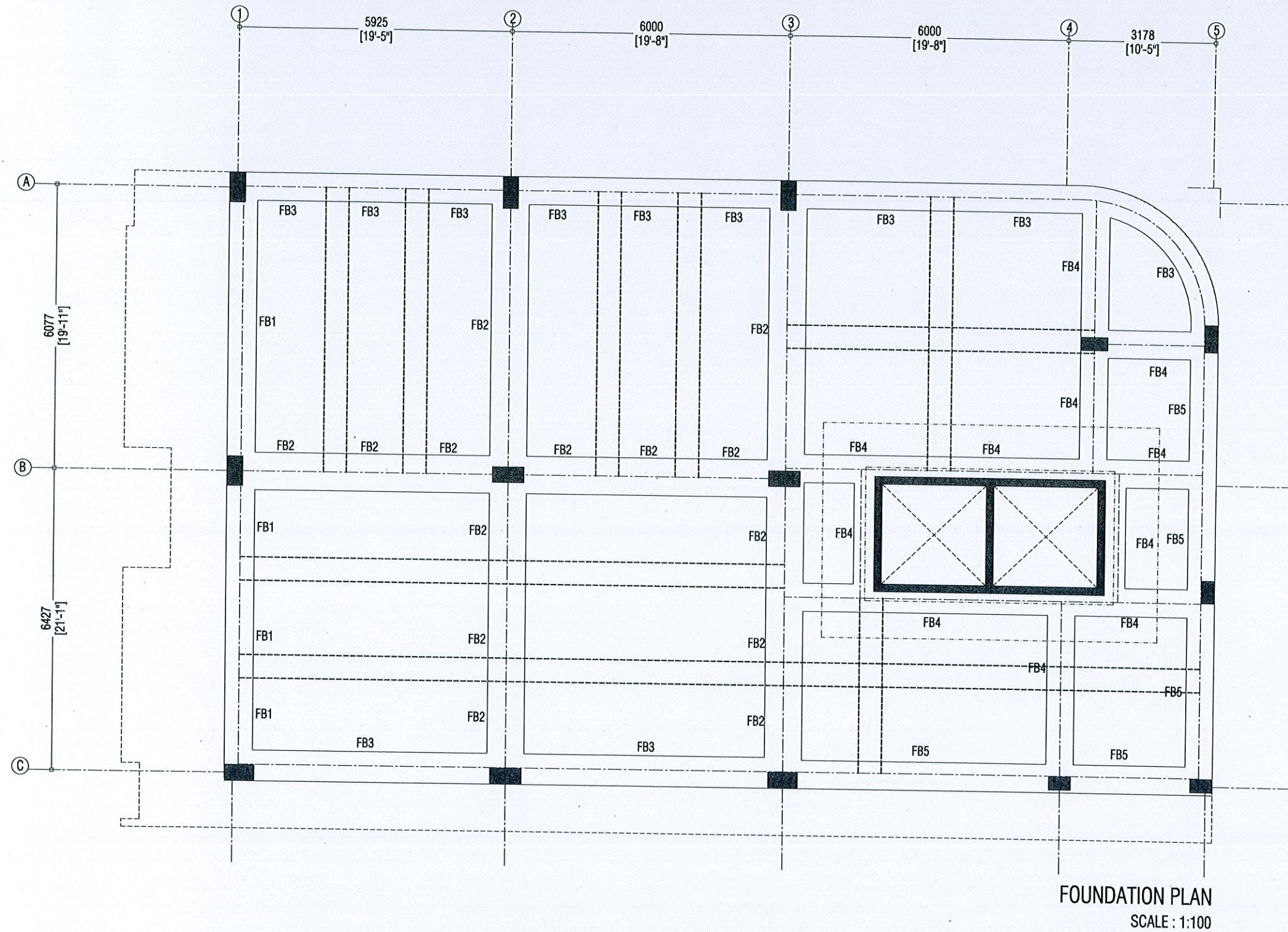
Name: Abdullahi Rameez VAILTY: 14.10.15 - 13.10.16
 Registration No: BPR2015022A1 A12015-022-001

NAME: Abdullah Rameez
REGISTRATION NO: BPR2015022A1
VALIDITY: 14.10.15 - 13.10.16
A1-2015-022-001


Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
 Name: Abdul Wahid Mohamed VAUDITY: 28.09.15 - 27.09.16
 Registration No: BPR2015011B1⁴ B1-2015-011-001

ARCHITECTURAL CHECKER B1
Name: Abdul Wahid Mohamed
VALIDITY: 28.09.15 - 27.09.16
Registration No: BPR2015011B1
B1-2015-011-001

AMENDMENTS	PROJECT	ARCHITECTURAL DESIGN BY:	STRUCTURAL DESIGN BY:	CLIENT	SCALE
	NEW 'CS BUILDING AT MALE'	SHAUFA MOHAMED SAEED [1161]	NASHI JAMAL (DEP)	MWSC	AS GIVEN
	TITLE	DRAWN BY:	CHECKED BY	CHECKED BY	DWG NO.
	ELEVATION B	SHAUFA MOHAMED SAEED [1161]	MOHAMED ALI (PE)	MOHAMED IMRAN ADMAN (EM)	NCE A. ELV01_12
					DATE
					MARCH 2016



NOTE:
SECONDARY BEAMS

SLAB THICKNESS: 500mm
REINFORCEMENT: TOP MESH
T16@125C/C [TOP]
T16@175C/C [BOTTOM]
BOTTOM MESH
T16@175C/C [TOP]
T16@125C/C [BOTTOM]
COVER: 60mm COVER TOP & BOTTOM & SIDES

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Abdul Wahid Mohamed
Registration No: BPR2015011B1
B1-2015-011-001

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A1
Name: Abdulla Rameez
Registration No: BPR2015022A1
A1-2015-022-001

AMENDMENTS	PROJECT	ARCHITECTURAL DESIGN BY:	STRUCTURAL DESIGN BY:	CLIENT	SCALE	 MALE' WATER & SEWERAGE COMPANY PVT LTD. ABDUL WAHID MAHMOUD MALE' 20-01 REPUBLIC OF MALDIVES Tel: (+960) 3333333, Fax: (+960) 3333333, E-mail: maw@mwsc.mv
	NEW CS BUILDING AT MALE'	SHAUFA MOHAMED SAEED [BDR2016208PA]	NASIH JAMAL (BDR2016118E)	MWSC	AS GIVEN	
	TITLE	DRAWN BY:	CHECKED BY	CHECKED BY	DWG NO.	
	FOUNDATION PLAN	SHAUFA MOHAMED SAEED [BDR2016208PA]	MOHAMED ALI (PE)	MOHAMED IMRAN ADNAN (EM)	NCB_S_FP_03	
					DATE	
					MARCH 2016	

Below is the methodology for trench protection

1. Excavate the plot area to 800mm
2. Start dewatering specially from the corners.
3. Drive the MS angle [65x65x6mm thick] the maximum amount possible.
4. Plunge the 9mm thick MS sheets to the maximum possible amount behind the MS angle.
5. Excavate the plot area further more to 1400mm.
6. Drive the MS angle further more in the excavated area.
7. Plunge the MS sheets to the maximum possible amount behind the MS angle.
8. Repeat the process until 3400mm has been achieved.
9. Weld the MS sheets to get the maximum depth of 3400mm and weld the adjacent MS sheets to attain the necessary length of the plot.
10. To avoid the sheets from collapsing, support the sheets using props at the maximum angle to get the strength.
11. Once the supports are placed, brace the complete structure in a grid using $\varnothing 100$ mm pipes.
12. Continue dewatering until the necessary process is done.

Note: it is advised to keep minimum two stand by pumps at the site at all times.

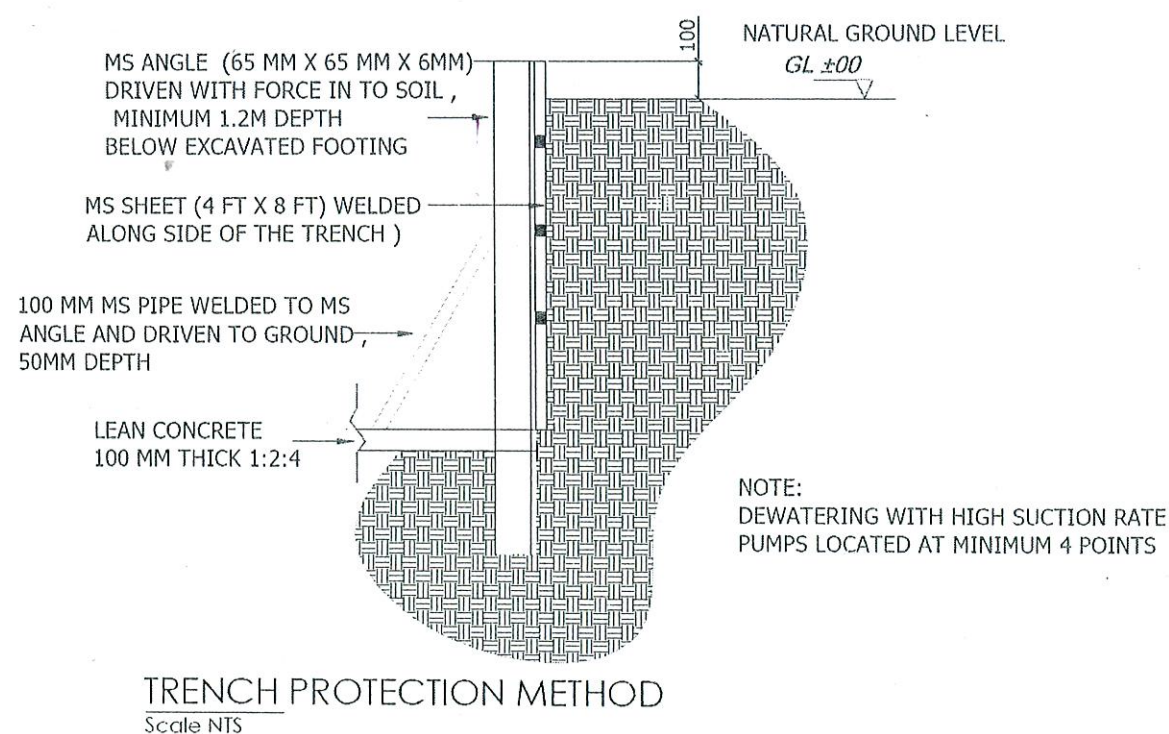
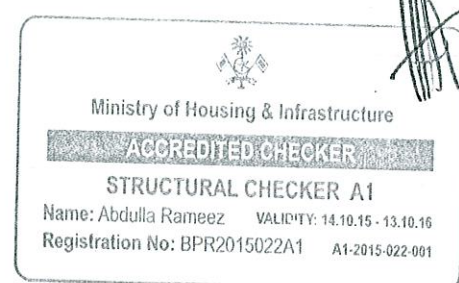


Figure 1: Trench protection method diagram



NEW CS BUILDING AT MALE'

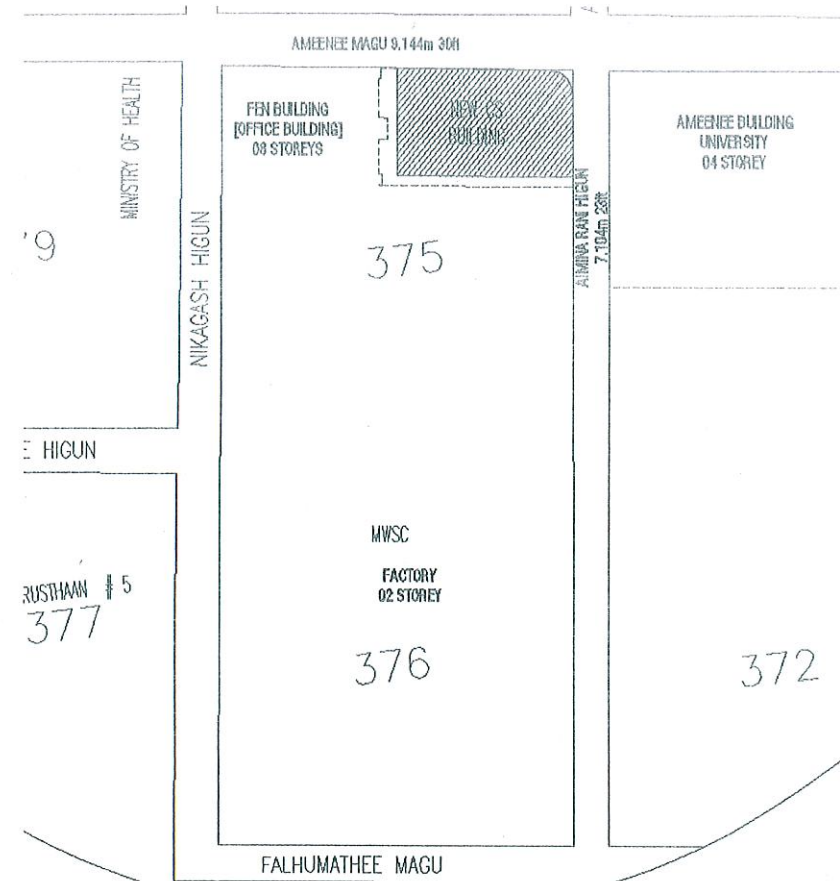
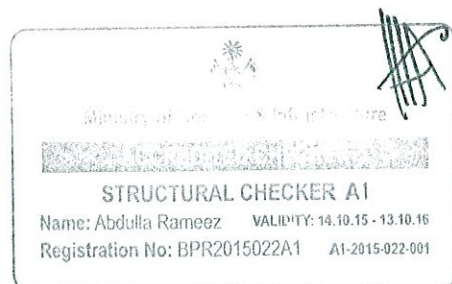


Figure 2: The plot of MWSC with NEW CS BUILDING LOCATED

Nasih Jamaal

Nasih Jamaal
BDR 2016118E



NEW CS BUILDING AT MALE'



MALE' WATER & SEWERAGE COMPANY PVT LTD.

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Curriculum Vitae

Personal Information

Name: Mohamed Hamdhaan Zuhair

Date of Birth: 13 July 1987

Permanent Address: G.Vehi, Male', Maldives

E-mail Address: m.hamdhaan.zuhair@gmail.com

Maldives National Identity Card Number: A-073472

Contact Number: +9607668606

Employment

(a) Maldives Environmental Protection Agency

Assistant Director, Environment Assessment

June 2015- February 2016

Working under the Director to implement EIA regulations and executing the work plan for Environmental Compliance and Assessment Section.

Environmental Analyst

December 2010– February 2013

Worked as stand in head of EIA section while the section head was abroad for studies. Took responsibility of looking after day to day activities in terms of implementing EIA Regulations and planned and executed the work plan for the EIA section in years 2011 and 2012.

Surveyor (Trainee)

October 2006– February 2008

Worked as a trainee staff in the EIA section of Maldives EPA, under the guidance of the section head. Involved in assisting

the implementation of EIA regulations and other activities of the section.

(b) Independent EIA Reviewer

(C) Project Management Unit, Ministry of Environment and Energy
Social and Environmental Safeguards officer (March 2016 to Present)

(d) Independent EIA consultancy work

Tertiary Education

University of Waikato

Masters in Management Studies (Management and Sustainability) 2014

Thesis: "An Evaluation of Public Participation in the EIA Process of Maldives"

Graduated with First Class Honors

University of Waikato

Postgraduate Diploma in Management Studies (Management and Sustainability) 2013

Graduated with Distinction

James Cook University

Bachelor of Environmental Science (Natural Resource Management) 2008

Graduated with Academic Medal

Training and Workshops

UNEP EIA training 2006 Maldives -August 2006

BOBLME Scientific Writing workshop in Phuket, Thailand -August 2011

BOBLME Scientific Presentation Workshop in Male', Maldives- October 2011

Participated in Asian Environmental Compliance and Enforcement Network workshop on mainstreaming climate change adaptation in Environmental Impact Assessment, Bangkok, Thailand- October 2011

Inception Workshop on Establishing a Data Management System in South Asia, Colombo, Srilanka- January 2012

Participated in Asian Environmental Compliance and Enforcement Network Regional Forum in Bangkok, Thailand- March 2012

Conference Presentations & Publications

Zuhair, MH. 2014. “An evaluation of public participation in Maldives EIA process”, paper presented at the FASSGRAD conference, University of Waikato, 17th -18th November 2014.

Zuhair, MH. 2013. “Climate change policy in Maldives: An analysis of the National Adaptation Programme of Action”, paper presented at the FASSGRAD conference, University of Waikato, 11th -12th November 2013

Zuhair & Priya A. Kurian (2016): Socio-economic and political barriers to public participation in EIA: implications for sustainable development in the Maldives, Impact Assessment and Project Appraisal, DOI: 10.1080/14615517.2016.1176404

Professional Experience

Actively participated as a facilitator in EIA Training and Awareness Program for councils of GDh. atoll, GDh. Thnadhoo- August 2011

Actively participated as a facilitator in EIA Training and Awareness Program for councils of Ha atoll, Ha.Dhihdhoo- September 2011

Actively participated as a facilitator in EIA Training and Awareness Program for councils of HDh atoll, HDh. Kulhudhufushi- September 2012

Organized staff capacity development program (EIA inspection and monitoring) for EPA- June 2012

Actively participated as the lead facilitator environmental awareness program at Dh. Kudahuvadhoo- September 2015

Actively participated as the lead facilitator environmental awareness program at Dh. Maenboodhoo- September 2015

Actively participated as the lead facilitator environmental awareness program at Dh. Bandidhoo- September 2015

Actively participated as the lead facilitator environmental awareness program at Dh. Rinbudhoo- September 2015

Actively participated as the lead facilitator environmental awareness program at Dh. Hulhudheli- September 2015

Actively participated as the lead facilitator environmental awareness program at Dh. Meedhoo- September 2015

Guest Lecture Maldives National University to students studying bachelor of tourism, Topic “EIA process in the Maldives”- September 2012

Guest Lecture Maldives National University subject Environmental Impact Assessment, course Bachelor Environmental Management, Topic “Public Participation in EIA process of Maldives” - March 2015

Guest Lecture Maldives National University subject Environmental Impact Assessment, course Bachelor of Environment Management, Topic “EIA quality and decision making”- March 2015

Participated in administratively organizing the 6th Regional 3R Forum in Asia and the Pacific- August 2015

Participated in the following EIA inspection trips as team leader:

EIA inspection of Ha.Manafaru resort development project- September 2007

EIA inspection in Thundufushi island resort resort development project- March 2011

EIA inspection of Traders hotel Power plant- February 2011

EIA Inspection of L.Maandhoo harbor development and reclamation project- June 2011

EIA Inspection of GDh. Faresmaathodaa harbor development project- March 2012

EIA Inspection of GDh. Gahdhoo harbor development project- March 2012

EIA Inspection of GDh. Maguhdhuvaa resort development project- March 2012

EIA Inspection of Ibrahim Nasir International Airport Development project- April 2012 and June 2012

EIA inspection of Kandooma- August 2012

EIA inspection trip Dh.Kudahuvadhoo road development project- September 2015

EIA inspection trip Dh. Maemboodhoo harbour development project- September 2015

EIA inspection trip Dh. Meedhoo reclamation project- September 2015

EIA inspection trip Dh. Bandidhoo harbour development project- September 2015

Note: Inspection trips are undertaken to check whether projects are undertaken as per the EIA report submitted.

Prepared the following EIA/EMP/Environment Monitoring Reports as lead author/consultant (work done in the capacity of environmental and safeguards officer for PMU):

ESMP for development of Island Waste Management Centre (IWMC) B.Maalhoo, B.Kendhoo, R. Inamaadhoo, R. Maduvarri, Lh. Hinavaru, N.Velidhoo, N.Holhudoo, N.Fohdhoo, N.Magoodhoo, N.Lhohi, N.Landhoo, N.Maalhendhoo, N.Henbadhoo (March 2016)

ESMP for the proposed IWMC upgrade at Hulhudhoo-Meedhoo (August 2016)

ESMP for the proposed IWMC upgrade at Fuvahmulah (May 2016)

ESIA monitoring Visitor Centre Development project, Eydhigali Kilhi and Koathey, S.Hithadhoo (October 2016)

Prepared the following EIA/EMP/Environment Monitoring Reports as a team member (Consultancy work):

EIA for the proposed development of an agricultural island at R.Ungulu (May 2016)
(lead consultant Ahmed Zahid)

EIA for the proposed development of 10-storey MWSC customer service building
(October 2016) (lead consultant Ahmed Zahid)

Involvement in International Organizations

Environmental Protection Agency, Maldives focal point for Asian Environmental Compliance and Enforcement Network (AECEN) from 2011-2012.

Objectives and aims of AECEN: Asian Environmental Compliance and Enforcement Network (AECEN) aims to promote improved compliance with environmental legal requirements in Asia. AECEN accomplishes this task through the exchange of innovative policies and practices among member enforcement agencies.

Awards and Achievements

Academic Medal (Masters Degree) – 2016

Golden Key Membership for Academic Excellence- January 2014

New Zealand Aid Scholarship- February 2013- March 2015

Academic Medal (Bachelors Course Work): James Cook University- May 2011

UBS Environmental Award James Cook University 2010 (for the student with highest overall GPA in second year for an environmental science degree)- May 2010

Australian Aid Scholarship- February 2008-December 2010

A'level: Maldives National top ten 3rd place- 2006

O'levels: Maldives National top ten 5th place- 2004

Referees

Professor Priya Kurian (University of Waikato, Hamilton, New Zealand)

Phone: +6478562889 (extension: 6109), E-mail: pkurian@waikato.ac.nz

Associate Professor Eva Collins (University of Waikato, Hamilton, New Zealand)

Phone: +6478562889 (extension: 4083), E-mail: evacollin@waikato.ac.nz

Associate Professor Kevin Parnell (James Cook University, Townsville, Australia)

E-mail: Keven.Parnell@my.jcu.edu.au

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