ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

PROPOSED INSTALLATION OF 5MW GRID-TIED SOLAR PHOTOVOLTAIC SYSTEM IN GREATER MALE' REGION, KAAFU ATOLL

CONSULTANT

Foresight Surveyors Pvt Ltd

PREPARED FOR

ENSYS CO., LTD

APRIL 2022

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ASPIRE	Accelerating Sustainable Private Investment for Renewable Energy
BP Bank	Procedures
CO2	Carbon dioxide
CIF	Climate Investment Fund
DASA	Directorate of Aviation Security Administration
ESIA	Environment and Social Impact Assessment
EMP	Environmental Management Plan
EPA	Environment Protection Agency
ESMF	Environmental and Social Management Framework
FIT	Feed-in Tariff
FM	Financial Management Assessment
GENCO	Generation Company
GHG	Greenhouse gases
GoM	Government of the Maldives
GP	Good Practices
HPA	Health Protection Agency (Maldives)
IA	Implementation Agreement
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
IFRS	International Financial Reporting Standards
IP	Implementation Plan
ISA	International Standards on Auditing
KWp	Kilowatt peak
MEA	Maldives Energy Authority
MCAA	Maldives Civil Aviation Authority
MECC&T	Ministry of Environment, Climate Change and Technology (Former Ministry of Environment)
MNPH&I	Ministry of National Planning, Housing and Infrastructure
MW	Megawatt
NEAP II	National Environmental Action Plan II
NGO	Non-Governmental Organisation
OP	Operational Procedures
PAP	Project-Affected People
PMU	Project Management Unit of MECC&T
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PRG	Partial Risk Guarantee
PS	Performance Standards
ToR	Terms of Reference
WBG	World Bank group

CONSULTANT'S DECLERATION

I certify that the statements made in this Environment and Social Management Report to the proposed installation of 5.6MW of Solar PV system in greater Male' area is complete and correct to the best of my knowledge and it is in accordance with EIA Regulation 2012.

Firdous Hussain
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ENSYS

Ref: EL2-21-025

Date: August 2nd, 2021

Mr. Ibrahim Naeem
Director general
Environment Protection Agency,
Ministry of Environment and Energy,
Green Building, Male', Maldives

Dear Sir,

As the proponent of the proposed 5MW Solar PV system in greater Male' area, I grantee that I have read the report and to the best of our knowledge, all the information present in the report regarding the project are accurate and complete.

Similarly, as the proponent of the project, I assure you my commitment to undertake the proposed mitigation measures and monitoring programme given in the report.

Thank you

Sincerely Yours,
ENSYS Company Limited

บริษัท เอ็นซิส จำกัด
ENSYS
ENSYS CO.,LTD.

.....
Mr. Chumpol Patanukom
Executive Director

NON-TECHNICAL SUMMARY

This is the Environmental and Social Management Report (ESMP) for the 5MW solar PV project proposed for greater Male' region, under the Accelerating Sustainable Private Investment for Renewable Energy (ASPIRE) program. This study is commissioned by the Ministry of Environment, Climate Change and Technology (MECC&T), the Government of Maldives. This ESMP establishes a mechanism to determine, assess, mitigate and manage future potential environmental and social impacts from the activities of the ASPIRE program during implementation of the planned ground and rooftop solar PV investments.

The current project proposed by the GoM under the ASPIRE program, it is aimed to develop the capacity to generate 5.6 Megawatt of electricity by a Solar Photovoltaic System in the Greater Male' region. The project is managed by MECC&T on behalf of the GoM. Within MECC&T, the Project Management Unit (PMU) will be responsible for the day-to-day implementation. The State Electric Company (STELCO) is envisaged to purchase renewable energy from private suppliers produced under ASIPRE program. The Maldives Energy Authority (MEA) establishes tariffs, issues guidelines and regulations to ensure the reliability, security of the grids, and also ensures the rights and obligations of consumers and service providers are safeguarded (Shaig, 2014).

The project is awarded by the GoM on a long term contract of 15 years to Ensys Co., Ltd. Ensys will design, build, finance, own and operate the system for a period of 15 years after which the operation will be transferred to the GoM. Ensys is a foreign company based in Thailand, who has been providing services in the fields of electricity, power, energy, mechanical and environmental engineering for the past 25 years. On behalf of GoM, STELCO will take over the operation of the project after the Ensys.

This ESMP report describes and highlights potential environmental and social impacts from the activities of the proposed project during the construction and operational phase of the project. Furthermore, this report is submitted by the proponent of the project to fulfill the requirements of Environment Impact Assessment Regulation 2012, under the Environmental Protection and Preservation Act of the Maldives (Law No. 4/93). Additionally, the report aims to fulfill the world bank's environmental and social safeguard policies on undertaking the proposed project. As per the screening decision issues by EPA, an EMP will be sufficient for the project. Hence, no ToR has been issued by EPA, rather the report followed a ToR issued by WBG.

The project is proposed on the pavement area of the link road between Male'-Hulhumale, southern side pavement area of Boashimaa Hinhun in Hulhumale and on roof top of 8 residential buildings in Hulhumale phase-1.

In pavement areas, the PV modules are fixed over an elevated roof structure in such a way that it covers and shades the pavement whereas in selected buildings, they will be fixed over the existing roof. The total length of the line along the pavement, including the island (empty space at the middle of the widest part of the link road) is 3,510m. The line will include a total of 10,691 panels with a capacity of 495 Wp by each link. Hence, the total installed capacity along the road side will be 5,292,045 Wp. Additional 720 panels will be installed on the roof top of the 8 selected residential buildings whose total capacity will be 356,400 Wp. Therefore, the installed total capacity under the proposed project would be 5,648,445 Wp.

There are very few and limited risk factors associated with this project that could possibly have both financial, environmental and fatal implications given that the mentioned safety attires are worn by the workers and safety measures are properly taken in handling machineries and hazardous items. The major social impact envisaged from the project is the restriction to vehicle movement due to part of road closure during the construction stage in link road and Boashimaa Hingun. Since the proposed project site is not seen to have any significant terrestrial life, no considerable risk on biodiversity has been identified. However, unavoidable and short-term risks such as waste generation and typical minor construction related impacts are associated with the construction stage of the project.

Effective impact mitigation measures are to be undertaken during the construction and operational works. The construction work of the project should be completed within the shortest possible time to mitigate

the negative impacts due to construction. A schedule that highlights the times of road closure will be made public before the events of closing begins. Only a single lane out of the 2 lanes that allow traffic movant in one direction will be closed. Hence, even though slow and restricted, vehicle flow will still be maintained in link road and Boashimaa Hingun.

In order to ensure that the envisaged impacts are within the estimated limits, environment monitoring program outlined in this report has to be followed. Undertaking environment monitoring during construction and operational phase is of uttermost importance for ensuring that the expected impacts are controlled within acceptable limitations. Monitoring has been given for each and every impact identified. Furthermore, there is a proposed Grievance Redress Mechanism (GRM) for the public and stakeholders to raise any projected related issue.

Alternatives to the proposed project in terms of design, technology, and location has been discussed in the report including the 'no-project' option. Although 'No-project' option is not favoured, alternatives to the design have been discussed. Given the prevailing issue of land scarcity in greater Male' area and use of Solar PV system in Maldives, no favourable alternative has been suggested.

Stakeholder consultations were carried out with a large number of stakeholders of the project as highlighted in the approved ToR. The major concerns highlighted in the stakeholder meetings were the possible restrictions on traffic flow in Boashima Hingun and Link road and undertaking construction activities within 10ft buffer area of airport's security fence in Boashimaa Hingun. Similar, possibility of glare effect from the PV modules during the operation stage is a concern of the Civil Aviation Authority.

No long-term sever environmental or social impact is predicted for the project. However, due to high the socio-economic benefit of the project, it is recommended to undertake the proposed project in the proposed location. Furthermore, developing the renewable energy sector in Maldives is in line with the development goals of the Country. Decreasing the dependency on diesel powered electricity generation in Maldives with the provision of renewable energy throughout the country is one of the development goals of the government.

ސުވަރ ނުލާނެ

ދ. ތަކުދޫ ފަށ ގަދަ ކަނޑުގެ ދަރިފުޅުގައި ހިއްކާފައިވާ ކަންކަމާ ގުޅިގެން ދަތުރުކުރާ ފަރާތްތަކުގެ ދަށުން ކަނޑުގެ ތެރެ ހިނގާ ދަތުރުތަކުގައި ކަނޑުގެ ތެރެ ދަތުރުކުރާ ފަރާތްތަކުގެ ދަށުން

މަޝްރޫޢުގެ އަމަލީމަސައްކަތް ކުރިއަށްގެންދާނެގޮތާއި އަދި މަސައްކަތުގައި ކުރިއަށްދާނެގޮތާއި އިސްތިޢުމާލުކުރާ ތިމާވެށްޓަށް ގޮތުން ކުރިމަތިވެދާނެ އަސަރުތައް އަދި ނުރައްކާ އަސަރުތަކުގެ ހުރި ރިސްކްތަކާއި ފުރަގަސްކުރެވިދާނެގޮތާއި މިންވަރުގައި ކަންތައްތަކުގެ މުއްދަތުތަކާއި ތިމާވެށި ޤާނޫނާ ކުރިމަތިވާނެ ޖެހިފައި ވާނެ ކުރެވިދާނެ ފިޔަވަޅުތައް ބެލެހެއްޓޭނެ ގޮތް ވަނީ ފާހަގަކުރެވިފައި ގޮތުން ކުރިމަތިވާނެ ގޮތުގެ ދެކޮޅަށްވާނެ ގޮތްތަކާއި. ވީމާ ދައުލަތުގެ ޤާނޫނުތަކާއި އެކުއެކި ފެތުރުމަށް ނިންމާފައިވާ މަސައްކަތުގައި ގެއްލުން ދަތި އުނދަގޫ ނުވާގޮތަށް އެހެނިހެން ގޮތްތަކުން މަސައްކަތުގެ ބޭރުން ފެށޭ ތަކެތިއަށް ގެއްލުމެއް ނުވާނެ ގޮތަށް ކަމަށް ވެއެވެ.

މިމަޝްރޫޢު ކުރިއަށްގެންދާ ސަރަހައްދު ބަދަލުކުރެވޭން، ނުދީ ޖެހިއްޖެ ބަދަލުކުރެވޭނެ ހައްލުތަކާއި އެހެން ބަދަލުތަކުގެ ނޯ-ޕްރޮޖެކްޓް އޮޕްޝަން (މަޝްރޫޢު ކުރިއަށް ނުގެންދިއުން) ވެސް މިމަސައްކަތުގެ ތެރެއިން ބަދަލުގައި ޖެހިއްޖެ ދިރާސާކުރެވިފައި އިސްކޮށް ޖެހިއްޖެ ބަދަލުތަކުގެ ފާހަގަކޮށްފައިވާ ބަދަލުކުރެވިފައިވެއެވެ. މަޝްރޫޢު ކުރިއަށް ނުގެންދިއުން އެއީ މިމަޝްރޫޢު ފުރިހަމަ ބަދަލު އިޖްތިމާޢީ ބޭނުމާއި ފާހަގަކުރެވިފައިވާ ނުވެއެވެ. އަދި މިމަޝްރޫޢަކީ ސިޔާސީ ވަރަށްގިނަ ކަންތައްތަކެއް ބައްލަވާ ފާހަގަކުރެވިފައިވާ މަޝްރޫޢު މަސައްކަތުން ގެނެވޭނެ ފައިދާތަކާއި މަސައްކަތެއް ނުވެއެވެ. މަޝްރޫޢުގެ މަސައްކަތް ކުރިއަށް ގެންދިއުމުން ހުރިހާ ގޮތްތަކަކުން ޖެހިއްޖެ ބަދަލުކުރެވޭނެ ސަރަހައްދާއި ދަނޑުވެރިޔާއި އަދި ބޭނުންތައް އާބާދީގެ ތަކެތި މަސައްކަތް ކުރެވިދާނެ ބަދަލުކުރުމުގެ ތިމާވެށީ ކުރިމަތި ދިރާސާކުރި، އަސަރުކުރާ ފިޔަވަޅުތައް ވީހާވެސް ކުޑަކުރުމަށްޓަކައި އަޅަންޖެހޭ ފިޔަވަޅުތައް ބަޔާންކުރެވިފައި ވެއެވެ.

ޖިއޮގްރަފިކަލް ފެންނަ ކަންތައްތަކާ ގުޅިގެން މަސައްކަތުގައި މުހިއްމު މިފަދަ ކަންކަމުގައި ދެރަ ބަދަލުތަކުން މިމަޝްރޫޢުގައި ބޭނުންކުރާ މަޝްރޫޢު ކުރެވިފައި ވެއެވެ. މިމަޝްރޫޢުގައި ފެންނަން ހުރި ތަކެތި މަސައްކަތުގެ މަސައްކަތް ނިމުމުން ބަދަލުކުރެވޭނެ އިތުރު އަދި ދިރާސާގެ ބެލުމާ ހިސާބުތަކުގެ ދިރާސާކުރެވިފައިވާ އުސޫލުތަކުގެ ސަރަހައްދު ފަސްގަނޑު 10 ފޫޓް ކަނޑައެޅިފައި މަސައްކަތް ކުރެވޭނެ.

ރަސްމީކުރުގެ މަސައްކަތާއި އެކުލެވިގެން ދިރާސާކުރެވިފައި ސިޔާސަތު މަސައްކަތްކުރެވޭ. އަދި ރަސްމީގޮތުން ބެލެހެއްޓުމަށް ދިރާސާކުރެވިފައި ހުރިހާ ދިރާސާތަކުގެ ބައިވެރިވުން ކަމުގެ ކުރިއަށްދިޔަގޮތް ރަށްގައި ކުރިއަށް ގެންދިއުމުގެ މަސައްކަތާ ގުޅޭގޮތުން އިސްކަންދެއްވާ ދިރާސާގައި ވެއެވެ. އާބާދީގެ މިރަށުގައި ކުރުމުގެ ހުރިހާ ގޮތްތަކާއި މިއީ ކަމެއްކަމަށް މިފަދަ ބައިވެރިވުމެއް އަށްކަނޑައެޅުމުގެ ފިޔަވަޅުތައް އެއްބާރުލުން ކުރިއަށް ގެންދިއުމުގެ އެއްބަސްވުން ކަމުގެ ފަރާތްތަކާއި ވާހަކަދެކުނު ކުރުމަށް ކަނޑައެޅިފައިވާ ގޮތުން މުހިއްމު ކަމަށް ފާހަގަކުރެވިފައިވެއެވެ. ހަމަ ހަމަ ކުރިއަށް ނުގެންދިއުމުގެ މަސައްކަތުގެ މަޝްރޫޢުގެ ކުރިއަށް ގެންދިއުމުގެ ރިސްކުތައް ވަކިވަކިން ކަނޑައެޅިފައިވާ އެއްބަސްވުން ވެއެވެ.

ދިރާސާކުރުމުގެ ނަތީޖާއަކަށް މިމަޝްރޫޢުއަކީ ގެދޮރަށް ނުރައްކާ އަދި މަޝްރޫޢުގެ ސަރަހައްދުން ބޭރުން އިތުރުސަރު އަދި އިޖްތިމާޢީ ފައިދާތަކުގެ ބޭނުންތަކާއި މަޝްރޫޢުގެ މަސައްކަތް ކުރިއަށްގެންދިއުމުން އެކުލެވިގެންވާނެ ފާހަގަކުރެވިފައިވެއެވެ. މިގޮތުން ރިޕޯޓުގައި ހުށަހަޅާފައިވާ ފިޔަވަޅުތައް އަޅައިގެން މަސައްކަތް ކުރިއަށް ގެންދިއުމަކީ މުހިއްމު ގޮތަކަށް ފާހަގަކުރެވޭ ކަމެއް ކަމަށް ހިތުން ވެއެވެ.

1 INTRODUCTION

1.1 Background

The Government of Maldives (GoM) aims to develop private investments in the sector of renewable energy by addressing and removing key barriers to private investments through assistance and provision of appropriate risk mitigation measures. Maldives is one of the six pilot countries participating in the Scaling Up Renewable Energy Program in Low Income Countries (SREP) (MEE, 2012). Accelerating Sustainable Private Investment in Renewable Energy (ASPIRE) is one of the key components of the Maldives Scaling-Up Renewable Energy Program (SREP). One of the main targets of the ASPIRE program is to encourage the involvement of private parties in the renewable energy sector of the Maldives (Shaig, 2014). ASPIRE program is continued and managed through a phased approach to developing sector investments, in such a way that the early investors are supported and secured through greater risk mitigation measures by International Development Association (IDA), through a series of IDA partial risk guarantees (PRGs), and SREP funds (for subsidies, capacity building, and additional guarantee support) (Shaig, 2014). The ASPIRE program is financed by the World Bank Group (WBG) (Shaig, 2014).

1.2 Objectives

This is the Environmental and Social Management Report (ESMP) for the 5MW solar PV project proposed for greater Male' region, under the Accelerating Sustainable Private Investment for Renewable Energy (ASPIRE) program. This ESMP report describes and highlights potential environmental and social impacts from the activities of the proposed project during the construction and operational phase of the project. Furthermore, this report is submitted by the proponent of the project to fulfill the requirements of Environment Impact Assessment Regulation 2012, under the Environmental Protection and Preservation Act of the Maldives (Law No. 4/93). Additionally, the report aims to fulfill the world bank's environmental and social safeguard policies on undertaking the proposed project.

1.3 Institutional arrangements

The current project proposed by the GoM under the ASPIRE program, it is aimed to develop the capacity to generate 5.6 Megawatt of electricity by a Solar Photovoltaic System in the Greater Male' region. The project is managed by MECC&T on behalf of the GoM. Within MECC&T, the Project Management Unit (PMU) will be responsible for the day-to-day implementation. The State Electric Company (STELCO) is envisaged to purchase renewable energy from private suppliers produced under ASIPRE program. The Maldives Energy Authority (MEA) establishes tariffs, issues guidelines and regulations to ensure the reliability, security of the grids, and also ensures the rights and obligations of consumers and service providers are safeguarded (Shaig, 2014).

The project is awarded by the GoM on a long term contract of 15 years to Ensys Co., Ltd. Ensys will design, build, finance, own and operate the system for a period of 15 years after which the operation will be transferred to the GoM. Ensys is a foreign company based in Thailand, who has been providing services in the fields of electricity, power, energy, mechanical and environmental engineering for the past 25 years. On behalf of GoM, STELCO will take over the operation of the project after the Ensys.

1.4 Project risks and major impacts

There are very few and limited risk factors associated with this project that could possibly have both financial, environmental and fatal implications given that the mentioned safety attires are worn by the workers and safety measures are properly taken in handling machineries and hazardous items. The major social impact envisaged from the project is the restriction to vehicle movement due to part of road closure during the construction stage in link road and Boashimaa Hingun. Since the proposed project site is not seen to have any significant terrestrial life, no considerable risk on biodiversity has been identified.

However, unavoidable and short-term risks such as waste generation and typical minor construction related impacts are associated with the construction stage of the project.

1.5 Studies undertaken for the project

Main findings of the report are based on qualitative and quantitative assessments undertaken during site visits undertaken during March to May 2021 and March 2022. Site surveys undertaken for the project includes a visual inspection survey (terrestrial survey), topographic survey and onsite underground cable identification survey with certain stakeholders. Relevant data was collected from available sources, such as long-term data on meteorology and climate from local and global databases. Additionally, data published in the similar projects taken place across the country are referred and used. Some of the reports referred for the purpose of this report includes;

- Renewable energy roadmap for the republic of Maldives ((IRENA, 2015)
- Environment and Social Management Framework for the proposed Solar PV projects under Accelerating Sustainable Private Investments for Renewable Energy (ASPIRE) Program (Shaig, 2014)
- Environment Impact Assessment for the proposed development and operation of floating solar PV platform in Cheval Blanc Randheli (Shaig, 2020)
- Environment Management Plan for Clean Electricity for Dharavandhoo – a floating Solar Project at Dharavandhoo, Baa Atoll (Zahir, 2015)

1.6 Structure of the Report

The report is structured in such a way that it meets the requirements of the EIA regulation 2012 and the amendments followed. Furthermore, it is presented under 15 chapters to directly reflect the requirements highlighted under the ToR approved by MECC&T and world bank. Below given are the distinctive chapters presented in the report.

1.6.1 Executive summary

The report begins with the non-technical summary which highlights the main findings of the surveys and studies undertaken for the preparation of this document. A translation of executive summary is included in local Dhivehi language.

1.6.2 Introduction

Followed by the non-technical summary is the introduction. Explained under the introduction is the background to the proposed project, the structure followed in the report, scope and extent of the report.

1.6.3 Project Setting

There are number of laws, regulations and international treaties and conventions to be met and followed in undertaking the proposed project. Those legal requirements, emphasizing the relevant regulations are presented under ‘project Setting’.

1.6.4 Project Description

Under ‘Project Description’, the proposed developments and work methodologies are explained in detail. It will include the information on project proponent, location and major project inputs and outputs. The section will also include the project management components including, schedule, manpower, machinery list and other safety measures to be taken during the project. More importantly, the section will look at the justifications for undertaking the proposed project.

1.6.5 Existing Environment

Physical, biological and social environment of the proposed project area will be explained under this section. It will include the information on local climate and potential natural hazard and disaster possibilities.

1.6.6 Impact identification and assessment

The envisaged positive and negative environmental and social impacts with their nature and extent of the proposed development activities will be discussed under this section. Impact identification methods, impacts duration and severity are explained under the section. Impacts associated with various components of the project will be assessed.

1.6.7 Project Alternatives

There are number of different ways to undertake a project in terms of methods, materials and design. Different methods, materials and designs will have their pros and cons over the others. Under 'project Alternatives' alternatives to the proposed components or activities in terms of location, design, environmental and economic considerations would be suggested.

1.6.8 Mitigation and management of adverse impacts

The identified social and environmental impacts of the project have to be mitigated to carry out the project activities in the most beneficial manner. Mitigation measures for all the identified impacts, for both the construction and operational stage would be provided.

1.6.9 Grievance Redress Mechanism (GRM)

Local communities, employees and other affected stakeholders should have a set policy to follow in times of grievance for the project to run smoothly. Hence, a GRM specific for the stakeholders and employees have been developed for the project. The GRM will ensure and facilitate a way to protect the rights of all parties related and involved in the project.

1.6.10 Monitoring and reporting plan

A monitoring program, together with an estimated program cost, for the construction and operational phase of the project would be included in the report. Monitoring would ensure that the proposed activities are undertaken with caution and appropriative care to protect and preserve the social and the environmental aspects of the project that are to be affected by the development

1.6.11 Summary of all training recommendations

Trainings required to strengthen the capacity of the contractor to implement and ESMP during the construction and operation phase of the project will be highlighted under the section.

1.6.12 Stakeholder Consultations

Stakeholder consultation regarding the project will be undertaken as outlined in the approved ToR. Meetings held and the main issues discussed in those meeting by the stakeholders will be highlighted in the report.

1.6.13 Conclusion

Main findings of the report will be concluded here together with recommendations to be followed during construction and operation.

1.7 Tasks already undertaken

No physical task of the proposed development has been undertaken yet. However, initial site survey and assessment has been completed. Detail designing, approval of drawings and material is currently on going.

2 LAWS AND REGULATIONS

This section outlines and summarizes key policies, applicable laws, regulations and regulatory bodies regarding environmental protection in the Maldives. The project meets the requirements of the Environmental Protection and Preservation Act of the Maldives, Law no. 4/93. The ESMP has been undertaken in accordance with the EIA Regulation 2012 (and all amendments to the regulation) of the Maldives by a registered consultant. Additionally, it adheres to the principles outlined in the regulations, action plans, programs and policies of both international and national related to the project, including the 10 safeguard policies of the world bank.

Major environmental laws, guidelines, regulations and action plans relevant to the project have been summarized below.

Table 2.1: Summary of main Laws, regulations and policies relevant to the project

Law/Regulation/Policy	**Implication**	**Key Stakeholder**
Employment Act (Act no. 2/2008)	The employment conditions and works hours for employees will be in accordance with the provisions of the Employment Act. The Act governs the rights and responsibilities of the workers in Maldives.	Ministry of Economic Development & Larbour Relation Authority
Immigration Act (Act no.1/2007)	Guidelines on the entry, departure and deportation of foreign workers and nationals in Maldives are stated in Maldives Immigration Act	Maldives Immigration & Larbour Relation Authority
Anti-Human Trafficking Act (Act no.12/2013)	Human trafficking in Maldives is a criminal offence. Periodic monitoring will be undertaken to ensure there is no human trafficking associated with the project by a committee formed to do so.	Maldives Immigration & Larbour Relation Authority
Prevention of Sexual Harassment Act (Act no.16/2014)	The Act prohibits employers and employees from subjecting those who work under them or their co-workers to any extent any type of sexual harassment.	MECC&T & Ensys
Gender Equality Act (Act no. 18/2016)	Under the Act, employers are mandated to ensure gender equality in work place. No gender-based discrimination whatsoever is allowed to be exercised in any work environment.	Ensys & Larbour Relation Authority
Maldives Pension Act (Act no.08/2009)	All Maldivian workers involved in the project will have to be registered with MPAO for retirement pension.	MPAO & Ensys
Law on Cultural and Historical places and objects of the Maldives (27/79)	The Law on Cultural and Historical Places and Objects of the Maldives 27/79 prohibits destroying or damaging any historical and cultural places, sites, objects and artefacts belonging to the sovereign area of the Maldives. However, no such places or objects are present in the project site.	Ensys
Heritage Act of Maldives (Act no. 12/2019)	The Heritage Act ensures the documentation, preservation and protection of cultural heritage. However, there are no sites, monuments or objects of heritage significance in the project site.	Ministry of Arts, Culture and Heritage Department of Heritage
WB's Environmental and Safeguards	The proponent will ensure that WB's safeguard policies, disclosure policies and performance standards are undertaken during construction and operation stages of the project.	Ensys & MECC&T

Environment Protection and Preservation Act	This ESMP is submitted to fulfil the requirement of Article 5 of the EPPA on EIA	MECC&T & EPA
Environment Impact Assessment Regulation 2012	This ESMP is submitted to EPA and conforms to the TOR issued by EPA	MECC&T & EPA
Environmental Damage Liability Regulation (R-9/2011)	The proponent will ensure that environmental and social monitoring is undertaken during construction and operation stages of the project.	MECC&T & EPA
Maldives Civil Aviation Regulation (MCAR – 139 – Aerodrome rules)	It should be ensured that the solar farm meets the requirements of the obstacle chart and approval is obtained from Civil Aviation Authority before construction. This task has already been completed.	Ministry of Transport and Civil Aviation Civil Aviation Authority
Work visa regulation	Quota, work permit, deposit, work permit card, medical insurance, and work visa will be organized for all migrant workers according to the provisions of these regulations.	Larbour Relations Authority
Waste Management Regulation (R-58/2013)	Waste generated by the project will have to be managed and disposed to the approved waste disposal sites.	MECC&T & EPA
Regulation on protection and conservation of the old trees and trees with environmental significance	The regulation is made to protect and preserve the old plants and trees of Maldives. Furthermore, it prohibits uprooting and removal of trees with environmental significance. But no such trees are present in the project area.	MECC&T & EPA
Operation Licensing and Facility Registration Regulation 2021	The regulation highlights the steps to be taken to register the utility service under the URA for providing service to the public.	URA & MECC&T
Mosquito control regulation 2007	The regulation provides responsibilities of landlords and developers on prevention of mosquito growth in households, buildings work areas. The project site has to be regularly cleaned and kept free of mosquito breeding sites.	MECC&T & EPA
Regulation on safety standards required in the construction industry (2019/R-156)	The regulation set the minimum safety standards required to be present in construction sites to ensure the safety of construction workers and the general public.	MECC&T & Ensys
Energy Policy	Main target of the policy is to provide all citizens with access to affordable and reliable supply of electricity	MECC&T

Montreal protocol on Substances that deplete the Ozone layer	Ministry of Environment has issued number of circulars to control the import of items having ozone depleting substances as marked under Montreal protocol. They are Halon gas-based chemicals, Halon-1211, 1301, 2404, Methyl Chloroform, Bromochloromethane (CH_2BrCl), Methylebromide (CH_3Br).	MECC&T & Ensys
Kyoto Protocol and United Nations Framework Convention on Climate Change (UNFCCC)	The Convention and the protocol aim to lower down the greenhouse gas (GHG) emission by the binding countries so that GHG concentration in the atmosphere will be lowered. The reduction on GHG emission will be achieved within a planned time frame so that it will be economically viable and naturally adaptable for ecosystems.	MECC&T & Ensys
International Larbour Organization Conventions	The conventions include Forced Labour Convention, 1930 (No. 29), Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87), Right to Organise and Collective Bargaining Convention, 1949 (No. 98), Equal Remuneration Convention, 1951 (No. 100), Abolition of Forced Labour Convention, 1957 (No. 105), Discrimination (Employment and Occupation) Convention, 1958 (No. 111), Minimum Age Convention, 1973 (No. 138) and Worst Forms of Child Labour Convention, 1999 (No. 182). The project staff be entitled to the rights stated in these conventions.	MECC&T & Ensys

3 PROJECT DESCRIPTION

3.1 Project concept

Greater Male' region is a densely populated area with limited land space available for any use, let alone for utility or commercial usage. Considering the land scarcity, the project is proposed on the pavement area of the link road between Male'-Hulhumale, southern side pavement area of Boashimaa Hinhun in Hulhumale and on roof top of 8 residential buildings in Hulhumale phase-1.

In pavement areas, the PV modules are fixed over an elevated roof structure in such a way that it covers and shades the pavement whereas in selected buildings, they will be fixed over the existing roof. The total length of the line along the pavement, including the island (empty space at the middle of the widest part of the link road) is 3,510m. The line will include a total of 10,691 panels with a capacity of 495 Wp by each link. Hence, the total installed capacity along the road side will be 5,292,045 Wp. Additional 720 panels will be installed on the roof top of the 8 selected residential buildings whose total capacity will be 356,400 Wp. Therefore, the installed total capacity under the proposed project would be 5,648,445 Wp.

A 1000 kVA transformer is set up for each link section. Other than link section 5. The proposed transformer size in link section 5 is 630kVA. They will be connected to the power grid of STELCO by means of 1 or 2 connections. The connecting cable will run across Boashimaa Hinhun to the powerhouse on the land side of that road. Allocations for the crossing of utility line had been included under the ground during road construction.

The power generated by the panels at the roof top will be fed to the grid by connecting them to the electrical penal boards in each building separately.

3.2 Design requirements by HDC and MNPI

It was a requirement of HDC to fix lights below the PV models so that the pavement area can be light up during night time. Even though this has not been incorporated in the initial design, contractor has agreed to include lights below the PV modules as part of the project, in pavement areas, excluding the island link. Further discussions are underway currently to include the island link as well.

Furthermore, it was a requirement of MNPI for the PV module mounting structure to be modular enough to allow access for repair works of the rock boulder revetment on the eastern side of the road if any repair work is required. The mounting structure is assembled by using clamps and bolts. Additionally, the PV modules are fixed by using a similar methodology. Hence, the structure can be removed and reassembled when needed. However, it will discontinue the production of electricity by that specific link. Currently MNPI has not identified any part of the revetment to be requiring any sort of repair and maintenance.

Table 3.1: Design details of the concept

Design Concept						
Installation Area	No. of Inverter 175kW	PV Module	No. of PV Module	Wp Installed	Orientation	Length
PV Array South Side	4	495 Wp	1,620 panels	801,900 Wp	51° E	615m
PV Array Link Section 1	4	495 Wp	1,728 panels	855,360 Wp	288° E	685m
PV Array Link Section 2	2	495 Wp	864 panels	427,680 Wp	110° E	380m
PV Array Link Section 3	3	495 Wp	1,296 panels	641,520 Wp	110° E	505m
PV Array Link Section 4	4	495 Wp	1,728 panels	855,360 Wp	295-310° E	705m
PV Array Link Section 5	3	495 Wp	1,215 panels	601,425 Wp	295-310° E	290m
PV Array Island	5	495 Wp	2,240 panels	1,108,800 Wp	110° E	330m
Tatal	25		10,691 panels	5,292,045 Wp		3,510m

3.2.1 Conceptual drawings

Scaled A3 drawings are provided under the appendix of the report.

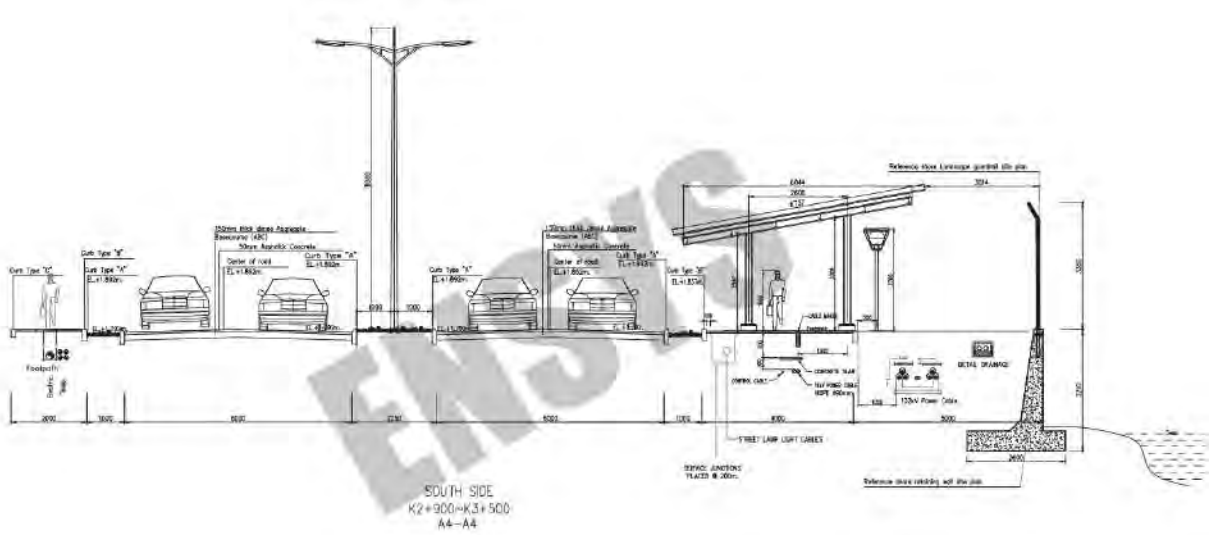


Figure 3-1: South side

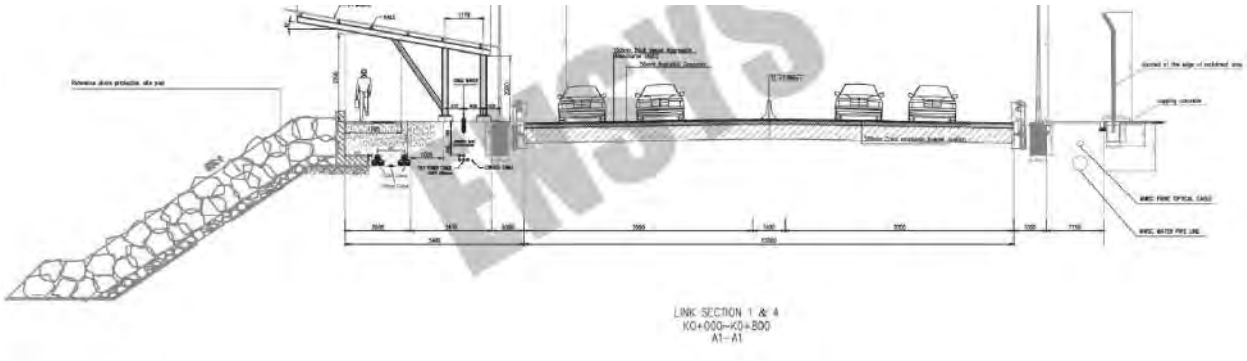


Figure 3-2: Link section 1 and 4

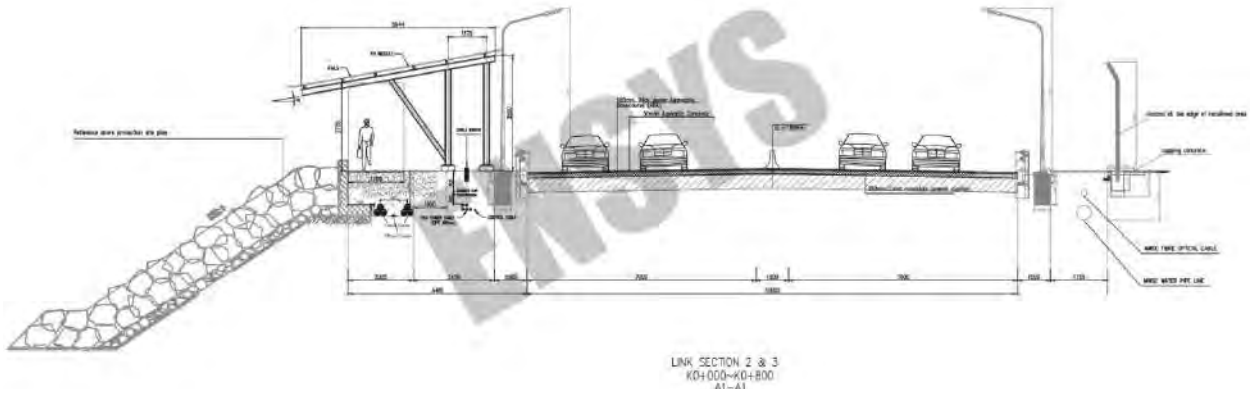


Figure 3-3: Link section 2 and 3

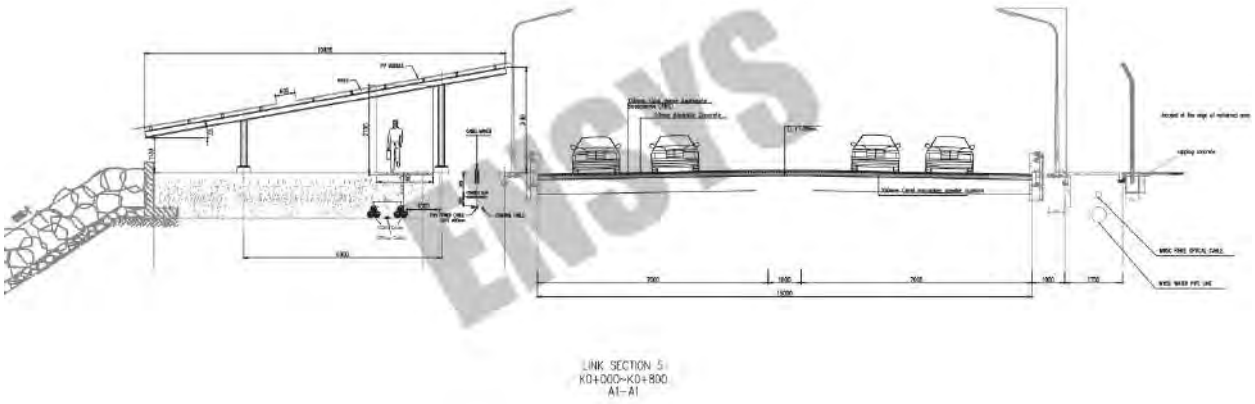


Figure 3-4: Link section 5

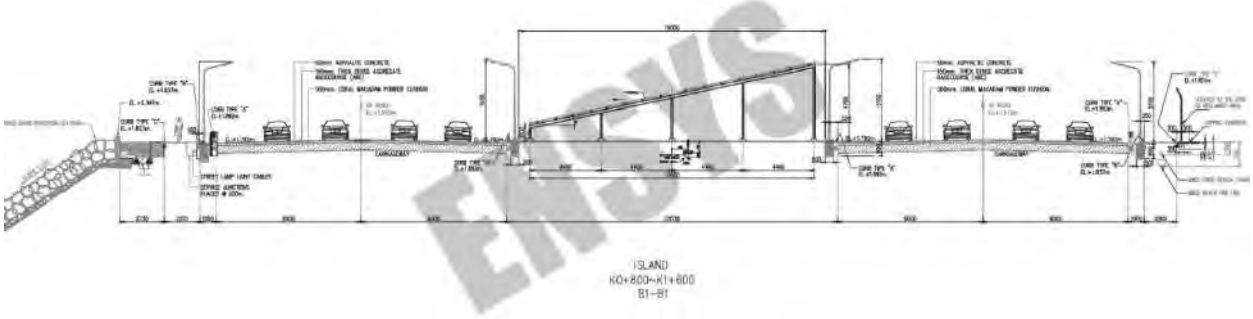


Figure 3-5: Island section

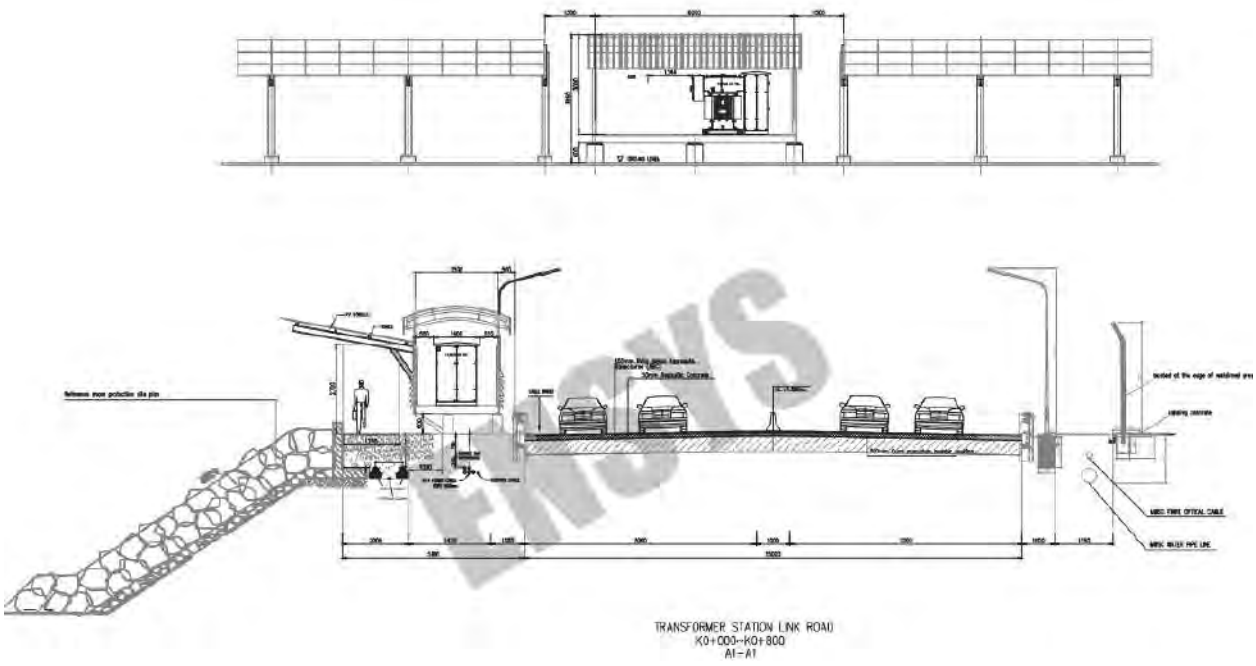


Figure 3-6: Transformer Station (link road)

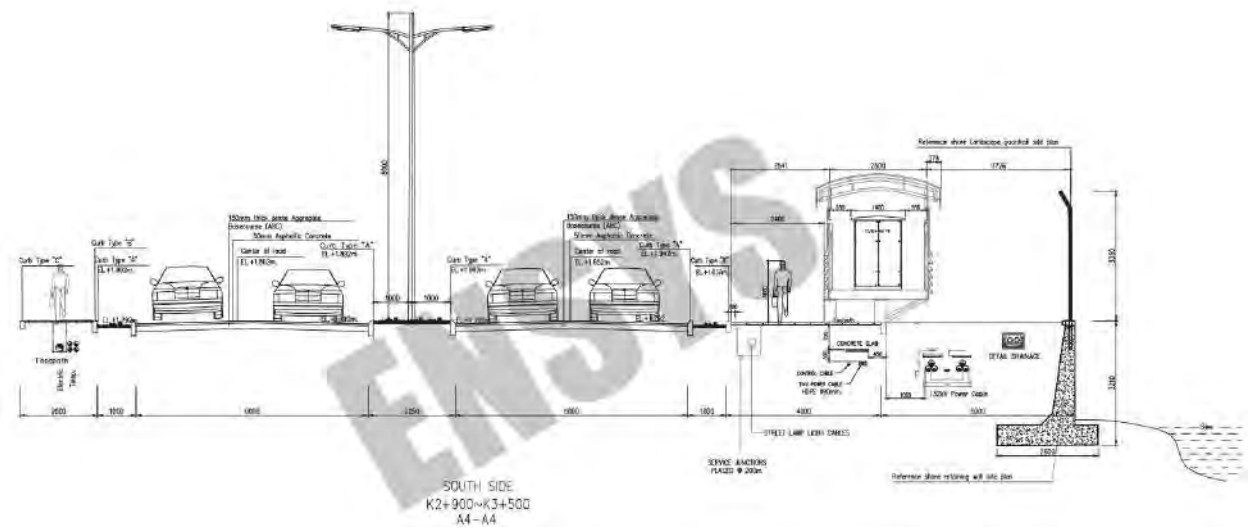


Figure 3-7: Transformer station (South side-Boashimaa Hingun)

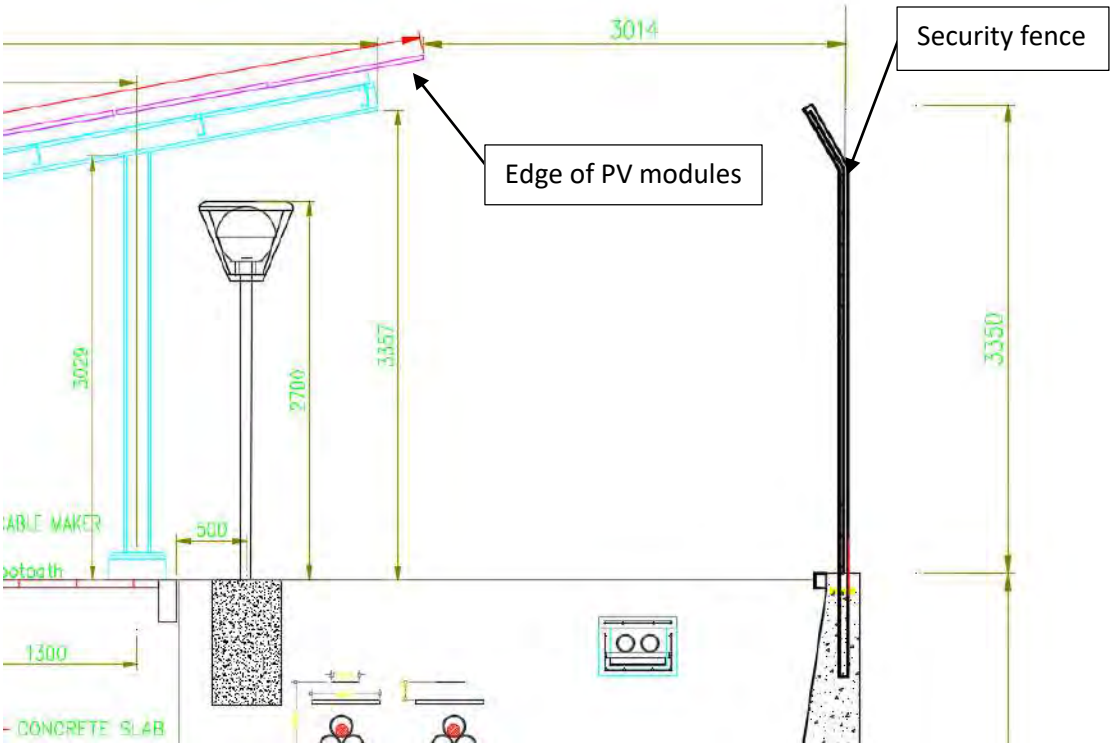


Figure 3-8: Distance between security fence and PV modules in Boashimaa Hingun

3.3 The Proponent

The project is awarded by the GoM on a long-term contract of 15 years to ENSYS CO., LTD. ENSYS will design, build, finance, own and operate the system for a period of 15 years after which the operation will be transferred to GoM. On behalf of GoM, STELCO will take over the operation of the project since STELCO is the main electricity provider of the state.

Proponent: Ensys Co., Ltd
Address: 636/4-6 Soi Ramkhamhaeng 39 (Thepleela 1),
Pracha-Uthit Road, Wangthonglang, Bangkok, 10310, Thailand

3.4 Project location

The project is proposed for the greater Male' region in 2 separate locations. They are the pavement area of the link road between Male'-Hulhumale, southern side pavement area of Boashimaa Hinhun in Hulhumale and on roof top of 8 residential buildings in Hulhumale phase-1.

- Area-1 (Link Road and Boashimaa Hingun)): The area between the eastern side road edge and revetment. End coordinates of the complete sections are:
    - North: 4°11'56.95" N, 73°32'28.58" E.
    - South east: 4°10'41.84" N, 73°31'54.25" E.
    - Island section (North: 4°11'23.43" N, 73°32'17.36" E, South: 4°11'13.46" N, 73°32'13.38" E)
    - Boashimaa Hingun: The area between the southern side road edge and airport security fence. However, once constructed, a gap 3.014m will be left between the fence and the edge of the PV structures. Link section end point coordinates are:
    - North west: 4°12'21.68" N, 73°32'10.14" E.
    - South east: 4°12'6.00" N, 73°32'22.58" E.
- Area-2: Roof top of 8 residential building in Hulhumale phase-1, neighborhood 3.
- Area-3: Temporary storage site in Hulhumale phase-2.

PROJECT AREA

Proposed Installation of 5MW
Grid-Tied Solar Photovoltaic System
in Greater Male' Region
Kaafu Atoll

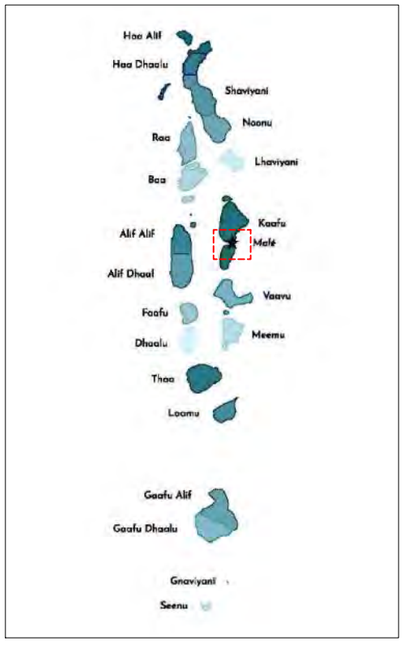
FORESIGHT SURVEYORS 2022

Environment and Social Management
Report

Ellipsoid: WGS84
Projection: UTM Z43 N
Unit: Meter

LEGEND:

- Project area
- Temporary Project site



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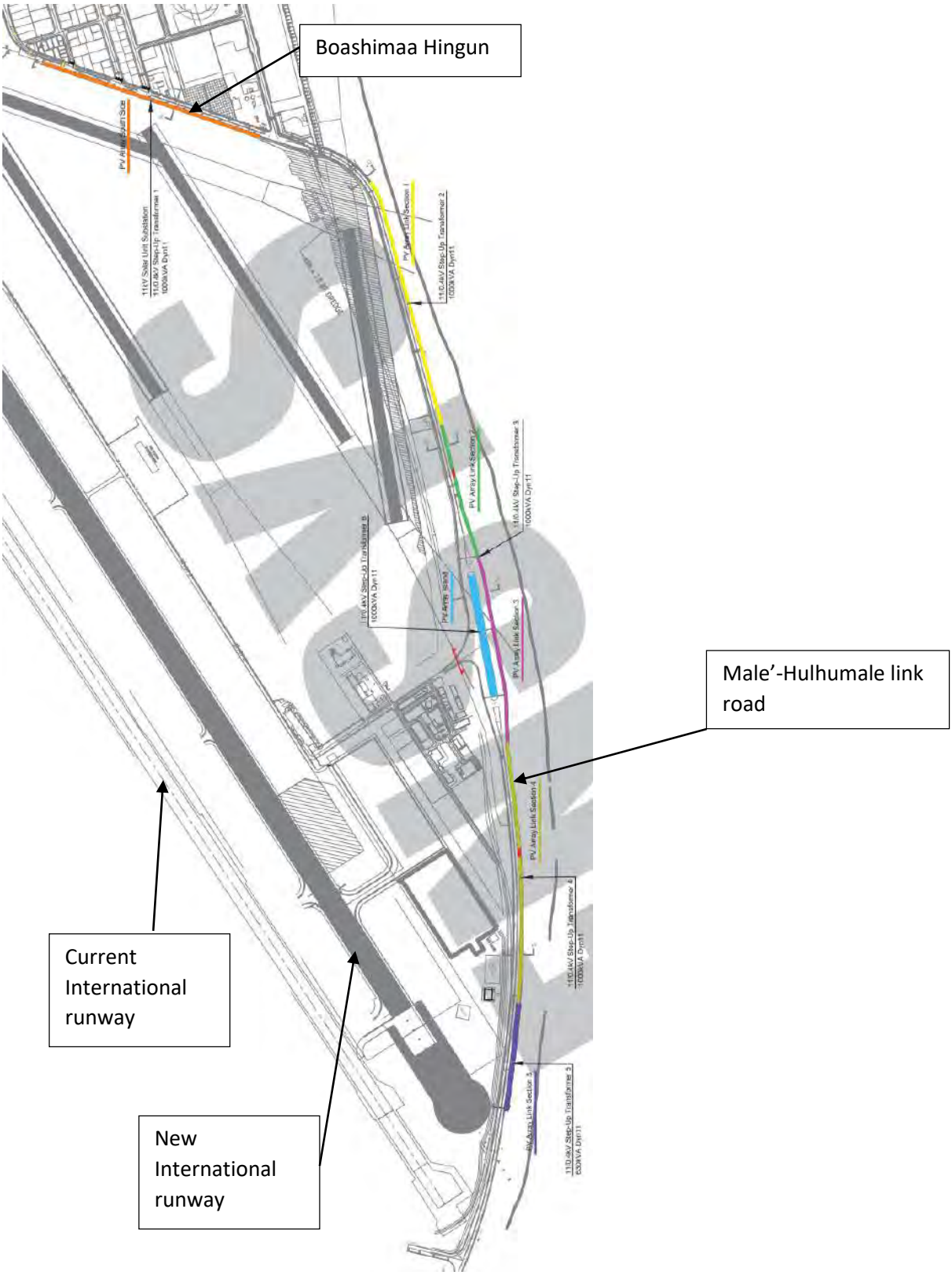


Figure 3-10: Main project site (road pavement area)

3.5 Study Area and Limitations

General study area for the proposed project is quite large, especially when the socio-economic impacts of the project are considered. Study area for the socio-economic impacts includes the greater Male' area. Field surveys for the project are carried out from the proposed project site and immediate surroundings. Social surveys for the project were carried out with the major key stakeholders of the project to identify any potential impact that might arise due to the proposed project.

3.5.1 Planning and methodology

Main project area is just few meters away from the coastline. Although the coastline along the project area has been protected by hard structures, the pavement area of the link road experiences the effect of topping and splashing waves during high tide. Site specific data on natural hazard vulnerability is not available. Reference was made from reports that were generally made to account the whole country.

Given the limited space available for the operation of machinery in project area 1, it is likely that work methodology and road closure schedule will require frequent update. Any change in the method and schedule will be immediately shared with stakeholders.

3.6 Project Components

The proposed project consists of number of components carried out under 4 different phases. The different phases of the project are designing and approval of drawings and initial assessment reports, manufacture and procurement of items, construction and installation of items and the final phase which is the operational phase of the project. First two phases are currently on going. This report will mainly discuss and describe the components under the last 2 phases.

Specific project components under construction and installation include;

- Site Surveying
- Mobilisation and Demobilisation
- Site preparation
- Installation of foundation footings
- Installation of transformers
- Excavation and cable work
- Installation of mounting structures (link road and Boashimaa Hinhun)
- PV module installation
- Finishing and landscaping
- Testing and Commissioning

3.6.1 Site surveys

Prior to the beginning of any physical or design work of the project, site surveys are undertaken to define the scope and boundary so that areas outside the project boundary stays safe and sound. Surveys ranging from topographic survey, a survey to identify underground cables and other existing structures in the area were carried out. Project design is carried out after assessing the available space for installation in the pavement area.

Methodology

Topographic survey to understand the topography of the area and other existing structures were undertaken by using GNSS RTK positioning method. Locations of the underground cables are identified by referring to published secondary information sources provided by relevant authorities. Visual inspection together with general photography of the project area is carried out to understand the physical environment.

Justification

GNSS surveying is robust, fast and easier for surveying large areas. RTK drone mapping is an emerging technology used to survey huge areas. Since most of the relevant authorities were able to provide information on the underground cables in the area, that information was referred as reliable sources instead of undertaking a survey to identify the cables by using a cable detector.

3.6.2 Mobilization and demobilization of machinery and items

Project machineries will be hired for the period of the project from a contractor in Hulhumale'. Number of different machineries are required at various stages of the project. Machineries will be mobilized to and demobilized from the site as needed. If a machine with a metal track is to be mobilized, it will be carried over a trailer. The list of machineries that will be used at various stage of the project are listed under the equipment list with specific details and pictures. Although they are not the exact machine to be used, a machine of similar capacity with almost the same characteristics will be used.

Mobilization and demobilization of machinery, various items and goods used in the project will require part of road closure in Male'-Hulhumale link road and Boashimaa Hinhun, at the point of mobilization and demobilization. Hence, a table has been created to represent the days and the duration of road closure during various components of the project. It is estimated that the maximum width of the area to be closed will not be wider than the width of a single lane, keeping the other lane for vehicle movement. However, the length of the area to be closed can differ, starting from 20m to 50m.

Methodology

Movable machineries with wheels will be mobilized by driving. Immovable items will be moved by loading into trucks or crane trucks. In case of normal trucks, items will be loaded to and unloaded from the truck either by using a crane of an excavator or a forklift. Depending on the item to be loaded and unloaded, most appropriate machine will be selected for loading and unloading. Machines with metal tracks will be carried over trailers. No such machine will be moved on the paved road.

At project completion, demobilization will take place in a similar fashion where machineries will be taken back to the sites from where they are from or to another site of the contractor at the mobilisation stage. Step by step procedure to be followed during the mobilization and demobilization is provided below.

- The contractor/client plans and make the updated project schedule together with the machinery list, construction methodology and road closure schedule which will be sent to key stakeholders named in the report prior to the construction. It has to be noted that these documents have already been shared with these stakeholders as part of this report. However, any preceding change or update has to be shared before the beginning of the construction. Stakeholders are expected to respond back with any comments or suggestion upon the reception of these documents.
- Identify the exact machinery to be mobilized or demobilized depending on the specific work to be carried out in the site.
- Identify if there is any specific time allocated or recommended by any of the key stakeholders for mobilization and demobilization since the pavement area is a high security zone apart from being an area that experiences heavy traffic. It is highly recommended to avoid mobilization and demobilization at peak traffic hours which is expected to be between 7:00AM to 9:00AM and 15:00 to 17:00.
- Inform the traffic police and obtain assistance in vehicle management during road closure, or follow a recommended procedure by the traffic police and carry out the mobilisation and demobilization as per the instructions. Even if no recommendation has been received, there must be traffic controllers or flagman at both ends of the closed area to guide vehicles.
- Road closing should be limited to the schedule provided by the contractor/client. Changes in

duration and timings must be properly communicated.

- No machinery with metal track line moves directly on the paved road without a protective layer been spread over the road. As per the procedure of HDC, any machinery with metal track should be directly unloaded to the work site from the trailer without touching the ground, even with any sort of protection between the track line of the machine and the road. However, if for any reason it is not possible to do so, mobilization and demobilization has to be carried out under the direct supervision of the Municipal Service Section of HDC.
- The railing on the side of the road will have to be removed for the machine to move into the site. Railing can be manually removed. It will only be removed to the required length.
- Handling instruction of items, especially fragile items must be followed in mobilising such items.

Justification

This method of mobilisation by using a tailer for equipment with metal track is the only viable option for the project. The other option could be to direct the machine to pavement area from Hulhumale side and move it along the line to the necessary points. But given the narrowness of the area, this is not a feasible option.

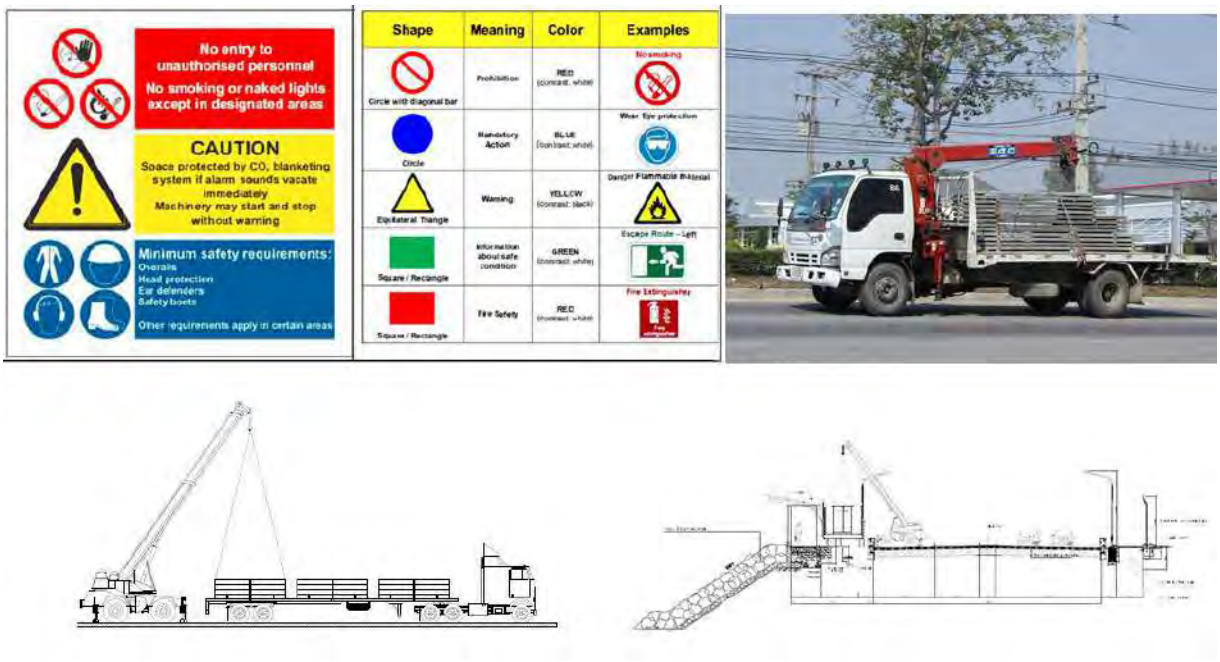


Figure 3-11: A typical site safety board and mobilisation method

3.6.3 Preparation of project site

Site preparation in link road and Boashimaa Hingun includes the removal of the existing pavement area and leveling the area to begin civil works. The removed paving blocks will be piled in the project area at different locations as decided by the contractor. The new pavement will be paved by using the same blocks at the completion of the project. Additionally, safety sign boards will be erected along the project area.

Methodology

Existing pavement will be removed manually. However, a mini excavator might be required to lift

and move the curb stones. Sign boards will be erected by using of GI pipes or any other suitable material that could long last for the duration of the project. The area will be levelled by using a mini excavator or a loader.

Justification

Removal of the pavement has to be carried out by manually. If machinery is to be used, it is very likely that the paving blocks will break. Hence, this is the only justifiable method of pavement removal.

3.6.4 Installation of foundation footings

The foundation footings to be used to place transformers and mounting structures of the PV Modules would be metal screw piles, screwed into the ground by a spin system attached to a PC30 backhoe. The foundation structure will be 1m away from the high voltage cables of STELCO which is laid more towards the revetment.

Methodology

- Procurement of the material and storage in the temporary storage area.
- Mobilization of PC30 backhoe and materials to the starting area as per the mobilization schedule.
- Setting out of drilling points as per the design drawing by a surveyor.
- Check the drilling area with a metal detector for the presence of any cable underneath.
- Screw drive the pile with vertical pressure into the ground by PC30 backhoe with spin head until the pile is at the level according to the design. The length of each screw pile is approximately 3 meter, which is enough for coupling together.
- Pile deviation will constantly be checked during the pile driving.
- Following the foundation footings (piles), over ground metal frame structure will be fixed to the screwed piles by bolts.
- The foundation footings will be at least 1m away from the high voltage cables of STELCO.

Justification

Screw piling will be less destructive to the surrounding environment compared to other forms (hammer) of piling.

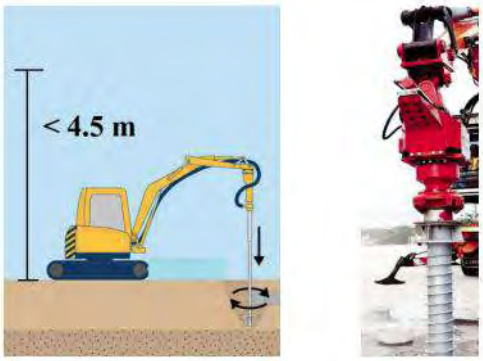


Figure 3-12: Foundation piling

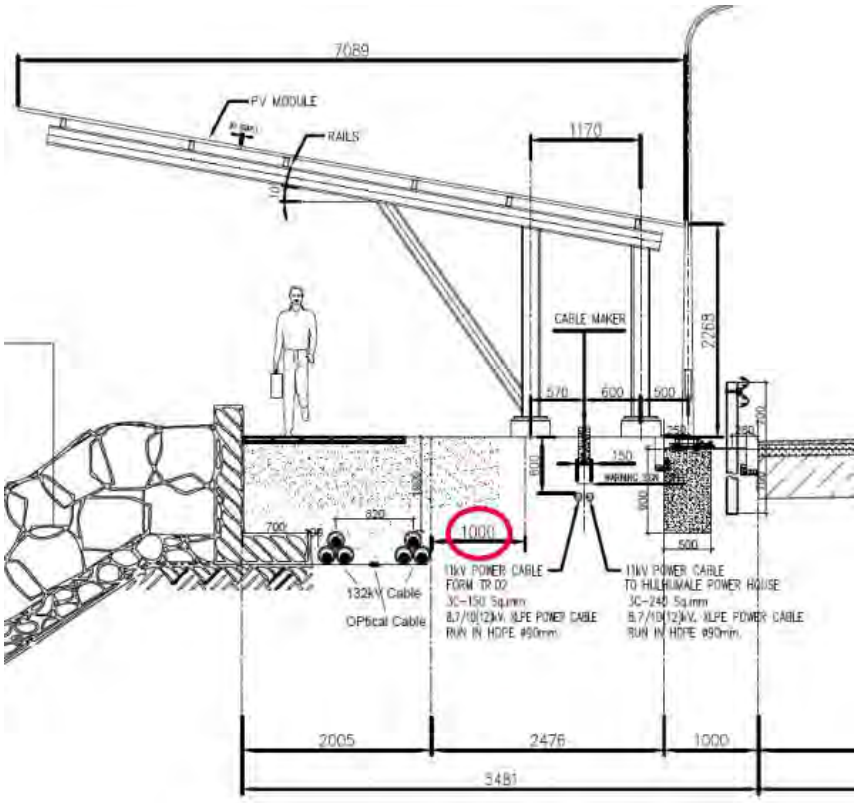


Figure 3-13: Typical structural arrangement of the structure

3.6.5 Installation of Transformers

A total of 6 container type transfers and RMUs are proposed under the project. A transformer is installed in each link section in the pavement area. However, a single transformer is placed for link section 2 and 3. Each container is placed over a metal frame supported footings that emerge from the ground.

Methodology

- During the installation of foundation footings, footings required for the placement of transformers also would be established.
- The required materials and machinery will be mobilized to the site as per the mobilization and demobilization method.
- Once the foundation footings are set, a metal platform will be assembled in site and placed over the footings by using a crane. Afterwards, the workers will install the pre-cast concrete slab on the platform.
- The container type transformer and RMU equipment will be delivered to the designated location by a truck. It will be placed over the platform by using a crane.

Justification

The method explained above is the most feasible method for the placement of transformers in this project.

Figure 3-14: Installation of transformers (reference pictures of similar works)

3.6.6 Excavation and cabling work

A 11kV cable will be laid along the link road and Boashimaa Hinhun pavement area to connect the system to the power grid of STELCO. The laid cable will be within a HDPE pipe, buried about 0.45m below the existing ground level and over the type-2 footing. Rooftop installation in the building area is not expected to require underground cable burial.

Methodology

- Mark the cable route and manhole location on the ground with a suitable paint. This is the cable that will connect the PV system to STELCO's power grid via the power house in Boashimaa Hinhun, Hulhumale. Since road crossing ducts have already been constructed in Boashimaa Hinhun during the road construction, no excavation across the road (Boashimaa Hinhun) is required.
- Check along the marked line for presence of cables underneath by using a cable detector before excavation.
- Cable line will be excavated by a mini excavator to the depth of 1m at the width of the bucket.
- Manholes will be placed at the marked locations by using the excavator.
- HDPE pipe together with the cable will be placed along the trench.
- The area will be backfilled with fine sand for a height of 0.3m and a warning slab will be casted before backfilling to the ground level. The line will have markings on the surface to identify the locations.
- The cable connecting the adjacent PV modules will run below the mounting structures. They will be securely attached to the structure by metals ties.

Justification

The explained method is the standard for laying cables in such similar projects carried out.

Figure 3-15: Cable connection and installation (reference pictures of similar works)

3.6.7 Installation of mounting structures (link road and Boashimaa Hinhun)

The mounting structure is only required for the project area in link road and Boashimaa Hinhun. The entire mounting structure comprise of the foundations, array frames which provide the main mechanical support, and array super-structure onto which the PV modules are bolted. Array orientation and tilt angle shall be designed to meet the technical requirement to minimise the reflective glare from the structure.

Methodology

- The exact link section to commence the placement of footings will be decided during the project inception meeting with stakeholders. Currently, it has been decided to start the physical work from either link section 1 or 5 since they are close to a water and an international runway that is to start operation soon.
- Once the site is ready for installation of the mounting structures, front and rear steel columns will be erected and bolted to the already established pile footings.
- Afterwards, column bracing and purlin installation will be carried out which will connect the separate columns into one structure and a frame, ready for the placement and fixation of PV modules.

Justification

The method explained is a typical method which has been used and experienced in different areas of the world for fixation of similar structures.

Figure 3-16: Installation of mounting structures

3.6.8 Installation of PV modules

Upon the completion of the mounting structures in link road, PV modules will be taken to site for installation. Similarly, PV modules will be taken to the specific buildings for installation. Transfer of PV modules to site will be carried out as per the mobilization and demobilization procedure.

Methodology

- PV modules are fragile and steps highlighted in the safety recommendation must be followed during handling, loading, transfer, unpacking and installation. All the handling instructions provided by the manufacturer must be followed.
- The unpacked PV Modules will be lifted to the mounting structure by a scissor crane (scissor aerial work platform). Workers will unload the PV module and move it to the installation position and install it.
- The connection of the module to the racking system will be done through the mounting holes, with clamps, or an embedded system on the frame. Modules can be attached using the mounting holes on the back of the module frame, by fixing the module to the support rails with bolts.
- Another method of module fixation is by using mounting clamps on the sides of the module.
- All module frames and mounting racks must be properly grounded in accordance with appropriate respective National Electrical Code.
- Proper grounding is achieved by bonding the module frame(s) and the complete metallic structural frame together, using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or any other material acceptable for use as an electrical conductor per respective National Electrical Codes. The grounding conductor will be connected to earth using a suitable earth ground electrode.
- The grounding hardware comes in a package that includes the grounding screw, flat washer, star washer and wire. Electrical contact is achieved by penetrating the anodised coating of the aluminum frame, and tightening the mounting screw.

Justification

The method explained for installation of the PV modules over the mounting frame is the standard mounting method for such installations.

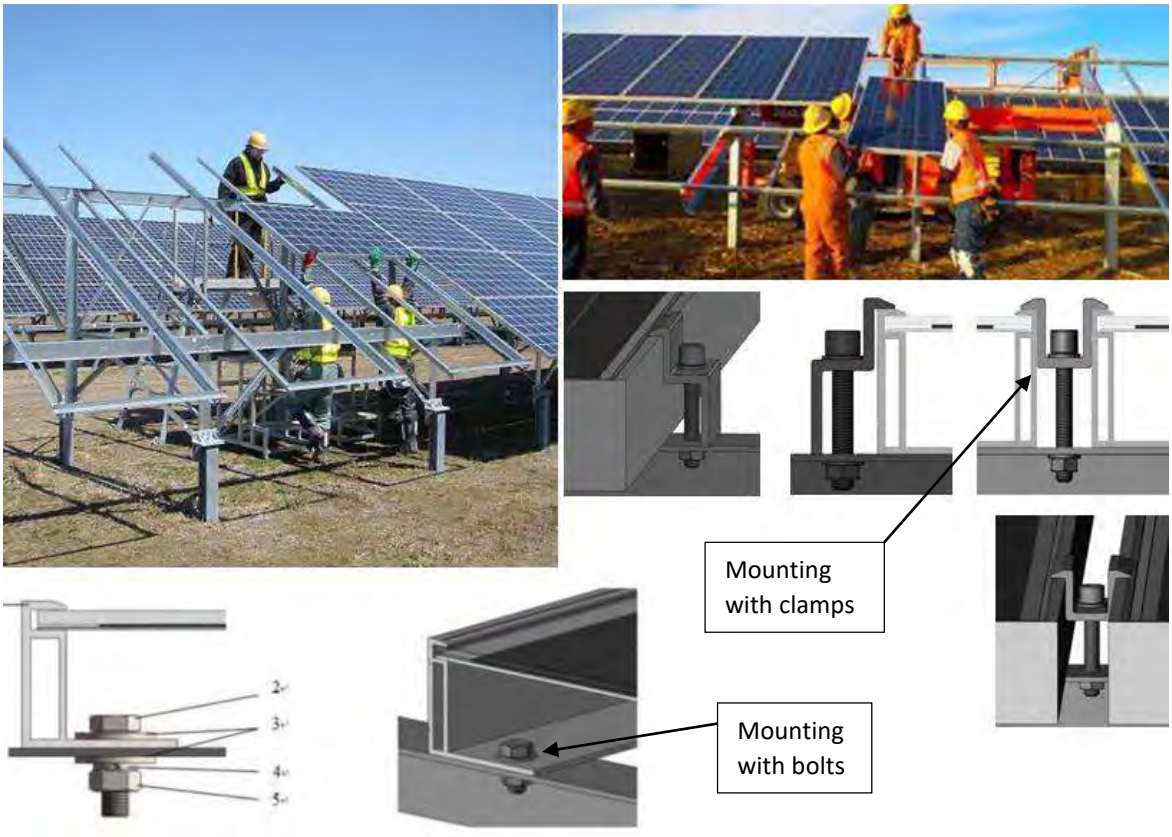


Figure 3-17: Installation of PV modules

3.6.8.1 Installation of PV modules on rooftop

No considerable modification will be brought to the roof structure of the buildings to fix the PV modules. They will be fixed on the existing roof structure by using mounting clamps, bolts, racking etc.

Methodology

- Prior to mobilization, a small area from the proximity of each building will be allocated for temporarily keeping the machinery and unloaded items such PV modules in the area. Such an area will be decided with the approval of HDC in a way that it will not obstruct the daily movement of residents in and out of the building. This area will be cordoned from public entrance.
- Similarly, prior to mobilization, residents of each building will be informed about the project and duration of the proposed work.
- Ideal areas for the temporary site near the buildings would be the areas with least public use such as the ends and back side, not the front side where the access to the building is located.
- Machinery and items will be mobilized to the building area where the work is to be started first as per the mobilization and demobilization method.
- Transfer of material from the ground to the rooftop will be carried out from the cordoned area, either by using a crane or a large scissor platform (item 8 and 9 in machinery list).
- No change or modification to the roof structure is needed.
- PV modules will be fixed on to the existing roof structure by using mounting clamps, bolts, racking etc

A schematic diagram on how the modules will be fixed is given below.

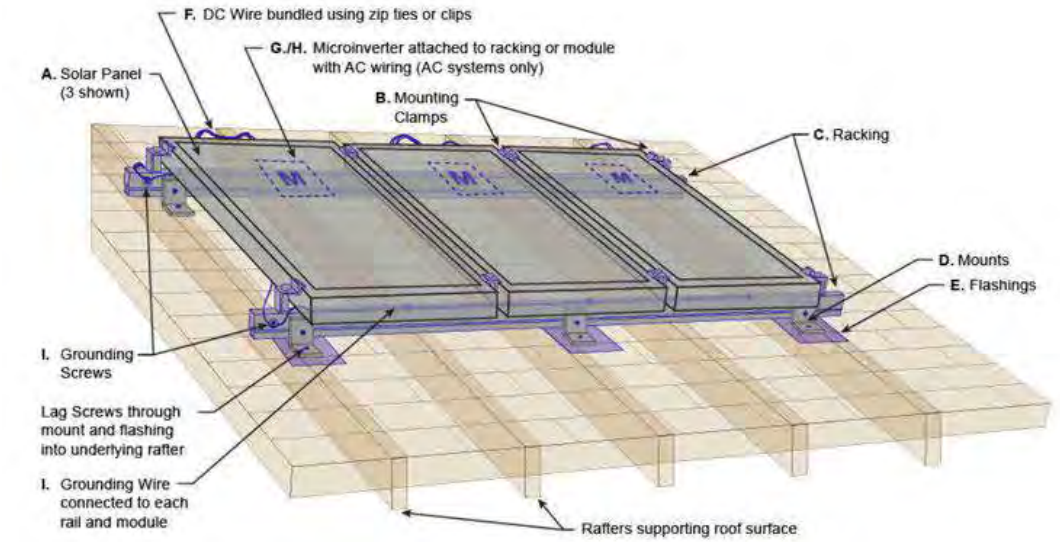


Figure 3-18: A schematic diagram to represent rooftop fixation (Courtesy: Solarpowerworldonline.com)

3.6.9 Finishing and landscaping

Once the major construction work is finished, finishing and final landscaping work will be carried out. Finishing and landscaping includes ground leveling, placement of the pavement under the PV modules and repair work of any damage that has occurred to the immediate project area during the construction work. Any damage that has occurred to the paved road, side quay-wall or building must be repaired by the client at the completion of the construction period of project.

Methodology

- Carry out a visual inspection of the immediate project area including the link road, Boashimaa Hinhun and the 8 residential buildings together with HDC and PMU of the Ministry to identify any damage that has been occurred during the project to immediate surroundings of the project area.
- Since the link road and Boashimaa Hinhun area will be covered by the PV modules, final level work will be manually carried out by using shovel and spade.
- Pavement line will be marked following which blocks will be arranged. Paving blocks will be manually arranged on a compacted surface. Placement of curb stones might require the assistance of machinery in which case it has to be pre planned and completed before the area is fully covered by PV modules.
- Fixtures such as electric lights will be fixed below the PV modules to light up the pavement area during the night time.
- The system will be connected to the power grid of STELCO by connecting it to the STELCO's powerhouse in Boashimaa Hinhun, Hulhumale. In residential buildings, it will be connected to the electric penal boards of each building.

3.6.10 Testing and Commissioning

At the completion of the construction work, final testing and commissioning will be carried out in coordination with the relevant government institutions such as STELCO. System synchronization and all required testing will be carried out.

3.7 Project Justification

3.7.1 The Project

In the past, Maldives entirely depends on imported fossil fuel in meeting the country's energy. However, in recent years, GoM has taken solid steps forward in developing and investing on projects for the generation of renewable energy. In an interview with BloombergNEF, Dr. Hussain Rasheed Hassan- Former Minister of Environment has been recorded to have said that, *"The nation spends almost 10% of its GDP importing fossil fuels to generate power and to provide mobility. The cost of power from the most efficient diesel plant is 23 U.S. cents per unit. Power from a solar plant is available at less than half of that. That is the reason why we have renewable energy as a top priority,".* (Gombar, 2020).

As per the National Environmental Action Plan III (NEAP III), which sets out the agenda for environmental protection and management in the Maldives, one of the main targets aimed to achieve was working towards a carbon neutral nation. NEAP III aims to make a livable and a sustainable environment a component of development projects carried out in Maldives. NEAP III provides the basis for environmental planning, budgeting, performance measurement, and accountability. In NEAPA III, it has been aimed to decrease the dependency on diesel powered electricity generation in Maldives with the provision of renewable energy throughout the country. Similarly, the importance and composition of the much-needed legal framework to assist the development of the sector of renewable energy is highlighted in NEAPAIII. The proposed project would function as a key project in assisting to move towards a carbon neutral nation.

Furthermore, ensuring access to affordable, reliable, sustainable and modern energy for all is one of the 17 Sustainable Development Goals (SDGs), also known as the Global Goals, which were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. One of the key target of this goal is to invest in solar, wind and thermal power, improving energy productivity, and ensuring energy for all.

3.7.1.1 Project Location

The project is proposed in greater Male' regions. Greater Male' region is a densely populated area with limited land space available for any use, let alone for utility or commercial usage. Similarly, availability of a shallow lagoon area around Male' is also limited. Considering the land scarcity, the project is proposed on the pavement area of the link road between Male'-Hulhumale, southern side pavement area of Boashimaa Hinhun in Hulhumale and on roof top of 8 residential buildings in Hulhumale phase-1.

Erection of solar panels on the pavement area of the link road and Boashimaa Hinhun will provide shade for pedestrians once the area is open to the public. HDC plans to open the pavement area of the link road for public use after the completion of the project.

In order to select and finalise the buildings selected for installation of PV modules on roof tops, HDC sent a letter to the residents of each buildings to see if any of the residents of the selected buildings are against it. Those 8 buildings are finalized for roof to installation since none of the resident of these building objected it.

3.7.2 Justification of the project concept/design

Since Maldives is located over the equator, receiving abundant solar energy throughout the year, energy generation from solar power has been experienced to be the most effective renewable energy generation technique so far. The emerge number of sunny days experienced in Maldives per annum is 28-300 (Azwar, 2010). Maldives receives about 400 Mullion MW of solar energy per annum with the daily average global irradiation of 4.5-6 kWh/m2/day (Azwar, 2010).

3.8 Project Management

Project will be managed by the project director/manager working in the head office. Under the project manager, site manager/engineer and foremen will work at project management and supervisory level. Site manager/supervisor will run the day to day activities of the site as per the schedule. A health and safety officer will ensure that day to day construction activities meet the requirements highlighted in the ESMP. A project schedule will be created with targets which will be used to monitor the project as it progresses. Additionally, a site staff from the PMU of MECC&T will be stationed at site to supervise site activities.

3.8.1 Stakeholder engagement

Regular stakeholder engagement meetings must be held with all key stakeholders during the construction phase of the project. During the first month of the construction stage, meetings must be held weekly which can later be held fortnightly or monthly depending on the outcome and urgency of the first month's meeting. The first meeting must be held prior to the beginning of the construction period. Hence, during the course of the construction period, a minimum of 11 such meetings will be held.

Stakeholder engagement meetings must be planned and informed to the stakeholders a week before the construction stage. For the easiness of the attendees and as a COVID19 precautionary measure, meetings are better arranged online. Meetings must be headed and attended by senior level officials of the contractor who has proper knowledge of the project.

Table 3.2: Stakeholder engagement meetings

Meeting	Minimum Discussion
1st meeting (held prior to the beginning of construction)	• Must confirm and pass the updated schedules (machinery, manpower, work, road closure etc). • Set deadlines or plans to attend/solve any identified issue.
The following 17 or 11 meetings	• Client or the contractor must highlight any changes to any of the project schedules. • Details of any work place accidents or incidents and steps to be taken by the contractor to eliminate further such incidents. • Must identify and highlight whether the adverse environmental impacts during the construction period are within the envisaged limits in the report.

The following stakeholders must be informed and called for the meeting;

- Housing Development Corporation (HDC)
- Maldives Civil Aviation Authority (MCAA)

- Directors of Aviation Security Administration
- Ministry of National Planning, Housing and Infrastructure (MNPH&I)
- Traffic Police
- Maldives Airports Company Limited
- Male' City Council
- Ministry of Transport

3.8.2 Traffic Management

During the construction period, especially during project mobilisation, loading and unloading, part of the road in link road and Boashimaa Hinhun will have to be closed. Road closure and traffic management will be carried out in coordination with Maldives traffic police. It has to be noted that road closure is referred in the report to refer to the close of a maximum of a single traffic lane from link road or Boashimaa Hinhun, not the complete road.

The preliminary road closing schedule is given below which will be adjusted as required with prior notification to the key stakeholders. Note that month-1 is the table is referred to the first month where the construction stage begins. Hence, it will align with the month-8 in the main schedule.

Table 3.3: Traffic Management Schedule

	06:00 – 07:00 hrs.	17:00 – 18:00 hrs.	Remarks
Month1 Day 1	Machine no: 2,3, 4 & 5 Activity: Unloading materials at site Construction content: Land preparation Duration: 120min Site Area: PV Array Link Section 1 (60 min) PV Array Island (30 min) PV Array South Side (30 mins)		The truck mounted cranes start to unload materials for land preparation work. The materials for link sections will be unloaded at Link section 1, excavators and forklifts will be left at site until work completion.
Month1 Day8	Machine No: 4 Activity: Unloading materials at site Construction content: Land preparation Duration: 120 min Site area: PV Area Link Section1 (60min) PV Array Island (30 min) PV Array South Side (30 min)		Unloading materials for supplement every other week.
Month1 Day 15	Machine No: 4 Activity: Unloading materials at site Construction content: Land preparation Duration: 120 min Site Area: PV Array Link Section 1 (60 min) PV Array Island (30min) PV Array South Side (30min)		Unloading materials for supplement every other week

Month1 Day21	Machine No: 4, 5, & or 7 Activity: Unloading Material at site Construction content: Foundation work, cable trench, excavation Duration: 120 min Site Area: PV Array Link Section1 (60min) PV Array Island (30min) PV Array South Side (30min)		The truck- mounted cranes &/or Trailer starts to unload materials for foundation. The materials for link sections will be unloaded at Link Section1. The piling machine will be left at site until the work is finished.
Month1 Day 28	Machine No: 4 &/or 5 Activity: Unloading materials at site Construction content: Foundation work, cable trench, excavation Duration: 120 min Site Area: PV Array Link Section1 (60min) PV Array Island (30min) PV Array South Side (30min)		Unloading materials for supplement every other week
Month2 Day5	Machine No: 4&/or 5 Activity: Unloading materials at site Construction content: Concrete, foundation work, cable trench, excavation, mounting structure installation. Duration: 120 min Site area: PV Array Link Section1 (60min) PV Array Island (30 min) PV Array South Side (30min)		The truck – mounted cranes &/or Trailer starts to unload materials for transformer yard & RMU housing work. The materials for link sections will be unloaded at Link section 1
Month2 Day 12	Machine No: 4 &/or5 Activity: Unloading materials at site Construction Content: Foundation work, cable trench excavation, Mounting structure installation, PV Module installation. Duration: 120 min Site Area: PV Array Link Section1 (60min) PV Array Island (30 min)		Unloading materials for supplement every other week

	PV Array South Side (30min)		
Month2 Day 19	Machine No: 4 &/or 5 Activity: Unloading materials at site Construction content: Foundation work, cable trench, excavation, mounting structure installation, PV Module installation. Duration: 120 min Site Area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30 min)		The trailer starts to unload materials for PV module installation work. The materials for link sections will be unloaded at Link section 1
Month2 Day 26	Machine No: 4 &/or 5 Activity: Unloading materials at site Construction content: Transformer yard & RMU housing, foundation work, cable trench excavation, mounting structure installation, PV Module installation. Duration: 120 min Site Area: PV Array Link Section 1 (60min) PV Array Island (30 min) PV Array South Side (30min)		The truck mounted cranes &/or trailer starts to unload materials for transformer yard & RMU housing work. The materials for link sections will be unloaded at Link section1
Month3 Day3	Machine No: 4 &/or 5 Activity: Unloading materials at site Construction content: Transformer yard & RMU housing, foundation work, Cable trench excavation, Mounting structure installation, PV Module installation. Duration: 120 min Site Area: PV Array Link Section 1(60min) PV Array Island (30 min) PV Array South Side (30 min)		Unloading materials for supplement every other week
Month3 Day 10	Machine No.: 4 &/or 5 Activity: Unloading materials at site Construction Content: Transformer yard & RMU housing, foundation work, Cable trench excavation, Mounting structure installation, PV Module		The Trailer starts to unload materials for string inverter installation work. The materials for link sections will be unloaded at Link section 1.

	Installation, String Inverter Installation. Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30min)		
Month3 Day17	Machine No.: 9, 4 &/or 5 Activity: Unloading materials at site Construction Content: Transformer yard & RMU housing, foundation work, Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30min)		The truck-mounted cranes &/or Trailer starts to unload materials for cable installation work. The materials for link sections will be unloaded at Link section 1.
Month3 Day24	Machine No.: 4 &/or 5 Activity: Unloading materials at site Construction Content: foundation work, Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30min)		Unloading materials for supplement every other week.
Month4 Day1	Machine No.: 4 &/or 5 Activity: Unloading materials at site Construction Content: foundation work, Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30min)		Unloading materials for supplement every other week.

Month4 Day8	Machine No.: 4 &/or 5 Activity: Unloading materials at site Construction Content: foundation work, Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30min)		Unloading materials for supplement every other week.
Month4 Day15	Machine No.: 1, 4 &/or 5 Activity: Unloading materials at site Construction Content: Container Type Transformer Installation, Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (60min)		The crane and trailer will be used for container type transformer installation work.
Month4 Day16	Machine No.: 1, 4 &/or 5 Activity: Unloading materials at site Construction Content: Container Type Transformer Installation, Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 2 (60min) PV Array Link Section 3 (60min)		The crane and trailer will be used for container type transformer installation work.
Month4 Day17	Machine No.: 1, 4 &/or 5 Activity: Unloading materials at site Construction Content: Container Type Transformer Installation, Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 4 (60min) PV Array Island (60min)		The crane and trailer will be used for container type transformer installation work.

Month4 Day24	Machine No.: 4 &/or 5 Activity: Unloading materials at site Construction Content: Cabling work, Mounting structure installation, PV Module Installation. Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30min)		Unloading materials for supplement every other week.
Month4 Day30		Machine No.: 1, 2 ,3, 4, 5, 6 Activity: Loading materials at site and leave Construction Content: Duration: 120min Site area: PV Array Link Section 1 (60min) PV Array Island (30min) PV Array South Side (30min)	Finish the site installation work

3.8.3 Project Schedule

The whole project is expected to take about 14 months for completion, including the survey, design, procurement and construction period. However, due to the covid pandemic, it has been delayed. The construction period together with commissioning and testing will take 7 months. On average, construction work at each link section will take a month. Complete project schedule is included under the appendix.

3.8.4 Project Manpower

About 30-50 workers will be involved in the project at various phases of construction. They will mostly include foreign workers. They will actively involve in the project at different stages.

Table 3.4: Project manpower

No.	Description	Quantity
1	Project Manager	1
2	Project Engineer	1
3	Site Manager	1
4	Health and Safety Officer	1
5	Warehouse/ Storage Officer	1
6	Electrical Engineer	1
7	Electrical Supervisor	1
8	Civil Engineer	1
9	Civil Supervisor	1
10	Foreman	5
11	Technician	8
12	Skilled Worker	15
13	Unskilled Worker	8
14	Site staff by PMU of MECC&T	1
Total		**46**

3.8.5 Major project machineries

Number of heavy machineries are used at various stages of the project. The picture of the machinery shown in the list is not the exact machinery to be used. However, a machine of similar capacity and functionality will be used depending on the availability at the time of construction.

Table 3.5: Main machinery list

Item	Type of Machinery	Figure	Main Use	Description
1	CRANE 25 TON		• Loading and unloading of items • Installation of transformers • Installation of over ground structures	Maximum lifting capacity: 25 ton Dimension: 11.565 ×2.62×3.475m (L×W×H) Gross weight: approx. 26,495 kg Maximum travelling speed: 49km/h
2	EXCAVATOR		• Excavation	Operating weight: 22,500 kg Dimension: 9.53×2.78×2.96m (L×W×H) Maximum digging depth: 6.62m Bucket capacity: 1.14m^3
3	FORKLIFT 5 TON		• Loading and unloading of items	Load Capacity: 5 ton Maximum output (kW/r.p.m): 90/2200 Load Center: 600 mm Maximum Height: Approx. 6m
4	TRUCK MOUNTED CRANES (5 TONS)		• Loading and unloading of items • Site mobilization	Maximum lifting: 8,200kg at 1.8m Maximum Hook Height: Approx. 11.5m Maximum Load radius: 9.25m

5	TRAILER		• Site mobilization • Transfer of machineries	Weight: 7,200 kg Payload Capacity: 32,800 kg Dimension: 13.62×2.48×2.94m (L×W×H)
6	CONCRETE WINGET (to be used in temporary project site Hulhumale phase-2)		• Mixing concrete	Weight: 800 kg Capacity: 500 L Drum Speed: 28 Rpm Dimension: 3.5×2.5×3.0m (L×W×H)
7	PC30 backhoe		• Piling for foundation footings of the main structure in Site area-1	Operating weight: 20,500 kg Dimension: 9.00×2.5×4.0m (L×W×H) Maximum digging depth: 6.62m Bucket capacity: 1.14m^3
8	CRANE 25 TON (for project area 2)		• Transfer of items to rooftop	Maximum lifting capacity: 25 ton Dimension: 11.565 ×2.62×30m (L×W×H) Gross weight: approx. 28,500 kg Maximum travelling speed: 49km/h
9	Scissor crane		• Lifting PV modules up to the mounting frames in project area-1	Maximum lifting capacity: 3 ton Dimension: 1.5 ×0.5×5m (L×W×H)

3.8.6 Waste management

Waste management during construction and operation of the project will be undertaken via Waste Management Corporation Limited (WAMCO). WAMCO is mandated to provide a sustainable waste management solution throughout the country.

There are three major types of waste that will result from the construction phase of the project. They are general domestic waste, construction waste and hazardous waste. Hazardeous waste include oil, grease and any damaged PV module. Waste bins will be placed within the construction areas which will be removed and replaced as needed. Hazardous waste such as grease, oil and broken any PV modules will be stockpiled in the project area in solid containers which will finally be taken to Thilafushi by WAMCO. Similarly, prior arrangements will be made with WAMCO to dispose the construction waste including the excavated sand to Thilafushi. During the construction phase, it is a responsibility of the contractor to ensure the removal of waste and clear the site. No waste generated during construction should be left in site.

Operational phase of the project is not expected to generate much waste. However, during maintenance work which will be rare, some amount of waste such as damaged PV modules or any sort of work related waster can be generated. Similar to the construction stage, any such waste will be removed via WAMCO.

3.8.7 Health and Safety

Workers should be provided with safety shoes, helmets, overalls and other work specific safety gears to be worn during the working hours within the work site. No worker should be allowed to work without proper safety attire. Workers should be made aware of safety policies, emergency plans or evacuation policies in times of emergency. Fire extinguishers and first aid kits should be readily available within a known place in the work site for health and welfare purpose. First aid kits should be readily available in the site at all times. Proper construction signage should be erected within the site. Fires extinguishers must be kept at identified places in the site and workers should be trained to use them if required.

Construction site should be fenced and only authorized people should be allowed in. Proper construction sign boards should be erected around at the site entry and around the site. All works and activities should be carried out under the supervision of a skilled or an experienced worker. Oxygen, acetylene or LPG bottles will not be left free standing. All welding and cutting works will be carried out with all safety measures by experienced personnel.

3.8.8 Site accommodation and food

Workers will be accommodated in accommodation units rented from Hulhumale. Food will be sourced from nearby cafeterias and restaurants. Number of cafeterias and restaurants are available in Hulhumale. Staff will be accommodated in clean and hygienic rooms that has proper ventilation and are adequately lit. Depending on the room size, no more than 4 or 6 staff will be accommodated in a single room. Each room will have separate toilet for the inhabitants of the room or a common toilet area will be available. There would at least be a toilet for every 6 staff. Female staff will be provided with separate toilet access and room. A common washing area or the service will be available in the accommodation area.

3.8.9 Fuel storage and handling

Fuel storage is not required in this project. Refueling of project vehicles will be carried out by oil bowser brought as required from a supplier. However, refueling is recommended to be carried out over a hard surface and during refueling, it is recommended to have absorbent mats to wipe out any leakage.

3.8.10 Machinery maintenance

No major machinery maintenance will be carried out in the project site during the course of the project. However, if for any reason such a maintenance is required, it will be carried out in the main workshop of

the party to whom the machine belongs to. Key machineries will be hired from a secondary party for the project.

3.8.11 Machinery movement

Movement of heavy machinery has to be restricted to the timings given in the in the traffic management schedule. If for any reason, machinery movement is to be carried out in different timings and for a longer period of time with road closure, it has to be communicated with the relevant key stakeholders such as traffic police, HDC and Ministry of Transport.

3.8.12 Noise and vibration

Anticipated noise level of machinery operation will not be high unless it is in very close range. Average noise level during the operation of machines will be between 65-70dbA which will mostly be heard within the immediate project area. Generally, noise readings over 65dbA is considered as nuisance.

Since the proposed foundation methodology involves screw piling the footings, the vibration that is expected to result from foundation and other construction activities will be negligible. It is anticipated that the existing vibration in the project area can be considered negligible or within 0.5-1.0mm/sec as the area experiences vehicle movement (Paulus, 2008). Hence, no additional vibration is expected to result from the proposed project activities.

3.8.13 Potential accidents and emergency response plan

Strict adherence to the set policies and safety measures will leave less room for accidents in work place. However, in case of accidents, depending on the severity and seriousness, site evacuation or halting a specific task temporarily or immediate medical attention might be needed. Site staff should be made aware of such emergency plans and policies prior to the commencement of the physical work in the site.

3.8.13.1 Accidental fire incidents

- Inform the health and safety officer.
- If the severity is low and fire can be extinguished by the fire extinguishers in the site, the incident should be attended at site level under the direct supervision of health and safety officer.
- Flammable items in the close vicinity should be moved further away along the project area.
- If the fire is heavy and extensive, or takes longer to be extinguished, Fire and Rescue Service of MNDF must be notified via the emergency number-118. Similarly, Traffic Police, HDC and PMU of MECC&T must be informed.
- Site staff must be moved to a previously identified emergency assembly point.

3.8.13.2 Road accidents

- Inform the health and safety officer.
- Any road accident, whether minor or serious, if resulted due to any of the project activities, must be informed to traffic police.
- If medical assistance is required, assistances will be provided by the site to transfer the victim to the nearest hospital. From thereon, the victim's relatives and/or family members must be informed.
- If required by the victim, the incident has to be lodged as a grievance under the GRM. Afterwards it will be dealt with the set procedure under GRM mechanism.

3.8.13.3 Accidents in the work area

- Inform the health and safety officer.

- Minor accidents that can be handled by the health and safety officer, by using available items in the site must be attended and solved at site level.
- Under any serious incidents that require medical assistance, it must be immediately provided, whether by means of first aid or by hospital treatment.
- If the victim requires, any site incident must be lodged as a grievance.

3.8.13.4 Accidental oil leakage

- In case of oil leakage or spill from the machineries, work has to be completed stopped and the issue must be rectified. If the issue cannot be immediately rectified, it should be brought to the attention of relevant authorities such as EPA and Ministry of Fisheries, Marine Resources and Agriculture

3.8.14 Risks associated with the project

There are very few and limited risk factors associated with this project that could possibly have both financial, environmental and fatal implications given that the mentioned safety attires are worn by the workers and safety measures are properly taken in handling machineries and hazardous items.

3.8.15 Larbour Management Procedure

The proposed project will mostly involve the use of permanent and contract workers. Permanent workers are the permanent employees of the contractor, whereas contract workers are those who are temporarily hired for the project, including subcontractor's staff in case if any component of the project is subcontracted to another party by the contractor.

According to the Environment and Social Standard 2 (ESS2), Labor and Working Conditions, of the World Banks Environment and Social Framework, a Labor Management Procedure (LMP) is required for the Accelerating Renewable Energy Integration and Sustainable Energy (ARISE) projects. The LMP will look into the possible risks associated with larbour management by the contractor and ways of minimizing those risks to protect the rights of the workers. The LMP aims to achieve the following;

- Prevent forced and child larbour.
- Provide a safe and healthy work environment for all, regardless of any gender, nationality, disability etc.
- Provide a fair ground for all with equal opportunities to work.
- Development of code of conduct for the workers.
- Prevention of human trafficking.
- Prevention of sexual harassment and violence against women.

3.8.15.1 Prevention of forced and child labour

In order to ensure the prevention of forced and child larbour, the following steps must be taken by the contractor.

- All permanent and temporary (contract) staff employed for the proposed project must be above 18 years of age.
- Every employee must be employed based on a written employment agreement which states out the details as highlighted under the Employment Act of Maldives.
- For each job post, there must be a written job description which has to be agreed by both the employer and the employee.
- Every employee has the right to strike and abstain from work as per the Regulation on Resolving Disputes between Employers and Employees, issued by Larbour Relations Authority.

3.8.15.2 Provision of safe and healthy work environment

Every employee, regardless of employment type, gender, age, marital status, nationality, disability and r any other physical or mental attribute, must be provided with a safe and healthy work environment. The following actioners must be taken by the contractor to ensure safety of work site and employees.

- PPE must be provided to all workers alike, appropriate to the type of job performed.
- Make the employees aware of the emergency site evacuation and response plan, and emergency contact numbers.
- Emergency contact number of Maldives Police Service – 119
- Emergency contact number of MNDF Fire Service – 118
- Ambulance - 102
- Equipment needed for the safety of the work site, such as fire extinguishers and First Aid kits must be available in the site.
- A health and safety officer must be employed to manage the health and safety policy of the project.
- Provide a clean hygiene work environment.
- Where possible, overtime work must be avoided.
- Employees must be provided with set meal breaks or meals must be provided at set times.
- Breaks and off days must be provided as agreed in the employment agreement.
- A medically unfit employee must not be forced to attend work.
- Conduct induction and regular toolbox meetings, identify issues of the employee and attend them.

3.8.15.3 Provision of fair and equal opportunities for all employees

To ensure that every employee is subject to fait treatment and equal opportunities, the contractor must take the following steps.

- Promote and advocate for equal opportunities of all the employee at all stages of the employment.
- Provide equal wages, benefits overtime compensation and allowances to employees who perform same responsibilities at the same place of employment.
- Employment opportunities must not be advertised restricting a particular gender and age group (once over the legal age group of over 18 years).

3.8.15.4 Code of conduct for the employees

A code of conduct for the workers would ensure that both the employees and the employer are fully aware of each other's responsibilities and the expectations regarding the project. Hence, it would further assist the project to run smoothly. A code of conduct highlighting the points stated below must be developed for the project. At all times, the employees must;

- Comply with all reasonable instructions and work order as directed by seniors.
- Be familiar with, and abide by the policies of the work area.
- Be familiar with, and consistently apply, the requirements of operational manuals, as well as wider company policies and procedures that affect the work.
- Be consistent and honest in performing the job.
- Abide by the rules, set duties and responsibilities of the project, do not exploit or abuse any power or authority accorded to the employee depending on the responsibilities of the job.
- Not give any false information or make any false declaration.
- Not create any liability for the company beyond employee's authorization.

- Show reasonable care for the company property, resources, and funds and neither use nor approve them to be used for anything other than authorized purposes.
- Inform the supervisor within 30 minutes of work starting time, or in accordance with the relevant policy, if the employee is unable to work because of sickness, or an emergency.
- Set reasonable penalties for the employees who disobey the code of conduct.

3.8.15.5 Prevention of human trafficking

It is expected that mostly foreign workers will be involved in the project during the construction period. Hence, there is the possibility of human trafficking in sourcing the required human resource. Strick measures must be taken by the contractor to prevent any possible human trafficking in relation to the proposed project. These measures include;

- Any foreign national to be employed in the project must obtain employment approval as per applicable laws of Maldives.
- Any foreign national to be employed in the project must obtain work permit or work visa as per the regulation on employment of expatriates in Maldives.
- Employer must treat the foreign employees in accordance with the Employment Act of Maldives and other applicable laws.
- Employer must pay any fees or deposit related to the work permit or visa of the employee brought for the purpose of the project.

3.8.15.6 Prevention of sexual harassment and violence against women

Any form of gender-based discrimination and harassment is prohibited in the Maldivian employment system under the Gender Equality Act. The working environment must be managed in a way that promotes equality and fairness between both genders. The following steps must be taken to ensure the prevention of sexual harassment and violence against women.

- Eliminating weaknesses or difficulties caused by inequality between men and women.
- Reducing the negative effects of inequality between men and women.
- Facilitating the special needs of a particular gender to achieve ease of attainment of services.
- Any form of sexual harassment and violence must not be tolerated in the work environment. Actions must be taken against such incidents as per the code of the conduct.

3.8.16 Maintaining the environmental and social aspects of the project

Environmental and social aspects of the project will be managed by a fulltime health and safety officer who will be managing and enforcing the environmental, social, health and safety requirements of the project. Safety officer must be someone who has past experience in similar projects and working environments.

The following key steps must be followed by the health and safety officer to ensure the management of environmental and social aspects of the project.

- Staff should be made aware of response procedures in case of emergency. Emergency evacuation plan must be made and kept on display for everyone to get familiar with.
- Evacuation drills should be conducted at project inception, at least once or twice during the course of the project to ensure that everyone can follow the plan in case of actual emergencies. Staff must be made aware of safety information such as emergency evacuation plan, emergency assembly point, locations of first aid kit, locations of fire extinguishers etc.
- Toolbox meetings must be held in site in every other day to ensure site safety.
- Health and safety officer must prepare emergency site evacuation plan prior to the beginning of the construction work, after assessing the project area (link road, Boashimaa Hinhun and

residential buildings). There existing ample space around the project site to allocate emergency assembly points in case of emergency.

3.9 Project Inputs and Outputs

3.9.1 Project Inputs

The project has inputs in terms of machineries, human and natural resources which are summarized in the below given table.

Table 3.6: Main inputs of the proposed project

Input Resources	Source/Type	How to obtain the resources
Site workers (around 44)	Local and Foreign	Contractor's manpower which include mostly foreigners
Water supply (during construction)	Desalinated water	From MWSC (with prior arrangement)
Electricity	Mobile generator or existing electric grid of STELCO	Mobile generator will be provided by Contractor/Client, power from STELCO will be obtained with prior arrangements
Food	Outsourced from existing café/restaurants in Hulhumale	Arrangements will be made by the contractor
Telecommunication	Mobile phones and internet facilities	Provided by contractor
Fuel	Mainly diesel	Obtained from local suppliers via bowser (no storage in site)
Construction material	Plywood, wood, Sand, Cement, Aggregate, steel bars, steel pile, power cable, cable manhole, HDPE pipe, metal frames, PV modules, clamps, bolts, Lights, Transformer Station, and fixers	Procured from overseas by the contractor
Construction equipment	Crane (25T), Excavator, Forklift (5T), Crane lorry, Trailer and Concrete Winget	Provided by contractor, Obtained locally if available
Health and Safety equipment	Personal Protective Equipment, First aid box, Fire extinguishers	Provided by contractor

3.9.2 Project Out puts

The main outputs of the project are summarized below.

Table 3.7: Main outputs of the proposed project

Out put	Anticipated Quantities	Method of Disposal
Waste water	Around 20L/person/day	Through island's existing system
Hazardous waste (oil and grease)	Minor amounts	Will be stockpiled in the site and taken disposed via WAMCO
Air pollution	Minor amounts of Sulphur and Nitrogen oxides and dust will be released into atmosphere by vehicles during the construction period	Unavoidable, but will be localized to the project area
Noise pollution	Localized to the project area	Unavoidable during construction phase and project doesn't involve activities that generate very loud noise
Solid waste from work force	Moderate	Collected in bins and taken to Thilafushi via WAMCO
Construction waste (timber, cardboard, packing material and scrap metals)	Moderate	Taken to Thilafushi via WAMCO
House hold waste	Minor	Disposed to island garbage via WAMCO
Sand (around 1,500 cbm)	Excavation for foundation and laying the cable to connect to STELCO's grid	Disposed to Tghilafushi via WAMCO
Energy produced by Solar PV	5.6MW	Connected to the power grid of STELCO for usage in greater Male' area

4 PROJECT ALTERNATIVES

It is a requirement of the EIA regulation to provide at least two alternatives including the no-project option. Not all the impacts of a project can be completely prevented. But with the use of relevant technology and management methods, the magnitude of most of these impacts can be reduced. Nevertheless, the effectiveness of the technology and mitigation measures highly depends on the environmental condition and procedures in which they are applied in the field. On the other hand, there are complex and sophisticated procedures of minimizing environmental impacts by means of alternative methods.

If the project were to continue, it would be necessary to take technical, economic, ecological and social aspects of the project into consideration and ensure that these concerns exist within a delicate balance. Neither the economic benefits nor the social and ecological concerns can be avoided. Therefore, it is important to consider all options and ensure that the best available option(s) is/are chosen to solve the issues/problems.

4.1 No-project option

No-project option is not a favourable option for the proposed project. No project option means the proposed activities of the project will not be carried out in greater Male' area.

As highlighted under the project justification, the proposed project has number of long-term benefits. The project is in line with the national development goals of the country.

As per the National Environmental Action Plan III (NEAP III), which sets out the agenda for environmental protection and management in the Maldives, one of the main targets aimed to achieve was working towards a carbon neutral nation. NEAP III aims to make a livable and a sustainable environment a component of development projects carried out in Maldives. NEAP III provides the basis for environmental planning, budgeting, performance measurement, and accountability. In NEAPA III, it has been aimed to decrease the dependency on diesel powered electricity generation in Maldives with the provision of renewable energy throughout the country. Similarly, the importance and composition of the much-needed legal framework to assist the development of the sector of renewable energy is highlighted in NEAPAIII. The proposed project would function as a key project in assisting to move towards a carbon neutral nation

In any case if the project is decided not to be continued, the following consequences are possible:

1- Increase in carbon emission due to the usage of fuel for energy production.
2- Increase in the load of electricity with the exceeding population in the greater Male' region.
3- With increase in demand for electricity, and failure to provide electricity would create a disturbance and public outrage.
4- The demand and interest for adopting and investing in renewable energy would be decreased as the general public and private parties would not be able to witness the feasibility of adopting such energy options in the Maldives.

Based on the evaluation of social, environmental and economic perspective, having a no project alternative would be a disadvantage for the general public as well as the government. With a growing demand for electricity in the region, it is of high priority for the government to find suitable and feasible options for electricity to cater the demand and load of electricity. In addition to this, with the commitment to international treaties to deter the carbon emission, Maldives is subjected to take mitigation measures to reduce carbon emission, hence, having a no project option would prove to be disadvantageous in an environmental and economic perspective.

Table 4.1: Comparison of 'No project' option

Description	Advantages	Disadvantages
No project option	• Saves the cost of development. • No adverse environmental impacts due to the proposed project activities. • No social impacts due to project activities such as road closure and airport security issues.	• More GHG emission as the increase in fuel would result in carbon emission. With increasing population, the demand for electricity would increase hence the usage of fuel for electricity would increase. • With increase in carbon emission, would contribute to GHG emissions while indirectly triggering the after impacts of climate change locally. • With the increasing population in Male' and Hulhumale' due to migration and excessive labour force, the need for electricity continues to grow. Adopting to only fuel usage for electricity would be difficult to maintain hence any disruptions to electricity would result in public outrage. • The cost of utility especially in the case of electricity is a huge concern for the general public mostly in the greater Male' region. With the increase in population, the demand and load of electricity has risen and the utility providers have often found it difficult to maintain the electricity connection due to power surges. Without an adoption of another energy option such as solar energy, it would prolong the existing issues. If the utility providers are to cater the existing and future electricity demands they would require to upgrade to cheaper, long lasting energy generation methodologies that are more environment friendly.

4.2 Alternative project location

The proposed project is located on the eastern side pavement area of the link road between Male'-Hulhumale, southern side pavement area of Boashimaa Hingun in Hulhumale and rooftops of residential flats in Hulhumale phase 1.

The project is proposed for the greater Male' area where the land scarcity is one of the major social issues. According to the census 2014, 38% of Maldivian population reside in the greater Male' area. This figure is expected to be much higher now. There has been a high demand for lands in this area. Hulhumale and Villimale have been developing as per a long-term master plan. Hence, it is very obvious that no land area is available in greater Male' area to make available solely for a project of this scale, nor can the total project capacity can be managed by installing the PV modules over rooftops. The only available space for a project of this scale would be in deep sea, within the atoll. However, installation of a project of this scale in deep sea is expected to almost double the project cost. Hence, no alternative or considerable land space

is available in greater Male' area for the proposed project other than the location that has already been proposed.

Similarly, if the total project is to be installed on rooftops, it would require approximately 110-120 buildings or rooftops which are roughly the size of the rooftops that have been selected in Hulhunale. Any roof top cannot be selected for the installation. It is applicable for durable roofs with high strength and preferred orientation or angle to capture the right amount of sunlight.

Hence, currently, no better alternative location can be selected from greater Male' area.

Table 4.2: Comparison of possible alternative project locations

Project location	**Advantages**	**Disadvantages**
Proposed location (mainly the pavement area in link road and Boashimaa Hinhun).	• The location proposed for the project is not planned to be used for another purpose, nor can it be used for mush activities due to the narrowness of the area. • Since the main project area involves covering the pavement area in Boashimaa Hingun and link road, it would provide shade for the pedestrians during the day time. • Main project area is not located in a residential area, hence, adverse impacts of the project during the construction phase will note be much felt by the public.	• The main project area is a narrow strip of land in between the pavement and seawall. Hence, during the construction phase of the project, restrictions on traffic movement will be experienced. • Will have to undergo difficulties and bear additional cost in attending revetment repair work on the eastern side of the link road.

Deep sea, within inner atoll	• Away from the residential areas. Hence adverse impacts on the community during the construction phase will be very less. • No land area is permanently taken up for the project. • Project surrounding is free from other structures. Hence, no impact on the surrounding structures. • Large area can be taken up for the project. • Efficiency could be higher as the floating solar platforms over water can provide a cooling effect during day time when cell temperature increases.	• Installation will be very costly compared to installation on land. • Possible adverse impacts to the marine environment, especially during the construction period. • Obstructing the wave dynamics and surface current flow could cause hydrodynamic changes around the nearby islands which in turn lead to changes in coastlines. • Salt spray can reduce the durability of the platforms. • Challenges in maintenance especially during rough seasons. • More maintenance works.
Only rooftops	• No land or lagoon space is taken up. • Cheaper as foundation for mounting structures will not be needed. Mounting structures would be just a frame with bolts and clamps. • Easy and quick installation. • Less likely to face the glare issue since most of the buildings could be higher with 2-5 storeys.	• The required roof area would be large and it would be difficult to secure rooftops for the production of 5.6MW energy. • Just any building is not advisable to be chosen. Applicable for durable roofs with high strength. • Could generate less PV output due to share and orientation of the roof.

4.3 Alternative Designs

Changes to the project deign in terms of the current design and available technology have been discussed. Project design changes when the installation location changes between land, sea and roof top.

4.3.1 Alternative foundation design

The proposed foundation design of mounting structures and transformer base in link road and Boashimaa Hingun consists of screw piling. There are different techniques of foundation methods that could have been adopted in projects of this nature. They are discussed below.

4.3.1.1 Vibratory piling

In vibratory piling, a vibratory pile driver machine installs the pile into the ground by applying a rapidly alternating force to the pile. The driver machine is referred as the hammer. Since the main driving technique involves generation of vibration, ground vibration will also be experienced to certain extent during piling by using this technique. Given that the project area is very close to the paved road and seawall, a piling method that generates less ground vibration would be much better in an environmental and socio-economic perspective.

4.3.1.2 Screw piling

Screw piling or rotary piling will generate less ground vibration compared to vibratory piling. In these techniques, the main pile driving force is achieved by rotation rather than by hammering or vibration. These methods of piling are well suited for work in cities, built up areas or areas surrounding existing structures as the vibration and ground disturbance caused by installation is minimal. Given that the rest of the impacts will more or less likely be constant for all these methods of piling, screw or rotary piling would be more suitable for the project environment than vibratory piling. Hence this is the proposed method of foundation for the project.

4.3.1.3 Concrete foundation

If a concrete foundation method is adopted, the footing would either be pre cast in the temporary site or in situ. But such a method would involve extensive excavation of the area for the placement of the footings or the formwork. The proposed foundation area is narrow and extensive excavation by using machine for foundation work is not recommended.

4.3.2 Inclusion of solar battery storage

A solar battery storage system saves the excess energy the photovoltaic panels produce, when the demand is lower than the capacity of solar energy generation. Later the battery storage will supply the power when needed.

For an off-grid PV system, a battery bank is necessary for providing power at night or on cloudy days. However, with a grid-tied solar array, similar to the one proposed under the project, batteries are not necessary since the total amount of energy produced is expected to be used up on daily basis. Hence, inclusion of battery storage is not identified as a fevourable design alternative.

4.4 Alternative technology (renewable energy source)

Various different types of renewable energy sources have been in use today across the world. However, depending on the location, environment and geomorphology of each distinctive location, country, the effectiveness of energy production by each of these sources differs considerably. Comparison of some of these sources have shown that renewable energy production by using solar power is the most relevant and suitable type of renewable energy technology to the Maldivian environment.

Table 4.3: Comparison of renewable energy technologies

Type	Advantages	Disadvantages
Wind energy (generated by using wind turbines, the turbines are rotated by the wind to generate energy)	• Installation of turbines and running them is a comparatively easy and inexpensive process. • Turbines produce more energy than solar panels • Wind can be harnessed during day and night. • Less polluting than solar panels.	• Turbines can be noisy. • More susceptible for damages due to lightening and wind. • Could be harmful for birds and other flying animals. • Not practical for densely populated urban areas such as Male'. Need a large area for installation • Unpredictable energy source due to changes in wind speed. • For efficient functioning, requires a strong wind to blow continuously. • Cannot be installed at roof tops. Need space that are not used for any other purpose for installation.
Solar energy (energy production by solar, the panels absorb the sun's rays which are converted to generate electricity or heat)	• Installation is a comparatively easy and inexpensive process. • Roof top installation is possible and suitable for urban areas. • Once installed, require less maintenance. • Require less space compared to wind turbines. • Will not be noisy like wind turbines. • More suitable for densely populated urban areas. Can be mounted on almost anywhere if the panels face and receive sun light. • More suitable for tropical areas where sunlight is available for most part of the day and the year.	• Will not produce energy during night or cloudy days. • Not all roofs have the right orientation or angle to capture the maximum solar energy. • Rate of energy production is less compared to wind turbines.

Tidal Energy (Energy generated from the movement of tides in the ocean)	• Renewable energy source. • Tidal power plants are long lasting and generate large amounts of energy.	• Building tidal power plant is expensive and technically challenging compared to solar and wind energy. • Tidal power plants change the movement of the ocean and as a result harm the environment and nearby coastal areas. • Adverse coastal impact unlike wind and solar energy.

5 SURVEY METHODOLOGY

Baseline environmental surveys to assess the physical and biological environment of the project area has been undertaken.

The project area has been studied and surveyed by using standard scientific methods. Field surveys were undertaken in the project site during early 2021 and March 2022. They were undertaken by experienced field surveyors from Foresight Surveyors Pvt Ltd, by using appropriate methods and instruments. General information on the existing environment was based on environmental reports of similar projects, available secondary data, such as climatic data from the meteorological center at K.Hulhule. The approach to data collection and compilation of the report are done by;

- Evaluation of available and relevant literature on environmental reports associated with similar projects, such as;
    - Environment Impact Assessment to the proposed development and operation of floating PV platform in Cheval Blanc Randheli (Shaig, 2020),
    - Environment Management Plan for Clean Electricity for Dharanvandhoo – a floating solar project at Dharavandhoo, Baa Atoll (Zahir, 2015),
    - Labour Management Procedure – Accelerating Renewable Energy Integration and Sustainable Energy (ARISE) Project (MoE, 2020),
    - Environment and Social Management Framework for the proposed solar PV projects under Accelerating Sustainable Private Investment for Renewable Energy (ARISE) Program (Shaig, 2014).
- Examination of the existing environment to identify significant environmental components that are likely to be affected and
- Consultation with major stakeholders to exchange information on the project and to follow the procedures required for the report.

5.1 Topographic Survey

Topographic survey of the project area was carried out in GNSS RTK positioning method by using Comnav T300 DGPS. During the survey the horizontal accuracy was maintained at ±0.02m whereas the vertical accuracy at 0.015m. GPS base station was set over a survey mark which has a reduced level relative to MSL. Survey was carried out with reference to the national survey mark: MALE' GIS 01 located in republic square (Gumhooree Maidhaan).

5.2 Traffic flow and volume survey

Traffic flow and volume measurement was carried out at 2 locations in the project area at 3 different times. A visual observation of the traffics at a determined time period of 1 hour was undertaken. Vehicles were noted down under four different categories. They are bicycle, motorcycle, car/van, bus and pickups/trucks. For better visualization, the results were graphically represented in Microsoft Excel.

5.3 Noise pollution

Handheld digital noise measurement devices were used to measure noise levels at two different locations in the project area. Repeated measurements were taken at each location and the average value is included in the report.

5.4 Stakeholder consultations

Stakeholder consultations were conducted using via video conference and email communications. In

every meeting, initially the participants were given a brief introduction by the consultant to the proposed development and the reason for undertaking these consultations. Afterwards participants were given the chance to express their views and concerns on the proposed development. Hence, in every meeting, interactive discussions took place. Main points of the discussions were noted down.

Public consultation near the residential flats were conducted in person.

5.5 Physical environment

The physical environment surrounding the project area was visually inspected for presence of trees, terrestrial animals, any visible defects or cracks on roads and for the presence of environmentally sensitive sites. Photographs of the surrounding were taken.

5.6 General meteorological conditions

General meteorological condition of the local environment was mostly obtained from publications of Maldives Meteorological Service.

6 EXISTING ENVIRONMENT

6.1 Introduction

Under this section, existing environment relevant to the proposed project is discussed for understanding the baseline conditions of the project site. Understanding the baseline conditions are of extreme importance as environmental monitoring during the project requires comparative analysis. Major areas looked under this section are;

- Geography and setting
- The climate
- Physical and biological environment
- Terrestrial environment
- Socio-economic environment
- Hazard vulnerability

6.2 Geography and setting

Maldives is an archipelago consisting of 1,192 small coral islands which are grouped into 26 natural atolls. They are spread in north to south direction on the Laccaduves-Chagos submarine ridge in the Indian Ocean, between 7º 6' 5" North to 0º 42' 24" South and 72º 33' 19" East to 73º 14' 36" West (MEE, 2017).

The length of the island chain is 860km long and the width varies between 80 to 120 km, whereas the total reef area of the Maldives is 4,513sqkm. More than 80% of the country's land area is less than 1m above the mean sea level (MEE, 2017).

6.3 Project area

The project is proposed for the greater Male' region which comprises of islands of Male', Hulhule, Hulhumale, Vilimale, Gulhifalhu and Thilafushi. Male' is the capital city of Maldives which is also among the most densely populated cities in the world. Male', Vilimale and Hulhumale are the only residential islands currently among these 6 islands. Greater Male' region is a highly urbanized area with a huge population. According to the census 2014, 38% of Maldivian population reside in the greater Male' area. This figure is expected to be much higher now.

In greater Male' region, the proposed project is located in 2 distinctive locations which are;

- Location-1: Eastern side pavement area of Male'-Hulhumale link road, including the southern side pavement area of Boashimaa Hingun in Hulhumale.
- Location-2: Rooftops of 8 residential flats in Hulhumale, phase 1.

6.3.1 Location-1

6.3.1.1 General Environment

Location-1 consists of the eastern side pavement area of Male'-Hulhumale link road, including the southern side pavement area of Boashimaa Hingun in Hulhumale. The project area-1 is considered as a highly urbanized area with insignificant terrestrial presence. Location-1 is located between highway and quay wall with a limited space for construction. Over 80% of the area is reclaimed land within the last 10-20 years as part of Hulhumale' and link road development project. Hence, this area consists mostly of bare soil and grass with no environmentally significant life.

Figure 6-1: Southern side of the Boashimaa Hingun (airportt security fence is on the southern side boundary of Hulhumale)

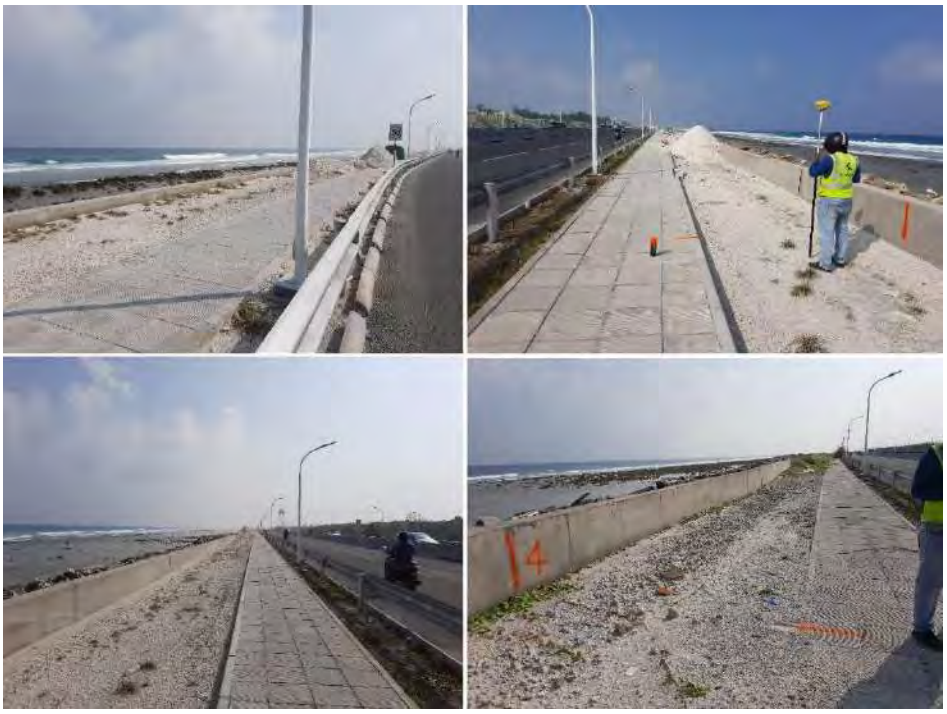


Figure 6-2: Eastern side of the link road

6.3.1.2 Significance and sensitivity of the area

The proposed project area-1 has no environmentally significant or sensitive lifeform. However, the area is commercially sensitive since number of utility cables have been buried within the footprint of the direct project location. Among them includes high voltage electric cables of STELCO which connects the power grids of Male' and Hulhumale. The area in link road and Boashimaa Hingun have been identified to have the following cables;

- High voltage electric cables of STELCO – This cable is located between the existing pavement and sea-wall, about 0.7m away from the eastern side curb of the pavement, at about 1m depth from the existing ground.
- Normal electric cables for light posts – They are placed under the pavement area, on the western side of the pavement within a service junction.
- CCTV network cable of MPS - This cable is only laid in island section and the eastern side pavement area in this part of the project location. They too are placed within the service junctions.

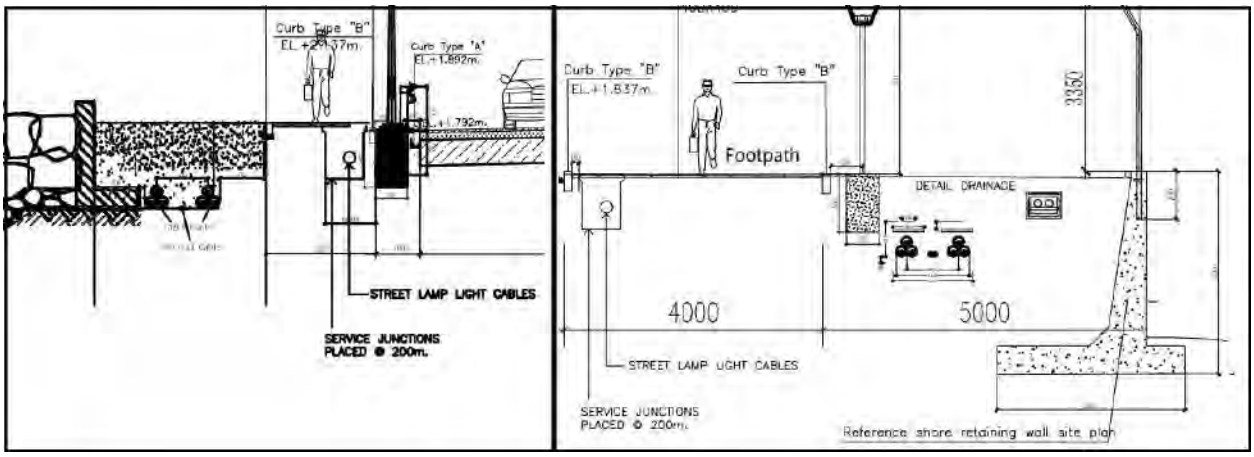


Figure 6-3: Identified underground cable location in project area-1 (A3 drawings have been included in the appendix)

6.3.1.3 General topography of the area

Maldivian islands are low laying islands which are just +1.0m above the MSL. Hulhumale is a man-made island which has been reclaimed to a height of about +1.8m above the MSL. Hence, ground elevation in Boashimaa Hingun and most part of link road is between +1.8-2.2m. It has depressed to a high of +1.5m near the end of link section 5.

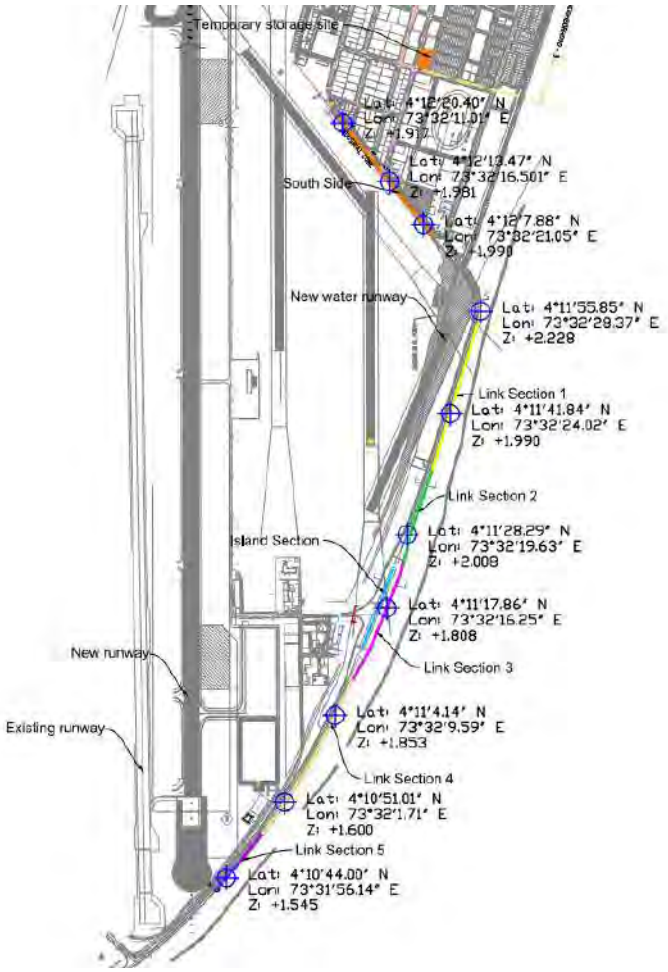


Figure 6-4: Ground elevation in location-1

6.3.2 Location-2

6.3.2.1 General Environment

Location-2 refers to the residential flats where rooftop installation is proposed. Eight residential flats were chosen by HDC after obtaining consent of the residents for the proposed project. These are recently constructed flats in Hulhumale Phase-1. Number of flats in this area, constructed under the similar scheme already has installed PV modules over their roof.

This is a residential area with parking space, play area and trees nearby. However, ample space is available for the project machinery to be active without damaging or removing any existing tree or structure. The 8 flats proposed for rooftop installation area number 84, 91, 92, 97, 98, 106, 121 and 135.

Figure 6-5: Rooftop installation area

6.3.3 Location 3 (temporary storage area)

6.3.3.1 General Environment

The temporary storage area is an empty land covered with grass, measuring about 31m in length and 30m in width. No mature tree or any form of structure is present within the boundary of the empty plot. The plot is located in Hulhumale' phase-2. No considerable environmentally sensitive feature is present in the plot nor within the area surrounding the plot.

Figure 6-6: Temporary project site in Hulhumale phase-2

6.3.4 Climate

Information on the Maldivian climate was collected mainly from Maldives Meteorological Service (MMS) and published secondary sources.

Maldives has a tropical climate which is warm and humid throughout the year. The average minimum temperature ranges between 25ºC to 30ºC and relative humidity varies from 73 percent to 85 percent. The annual average rainfall is approximately 1,948mm, whereas the annual average rainfall of the central parts of Maldives, where Male' is located is 1,924.7mm (MMS, 2018). As Maldives is located at the equator, which offers plenty of sunshine all year round, variations in daily temperature are relatively minor throughout the year. Even though the temperature varies only slightly, there is a significant variation in the monthly rainfall. The annual average rainfall in the southern atolls is higher than the northern atolls. In addition, greater extremes of temperature are also recorded in the southern atolls. On average southern atolls receive 2704 hours of sunshine each year.

Table 6.1 provides a summary of key meteorological findings for Maldives. The nearest meteorological station is to the project site is Hulhule Meteorological Centre

Table 6.1: Key Meteorological information of Maldives

Parameter	**Data**
Average Rainfall	9.1mm/day in May, November; 1.1mm/day in February
Maximum Rainfall	184.5 mm/day in October 1994
Average air temperature	30.0 C in November 1973; 31.7 C in April
Extreme Air Temperature	34.1 C in April 1973; 17.2 C in April 1978
Average wind speed	3.7 m/s in March;5.7 m/s in January, June
Maximum wind speed	W 31.9 m/s in November 1978
Average air pressure	1012 mm in December; 1010 mm in April

6.3.5 Local Monsoons

The tropical climate of Maldives is generally influenced by 2 seasons called Monsoons. Two monsoon seasons observed in Maldives are the Northeast (Iruvai) and the Southwest (Hulhangu) monsoon. The parameters that best distinguish the two monsoons are wind and rainfall patterns. During the southwest monsoon the weather becomes very versatile and it is the harsh rainy season while the northeast monsoon is the dry season, the sky is completely blue sometimes with gorgeous cloud formations. The southwest monsoon lasts from May to September and the northeast monsoon generally begins at the month of December and lasts till February. The transition period of southwest monsoon occurs during March and April while that of northeast monsoon occurs from October to November.

6.3.6 Wind

Monsoonal season determines the occurrence of wind over Maldivian islands. As Maldives lies in the equatorial belt, the two monsoons are considered mild given and makes severe storms and strong winds extremely rare. Strong winds and gales are infrequent although storms and line squalls can occur, usually in the period of May to July. During stormy conditions gusts of up to 60 knots have been recorded at Male'.

Wind has been uniform in speed and direction over the past twenty-plus monsoon seasons in the Maldives (UNDP, 2007). It is noticed that wind speed is usually higher and stronger in central region of Maldives during both monsoons, with a maximum wind speed recorded at 18 ms-1 for the period 1975 to 2001. The project site is located in the central region. Mean wind speed as highest during the months May

and October in the central region. Wind analysis indicates that, compared to the south the monsoon influence is greater in central and northern region of the Maldives (Naseer, 2003).

Besides the annual monsoonal wind variations there are occasional tropical climatic disturbances (tropical storms or low intensity tropical cyclones) in the central region which increases wind speeds up to 110 km/h, precipitation to 30 to 40 cm over a 24 hour period and storm surges up to 3 m in open ocean (UNDP, 2007).

Table 6.2: Local Monsoons and their onset periods

Season	**Month**
NE- Monsoon	December
	January
	February
Transition period 1	March
	April
SW- Monsoon	May
	June
	July
	August
	September
Transition Period 2	October
	November

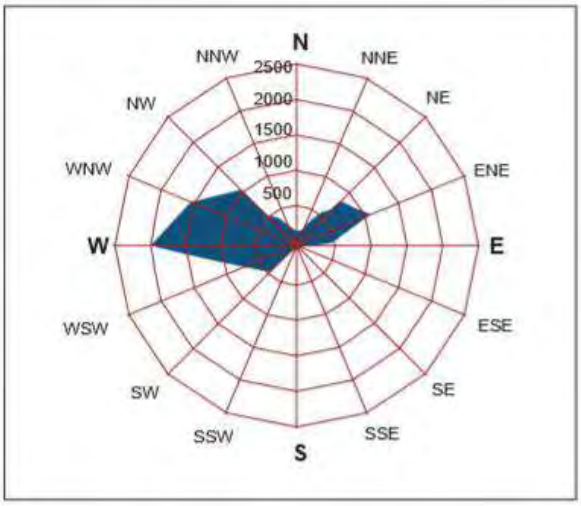


Figure 6-7: Wind rose diagram for 24 years (MMS, 2018)

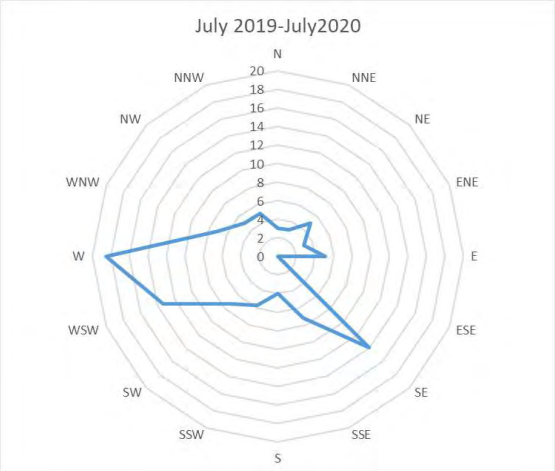


Figure 6-8 Wind Rose diagram from July 2019-July 2020 (Wind speed in m/s). Data was received from MMS.

6.3.7 Rainfall

Overall rainfall in the Maldives varies from region to region with the amount of rainfall increasing towards the south. The average annual rainfall for the archipelago is 2,124 mm. Southern atolls receive approximately 2,280 mm, and northern atolls receive approximately 1,790 mm annually (MEC, 2004). Mean monthly rainfall also varies substantially throughout the year with the dry season getting considerably less rainfall. This pattern is less prominent in the southern half, however. The proportions of flood and drought years are relatively small throughout the archipelago, and the southern half is less prone to drought (UNDP, 2006).

The mean annual rainfall for Hulhule', which is the closest weather station to the project location is 1991.5 mm and the mean monthly rainfall is 191.6 mm. Mean rainfall varies throughout the year with mean highest rainfall during October, December, May and lowest between February and April. The physical phase of the project will be commenced during June-Junly 2020, which is the SW monsoon period.

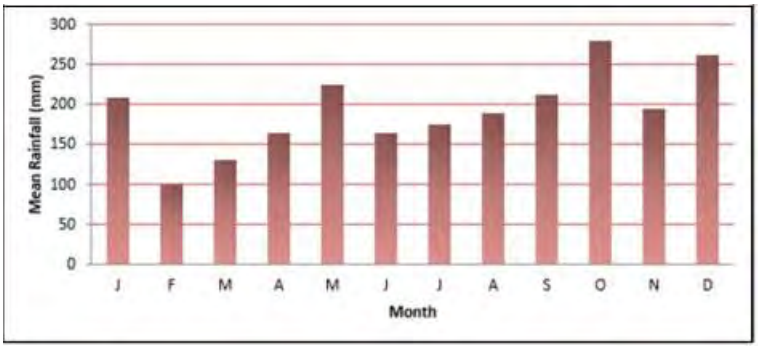


Figure 6-9: Average monthly rainfall in Hulhule (MMS, 2018)

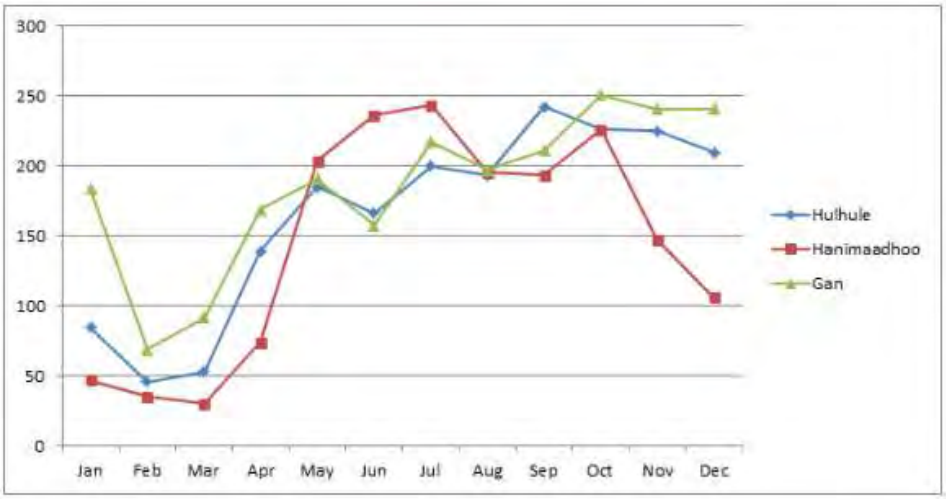


Figure 6-10: Comparisons of average monthly rainfall in 3 regions of Maldives

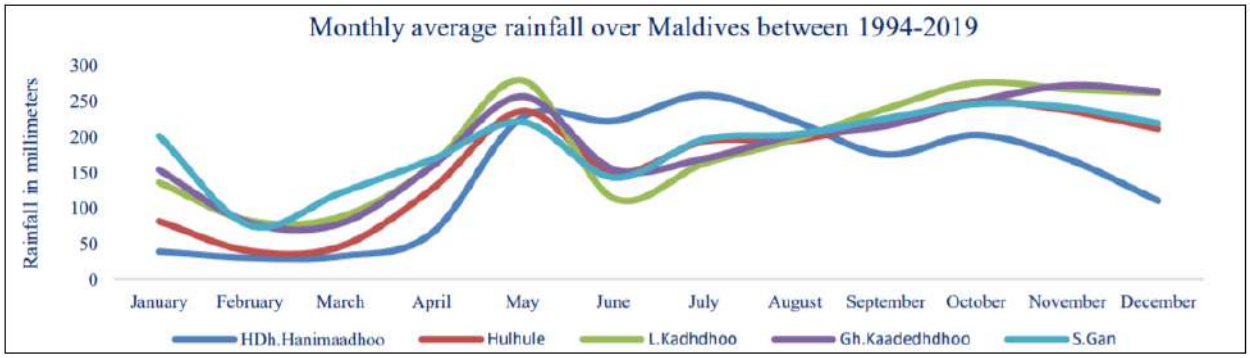


Figure 6-11: Monthly average rainfall over Maldives between 1994-2019 (MMS, 2019)

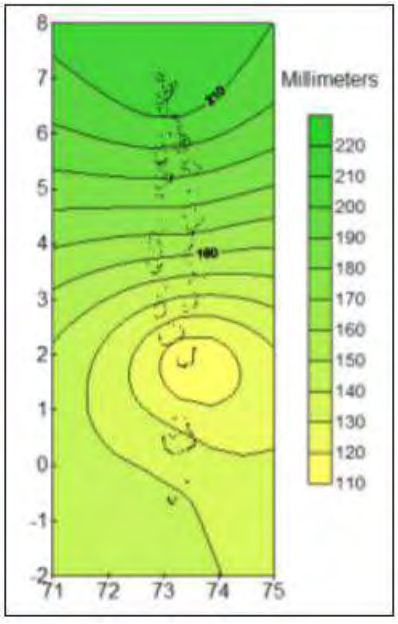


Figure 6-12: Spatial distribution of rainfall over the country during June (1994-2019) (MMS, 2019)

6.3.8 Temperature

The temperature remains consistent most of the year, however the daily temperatures of Maldives vary little throughout the year with a mean annual temperature of 28ºC. In the capital, Male' the annual mean maximum temperature recorded during the period of 1967 to 1995 was 30.4ºC and the annual mean minimum temperature for the same period was 25.7ºC. The highest temperature recorded for Male' was 34.1ºC on 16th and 28th of April 1973 while the lowest minimum average temperature was recorded in July 1992. The hottest month recorded was April 1975 with a maximum monthly average temperature of 32.7ºC, the next highest being 32.6ºC in April 1998.

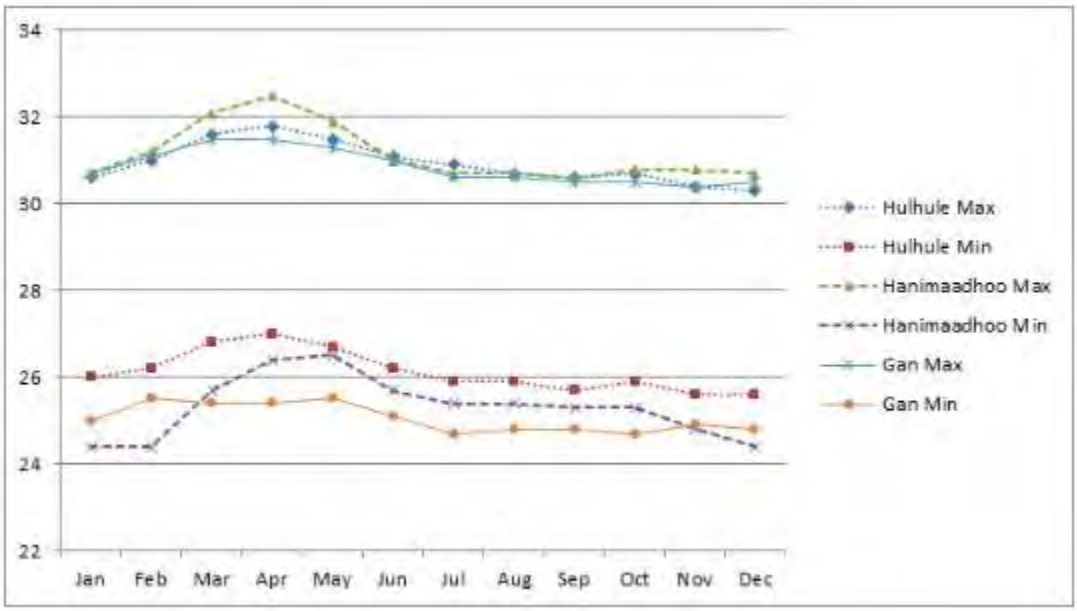


Figure 6-13: Average maximum and minimum temperature since 2000 (MMS, 2018)

6.3.9 Humidity and Evaporation rates

Based on data obtained from Hulhulé weather station over a period of 14 years from 1998 to 2012 given in Figure 4-5 (weatherspark.com), the relative humidity typically ranges from 68% (mildly humid) to 93% (very humid) over the course of a year, rarely dropping below 61% (mildly humid) and reaching as high as 100% (very humid). The air is driest around February 26, at which time the relative humidity drops below 71% (humid) three days out of four; it is most humid around November 30, exceeding 89% (very humid) three days out of four. Over the course of a year, the dew point typically varies from 23°C to 27°C and is rarely below 21°C or above 28°C.

6.3.10 Wave

The nature and the dynamics of wave pattern and height is an important factor to be considered in construction of any offshore or near shore structures such as the proposed project in link road and Boashimaa hingun.

Two major types of waves are expected to hit the coast of Hulhule and Hulhumale. They are waves generated by local monsoonal wind and swell waves generated by distant storms. The local monsoon predominantly generates wind waves that are typically strongest during May-July in the southwest monsoon.

Dominant swell waves approached from southerly directions, with some seasonal variations. Swells were predominantly from the south-southwest, between April to November, with a significant peak in wave height (Hs) of 1.8 m observed in June, and from south to south eastern directions between November and March, with a minimum Hs of 0.75 m being observed in March. Overall wave energy was

greatest on all islands during the westerly monsoon (Paul S. Kench, 2006).

According to the analysis for most part of the year (April to November) stronger wind generated waves will approach the project location from a westerly to north-westerly direction. During December to March wind generated waves approached the project location mainly from the north easterly to easterly direction.

Coast of the link road or the eastern side of Hulhule is exposed to receive swell waves approaching from a southern direction. Intensity of swell is estimated to be high due to the exposed nature and proximity of Hulhule to the rim of the reef on south and east. However, south Male' atoll could function as a form of protection for the swells approaching from south. Swell waves approaching on the southern side is expected throughout the year.

The project location in link road is protected from the westerly wind generated waves since runway and Hulhule is on west side of the link road. Similarly, Southern coast of Hulhumale (project area in Boashimaa Hingun) is facing to an enclosed area which includes the water runway of sea planes.

Based on the above findings, a general wave pattern around the island has been illustrated in the below given figure.

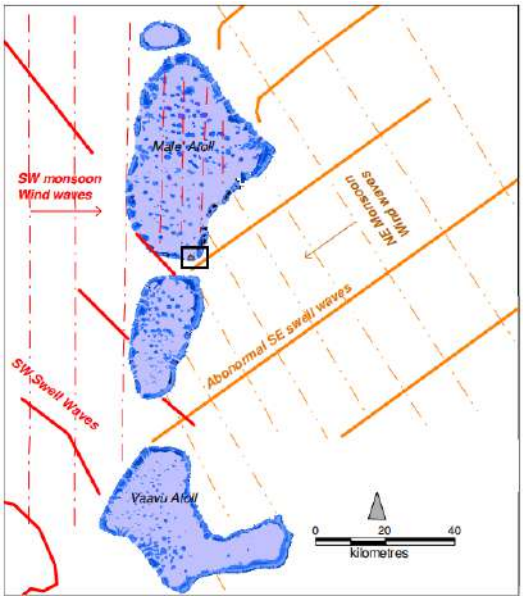


Figure 6-14: Estimated wave propagation pattern around Male' and Hulhule

6.3.11 Storm Surges

Vulnerability of the islands of the Maldives to flooding and storm surges and possibly complete inundation is considered to be high due to increasing vulnerability to the effects of global warming such as melting of polar ice caps. As a result, sea level rise due to climate change has uniform hazard throughout the country (RMSI/UNDP 2006). However, there are theories that support that high rates of evaporation in the tropical Indian Ocean may cause water levels to go down although pan evaporation studies may indicate of only evaporation due to sunlight falling on the pan excluding other meteorological factors.

There are no concerns related to storm water flooding as the island is small and does not cup towards the middle of the island.

According to the Disaster Risk Assessment report of 2006 (UNDP, 2006), Hulhule is located in a moderate storm surge hazard zone with probable maximum event reaching 0.6m above MSL or 1.53m with a storm tide. The combined historical records of nearby islands in Male' and Vaavu Atoll does not show any flooding caused by a storm surge (UNDP, 2007). Similar to the swell waves, the occurrence of any storm surge on Hulhule reef flat is dependent on a number of factors such as the wave height, location of the original storm event within the Indian Ocean, tide levels and reef geometry.

Depending on the location of project area-1, swell related flooding events are considered a hazard

for the project location on link road. This location, mainly the one on the eastern side of the link road is exposed to storm waves mainly from south and south east as shown in the map below. Events beyond this arch may not influence the island due to the protection offered by surrounding atolls.

Due to the unpredictability of the swell events and lack of research into their impacts on Maldives, it is not possible to forecast the probability of swell hazard event and their intensities (UNDP, 2007). Depending on a tentative exposure scenario, there is a probability of major swell events occurring every 15 years with probable water heights above 0.7 m and every 5 years with probable water heights of 0.4 m (UNDP, 2007). However, a swell of this magnitude is not expected to inundate the project area since the average topography of the area reaches +2.0m. Events with water heights less than 0.2 m are likely to occur annually especially as Udha. The timing of swell events is expected to be predominantly between November and June, based on historic events and storm event patterns (refer table 6.3). Maldives is located at the longitude band of 73°.

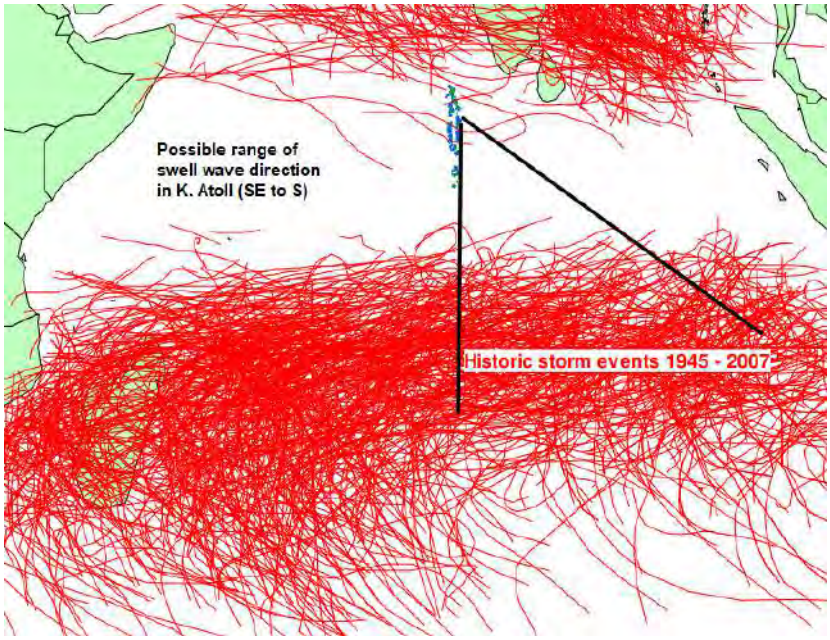


Figure 6-15: Historical storm tracks (1945-2007) in Indian Ocean and possibe direction of swell waves to project area in location-1

Table 6.3: Variation of severe storm events in south Indian Ocean between 1999 and 2003 (Buckley & Leslie, 2004)

	Severe wind event variation	
Longitude band	**Winter**	**Summer**
30 °E to 39 °E	12.5	17
40 °E to 49 °E	7.5	10
50 °E to 59 °E	7.5	26
60 °E to 69 °E	6	14
70 °E to 79 °E	6	6
80 °E to 89 °E	12	6
90 °E to 99 °E	12	8
100 °E to 109 °E	8	3
110 °E to 119 °E	15	7
120 °E to 130 °E	13.5	2

6.3.12 Risk of cyclones

Natural hazard vulnerability risks related to global warming and subsequent sea level rise remains a cause for concern. However, since Maldives is located within the equatorial region of the Indian Ocean, it is generally free from cyclonic activity. There have only been a few cyclonic strength depressions that have tracked through the Maldives (UNDP, 2006). 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. However, the proposed project area has not had flooding due to rain.

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 kilometers 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 here. Strong winds generated by severe local storms generate large wind-driven waves which are hazardous for Maldives (UNDP 2006).

Hulhule and Hulhumale falls within the third most hazardous zone for cyclone related hazards and has a maximum predicted cyclonic wind speeds of 69.6 Kts (Figure 6.14). There are no records of such high wind intensity resulting from a cyclone for the Male' region, although a number of gale force winds have been recorded due to low depressions in the region. Winds exceeding 35 knots (gale to strong gale winds) were reported as individual events in Hulhule annually between 2002 and 2006, all caused by known low pressure systems near Maldives rather than the monsoon (DoM, 2005). The maximum wind speed in Hulhule during this period was approximately 46 kts.

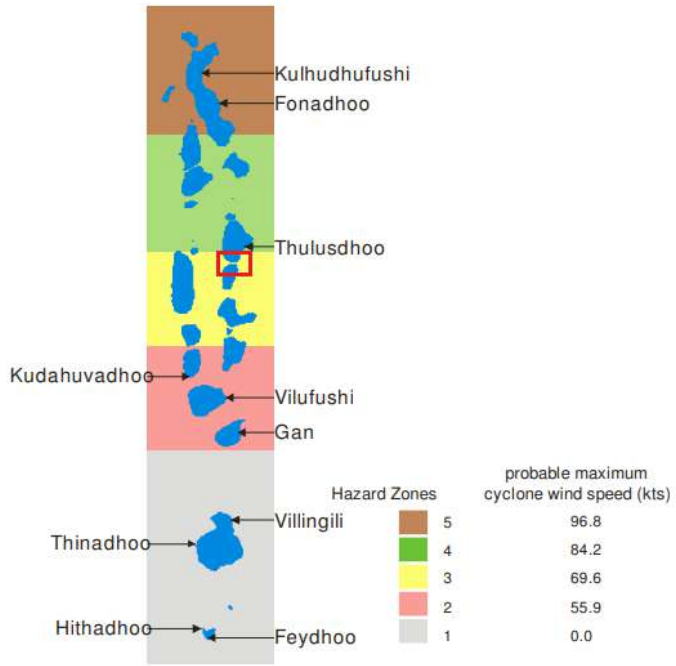


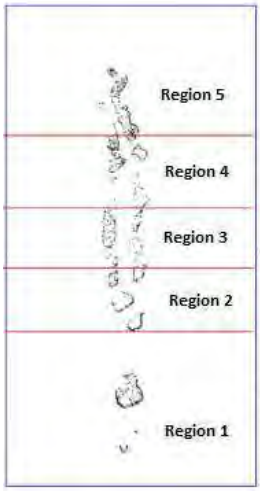
Figure 6-16: Cyclone hazard zones of the Maldives as defined by UNDP (2006)

6.3.13 Risk of Tsunamic

In Developing a Disaster Rick Profile for Maldives by UNDP (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. Referring to Suffir-Simpson Scale, the proposed project site is considered a prone site when cyclonic winds, storm surges, tsunamis and earthquakes over the Maldives are concerned (UNDP, 2007).

Figure 6.26 show that Maldives faces tsunami threat largely from the east and relatively low threat from the north and south. So, islands along the eastern fringe, such as the project location on link road are more prone to tsunami hazard than those along the northern and southern fringes. 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 ion (UNDP 2006).



Hazard Zone	Probable Maximum Wind Speed (knots)	Saffir-Simpson Scale
1	0.0	0
2	55.9	0
3	69.6	1
4	84.2	2
5	96.8	3

Figure 6-17: Hazard zones and Saffir-Simpson Scale for the Maldivian Islands in Indian Ocean (UNDP, 2006)

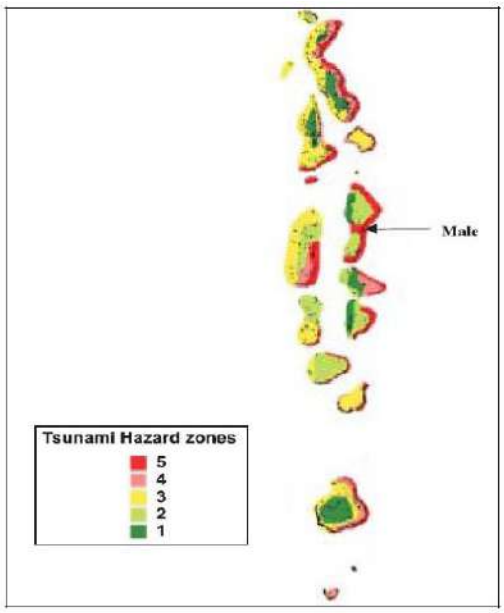


Figure 6-18: Tsunami Hazard Zones

6.4 Summary of the glare assessment report

6.4.1 Introduction

Since the main project area of the proposed project is located within the close proximity of Velana

International Airport, an initial assessment was needed to ensure that glare or reflection of sunrays from the installed PV modules will not cause any disturbance to the operation of the airport. Hence, the client of the project has undertaken a glare assessment report through a third party. The assessment was undertaken by;

- Department of Physics, faculty of Science, Naresuan University
- Phitsanulok, Thailand, 65000
- Tel: +66 55 963512, Fax: +66 55 963501
- Email: sesil_nu@hotmail.com

The initial report was completed on 5th May 2021 and has been revised as per the comments of MECC&T.

6.4.2 The assessment

The glare assessment report was based on guidelines followed in United States and Canada. It included studies of the aircraft takeoff and landing paths as well as for the circling approach for the 2 international runways and 5 paths of sea planes takeoff and landing. In general, the glide path was given as 3 degrees with 15m height over runway threshold for main planes and 5 degrees with 15m threshold for seaplanes. Airport traffic control tower height is in the range of 35 m. Two observation points were evaluated in the report.

The impact of glare depends on the interaction between the position of the sun, the tilt of the solar modules, the reflectivity of the modules' surface, the size of the project, and the relative location of the observer. The glare analysis was performed by using the Forge Solar GlareGauge4 software tool. This tool uses project inputs and solar positioning calculations to determine if glare will occur at identified observation points. If glare is found, the tool calculates the retinal irradiance (brightness) and subtended angle (size divided by distance) of the glare source. These two factors predict ocular hazards ranging from temporary after-image to retinal burn. The results would be categorized as follows;

- Green rated glare: indicates a low potential for after-image,
- Yellow rated glare: indicates the potential for after-image exists,
- Red rated glare: indicates the potential for retinal damage.

Glare that is beyond 50 degrees from a driver's line-of-sight does not constitute a safety hazard.

6.4.3 Results

The glare impact analysis showed that the Air Traffic Control Tower (OP1) and the flight path receptors chosen for the survey (FP1-FP10) are safe from any considerable glare issue from the proposed project. No 'yellow' glare (potential for after-image) for any flight path from threshold to 2 miles. Additionally, no 'red' glare or glare of any kind will be experienced by the Air Traffic Control Tower(s) and those using the link road due to the installation of the PV modules as per the provided design.

6.5 Structural assessment of the buildings proposed for rooftop installation

6.5.1 Introduction

Client's has performed a structural assessment of the buildings selected for the rooftop installation of PV modules. The existing structural drawings of the buildings provided by HDC were used to derive the parameters for the assessment.

6.5.2 The assessment

A structural assessment was run in an engineering application by applying the additional force to be exerted by the PV Modules on the roof structure. The additional force to be applied by the PV modules on the roof structure is 25kg/sqm. Assessment never failed at any point of analysis.

6.5.3 Results

The results show that it is safe to install the PV modules over the roof of the proposed buildings. The assessment shows that the average nominal shearing force and the yield strength of the structure ranges between 1500-2600 kg. As per the result, it is safe to mount the PV modules over the roof of these buildings without further reinforcement of the structure.

6.6 Summary of the geotechnical Investigation undertaken in project area-1

6.6.1 Introduction

Geotechnical assessment was carried out in 4 locations in the project area-1. The field work was carried out by a joint team from Foresight Surveyors Pvt Ltd and ELS International (Pvt) Ltd base in Maldives under the supervision of the project Engineer. Survey was undertaken by using standard scientific methods.

6.6.2 The assessment

The geotechnical field work was carried out from February 25, 2021 to March 4, 2021. The boreholes were drilled by means of rotary drilling machine and the drilling was carried out with overburden cutting tools and the wash boring process was adopted to remove the cuttings from the bottom of the borehole. During the drilling operation the walls of the boreholes were supported by 82 mm diameter NX type flush coupling casings. Every borehole was drilled to a depth of 10.45m. Samples were collected in investigation containers and tested laboratory. Tests performed includes SPT, soil classification, particle size analysis, moisture content, Atterberg limit etc.

6.6.3 Results

- The material present in the bore hole locations include fine sand to coarse gravel.
- The ground water level was noticed as 1.50m-1.60m from existing ground level at the time of soil investigation.
- The average skin friction coefficient is 43.75 kN/m^2.
- The average bearing capacity is 1,437.5 kN/m^2.
- Factor of Safety (FOS) of 1.5 is recommended for estimating the allowable carrying capacities in skin friction from the recommended ultimate skin friction coefficients.

6.7 Ambient Noise levels

Ambient noise levels were measured from 3 different locations near the project area at two different times by using digital sound meter on 4th March 2022. Average value of 5 recordings were noted as the baseline data. As per the recordings, the project area is not regarded as a calm environment.

Noise recording for each project area was measured from 2 locations. Location A is more towards the south of link road, whereas B is more towards north (Hulhumale). The recorded sound levels for these 2 locations are not considerably different.

Noise level recordings from Boashimaa Hingun shows different levels for the points C (east) and D (west). The reason could be that number of vehicles entering Hulhumale will turn to Reethigas Magu without crossing the point D.

Noise readings for the roof top installation area is lower compared to link road and Boashimaa Hingun. Because this is a residential area, where the other area is heavy traffic area.

Generally, noise readings over 65dbA is considered as nuisance. Since the ambient noise levels recorded are higher than 65dbA in project area-1, the proposed project area is already considered as a noisy area. However, the recorded average noise level within the residential area is just below 65dbA.

Considering the ambient noise levels in these areas, the physical activities of the project is not expected to cause a significant noise pollution in the area.

Table 6.4: Ambient noise levels in the project area

Time	Link road		Boashimaa Hingun		Average Noise level in residential area	
	A	B	C	D	E	F
9:00 – 11:00	73	74	71	69	63	65
20:00 – 22:00	73	73	73	68	64	65

6.8 Traffic flow and volume

An hour of traffic survey was conducted at the 4 surveyed locations in the project area (Site A, B, C and D). The survey was conducted on March 04, 2022, from morning 07:30- 8:30, afternoon 12:00-13:00, and 15:00-16:00, at the specified locations. Out of the 4 surveyed locations, site A and B refers to those vehicles travelling from Hulhumale to Male from the 2 lanes on the eastern side of the link road. Similarly, site C and D refers to those vehicles travelling to Hulhumale from the 2 lanes on the southern side of Boashimaa Hingun. These areas are considered since the project will only affect the vehicles on eastern side of link road and southern side of Boashimaa Hingun.

Out of the 4 sites surveyed, site A and B (link road) shows the highest flow of traffic. They show equal number of records since a vehicle passing through point A passes through point B without a turning point in-between. The highest number of traffic flow is experienced during the morning hours since it is the time where most people come out to attend jobs and errands. As per the survey the rush hour or traffic peak times are expected both in the morning and evening, approximately between 07:00-09:00 and 15:00-17:00 hours. Noon time is experiencing a considerably fewer number of vehicles compared to the peak hours.

In Boashimaa Hingun, site C experiences heavy traffic compared to site D. This happens since some of the vehicles turn on Reethigas Magu before passing the point D. However, more traffic is observed during the morning and evening hours compared to the noon time.

The traffic flow survey was not conducted during night time as the project activities that affect traffic will only be carried out during day time.

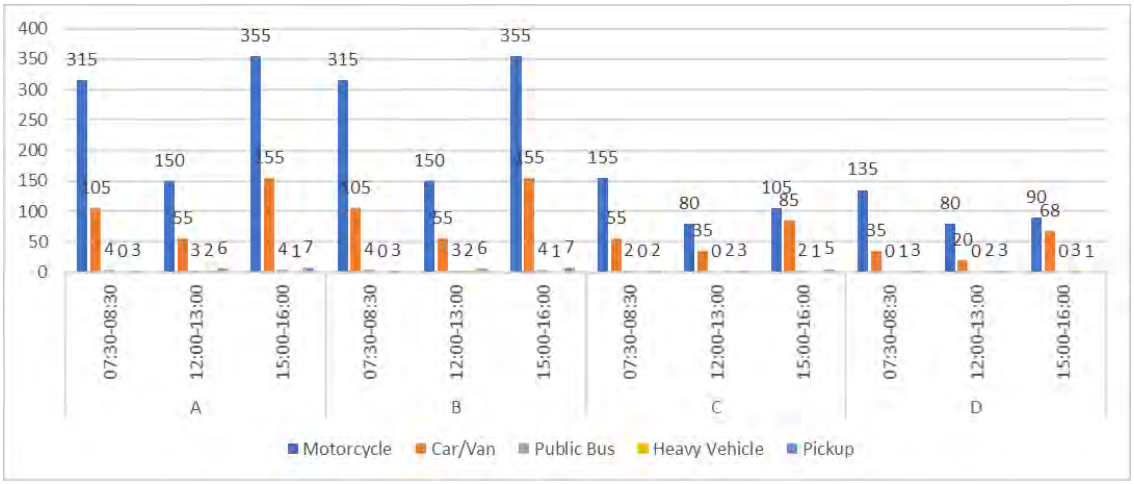


Figure 6-19: Traffic volume in link road (east) and Boashimaa Hingun (south)

6.9 Number of daily flights operating to Velana International Airport (VIA)

According to the Flightradra24 which is a global flight tracking service that provides with real-time information about thousands of aircraft around the world, during the month of March 2022, on average about 85-90 flights have operated to VIA. This number is expected to be higher once the second international runway is operational.

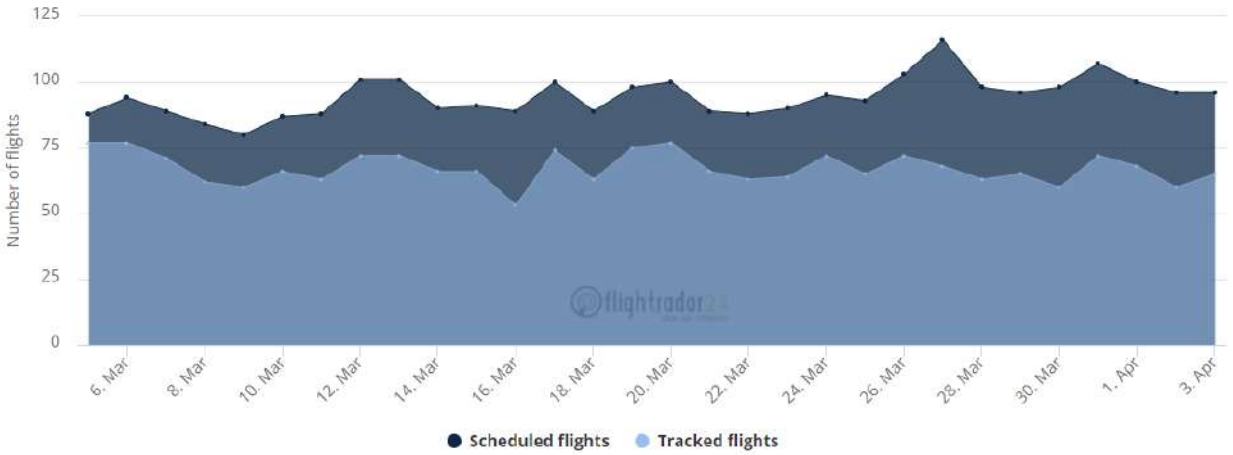


Figure 6-20: Number of scheduled departures for VIA per day, during March 2022

According to an article published in Royal Aeronautical Society (Read, 2019), there is no fixed schedule for seaplane departure and arrivals, as routes are worked out daily based on the number and destination of passengers. Schedules may also have to change at short notice if delays occur to the arrival or departure of international flights or because of adverse weather. The aircraft are sometimes also called upon for emergencies, such as medical evacuation.

The seaplanes only operate during in the hours of daylight using visual flight rules. During peak times, up to 20 aircraft may be operating at the same time with aircraft refueled between flights. Over a typical day, a pilot may do 5-6 flights and sometimes more. There are 3 seaplane operators currently operating seaplanes in VIA. They are Trans Airways Maldives (TMA), Manta Air and Island Aviation Services Limited (AIASL).

7 IMPACT IDENTIFICATION AND ASSESSMENT

7.1 Introduction

Any developmental project has impacts on the environment, which can either be positive or negative. They can also be direct or indirect and short term or long term in their existence. Identification of these impacts is important in the early stages of the project to assess whether they are reasonable, and if any mitigation measures can be made.

Different methods are available to categorize impacts and identify the magnitude and significance of the impact, such as checklists, matrices, expert opinion, modeling etc. Impacts on the environment from various activities of the project construction work (constructional impacts) and post construction (operational impacts) have been identified through interviews with the project management team, field data collection surveys and based on past experience in similar development projects.

7.2 Project Boundary and Impact Buffer Zones

Project boundary is identified to be the proposed construction site and temporary storage area together with the expected possible impact buffer zones. The proposed construction sites are;

- Link Road: The area between the eastern side road edge and revetment. End coordinates of the complete sections are:
  - North: 4°11'56.95" N, 73°32'28.58" E.
  - South east: 4°10'41.84" N, 73°31'54.25" E.
  - Island section (North: 4°11'23.43" N, 73°32'17.36" E, South: 4°11'13.46" N, 73°32'13.38" E)
- Boashimaa Hingun: The area between the southern side road edge and airport security fence. However, once constructed, a gap 3.014m will be left between the fence and the edge of the PV structures. Link section end point coordinates are:
  - North west: 4°12'21.68" N, 73°32'10.14" E.
  - South east: 4°12'6.00" N, 73°32'22.58" E.
- Roof top of 8 residential building in Hulhumale phase-1, neighborhood 3.
- Temporary storage site in Hulhumale phase-1, neighborhood 3.

Direct impact zone is identified to be the area that falls within the direct footprint of development area, whereas indirect impact zone is identified based on estimation, experience on previous projects of similar nature and relevant literature. Mostly physical and biological impacts of the project will take place within the direct project area. Social and cultural impacts will be faced within the greater Male' region and at a national level.

7.3 Impact Identification method

The proposed development will have impacts on the physical, biological and socio-economic components of the surrounding environment. An impact is any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity. The evaluation of baseline data provides crucial information for the process of evaluating and describing how the project could affect the biophysical and socio-economic environment.

The project impacts are predicted by using a Leopold matrix which categorizes each impact to describe the magnitude and its significance. Leopold matrix uses a grading system which assists in understanding the magnitude of the impact and prioritizing the need to address the impacts (Bosko Josimovic, 2014).

7.4 Uncertainties associated with impact identification

Magnitude and extent of many of the identified impacts are based on field survey, published research,

consultants experience on similar past projects. Different degrees of uncertainties are associated with them when related to the proposed project. For instance, the extent of ground vibration during various construction activities is refereed from a research conducted in America. The soil properties and features in America will be different to that in the proposed project area. Hence, certain degree of uncertainty will be present in the estimated degree of impacts. Extent of noise and air pollution is estimated based on past experience on similar projects. However, they can vary depending on the condition of the machineries used.

To reduce the impact of road closure, a schedule has been made by the contractor based on their estimations. It was estimated that road closing will only be needed during mobilization, demobilization, material loading and unloading. Contractor has never estimated to close the road for any other project activity. However, it is very likely that the road closing schedule will require amendments. Furthermore, due to the availability of limited space in the pavement area, it is likely that road closing might have to be extended for a project activity. Because the machines proposed to be used for project activities are large heavy machineries which might not have enough space to operate on within the pavement area in the link road.

Machineries included in the proposed machinery list are not the exact machineries to be used for the project. Those machines that are locally available, which are similar to the proposed ones, or has the same capacity or ability to achieve the intended purpose will be used in the project. Hence, the provided dimensions of the machines or their capacity is likely to differ.

Hence, different degrees of uncertainties are present in the identified impacts. However, consultant has put maximum effort to estimate the magnitude and nature of the identified impacts to the most appropriate extent or level.

7.5 Justification of the Method used

The Leopold matrix has been used to evaluate the overall impacts of the proposed development. The Leopold matrix presents a framework approach to impact assessment of the project. It is widely used in EIA reports done for various types of projects for the purpose of predicting and evaluating the significance of environmental impacts. Leopold matrix fits in the framework MCDM method and is internationally recognized (Bosko Josimovic, 2014).

Impact factors have been evaluated separately for each environmental component relevant to the scope of this study.

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. Spatial extent: the spatial extent over which the impact would be felt.

Table 7.1: Project Impact Factors

Factor	Scale	Attribute
Impact magnitude	0	No observable effect
	1	Low effect
	2	Tolerable effect
	3	Medium high effect
	4	High effect
	5	Very high effect
Impact Significance	L	Limited impact on location
	O	Impact of importance for municipality
	R	Impact for regional character
	N	Impact for national character
	M	Impact of cross-border character

Impact probability	M	Impact is possible (probability of less than 50%)
	V	Impact is probable (probability of over 50%)
	I	Impact is certain (100% probability)
Impact duration	P	Occasional/temporary
	D	Long-term/permanent

Table 7.2: Impacts associated with the project during the construction period

Direct Impact	Impact Area and activity	Magnitude	Significance	Impact Probability	Duration	Cumulative impact
Physical / Chemical impacts						
Noise pollution	All project areas and mobilization roads: Mobilization and demobilization of machinery and project items.	1	L	I	P	Yes
	Project area1 & 3: Foundation and concrete works	1	L	I	P	Yes
	Project area 1 & 2: General Construction activities which include erection of installation frames, installation of PV modules, land scaping and machinery operation.	1	L	I	P	Yes
Degradation of ground water	All project areas: No project component is expected to directly affect the quality of ground water in the project area. However, accidental spillage of oil and chemicals may contaminate ground water.	0	L	M	P	No
Ground vibration	Project area-1: Vehicle movement and construction activity	0	L • It is anticipated that the existing vibration in the project area is 0.5-1 mm/sec as the area experiences heavy vehicle movement (Paulus, 2008).	M	P	Yes

			Hence, the vibration from the construction activity and screw piling will be negligible.			
	Project area-2 & 3	1	L • Since these areas are free from heavy vehicle movement and activity, minor vibrations can be expected at the time of machinery operation within the immediate surrounding of the direct project area.	M	P	No
Air Quality	All project areas: Minor amounts of Sulphur and Nitrogen oxides and dust will be released into atmosphere by vehicles during the construction period.	1	L	I	P	Yes
Impact on Revetment and nearby buildings, structures during construction	Project area-1: Foundation and general construction work. Revetment and road area in link road and Boashimaa Hingun are in the immediate surrounding of the project area. Movement and operation of heavy machineries might inflict damages to nearby structures if proper management and supervision is not maintained.	2	L	M	P	No
	Project area 2: Operation of machineries near buildings in residential area.	2	L	M	P	No
Impact on existing utility lines	Project area 1: Foundation work. There are existing underground utility lines under the pavement in	3	O • The existing underground utility lines in the project area include,	M	P - However, depending on the severity of the	No

	link road and Boashimaa Hingun. Additionally, high voltage electric cables have been buried by STELCO in the area between the pavement and revetment or the fence wall.		high voltage electric cables of STELCO (which connects the power grid of Male' and Hulhumale), electric cables for lighting purpose and CCTV cables of MPS (in a small part of the link road). Any damage or adverse impact on these lines could be of municipal importance.		impact, it might take longer to get it rectified.	
Marine Pollution	Project area-1: All material transfer, loading and unloading will be carried out via the road. No project activity will be carried out over the revetment or in the sea. Hence, marine pollution from the proposed work is unlikely.	0	L	N/A	P	No
Handling hazardous substances	Hazardous substances that will be used in the project include oil, grease and paint. However, they will not be stored in the site. Construction time period of each link is between 1-2 months. Hence vehicle maintenance will not be carried out in the site, nor oil will be stored. Oil will be delivered to the site as required via bowser. However, there still exists the chance of spillage during refueling. The PV modules must be handles with care not to break them as they contain chemicals such as lead, cadmium and many others. These chemicals will be exposed to the environment if the penal is broken.	1	L	M	P	No

Aesthetical impacts	The major work of the project takes place in a non-residential area, in link road and Boashimaa Hingun. The work in this area will progress link by link and physical work in each section will take 1-2 months. Hence, it will not cause much of an aesthetical disturbance. However, roof top installation in residential flats would cause a higher degree of visual disturbance, but to a short period. Most of the activities will take place on roof top which will not be seen from the ground.	1	L	I	P	No
Biological						
Impacts on flora	No vegetation removal is required for the project. Pavement area in link road and Boashimaa Hingun does not have any mature tree. The roof too residential area allows vehicle movement without the removal of any tree. The proposed area for temporary site has grass and bush, but no mature tree.	0	N/A	N/A	N/A	N/A
Impacts on fauna	The proposed project area is located in an urban area. No animal species has been observed to live in any of the project areas.	0	N/A	N/A	N/A	N/A
Environmental significance	No environmentally significant or sensitive area has been identified within the direct project area nor within the immediate boundary of the project area 1 & 3.	0	L	M	P	No

	Project area-2: It has to be noted that the roof top installation is taking place on the roof of residential buildings.	1	L	M	P	No
Social and Cultural impacts						
Human trafficking	Employment of project staff	4	O	M	P	Yes
Forced and child larbour	Employment of project staff	3	O	M	P	Yes
Sexual Harassment and violence against women	Employment of project staff	3	O	M	P	Yes
Unsafe and unhygienic work environment	Employment of project staff	3	O	M	P	Yes
Inappropriate staff accommodation	Employment of project staff	3	O	M	P	Yes

Movement restriction, traffic flow and road usage	Project area-1: Mobilisation, demobilization, loading and unloading	3	O • Vehicle movement on Boashimaa Hingun and link road will be restricted, especially during mobilization and demobilization. Vehicle movement will be managed as per the road closure schedule given in the report. These roads are among the busiest roads in greater Male' region. This will have a direct adverse impact on the residents of greater Male' region, especially those who travel between Male' and Hulhumale via the bridge on daily basis for jobs, education and other purposes.	I	P	Yes
	Project area-2: Mobilisation, demobilization, loading and unloading	2	L • Loading and unloading of materials near the residential areas for roof top installation will cause visual disturbance and possible movement restrictions during working hours to the residents of these areas.	I	P	No
	Project area-3: Material transfer to and from project sites	0	N/A • Since area-3 is temporary material storage area which is in Hulhumale' phase-2, this will not face a considerable movement restriction due to the project activities.	N/A	N/A	N/A
Gender and group-	Project area-1: Project activities, especially mobilization and	1	L	M	P	Yes

based impacts	demobilization will affect those who use the link road between Male' and Hulhumale'.		• Construction stage impacts such as movement restriction, noise and air pollution that have been highlighted with regard to the project will have to be experienced by the groups of people who use the link road and Boashimaa Hingun. • Road closure will probably cause minor delays on taxi and public transportation services between Male' and Hulhumale' during the hours' of closure.			
	Project area-2: Project activities, especially mobilization and demobilization will affect those who live in and visit the 8 residential flats proposed for rooftop installation.	1	L	M	P	No
	Project area-3: Since the temporary project site is located in Hulhumale' phase-2, activities in this area will not have a significant impact.	0	N/A	N/A	N/A	N/A
Impacts on livelihood	Project area-1: All project activities	1	L • No significant impact on the livelihood of any group of people is expected. However, difficulties in using the link road and Boashimaa Hingun at certain times during the project will interrupt taxi movement and transportation of goods between Male' and Hulhumale. This is not expected to cause a	M	P	No

			significant or a noticeable adverse impact on the monthly outcome of any of the livelihood activities.			
	Project area 2&3: All project activities	0	L	M	p	No
Impacts on culture and heritage	Project site (No project area has any cultural or heritage site.)	0	N/A	N/A	N/A	N/A
Larbour influx and food security	The proposed project would mostly involve the use of foreign workers during the construction stage.	1	L • Greater Male' area has large number of foreign workers engaged in various types of activities. As per Census 2014, 16% of the total population of greater Male' area consists of foreign workers. This number is expected to be much higher now. Information on many of these foreign workers in Male' area is not fully documented and hence, their exact number and type of business they are involved in is not very clear. Hence, involvement of foreign workers in the project is not expected to have a huge negative impact on local culture. • However, it would add up as a cumulative impact to the already existing issue of the large population of foreign workers in the country. Immigration issues related to foreign workers are poorly regulated in the country.	M	P – Foreigners hired for the project are expected to leave as soon as the project is complete.	Yes

			• On the other hand, Lack of locals involved in construction stage of the project could result on public dissatisfaction towards the overall project.			
Health and Safety of work force	Project activities in all 3 project areas.	1	L	V	P	No
Health and Safety of local community	Project area-1: Project activities.	1	L • Project activities such as mobilization, demobilization, loading and unloading would impose higher safety concern than the normal construction activities. These activities involve the use of heavy machines and lifting heavy items. However, the project area would be cordoned for the public.	M	P	No
	Project area-2: Project activities	2	O • Since project activities in area 2 are carried out in a residential area, they are of more significance.	M	P	No
	Project area-3: Project activities.	0	N/A	N/A	N/A	N/A
Impact on airport operation	Project area-1: Construction activities and operation of machinery	1	N • No project activity is expected to cause an issue in airport operation. The landing areas of the proposed new international runway (near link section 5) and the water runway (near link section 1) have their take-off or	M	P	No

			landing ends clear from project activities. • Additionally, no machinery which has a height higher than 15 meters will be used for the project. • However, the activities in Boashimaa Hingun will involve the use of high security zone (activities are carried out near the airport's security fence).			
	Project area 2&3: Project activities	0	N/A	N/A	N/A	N/A
Fire hazard	Project activities in all areas	1	O • The project does not involve the use of highly flammable liquids or materials. However, use of chemicals, welding and electrical wiring have the possibility of a fire.	M	P	No
Impacts of COVID19 restrictions	Total project (project manpower)	2	M • The travel restrictions imposed due to the pandemic has already delayed the project by a year. It has imposed high restrictions on travelling between countries during the past year. • Furthermore, since many of foreign workers are expected to work in the project, they impose health risks to the local community and to each other once they enter the country and start working together.	M	P	Yes
Economic / Enhancement Plans						

Employment opportunities	Greater Male' area	1	R • Local contractors with the required expertise are less. Hence, employment opportunities for locals during the construction period will be less.	I	P	Yes
Local Economy	Greater Male' area	2	R • Local suppliers are expected to benefit from supply of construction materials such as sand, cement, aggregate, steel bars etc. • Similarly, construction machineries will be hired from local companies.	I	P	Yes
Contractor's CSR initiative	Greater Male' area	2	O • Contractor/client has not highlighted any plan or obligation under the project for the contractor to initiate or undertake any CSR projects for the local community. • Although no CSR project has been highlighted by the contractor or the client, it has been noted that some components of the project are outsourced to local companies. The ESMP has been assigned to a local company named Foresight Surveyors Pvt Ltd.	V	P	Yes

Table 7.3: Impacts associated with the project during the operation period

Direct Impact	Impact Area and activity	Magnitude	Significance	Impact Probability	Duration	Cumulative impact
Social and Cultural Impacts						
Impacts on road users	Project area 1: availability of a pavement area with shade	2	R • HDC highlighted that there is a plan to open the eastern side pavement of the link road for public use after the project. Pavement area with shade would provide usable space for walkers and runners at all times.	V	D	Yes
Limited machinery access to revetment	Eastern side rock boulder revetment of link road: Machinery access will be needed in case if a revetment repair work is needed.	3	R • No machinery access to revetment is available between PV Array Link section 1-5. • Access is only available at the ends of Link section 1 (south eastern corner of Hulhumale') and 5 (south east of Hulhule). • To provide machinery access to repair works, depending on the location, PV modules and mounting structures in that area will have to be temporarily removed.	M	D	No
Impact on airport operation	Project area 1: Possible glare and reflection of light from the PV modules	4	N • Presence of glare and light reflection at certain angles will obstruct aircraft landing and	M	D (Unless rectified)	No

			takeoff, hence, hinder the operation of the airport.			
Fire hazard	Project area 1 & 2: Project operation	1	L • Proper testing and commissioning will ensure safe operation of the system.	M	P	No
Economic / Enhancement Plans						
Employment opportunities	Employment opportunities in greater Male' area.	1	L • After construction, the system will be operated for 15 years by Ensys. Afterwards it will be transferred to GoM (STELCO). However, no much staff is needed to operate and manage the system. • As per STELCO, since number of solar PV installation projects are taking place in Maldives, they have a separate unit of staff to get specialized in this technology.	I	D	Yes
Impact on local economy	Reduction in the amount of money spend on purchasing fuel for energy production	3	L • This would be of high significance in terms of economic growth.	I	D	Yes
Impact on the price of electricity	Reduction of electricity price in greater Male' area.	3	L • As per STELCO, the amount of electricity proposed to be produced by the proposed project is not a huge amount compared to the existing amount of electricity generated by the main power house of STELCO in Male' region. The amount of electricity generated	I	D	Yes

			in Male' in 2019, at peak load is 59,490kW, whereas in Hulhumale it is 10,810kW (MEA, 2019). The amount proposed to be produced under the proposed project is 5.6kW which is very less compared to the total requirement. • Additionally, price reduction and adjustments to the price are basically set by the government as it is a basic need of the public. Hence, a price reduction is not expected even if the proposed project comes into operation unless it has been decided at policy level by the relevant government authorities.			

7.6 Significant impacts

7.6.1 Construction period

Most of those envisaged impacts during the construction phase of the project are minor and insignificant. Highlighted below are the significant ones that require proper management options and techniques.

- Restricted vehicle movement – Link Road and Boashimaa Hingun has 2 lanes on both sides of each road. At least a single lane from the side of the project will have to be temporarily closed during mobilization, demobilization, loading and unloading. A schedule for road closure has been included in the report. The closed area will run for about 50m in length at the link section where the work goes on. Since the link road between Male' and Hulhumle' is the busiest road/highway in greater Male' area, even a closure of a single lane from the link road, that directs vehicles from Hulhumale' to Male' will adversely affect the public who use the highway.
- Risk to the existing utility lines – The proposed project area is narrow. At the widest part (link section 5) it has about 10m between the road the revetment. Near the link section 1, it has about 5-6m between the road and revetment. Within the underground of this area, number of utility lines which include high voltage electric cables, CCTV cables and normal power cables are present. Even if their locations are available from as-built drawings, it is likely that accidental damages could occur to these lines since the working environment is small.
- Human trafficking – Greater Male' area already has large number of foreign workers engaged in various types of activities. Many among them does not have proper immigration and work visa documents. Although they might have entered the country legally, their stay without proper immigration and work visa document is illegal. Presence of large number of undocumented foreign workers in the country has become a huge social issue in Maldives. Hence, it is extremely important that any foreign worker employed in the project are properly documented as per the relevant regulations of the Maldives. And they will have to leave the country as soon as the contract period is over.

7.6.2 Operational period

Most of those envisaged impacts during the operational phase of the project are significant positive ones. The project has a high socio-economic associated with it, especially over a long-term period.

- Economic significance – The project has a highly significant and cumulative economic value since it will add up the total amount of energy generated from renewable sources within the country. This is in line with the targets highlighted under the National Environmental Action Plan III (NEAP III), and SDGs which were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. Furthermore, sales of construction materials, food items and accommodation rent of the project team will provide direct benefits to number of people in the community, especially at a time where many businesses have been going through a depression due to the pandemic.

- Possible reflection/glare issue - Although the initial assessment report made by the client during the design phase of the project proves that no glare issue will be imposed by the erected panels, it has to be practically confirmed during the operation.

- Machinery access space for possible revetment repair work – Although it has been a request of MNPH&I to provide access gaps for heavy machines to allow for revetment repair works, no such gaps are included in the design. The PV modules are installed in a one single line from link 5 – 1,

without large gaps enough to allow vehicle movement. However, when required, installed panels and the frames can be removed to allow machine access. Such an event will also reduce the amount of electricity produced by the system.

8 MITIGATION AND MANAGEMENT OF ADVERSE IMPACTS

8.1 Introduction

Since it has been certain that certain environmental and social impacts are going to take place due to the project, it is highly important that proper measures and actions are taken to minimise and mitigate them. As mentioned earlier, most of the impacts identified can be mitigated with precautionary steps. If taken at an earlier stage, the overall negative impact that could be having from this project on environment, social and economically could be negligible.

Under this section, environment and social mitigation and management measure relevant for the proposed development will be outlined. These measures must be adopted during the construction and operational phase so that the targeted impact will show reduction in its severity.

8.2 Justification for the proposed mitigation measures

The environment management and mitigation measures outlined in this report are selected based on number of factors. Most importantly, practicality of the proposed measures in a cost-effective manner with locally available expertise, technology and equipment is considered. These proposed measures have been widely used in Maldivian construction industry effectively with minimum usage of manpower. Hence, the proposed mitigation measures are considered to be the most suitable for the proposed development.

8.3 Limitations of the proposed mitigation measures

The mitigation measures are proposed for the identified impacts. As highlighted before, under the limitation of environmental impacts, the identified impacts do have limitations. The magnitude and severity of the impacts are estimates based on literature and experience. Hence, same degree of uncertainty will present in the proposed mitigation measures.

Table 8.1: *Proposed mitigation measures for the identified impacts of the project (for both pre-construction, construction and operational stage of the project)*

Project Activity	**Potential Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Institutional Responsibilities (Implementation and Supervision)**	**Estimated quantities required and Material specifications recommended**	**Cost estimation/ USD**	**Comments (e.g. primary, secondary or cumulative impacts)**
Detailed design and Planning Phase						
Design	Not meeting the legal and regulatory requirements as outlined under the Legislative and regulatory considerations. Not meeting the specific institutional requirements received from key stakeholders.	Incorporate the necessary regulatory and institutional requirements into the design. If not, must notify the supervisory body (MECC&T) by the client (Ensys) and come to an understanding with the GoM and donor.	Implementation by Ensys Co., Ltd, supervision by MECC&T	-	6,700.0 (LS)	Primary
Approvals	Unapproved engineering drawing set by certified engineers Unapproved engineering drawing set by local engineers as requested by MNPH&I Unapproved ESMP	Approve the final engineering drawing set by certified engineers, followed by licensed local engineers (as instructed by MNPH&I). Approve the ESMP from EPA and WBG.	Implementation by Ensys Co., Ltd, supervision by MECC&T	-	4,500.0 (LS)	Primary
Hiring foreign workers or a sub-contractor	Possible spread of COVID19 from the work force.	Conduct a health screen prior to recruitment and ensure that the project team members who had been positive to COVID19 in the	Implementation by Ensys Co., Ltd, supervision by MECC&T		2,500.0 (LS)	Cumulative

		past or had contact with COVID19 positive case or is from a residence where there was a COVID19 patient have fulfilled the prescribed quarantine period of 14 days. Ensure that the project team does not include workers who fall under COVID19 high-risk category, such as people who are over 65 years of age, who are taking long term medication or having chronic diseases. If workers who fall under COVID19 high-risk category are included in the project team, they must be fully vaccinated against COVID19 as per WHO guidelines. Identify an emergency contact person for all of the workers hired for the project. Adhere to the COVID19 safeguard measures and latest instructions of HPA (Maldives).		7,200 fact masks, 105 hand sanitizers (800ml), 65 soap bottles		
	Human Trafficking	All foreign nationals employed in the project must have employment approval,				Secondary

		work permit or work visa to work in Maldives. Foreign employees should be engaged as per the Employment Act of Maldives.				
	Forced and child larbour	All employees must be over 18 years of age. There must be a written employment agreement as per the Employment Act of Maldives, signed between the employer and the employee. There must be a written job description for each job created for the purpose of the project.				Secondary
	Sexual Harassment and violence against women	Promote gender equality in work environment as per the Gender Equality Act. Eliminating weaknesses or difficulties caused by inequality between men and women. Any form of sexual harassment and violence must not be tolerated in the work environment. Take				Secondary

		actions as per the code of conduct.				
	Unsafe and unhygienic work environment	All employees must be provided with job appropriate PPE. Make employees aware of the emergency response plan and emergency contact numbers. Keep the work environment clean and hygienic. Conduct induction and regular toolbox meetings in the site to attend employee issues. Work site must have fire extinguishers and First Aid Kits.				Secondary
	Inappropriate staff accommodation (if accommodation is provided by the client or contractor)	Staff must be accommodated in clean and hygienic rooms that has proper ventilation and are adequately lit. Depending on the room size, no more than 4 or 6 staff must be accommodated in a single room. Each room must have separate toilet for the inhabitants of the room or a	Implementation by Ensys Co., Ltd, supervision by MECC&T	-	5,500.0 (monthly)	Secondary

		common toilet area must be available. There should be a toilet for every 6 staff. Female staff must be provided with separate toilet access and room. A common washing area or the service must be available in the accommodation area.				
Pre-construction phase – Site preparation						
Public and stakeholder awareness	Public and key stakeholders are unaware of the correct project timeline, GRM and road closing schedule. Traffic Police and Transport Authority is unaware of road closing schedule. No specific project staff identified to ensure the health and safety management of the site.	Update the construction, machinery and road closing schedules once all approvals have been obtained and pass the information to all key stakeholders including the general public. Especially the procedure for GRM must be made publicly aware on a public forum such as local news. Project team must include a health and safety officer to ensure the implementation of the recommendations in ESMP. Plan regular meetings with key stakeholders on weekly or fortnightly basis.	Implementation by Ensys Co., Ltd, supervision by MECC&T	-	1,500.0 (LS)	Primary

Site preparation in Project area-1	Aesthetically disturbing. Site preparation activities such as ground leveling and removal of the existing pavement along the project area in link road and Boashimaa Hingun could cause minor air pollution. Project staff would be active in security area of the airport (within 10ft boundary of the security fence in Boashimaa Hingun). Maintaining a clear zone of 10ft after the security fence in Boashimaa Hingun.	Fence the area where the work is ongoing. Erect the construction sign boards. Unless for a project activity, no project staff must get closer than 10ft to the airport security fence in Boashimaa Hingun. The security fence must not be crossed by any project staff under any circumstances. The security zone (10ft from the security fence in Boashimaa Hingun) must be kept clear off any immovable item at all times. Project team must include a health and safety office to ensure the implementation of the recommendations in ESMP.	Airport Security is maintained by MACL. Implementation must be carried out by the contractor and/or Ensys Co., Ltd.	Fencing materials which could be plywood, roofing sheets or contractors own customized fence. About 81 sheets of plywood (8ft by 4ft) will be required to cover the project area which is a 50m line of road area. Supporting material such as wooden planks or iron pipes (120-150 Nos) and nails or screw will be required.	5,800.0 (LS)	Primary
Site preparation in Project area-2	Aesthetically disturbing. Operation of crane and heavy machinery in the immediate surrounding of residential buildings. Lifting heavy objects to the rooftops of the buildings.	Fence the area where the machinery operates. Keep a watchman to assist the crane operation. Maintain proper communication with the team on the roof and the land.	Implementation by Ensys Co., Ltd, supervision by MECC&T	About 90-100 sheets of plywood (8ft by 4ft) and Supporting material such as wooden planks or iron pipes and nails or screws.	7,050.0 (LS)	Primary

		Heavy objects should not be lifted over people. Every day, before the commencement of the work, must check for defects in the lifting cable of the crane.				
Site preparation in Project area-3	Aesthetically disturbing.	Fencing the site area. However, since the site is located in Hulhumale phase-2, away from residential areas, the impact is not significant.	Implementation by Ensys Co., Ltd, supervision by MECC&T	About 190-200 sheets of plywood (8ft by 4ft) and Supporting material such as wooden planks or iron pipes and nails or screws.	14,300.0 (LS)	Secondary
Construction phase						
Mobilization, demobilization, loading and unloading	Noise pollution, minor vibration on the road surface, air quality	Use properly maintained vehicles. Plan out transportation of materials and equipment in the most efficient way with a smaller number of trips. Plan out construction activities efficiently, reducing the number of hours vehicles are in use. Heavy machinery and equipment shall be fitted	Implementation by Ensys Co., Ltd, supervision by HDC. The roads in the proposed project area are managed by HDC.	-	4,500.0	Cumulative

		with air pollution control devices. Must follow the road closure schedule. Inform traffic police and get assistance. Machinery with metal tracks can only be mobilized over a trailer.				
	Road closure – closing a single lane out of the 2 lanes on the side closer to the project, in link road and Boashimaa Hingun	Plan the work to close the road for the least numbers time. Follow the instructions and guidance of MPS. Closing the lane during peak vehicle hours (7:00-9:00 and 14:00-18:00) is not recommended. Make the road closing schedule which represents the actual scenario with correct timings and publish it on a public forum such as via local news. Must flow the schedule.	Implementation by Ensys Co., Ltd, supervision by MPS and HDC.	-	-	Primary
	Aesthetical issue and disturbance to daily movement in area-2	Inform HDC and give notice to the residents of the buildings about the work.	Implementation by Ensys Co., Ltd, supervision by HDC.	-	-	Primary

		Assign an area to temporarily keep the machinery and project items.				
Work in temporary site	Noise and air pollution. Dust production.	Unavoidable impacts as they are part of construction. The impacts are insignificant since the temporary project site area is far from residential areas. Use properly maintained vehicles. Complete work as per the schedule.	Implementation by Ensys Co., Ltd, supervision by MPS and HDC.	-	-	Cumulative
Foundation work and general construction in project area-1	Possible degradation of ground water	No dewatering is required for any project activity. Hence, no direct impact on ground water lens. However, vehicle refueling (if carried out in site) and handling hazardous substances must be done with care over a hard surface. It is recommended to have absorbent mats to clean out any leaked substances.	Implementation by Ensys Co., Ltd.	Oil absorbent mats	345.0	Primary
	Minor ground Vibration	Use properly maintained vehicles. Timely plan the usage of heavy machinery used in foundation work.	Implementation by Ensys Co., Ltd.	-	3,850.0	Cumulative

		Avoid foundation methods that cause severe vibration such as hammer piling (It is proposed to use screw piling for foundation).				
	Possible damage to existing utility lines and cables. Damages to the high voltage electric cable between the existing road edge and revetment in link road, between road edge and security fence in Boashimaa Hinun. A damage to the high voltage electric cable can ignite a fire. Damages the electric cables to light posts in the road. The damage may disrupt the electricity supply to light posts. Damages to electrical cables can give rise to fatal incidents within the site. Possible damage to the CCTV camera of MPS. Such a damage would undermine the maintenance of security service in the area.	Foundation design must follow the available as-built maps showing the location and depth of the utility lines. Use a cable detector to ensure that no cable is present before foundation piling work begins. There must be a 1m safety gap between the foundation footings and the high voltage cables of STELCO. Make prior arrangements to attend any damage to the utility lines within a short span of time. This could be arrangements with the relevant utility company. Do not keep heavy machines such as cranes and excavator directly over the high voltage cables of STELCO while in operation.	Implementation by Ensys Co., Ltd.	-	4,230.0	Primary
	Possible damage to the rock revetment, paved road and road railings.	Use certified and experienced machinery operators.	Implementation by Ensys Co., Ltd, supervision by HDC	-	10,000.0 (could highly vary	Primary

		Use properly maintained vehicles. Adopt a foundation methodology that does not involve vibro-hammering to minimize the speed of vibration. Operate heavy machineries while keeping an assistant to lookout. Strick to the work schedule and complete the work as quickly as possible. Any damage must be rectified by the contractor before the site is demobilized and approved by the HDC.	and MNPH&I. The roads in the proposed project area are managed by HDC, whereas the revetment by MNPH&I.		depending on the rectification required)	
	Marine Pollution	Use properly maintained vehicles which are in good condition without leaks. Brief the workers about the sensitivity of the corals and marine environment. Provide clear instructions prior to work on safe movement around a coastal environment and actions to avoid such as littering.	Implementation by Ensys Co., Ltd, supervision by MECC &T	-	250.0	Secondary

		Clean the work site regularly and provide waste collection bins in the site.				
	Aesthetical disturbance which might lead to public complains and loss of natural view.	Fence the main project area as stated under pre construction stage mitigation.	Implementation by Ensys Co., Ltd, supervision by MECC&T	Requires about 81 sheets of plywood (8ft by 4ft) with supporting materials such as nail, screw and wooden planks.	5,800.0	Primary
	Handling hazardous substance	Any hazardous substance such as used oil will be stored in solid containers and disposed as per the waste management regulation. Hazardous substance must be handled and transported with case while wearing PPE. Refueling of machinery, if carried out in the site, must be carried over a hard mat/surface. Have absorbent mats in the site to immediately clean any spilled oil during refueling of machines.	Implementation by Ensys Co., Ltd, supervision by MECC&T	1-2 absorbent mat rolls/kits, 2-3 solid containers of 10-15L capacity (metal or plastic)	550.0	Primary

Project activity near airport's security fence	Project activity in Boashimaa Hingun will take place just next to the security fence of the airport. A 10ft offset distance from the fence is considered as high security zone by DASA.	Make the workforce aware of the security zone and the implications of breaking the security. Keep a 10ft offset after the fence free of immovable items as it is a requirement of DASA. Where possible always avoid activity within the 10ft security buffer. Coordinate with MACL in maintaining airport's security.	Airport Security is maintained by MACL. Implementation must be carried out by Ensys Co., Ltd and MECC&T in coordination with MACL. Working area supervision by HDC.	-	550.0	Primary
Construction in project area-2	Aesthetically disturbing. Operation of crane and heavy machinery in the immediate surrounding of residential buildings. Lifting heavy objects to the rooftops of the buildings. Aesthetical issue and disturbance to daily movement in area-2	Fence the area where the machinery operates as stated under mitigations for pre-construction stage. Erect proper danger and construction signages near the work area. Keep a watchman to assist the crane operation. Maintain proper communication with the team on the roof and the land. Heavy objects should not be lifted over people.	Implementation by Ensys Co., Ltd, supervision by HDC	About 90-100 sheets of plywood (8ft by 4ft) and Supporting material such as wooden planks or iron pipes and nails or screws. 100m long safety net and mater materials to erect the net.	7,050.0 5,100.0	Primary

		Every day, before the commencement of the work, must check for defects in the lifting cable of the crane. Objects should not be left freely on the roof with tendency to fall. They must be secured to the roof structure. Additional precautionary measures such as erecting a safety net around the roof edge of the building is recommended. Falling objects would be caught in the net without reaching the ground or a balcony. Small tools and objects must be either kept in a container secured to the roof structure or in working jacket or vest. Work and material transfer schedules must be made publicly available for the residents of the buildings by placing it in a suitable place such as building entrance (must be done in coordination with HDC)				

		Strictly avoid nigh time and overtime work.				
	Health and safety of site workers	Appoint a health and safety officer who will ensure the implementation of ESMP. Prepare a safety management plan for safety measures that can be taken during the construction stage including the safe handling and storage of construction materials and equipment. The safety management should include the implementation and availability of safety equipment such as first aid kit, fire extinguishers, masks, high-vest, emergency evacuation plan etc. All site workers should wear appropriate safety gear including hardhat, safety shoes and overalls or high vest at all times while in the site. Site workers should be aware of safety policies and emergency plans to be followed in the site during normal work routine and	Implementation must be carried out by the contractor and/or Ensys Co., Ltd.	PPE for the whole site team, including hard hat, high vest, safety shoes, glasses, gloves etc. The 46 (approximation as per the staff requirement list) site staff must be provided with the relevant PPE depending on the work they do.	Must have been managed within the project budget. If health and safety component is to be separately managed, it would approximately cost USD 5,800.0	Primary

		energy instances. Fire extinguishers and first aid boxes should be readily available within known places in the site. The project area should be fenced, and appropriate construction sign boards ('No Entry', 'Construction Site', 'Danger' sign boards) should be erected to warn the pedestrians and neighbors. Must undertake safety drills prior to the beginning of the construction stage and tool box meetings during construction period to ensure that site workers can properly follow the required safety management plans.				
	COVID19	Must provide general PPEs against COVID19 such as general flue medicine, hand sanitizers, soap, masks, gloves, foot operated lidded dustbins, dustbin bags etc. Workers must inform the health and safety officer if they develop CIVID19	Implementation must be carried out by the contractor and/or Ensys Co., Ltd. Working area supervision by HDC.	Additional covid related PPE for the whole site team, including masks, sanitizers, gloves, soap, cleaning	It is expected to cost between USD 3,000 – 5,000 for the duration of the project.	Cumulative

		related symptoms such as continuous cough, fever/high temperature (37.8°C or greater), loose sense of smell or taste etc, and they must be encouraged to abstain from work unless the worker has been proved to be negative to COVID19 either by PCR test or otherwise. Check temperature of workers at the start of every work shift, if the temperature is over 37.8°C, additional measures must be taken to ensure it is not due to COVID19. COVID19 positive workers or infectious staff must be separately kept from the general work force. Encourage to maintain strict mitigation measures against the spread of COVID19 virus in the work place such as assigning minimum number of people for groups tasks, encouraging to wear mask, keep personal distance, regularly sanitize or wash hands etc.		detergents etc. The 46 (approximation as per the staff requirement list) site staff must be provided with the relevant covid related PPE as highlighted under the covid 19 guidance note for the project duration.		

		Provide the workers with basic information on COVID19 symptoms, proper use of relevant PPEs, hand washing and sanitizing techniques during tool box meetings. Must follow the COVID19 guidance note included in Appendix.				
Operational phase						
	Reflection from solar panels (glare issue)	Include a contingency plan and a budget to bring changes to the angles of the installed penal if any glare issue is reported by MCAA and requires adjustments. During the initial period of operation, undertake close monitoring and communication with MCAA regarding the glare issue.	Implementation must be carried out by the contractor and/or Ensys Co., Ltd. Supervision and recommendation by MCAA.	Height of the mounting structures might need readjustments to change the angle of the installed PV modules. Else, additional components have to be designed and made for the purpose.	The project' contingency budget. The project is expected to have a contingency budget to attend the issues faced during the initial operational stage.	Primary
	Machinery access to revetment area	Include gaps in-between link section 1 and 5 to allow machinery access to the revetment area. Design modular sections that can easily be removed and reassembled without shutting down the energy	Implementation must be carried out by the contractor and/or Ensys Co., Ltd. Supervision and recommendation by MECC&T.			Primary

		production from the whole system.				

9 STAKEHOLDER CONSULTATION

Number of stakeholder consultations were held for the purpose of this ESMP with key stakeholders of the project. Consultations were held with the key stakeholders listed in the ToR via video conferencing. In each stakeholder meeting, participants were briefed on the proposed development activities. Furthermore, together with the initial meeting request, a brief introduction of the project was shared with each stakeholder. Their views, comments and concerns were noted.

After the project screening process, EPA decided that an Environmental Management Plan would suffice for the project. Hence, no scoping meeting with EPA was required for the project.

Stakeholder meetings were held with the following parties at the given dates.

Table 9.1: Stakeholders with whom consultation meetings were held with

Institution	**Requested Date**	**Date of the Meeting**	**Remarks**
Housing Development Corporation (HDC)	April 26, 2021	May 4, 2021	Online meeting
STELCO	April 26, 2021	May 2, 2021	Online meeting
Maldives Civil Aviation Authority (MCAA)	April 27, 2021	May 3, 2021	Online meeting
Maldives Police Service (MPS)	April 26, 2021	May 20, 2021	Online meeting
Maldives Airports Company Limited (MACL)		May 20, 2021	Online meeting
Male City Council (MCC)	April 27, 2021	June 3, 2021	Online meeting
Ministry of Transport		June 21, 2021	Online meeting
Director of Aviation Security Administration (DASA)		May 25, 2021	Online meeting
Ministry of National Planning, Housing and Infrastructure (OPERATION)	April 29, 2021	February 9, 2021	Online meeting
Residents of flats proposed for roof top installation	-	May 25, 2021	Meeting held in the residential area
Second Meeting with MACL, DASA, AVESCOM		July 8, 2021	Online meeting. The meeting was held for the request of the stakeholders
Dhiraagu	April 26, 2021	-	Received a response but a meeting was not arranged.
Ooredoo	April 26, 2021	-	Received required information.

9.1 Meeting with HDC

Apart from environmental consultant and participants from HDC, relevant staff from the PMU MECC&T participated in the meeting. Main points discussed in the meeting are given below.

- EIA Consultant: Gave a brief description of the proposed project and opened the for meeting for discussion.
- HDC: The existing pavement in link road and Boashimaa Hingun, that falls within the project footprint has to be removed and replaced by the client.
- HDC: Even though the pavement area in the link road is not currently open for public, it will be in a near future. Hence, the area beneath the PV modules must have lights.
- HDC: Any damage to the road, pavement or any of the existing structures nearby must be repaired by the client before demobilization.
- EIA Consultant: Since many of the residential buildings have roof top PV modules installed so far, it was inquired from HDC if it has received any complain regarding those installations, especially during the operation period.
- HDC: Notified that there have been no complains and issue faced during the operation of those PV Modules.
- EIA Consultant: It was noted that since the project area in link road and Boashimaa Hingun provide a narrow and limited space, part of the road on the side next to the project will have to be temporarily closed. However, out of the 2 lanes, it was proposed to close one lane while keeping the other for vehicle movement.
- HDC: Mentioned that closing the road will be a huge issue since it's a busy area. Noted that they cannot agree to totally block the vehicle movement in that area. However, where necessary, closing a single lane also should only be carried out for least possible amount of time.
- Meeting adjourned.

Table 9.2: List of participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Ahmed Fathhee	Asst. Director, Planning & development	HDC	990 0123	fathhee@hdc.com.mv
Mohamed Rasheed Hussain	Asst. Project Manager, Project & Contract Management	HDC	-	m.rasheed@hdc.com.mv
Aminath Samaha	Architect, Planning & development	HDC	775 4100	samaha@hdc.com.mv
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.2 Meeting with STELCO

Apart from environmental consultant and participants from STELCO, relevant staff from the PMU MECC&T participated in the meeting. Main points discussed in the meeting are given below.

- Environmental Consultant: Gave a brief description of the proposed project and opened the for meeting for discussion.
- STELCO: Noted that still the work of connecting the power grid of Male' and Hulhumale is ongoing. This work is ongoing in link road and Boashimaa Hingun, at the direct project location. At the time of the meeting, only the link section area 1 has been completed.
- STELCO: Noted that during the construction stage, it is not advisable for heavy machineries to operate over the buried high voltage cables of STELCO even though they are buried at a depth of about 1m from the existing ground level.
- STELCO: Strongly recommended to work by keeping a safe distance between the high voltage power cables while undertaking the foundation work.
- Environmental Consultant: Asked from STELCO whether they have been properly informed about the project and kept in the information loop starting from the first day. Furthermore, inquired about the capacity and existing resources of STELCO to run the project after it has been handed over to GoM.
- STELCO: Noted that they have been informed thoroughly regarding the proposed prject. STELCO currently has a unit to manage renewable energy projects since many such projects have been taking place at different locations of the country. STELCO noted that they have enough resources to manage the project once Ensys handover the project to them. During the operation period of Ensys, STELCO's staff will work with Ensys to gain experience and the knowledge need to operate the system. Participants of STELCO noted that no mush staff is required to manage and run the system once it is in operation stage.
- STELCO: Regarding the project design and concept, STELCO expressed concern over the fact that the project does not include energy storage service such the inclusion of battery storage facilities to store energy for later consumption.
- Environmental Consultant: Inquired about the possible benefits of the proposed project in terms of energy production by fuel, money spend on fuel and the cost of electricity.
- STELCO: Noted that the capacity of the proposed project is very less (about 5-8%) compared to the total existing power production. Hence, no much change in terms of energy production by fuel, money spend on fuel and the cost of electricity can be expected.
- Meeting adjourned.

Table 9.3: List of the participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Abdul Maliku Thaufeeq	-	STELCO	755 0996	malik@stelco.com.mv
Mariyam Ali	-	STELCO	-	Mariyam.Ali@stelco.com.mv
Hussain Ageel Naseer	-	STELCO	-	Hussain.AgeelNaseer@stelco.com.mv

Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.3 Meeting with Maldives Civil Aviation Authority (MCAA)

The meeting was joined by the environmental consultant, participants from MCAA and relevant staff from the PMU MECC&T. Main points discussed in the meeting are given below.

- The consultant briefed on the proposed project and key project activities to be undertaken.
- MCAA: Participants of MCAA informed that they have been informed about the project and have gone through the glare assessment report submitted to them. As per the existing information available regarding the project, they have no major issue. However, MCAA notified that any unforeseen issue faced during the operation of the project that affects the operation of aircrafts must be attended immediately, including any glare/reflection issue from the installed PV modules. MCAA inquired about the exact project dates and the details of project machineries, especially the height of the machines to be used.
- Environmental Consultant: Explained that the exact project dates and specific details of the machines were not clear at the time of the meeting. However, agreed to provide them at earliest after discussing the contractor.
- Hamdhaan from MECC&T: Inquired about the procedure for raising issues by the airline operators when there is an issue, especially if the operators face an issue from the proposed project.
- MCAA: Mentioned that airline operators will raise the issue with MACL following which MACL will inform the MCAA. MCAA will discuss the issue with relevant authorities and attend to it.
- Meeting was concluded with the highlights of above-mentioned points.

Table 9.4: List of the participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Fathimath Ramiza	Director Air Navigation and Aerodromes	MCAA	-	ramiza@caa.gov.mv
Hassan Samaah	Aerodrome Inspector	MCAA	-	-
Minvaal Ibrahim	Aerodrome Inspector	MCAA	765 3717	minvaal@caa.com.mv

Mariyam Anoosha	Asst, Aerodrome Inspector	MCAA	-	-
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.4 Meeting with Maldives Police Service (MPS)

A meeting with MPS is conducted since the advice and assistance of traffic police will be required for the traffic management during the road closure. Additionally, MPS is expected to have laid their CCTV cables buried under the ground of the direct project area.

- The Environmental consultant briefed on the proposed project and key project activities to be undertaken.
- Environmental consultant: Inquired about the location of any CCTV network cables of MPS in the project area and the procedure for obtaining assistance of traffic police during the time of closing the road.
- MPS: Participants of MPS noted that it would be better for them to show the locations of the CCTV network lines in the site. Furthermore, for traffic management during construction period, the traffic police could be informed via phone and they will be ready to provide assistance. MPS further noted that for any restriction on traffic flow during the construction, it should also be informed to Ministry of Transport.
- Meeting was concluded.

Note: A site visit was made on 21st June 2021 with officials of MPS to located CCTV network lines of MPS in the project area.

Table 9.5: List of the participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Ibrahim Rasheed	Sub Inspector of Police, Technology Department	MPS	-	i.rasheed@police.gov.mv
Thalhath Ahmed	Sub Inspector of Police, Traffic Police	MPS	-	ta_5085@police.gov.mv
Hamman Hassan	Sergeant, Traffic Police	MPS	963 5272	hammanhassan88@gmail.com

Abdulla Hashmath	Seargeant, Technology Department	MPS	-	hashmath@police.gov.mv
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.5 Meeting with Maldives Airports Company Limited (MACL)

MACL is one of the most important stakeholders of the project. MACL is the company responsible for the operation and management of the Velana International Airport in Hulhule.

- The Environmental consultant briefed on the proposed project and key project activities to be undertaken.
- MACL: Participants of MACL inquired about the exact project date, duration, types and dimensions of the machineries to be used. Furthermore, requested to forward a detailed method statement of the project activities.
- Environmental Consultant: Construction period of the project will take around 4-6 months. However exact project start date, types and dimensions of the machineries to be used are not clear yet since the foundation design of the installation structures and transformers are not complete yet. Agreed to forward a detailed method statement of the project.
- Environmental Consultant: Further inquired about the maximum allowable height of the machines that can be operated in the project area in link road and Boashimaa Hingun without hindering the operation of the airport.
- MACL: Participants noted that the height depends on the distance from the runway. However, noted that a height of 15m will not be an issue as there are buildings which are at that height and even machineries having that height have been operated within the airport area while the airport is in operation. But, noted that the exact height of the machine to be used will be accessed based on location and distance to the runway. It was noted that the construction activities of Male' and Hulhumale bridge was managed while allowing the heavy machinery operation and operation of the airport as well.
- Hamdhaan from MECC&T: Inquired about the procedure followed in attending the issues raised by airline operators and pilots.
- MACL: Stated that pilots will inform the issues they face during operation to Air traffic Control Tower (ATC). All issues raised will be discussed with MCAA.
- MACL: Noted that it is important to complete the construction work at link section 1 and 5 at the earliest since the end of link section 5 is close to landing and/or take off area of the new international runway that will be open within few months' time and the end of link section 1 is close to the landing and/or take off area of the new water runway. These new runways are at their final stage of construction and will be operational within few months' time.
- Meeting adjourned.

Table 9.6: Participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Mohamed Sola	General Manager, Infrastructure Development	MACL	790 5154	mohamed.solah@macl.gov.mv
Ibrahim Hameed	Associate General Manager, ATS	MACL	773 9100	i.hameed@macl.gov.mv
Hussain Abdul Gadir	Asst. Manager	MACL	778 8745	Hussain.gadir@macl.gov.mv
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T & T	766 8606	hamdhaan.zuhair@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.6 Male' City Council (MCC)

Faced difficulties in arranging a meeting with MCC. The meeting was not attended by any of the councilors. Main points discussed are given below.

- The Environmental consultant briefed on the proposed project and key project activities to be undertaken.
- MCC: Noted that they have no issue regarding the project. However, noted that it is important to have an additional meeting with councilors, officials of MNPH&I and MPS to discuss about the project in detail.
- Environmental consultant: Noted that it is fine to have a meeting as identified. However, it is difficult to have a meeting with all 3 institutions together since having a meeting with a single institution takes days to completed. It was requested from MCC to send an email following the meeting to request for such a meeting so that it can be forward to the relevant institutions.

Table 9.7: Participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Mohamed Mabrook	Project Manager	MCC	786 9266	secretariat@malecity.gov.mv

9.7 Ministry of Transport and Civil Aviation (MT&CV)

It is under the mandate of Transport Ministry to ensure the safety of land, sea and air transportation of the Maldives and main an affordable transport connectivity within the country. Hence, information about the proposed project which is going to affect the land transportation between Male' and Hulhumale during the construction phase of the project is important to be shared with the Transport Ministry.

- The Environmental consultant briefed on the proposed project and key project activities to be undertaken.
- MT&CV: Noted that they have to issue in undertaking the project. Advised to take all necessary approvals, especially to obtain assistance of traffic police in case where road closure and traffic management is needed.
- Environmental consultant: Inquired whether any specific policy has to be followed or any approval has to be obtained from MT&CV for road closure. Since MPS has noted that MT&CV must make a public announcement to inform the public regarding the traffic restrictions that will be faced during the construction period, it was inquired from MT&CV.
- MT&CV: Shameem noted that there is no such regulation or policy. However, advised to carry out the task after providing up to date information to the relevant authorities such as MPS and MT&CV.
- Meeting adjourned.

Table 9.8: Participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Ahmed Shameem	Director General	Ministry of Transport and Civil Aviation	777 4969	ahmed.shameem@transport.gov.mv
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.8 Director of Aviation Security Administration (DASA)

DASA manages and maintains the airport security. Airport Guards were required to check permits, air tickets and passports or permits of visitors and passengers who came to Hulhule or within the boundary of the airport security areas to be sure that they did not include undesirable elements. Main points discussed in the meeting with DASA are summarized below.

- The Environmental consultant briefed on the proposed project and key project activities to be undertaken.
- DASA: Roshan requested to clearly state the project dates, duration, types and dimensions of

the machineries to be used. Furthermore, requested to identify the distance between the PV Module structure and the security fence on the Boashimaa Hingun. He noted that as per the security regulation, no permanent structure will be allowed within a 10ft buffer area of the security fence. Similarly, unauthorized people, including the project staff are not allowed to be active within this buffer area.

- Environmental Consultant: Stated that a detailed project methodology, including the types and dimensions of the heavy machinery to be used are not made for the project yet. However, agreed to forward a detailed project method statement at the earliest. Noted that the distance between the installed PVmodule structure and the security fence in Boashimaa Hingun will be 3014mm. However, noted that it will not be possible to keep the 10ft buffer area free from the activities and movement of project staff during construction activities, whereas immovable items will not be kept in the area.
- Hamdhaan from MECC&T: Noted that relevant government instructions including MCAA, DASA and AVESCOM have been discussed at the early stage of the project and the project concept has been finalized after incorporating any requirements highlighted by these authorities.
- DASA: Roshan inquired about the project management and how it will be ensured that no project staff will impose a risk to the airport's security.
- Environmental Consultant and Hamdhaan: Noted that the project will be managed in the site by a qualified project manager. He will be assisted by a health and safety officer to maintain and ensure the adherence of project staff to safety regulations and ESMP. Furthermore, a supervisory staff of MECC&T will stay in site to supervise the work. Hence, the proposed project activities and team will not be a threat to airport's security.
- Meeting adjourned.

Table 9.9: Participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Roshan Mohamed	Sergeant	DASA	777 4969	roshan@avescom.gov.mv dasa@defence.gov.mv
Ibrahim Rasheed	Superintendent	AVESCOM	-	ibrahim@avsecom.gov.mv
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T & T	766 8606	hamdhaan.zuhair@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.9 Ministry of National Planning, Housing and Infrastructure (MoNPH&I)

MNPH&I is mandated with planning and undertaking the infrastructure development projects of the country. Despite our efforts, we were unable to arrange a meeting with MoNPH&I during the process of ESMP compilation. However, reference was made to a meeting held between MoNPH&I and MECC&T

on 9th February 2021 and the requirement and recommendations highlighted in a letter provided by MoNPH&I on 16th January 2021.

Main points highlighted by MoNPH&I in the letter (No: 471/438/2019/7).

- MoNPH&I: Noted that the PV modules and the installations structures must be modular enough to be easily removed at a low cost to attend any maintenance work of the rock boulder revetment on the eastern side of the link road.
- MoNPH&I: The design must allow the erection or fixation of road signs and cameras.
- MoNPH&I: The foundation design of the PV module installation structure and the base structure of the transformers should not undermine the nearby road or the revetment.
- MoNPH&I: The structural drawing set of the proposed project must be stamped by a certified local engineer.
- MoNPH&I: The project's preliminary design/concept must be approved by MoNPH&I before the production of detail design.
- MoNPH&I: Recommended to see the possibility of installing the PV modules on the western side of the link road since Ministry believes the eastern side a high-risk area.

Main points highlighted by MoNPH&I during the meeting with MECC&T on 9th February 2021. The said meeting was mainly held to get approval for the initial design/concept of the project as requested by MoNPH&I in their letter.

- MoNPH&I: Ms. Shanaa Farooq noted that there are no major issues of concern for the concepts from MoNPH&I.
- MECC&T: Hamdhaan requested for a written endorsement from MoNPHI for the concepts as a written request has been made by the Ministry of Environment on 18th January 2021.
- MoNPH&I: Ms. Shanaa agreed to provide a written endorsement as requested following which the meeting was adjourned.

Table 9.10: Participants of the meeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Aminath Hanaan Mohamed	Monitoring and Evaluation Officer	PMU, MECC&T	911 0414	aminath.hanaan@environment.gov.mv
Hassan Shiyam Mohamed	Legal Specialist	PMU, MECC&T	779 7014	hassan.shiyam@environment.gov.mv
Ahmed Zuhal Zaeem	Civil Engineer	PMU, MECC&T	795 8584	zuhalz@hotmail.com
Shaanaa Farooq	Director General	MoNPH&I	791 3342	shaana.farooq@planning.gov.mv
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MoECC& T	778 2539	Akram.waheed@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MoECC& T	775 3909	Nuzhath.ahmed@environment.gov.mv

9.10 Public Consultation in rooftop installation area

A public consultation was carried out on the project area (residential flats of Hulhumale') on 25th May 2021. As the time period coincided with COVID-19 pandemic restrictions, the consultation was carried out as per the HPA guidelines while maintaining social distance. No visits were made to the households, hence most of the participants were chosen randomly, from the residential area, asking politely to participate while they are outside their homes.

The following questions were asked from each interviewer, after providing a brief explanation of the project:

- Name, Contact, Flat residing, Age
- Their opinion about the project (solar energy)
- Concerns regarding the construction and operational phase of the project
- Recommendations

Main points highlighted by the participants were summarized below.

- Majority of the participants (over 90%) believe that adopting solar energy is environmentally beneficial. However, they have less information on how it would be reflected on their utility bills. In regard to this, participants stressed that it would be better if the client gives more information regarding on how these renewable energy methods can be beneficial to the overall public in an economic perspective.
- Among the people who were willing to participate, most of the youth (18-35) believed that generation more power by renewable methods would lessen the load on the engines of STELCO, hence, it would bring a permanent solution to the discontinuation of electricity from Hulhumale which had been frequent at times when the load is high. Furthermore, they highlighted that since the residing population of Hulhumale is increasing day by day, the overall demand for electricity would also increases proportionately. Hence any additional means of energy generation would lessen the issues currently faced which is mostly discontinuation of electricity at peak hours.
- Few people mentioned that there are already some solar panels that have been installed on the roofs of certain flats around 3 years back. However, there has been no reflection of that on their utility bills. Furthermore, they stressed that they have no idea or information regarding these solar panels and what are the purpose of these panels being installed on the rooftops of the housing flats.
- Participants recommended that prior to the installation, the contractor should inform the residents about the time of the project activities. It should be managed in a way that it gives the least disturbance to the public.
- Majority of the people strongly suggested that during the construction period, if there are any accidental damages to any of the nearby structure or property, the contractor should compensate and also recommended the use of safety methods to avoid any plausible dangers.
- Overall, most of the stakeholders are satisfied with the project and understand the environmental benefits of the project. However, very few understand the economical and social perspective and its benefits of the project.
- Meeting adjourned.

Table 9.11: Perticipants of the meeting

NAME	GENDER	AGE	FLAT NO.	CONTACT NO.
Ameen Ibrahim	M	21	131	752 7534
Aminath Jameel	F	48	117	763 2828

Laisa Nizar	F	19	119	750 1313
Aminath Sana	F	34	130	782 8209
Zain	M	20	135	993 1199
Ahmed Aban	M	29	104	773 1148
Sira Waheed	M	38	94	964 4440
Ahmed Najaah	M	27	92	988 0106
Ahmed Riyaz	M	43	88	784 4460
Asrar	F	46	97	787 7148
Ahmed Saeed	M	41	98	779 7649
Wisam	M	37	127	(Did not agree to share the contact)
Zahaan Zahir	M	23	129	(Did not agree to share the contact)
Aminath Anusha	F	31	103	914 3643
Mariyam Ibrahim	F	56	102	789 4460

9.11 Meeting with DHIRAAGU and Ooredoo

Dhiraagu and Ooredoo are the only 2 telecommunications companies providing service in Maldives. It is expected that they might have laid cables along the link road and Boashimaa Hingun.

Despite the request for a meeting, no official meeting was arranged with any of these companies. However, Ooredoo informed that they do not have any cable laid in the proposed project area. Their closest cable to the project area would be a submarine cable laid in the sea on the eastern side of Hulhule. We were not able to obtain any information regarding the cables of Dhiraagu during the time of report compilation.

9.12 Meeting with the operators of Air Taxi

A meeting was held with the operator of the Air Taxi. Main points discussed are included below.

- The Environmental consultant briefed on the proposed project and key project activities to be undertaken after which opened the meeting for the comments of the participants.
- Air Taxi Operators: Inquired about the height of the project machinery, duration of the project and glare assessments undertaken for the project.
- Environmental Consultant: Noted that the construction stage of the project will take about 4-6 months for completion. Details of the heavy machinery to be used for the project will be clear at a later stage.
- MECC&T: Hamdhaan noted that glare assessment report and other relevant information about the project have been shared with the aviation regulator (MCAA) who will be sharing it with other relevant parties. Since MCAA is the regulatory body, it would give rise to less complication if information is shared via MCAA.
- No major issue was raised by the participants.
- Meeting was adjourned.

Table 9.12: Perticipants of th emeeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Ahmed Azmee	Asst. Manager, Technical Operations	Trans Maldivian Airways	-	A.Azmee@transmaldivian.com
Indra Bhushan Chauhan	Quality Assurance Manager	Trans Maldivian Airways	-	Indra.Bhushan@transmaldivian.com
Mohamed Yasir Jauhary	Deputy Chief Pilot	Trans Maldivian Airways	-	Yasir.Jauhary@transmaldivian.com
Adam Haneef	Safety and Security Manager	TMA	-	Haneef@transmaldivian.com
Ismail Amra Umar	GM, Safety and Security	Island Aviation Services Limited	-	amrah@iasl.aero
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv

9.13 An additional meeting with MACL, AVESCOM and DASA

An additional consultation meeting was held with the named 3 key stakeholders for their request. Main points discussed are given below.

- AVESCOM & DASA: Made the following requests and statements;
  - Stated that a 10ft area from airport's security fence is a security zoon that must be kept clear from all sorts of activities at all times.
  - Requested to ensure the exact distance between the installed PV modules and the security fence in Boashimaa Hingun, also the height clearance beneath the installed PV modules.
  - Requested that the project activities must take place after a surveillance system has been installed in the area to monitor the activities.
  - Requested to state how the project activities will be managed in the area to ensure safety.
- Environmental Consultant and MECC&T: Made the following comments;
  - The 10ft security zone is currently an open public space where anyone can anonymously enter and leave at all times.

- With reference to the project drawing set, the requested distances were made clear.
- Noted that it is not possible to carry out the project activities without entering the stated 10ft area. However, agreed to keep the area free of any immovable item.
- It cannot be agreed and would cause conflict of interest for the contractor to establish and operate a surveillance system to monitor their activities.
- Noted that it must be the responsibility of the party maintaining the airport's security to establish such a system if it is required.
- Requested to know how the security of the area is maintained currently. How did the security of the area was maintained during the Male' – Hulhumale bridge construction and the cable project of STELCO which was still ongoing? Highlighting the above points, it was noted that it is important to approve the activities of the proposed project based on how the security of the area was maintained during the named projects.
- Noted that the project will be managed by a site manager as per the project schedule. He will be assisted in the site by a health and safety officer to ensure the safety of the site staff and activities. Furthermore, it was noted that a staff of MECC&T will be present in the site for supervising the work. Hence, even if the contractor is a foreigner, project activities will be managed and updated on time.

- AVESCOM & DASA: Made the following comments;
  - MACL must be responsible for establishing a system to ensure the security of the area.
  - MACL must ensure the activities of the proposed project can be monitored by using its available facilities and services.
- MACL made the following comments;
  - Establishment of a surveillance system to cover all the security zones of the airport is underway.
  - Currently, the system for maintaining the security is that a staff would visit the areas where the construction activities take place and monitor the area. However, noted that the proposed project area in Boashimaa Hingun is too far for maintaining the security by daily visits.
- Everyone agreed that a surveillance system cannot be established to monitor the security of the project area for the proposed project, neither it should be made a component of the project to establish such a system prior to the commencement of project activities.

Table 9.13: Perticipants of th emeeting

NAME	DESIGNATION	OFFICE	PHONE	E-MAIL
Firdous Hussain	Environmental Consultant	Foresight Surveyors	797 3873	firdous@foresightsurveyors.com
Ahmed Faseel	-	MACL	-	Ahmed.faseel@macl.aero
Masuood Hassan	-	Ministry of Defense	-	Masuood.hassan@defence.gov.mv
Abdulla Mufeed	-	MACL	-	Abdulla.mufeed@macl.aero
Ibrahim Hameed	Associate General Manager, ATS	MACL	-	i.hameed@macl.aero

Ibrahim Rasheed Abdulla	Superintendent	AVESCOM	-	ibrahim@avsecom.gov.mv
Hassan Bushry	-	AVESCOM		hassan.bushry@avsecom.gov.mv
Mohamed Hamdhaan Zuhair	Environment and Social Safeguard Specialist	PMU, MECC&T	766 8606	hamdhaan.zuhair@environment.gov.mv
Nuzhath Ahmed	Project Coordinator	PMU, MECC&T	775 3909	Nuzhath.ahmed@environment.gov.mv
Akram Waheed	Specialist Coordinator	PMU, MECC&T	778 2539	Akram.waheed@environment.gov.mv

9.14 Major issues highlighted during the stakeholder meetings and the response of the client

The below given table highlights the major issues and concerns highlighted by the stakeholders, during the meetings and the comments given by the client for the issues.

Table 9.14: Comments made to the key issues highlighted in stakeholder meetings

INSTITUTION	CONCERN	COMMENTS
HDC	Requested to fix lights beneath the PV modules in link road to light up the area during night time.	It was agreed by the client to bring the requested change in the link road sections. However, fixation of lights beneath the PV modules in the island link section has not been finalized at the time of the report.
STELCO	No energy storage facility such as the inclusion of batter.	As per the client, the design is based on the requirement of WB and GoM at the time. Hence, add on services such as battery storage facility is not included.
	Construction activities must be carried out by having strict and adequate safety measures to safeguard the high voltage electric cables buried about 1m below the ground, between the existing pavement and the revetment or the seawall in link road and Boashimaa Hingun.	Noted.

MCAA, MACL, AVESCOM, MPS	Requested for a detailed project methodology with road closer and project machinery schedule. Project Machinery schedule is expected to include the dimensions of the proposed machines to be used.	Shared on 1st July 2021. After the sharing the information, following requests for further clarifications from AVESCOM and MCAA were answered on 6th July 2021. MCAA further requested to provide the schedule for link section 1, 5 and south side. This information will be finalized just prior to the beginning of the construction activity since it has to be decided based on many other factors. Hence, it will be shared with the relevant stakeholders prior to the beginning of construction.
MCAA	Any issue which affects the airport operation, including glare issue of the PV modules and any other, must be rectified at any stage of the project.	Noted.
DASA & AVESCOM	Highly concerned about working within 10ft buffer area of the security fence in Boashimaa Hingun. As per DASA, this space is supposed to be kept free of any activity and item for security reasons.	On behalf of the client, Environmental Consultant and MECC&T noted that it is not possible to carry out construction activities in the area without entering the 10ft buffer area, however, immovable items will not be kept in the area. Construction site will be properly managed by the site manager. A health and safety officer will be in site to ensure the adherence of site activity and staff movement to the set security policies and recommendations in the ESMP. It was noted that even now the 10ft buffer area is freely accessible to anyone from the public without any restrictions. Hence, the project activities which will be properly managed where the information about the workers will be documented will not impose any additional risk to the security of the airport.
	As per the standard procedure, DASA noted that the 10ft buffer area from the security fence in Boashimaa Hingun must be continuously monitored during the project activities. Hence, requested to build such a service system to maintain the security of the area during construction.	On behalf of the client, Environmental Consultant and MECC&T noted that various construction activities have taken place in the area before the proposed project even. Installation of a surveillance system cannot be made part of the proposed project. It has to be installed and managed by MACL as the operator of the airport.

10 GRIVANCE REDRESS MECHANISM

10.1 Introduction

In order to maintain an effective and an efficient work force, a complete Grievance Redress Mechanism (GRM) is developed and followed in the project. The GRM will help to build confidence of the community members in the project, creating a productive and a healthy relationship between the relevant parties. It will ensure equitable and fair distribution of benefits and risks among the parties. Furthermore, it will help to avoid unforeseen project delays and cost increases by preventing any possible adverse impacts of the project on stakeholders, general public and the project workforce.

As much as the benefits the it provides to the project, stakeholders and the individuals involved in the project are benefited from a functioning GRM. It provides a cost-effective method to report the grievances and complaints by establishing a trusted forum and a structure to report with dignity and confidence. The GRM will ensure fair hearing and remedy through negotiation and discussion.

10.2 Potential scenarios of grievances

A wide range of discussions have been conducted with the key stakeholders of the project during the course of this report. No party is against the implementation of the project. The two major concerns identified during the stakeholder meetings, regarding the project are the difficulties it would cause by blocking the traffic on the main road between Male' and Hulhumale during the construction phase and a possible glare or a reflective issue that might arise from the installed solar panels during the operational stage of the project. Hence, as a precautionary measure, contingency plans are recommended to be in place to handle any possible issue from the most expected project scenarios prior to the beginning of the project.

Additionally, there exist the chances of grievances from the members of the project team, which could range from project related injuries, overtime work, etc. Therefore, the following GRM has been developed and proposed for the project.

Table 10.1: Grievance Redress mechanism (GRM) developed for the stakeholders

Tiers of Grievance	Nodal Person for Contact	Contacts, communication and other facilitation by the project	Timeframe to address grievance
First tier: ENSYS CO., LTD (Contractor)	Project Manager or a person assigned by the Project Manager for the purpose	Contractor should provide the following details of the assigned person and make it available to all the stakeholders named in the report under stakeholder consultation prior to the beginning of the construction stage of the project. This information should be updated on time if they are ever changed during the course of the project. However, it is recommended that they are never changed during the duration of the project. • Name and designation of the contact person • A hotline number and an email address • Any specific information or a detail that the contractor wishes to obtain together with the submitted grievance (if there is) Any individual may raise or submit a grievance in writing, via the designated hotline or email address, identifying the nature of the grievance. However, in case	7 calendar days for review and make a decision regarding the grievance.

		where the grievance is submitted via the hotline number, the contractor must record it in writing, identifying the aggrieved. A written confirmation of the acknowledgement of the grievance should be given to the aggrieved party once the grievance is lodged in writing. The grievance should be registered in the contractor's records and all received grievances (whether major or minor) should be shared and communicated with the PMU of MECC&T and the project section of HDC. They should be shared in a tabulated excel sheet where the history and decisions taken for the past grievances are also included. In case of emergency issues such as any damage to utility lines, fire, damage to property, water leakage, severe injury, breach of aviation security etc, the grievance should be attended immediately, within 24 hours. For all other issues it should be attended at least within 02 calendar days. The grievances should be resolved within 7 calendar days and the decision made should be formally communicated with the relevant person/authority. The complaints should be resolved internally by the contractor, or with joint discussion between the aggrieved party and/or with MECC&T AND HDC or with a combination of discussions with all these parties. All outcomes should be shared with the HDC and MECC&T. The aggrieved party should acknowledge the decision made within a period of 10 calendar days. If the aggrieved party fails to do so, then the decision will be considered as accepted.	
Second Tier: Project Section of HDC	A person assigned for the project or Project Section (PS)	Where the aggrieved party is not happy with the response from the contractor, the party may lodge the grievance with the second tier who is Project Section of HDC. All the grievances received to HDC will be forwarded to project section by HDC. A person will be assigned in the PS to address the grievances.	10 working days

		Aggrieved party should submit all the documents (letters, any complaint form for Tier, decision receipt) along with the complaint letter/form for Tier2 The PS will review the lodged complaint, to see if the matter is related to ASPIRE project. If it is related to the project, the lodged complaint should be officially accepted by sending a written acknowledgement letter to the aggrieved party. If the matter is related to the project, PS will discuss internally on the way to move forward with the matter. Depending on the nature of the matter, PS may visit the site to resolve it, or arrange a meeting with relevant parties. For any such meeting, a prior notification will be sent to the aggrieved party, explaining the nature of meeting, venue, time and date specified. The PS will ensure that there is no cost bared by the aggrieved party due to the grievance mechanism at the second tier. PS will notify the grievance party on the decision made by a letter along with the receipt within 10 working days, The aggrieved party should notify the acceptance within 10 calendar days. If the grievance party fails to do so, the decision will be deemed as accepted All the documents and forms should be archived in the PS records.	
Third Tier: Project Management Unit (PMU) of Ministry of Environment, Climate Change and Technology	For ASPIRE Projects, the Ministry of Environment, Climate Change and Technology will forward all the grievances to Project Management Unit (PMU)	Where the aggrieved party is not happy with the response from HDC, the party may lodge the grievance with the third tier who is Project Management Unit (PMU) of Ministry of Environment, Climate Change and Technology All the grievances received will be forwarded to PMU unit by the Ministry of Environment. A person will be assigned in the PMU to address the grievances. Aggrieved party should submit all the documents (letters, any complaint form for Tier, decision receipt) along with the complaint form/letter for Tier3 The PMU unit will review the lodged complaint, to see if the matter is related to ASPIRE project. If it is related to the project, the lodged complaint should be officially	10 working days

		accepted by sending a written acknowledgement letter to the aggrieved party. If the matter is related to the project, PMU will discuss internally on the way to move forward with the matter. Depending on the nature of the matter, PMU may visit the site to resolve it, or arrange a meeting with relevant parties. For any such meeting, a prior notification will be sent to the aggrieved party, explaining the nature of meeting, venue, time and date specified. The PMU will ensure that there is no cost bared by the aggrieved party due to the grievance mechanism at the second tier. PMU will notify the grievance party on the decision made by a letter along with the receipt within 10 working days. The aggrieved party should notify the acceptance within 10 calendar days. If the aggrievance party fails to do so, the decision will be deemed as accepted If the decision made is not as to the satisfaction of aggrievance party and wishes to move further, it should be noted within 10 days in writing to Ministry of Environment, Climate Change and Technology All the documents and forms should be archived in the PMU records. Next tier would be to take the matter to Judiciary.	

Table 10.2: Grievance Redress mechanism (GRM) developed for the project staff

Tiers of Grievance	**Nodal Person for Contact**	**Contacts, communication and other facilitation by the project**	**Timeframe to address grievance**
First tier: Contractor	Project Manager or a person assigned by the Project Manager for the purpose	Each and every project staff must be made aware of the GRM prior to the beginning of the construction phase of the project. They should be thoroughly explained on the procedures to be taken in any cases of grievance. Grievances must be registered via the designated complaint form. Assistance must be provided by the site manager or the assigned nodal person for those who have difficulties in filling the form. After reviewing the	7 calendar days for review and make a decision regarding the grievance.

		lodged grievance, if it is relevant to the project activities, acknowledgement of the receipt of the grievance must be confirmed by the contractor in writing. The Project Management Unit (PMU) of the contractor will discuss internally on the way to move forward with the matter. Depending on the nature of the matter, PMU may arrange a meeting with relevant parties. For any such meeting, a prior notification will be sent to the aggrieved party, explaining the nature of meeting, venue, time and date specified A decision will be made after review of the matter within the specified timeframe. The decision of the lodged matter should be notified via a letter to the aggrieved party. The aggrieved party should acknowledge the decision made within a period of 7 calendar days. If the aggrieved party fails to do so, then the decision will be considered as accepted. The complaints should be registered and archived within the project documents. These documents should be readily accessible to the PMU if needed.	
Second Tier: Project Management Unit (PMU) of Ministry of Environment, Climate Change and Technology	For ASPIRE Projects, the Ministry of Environment, Climate Change and Technology will forward all the grievances to Project Management Unit (PMU)	Where the aggrieved staff is not happy with the response from the contractor, he or she may lodge the grievance with the second tier who is Project Management Unit (PMU) of Ministry of Environment, Climate Change and Technology All the grievances received will be forwarded to PMU unit by the Ministry of Environment. A person will be assigned in the PMU to address the grievances. Aggrieved party should submit all the documents (letters, any complaint form for Tier, decision receipt) along with the complaint form/letter for Tier2) The PMU unit will review the lodged complaint, to see if the matter is related to ASPIRE project. If it is related to the project, the lodged complaint should be officially accepted by sending a written acknowledgement letter to the aggrieved party. If the matter is related to the project, PMU will discuss the matter with the contractor. Depending on the nature of the matter, PMU may visit the site to resolve it, or	

		arrange a meeting with relevant parties. For any such meeting, a prior notification will be sent to the aggrieved party, explaining the nature of meeting, venue, time and date specified. The PMU will ensure that there is no cost bared by the aggrieved staff due to the grievance mechanism at the second tier. PMU will notify the aggrieved person on the decision made by a letter along with the receipt within 10 working days. The aggrieved person should notify the acceptance within 10 calendar days. If the aggrievance staff fails to do so, the decision will be deemed as accepted If the decision made is not as to the satisfaction of aggrieved staff and wishes to move further, it should be noted within 10 days in writing to Ministry of Environment, Climate Change and Technology All the documents and forms should be archived in the PMU records. Next tier would be to take the matter to Judiciary.	

10.3 World Bank's Grievance Procedure

Any party who believes that they have been adversely affected by a project supported by the World Bank has the right to directly lodge a complaint to the Bank through the Bank's Grievance Redress Service (GRS). A complaint can be submitted to the Bank GRS through the following means:

- By using the online platform at:
  - https://wbgcmsgrs.powerappsportals.com/en-US/new-complaint/
- By email: grievances@worldbank.org
- By contacting the World Bank Maldives Country Office at:
  - Hotel Jen 4th Floor, Ameer Ahmed Magu
  - Male', Maldives. Tel: +9603005289
  - email:infomaldives@worldbank.org

  The complaint must clearly include or identify the following;
  - Adverse impact(s) caused by the project,
  - Complain should be supported by available documentation and evidence,
  - A point of contact for communications.

11 SUMMARY OF ALL TRAINING RECOMENDATIONS

11.1 Introduction

In order to implement the ESMP and adhere to the recommendations stated in the report, specific and general training have to be undertaken prior to the commencement of the project, during the construction and operational phase of the project as well. Starting from general health and safety trainings to specific technical training are required along the course of the proposed project.

Table 11.1: Training recommendations to strengthen the institution

Institutional Strengthening Activity	**Positions**	**Scheduling**	**Responsibilities**	**Cost of Estimates/USD**
Hire staff	Health and Safety Officer	Hired 1-2 weeks prior to the beginning of the construction period. Must be contracted to at least for the duration of the construction period.	• Directly report to the project manager. • He may or may not be site based, however, the vested duties must be taken care of. • Ensure that the project activities comply with the approved ESMP and relevant laws and regulations. • Ensure that environment monitoring is carried out and significant environmental impacts are properly managed. • Immediately inform the project manager if any of the impact is not properly mitigated. • Prepare documents and environmental reports to be submitted to the relevant authorities. • Ensure the health and social wellbeing of the project staff are maintained. • Ensure that project staff maintain a healthy life style. • Ensure that specific measures as highlighted in the report, by HPA and related government authorities are taken to stop the spread of vector-borne dieses such as covid. • Ensure that arrangements are in place to attend staff in case of health emergency. • First point of contact for GRM from client's or contractor's side. • Ensure that all site staff are provided with work specific PPE. • Apart from issues submitted under GRM, maintain a record of site incidents, whether minor or major. An incident could be an injury to a site staff during site work, a traffic accident due to site work, damage to a nearby property or structure, fire incident etc. • Maintain a record of all work permits and agreements of the staff.	5,000.0 per month

	Technicians to maintain the Solar grid	Must be hired during the operational phase of the project. Since STELCO would take over the project after 15 years of operation by the Ensys, these staff must be hired through STELCO. They can be existing staff of STELCO even. A minimum 2 staff must be trained.	• Work together with Ensys team during their operational period and learn the operation, maintenance and troubleshooting the system. • Carry out maintenance work of the system when required. • Must be able to remove the PV modules and install them back if MoNPH&I require them to be removed to carry out any repair work of the rock boyulder revetment on the eastern side of the link road. • Advice and provide assistance to the policy makers to develop the renewable energy production industry in Maldives.	1,700 per head per month

Table 11.2: Training recommendations as part of capacity building of staff and related stakeholders

Training Activity	Participants	Types of Training	Content (Modules, etc)	Scheduling	Cost of Estimates/USD
Health and Safety Trainings	All the site staff	Induction training	• Staff's code of conduct • Emergency site evacuation plan • GRM policy • Emergency contact numbers such as, fire, traffic police, ambulance etc. • Information on Occupational Health and Safety (OHS) relevant to the work • Number, dates and information on toolbox talks, sessions • Information on ESMP requirements and covid 19 special consideration in Civil work contracts • Usage of fire extinguishers	• Prior to the commencement of the construction work. • Every time a new staff or a group of staff join the team.	1,000.0 per training
		Basic First Aid	• Attending an injured staff • Information on the medicines and items available in the first aid box available in the site	• Prior to the commencement of the construction work. • Every time a new staff or a group of staff join the team.	1,000.0 per training to hire a training expert
Drills	All the site staff	Induction training	• Fire emergency drills • Emergency site evacuation drills	• Prior to the commencement of the construction work. • Every time a new staff or a group of staff join the team.	1,000 per training

Weekly sessions	All the site staff	Toolbox sessions	• Provide information and stress on precautionary measures, especially based on any past incident in the site, if any.	• Weekly	Nil (No additional cost is required)
Operational and Maintenance of Solar PV System	Operational staff (staff of Ensys, STELCO, MECC&T	System operation	• Information on each and every component of the system and their specific function. • Specifications and requirements of the system. • Most common issues faced by Solar Systems. • Technical knowledge and practical experience on how to change components, modules, if required and carrying out maintenance work. • Troubleshooting the system.	• Daily or weekly during the operation until the staff have been fully trained. • Once fully trained, they must be included in the operation team of Ensys occasionally so that they will gain more experience and retain what they have lerned.	Nil (No additional cost is required)

12 CONTINGENCY PLAN

12.1 Introduction

Although the probable impacts have been estimated based on site specific survey, studies, similar projects and consultant's experience, a contingency plan must exist to attend any unforeseen circumstances. A contingency plan will facilitate the system to return back to its original state (whether construction or operation) under unfavorable circumstances.

12.2 Performance related issues

The envisaged adverse environmental impacts of the project have been predicted to be within certain limit. In any case if these impacts are experienced at a greater extent compared to the predicted or estimated threshold levels, the project would lead to unforeseen circumstances. Under such circumstances, either the project activity (whether construction or operational) will be temporarily stopped until the impact has been mitigated to the predicted extent or an alternative solution has been sough through the responsible authorities.

12.3 Risk of natural hazards

Together with site surveys, an assessment on natural hazard vulnerability has been made at the design stage of the project. The project has been designed to withstand in a harsh coastal environment that would typically be experienced in Maldivian environment. The client would attend to any shortcomings faced and maintain the production of energy to the total capacity of the project during the 15 years' period, as per the contract terms. However, any unforeseen natural event that has not been covered in the contract will be solved via consultations with MECC&T and relevant authorities.

13 MONITORING AND REPORTING PLAN

13.1 Introduction

It is highly important to undertake the given monitoring programe to compare those impacts predicted in this report against that of the actual impacts that take place while the physical work is going on. Such monitoring programs will help for better environmental decision making and predicting possible impacts of similar future projects. It will enhance the management of environmental matters in a synchronized manner.

Monitoring will be undertaken in all stages of the project including designing phase, pre-construction phase, construction phase and operational phase.

13.2 Monitoring cost

Other than for very few items, monitoring cost can be managed through the project budget, especially with the presence of a health and safety officer in the site, measurement of parameters can be carried out without the need for a survey team. The cost represents the estimated cost of the component if it is to be carried out separate from the project.

13.3 Monitoring Report

A monitoring report has to be compiled at the end of each month during construction period and annually during operation period. Hence, there should be a monitoring report submitted to EPA at every month during construction and annually for the years highlighted in the plan. Additionally, those noted to be monitored daily and weekly should be documented and kept ready to be shared with any relevant authority if requested. They should be included in the monthly monitoring report submitted to MECC&T and EPA. There will be 7 monthly monitoring reports since the construction activity of the project will last for 7 months.

For the operation phase monitoring program, a report should be submitted to EPA MECC&T for every year until 5 years, starting from the time when the system was brought into operation. Hence, 5 reports will be compiled during the operation stage of the project. The monitoring report should be compiled by a certified environmental consultant. It should include all baseline data. It should be submitted to EPA and all relevant authorities.

The report can follow the below given structure, though not limited to;

- Cover page with the name of the project and consultant
- Introduction
- Details of the site at the time of survey
- Data collection and processing methods
- Data Analysis and comparison (infographics showing the comparing of all data, starting from EIA baseline data should be presented in the report)
- Quality control measures
- Limitations and sampling frequency
- Conclusion and recommendation

Table 13.1: Monitoring plan

Proposed Mitigation Measure	Parameters to be monitored	Location	Measurements (method and equipment)	Frequency of Measurement	Responsibilities (review and reporting)	Cost/USD
Detailed design and Planning Phase						
Incorporate the necessary regulatory and institutional requirements into the design.	Comments for the final drawing set from the respective institutions, especially MoNPH&I	Location 1 and 2	Submit the final drawing set to MECC&T, MoNPH&I and HDC	Once or as required during design phase	Implementation and reporting by Ensys, Review by MECC&T and EPA	300.0 (once)
Approve the final engineering drawing set by certified engineers, followed by licensed local engineers (as instructed by MoNPH&I).	Approved engineering drawing set by certified engineers Approved engineering drawing set by local engineers as requested by MoNPH&I	Location 1 and 2	Submit the final drawing set to MECC&T, MoNPH&I and HDC	Once or as required during design phase	Implementation and reporting by Ensys, Review by MECC&T	2,140.0 (once)
Approve the ESMP from EPA and WBG.	Approved ESMP	-	Submit the final ESMP to EPA and WB.	-	Implementation by Ensys, Review by MECC&T	10,250.0 (once)
Conduct a health screen of project staff prior to recruitment and ensure a valid work permit visa is present.	Identify vaccinated workers. A worker that falls within the high risk category for COVID19 A worker that has been made contact with a COVID19 positive case within the last 2 weeks	-	Identifying the past/history of staff through interview and via document evidence	Once and weekly in toolbox sessions	Implementation and reporting by Ensys, Review by MECC&T and EPA	1,850.0 (once)

	A resident of house put under monitoring or quarantine due to COVID19					
Hiring project staff through fair selection	Everyone must have a valid employment agreement. Everyone foreign worker must have a valid work permit to work in Maldives. Every worker must be over 18 years of age. Workers must be selected via a fair merit-based selection procedure. Staff accommodation must be as per section 3.8.8. Every worker must be informed of the code of conduct and related staff policies at the time of employment.	-	Interview, visual assessment and via document evidence	Once during hiring the worker	Implementation and reporting by Ensys, Review by MECC&T	1,850.0 (once)
Pre-construction phase – Site preparation						
Update the construction, machinery and road closing schedules once all approvals have been obtained and pass the	Updated work, road closure, machinery and manpower schedule	-	Updating schedules (documentation)	Once (Inception meeting)	Implementation and reporting by Ensys, Review by MECC&T	450.0 (once)

information to all key stakeholders including the general public.						
Publish stakeholder GRM on a public forum such as local news.	Public announcement	-	Announcement in a public forum such as social media, local news etc	Daily, 1 week before construction	Implementation and reporting by Ensys, Review by MECC&T	100.0 per announcement
Employment of health and safety officer to ensure the implementation of the recommendations in ESMP.	Implementation of ESMP	-	Incorporate ESMP in project management schedule	Every day during the project	Implementation and reporting by Ensys, Review by MECC&T	1,500.0 per month
Work place safety measures	Presence of boundary Fence, construction sign boards, fire extinguishers, first aid kit and emergency response plan	Project area 1, 2 and 3	Fencing the project sites	Once before the construction	Implementation and reporting by Ensys, Review by MECC&T	30,325.0 (once)
	Safety net around the edge of roof	Project area 3	Erection of safety net	Once before the construction	Implementation and reporting by Ensys, Review by MECC&T	3,250.0 (once)
Maintaining the airport's security zone	Presence of immovable items and unrelated people	10ft from the security fence in Boashimaa Hingun	Visual inspection and guidance	Daily or as required	Implementation and reporting by Ensys, Review by MACL	500.0 (monthly)
Stakeholder engagement meeting	Main issues discussed, Meeting minutes	-	Holding the meetings	Once before the construction	Implementation and reporting by Ensys, Review by MECC&T	50.0 (once)
Minimizing accidents in work place	Operator license, vehicle maintenance document	-	Availability of documents	Once before the construction	Implementation and reporting by Ensys, Review by MECC&T	50.0 (once)

Inception meeting for workers	Staff orientation activities	Project area 1, 2 and 3	interview and via document evidence	Once before the construction	Implementation and reporting by Ensys, Review by MECC&T	600.0 (once)
Pass project specific information to the residents of the buildings including schedule	Awareness of the residents Grievance of residents	Project area 2	Interview	Once before the construction	Implementation and reporting by Ensys, Review by MECC&T	50.0 (once)
Construction phase						
Use of regularly maintained machinery	Noise and air pollution	Project area 1,2 & 3	Digital sound and air quality meter	Monthly	Implementation and reporting by Ensys, Review by MECC&T	100.0 (monthly)
Minimizing ground vibration	Vibration	Project area-1, during foundation work	By using a Vibration meter or visual assessment	Daily during foundation work	Implementation and reporting by Ensys, Review by MECC&T	50.0 (daily)
Following the road closure schedule	Adherence to toad closure schedule	Project area-1	Visual inspection and daily work progress reports	Daily during mobilization, material loading and unloading	Implementation and reporting by Ensys, Review by MECC&T	20 (daily)
	Maintaining vehicle flow along the road (Hulhumale to Male' link road)	Project area-1	Visual inspection	Daily during mobilization, material loading and unloading	Implementation and reporting by Ensys, Review by MECC&T and EPA	20 (daily)
Monitoring ground water contamination	Oil leakage	Project area-1, 2 & 3	Visual inspection and photographic evidence	Monthly and during machinery refiling	Implementation and reporting by Ensys, Review by MECC&T and EPA	20 (daily)

Maintaining the safety of underground utility cables	Damages to utility line	Project area-1	Visual inspection during underground activities and by using cable detectors	Daily during underground works	Implementation and reporting by Ensys, Review by MECC&T	20 (daily)
Health and safety of project staff	Workers knowledge on site safety policies, code of conduct, emergency response plan, PPE. Staff accommodation must be as per section 3.8.8. Every worker must be informed of the code of conduct and related staff policies at the time of employment. Staff grievance	Project site 1, 2, 3 & staff accommodation units	Visual inspection and through interview or weekly toolbox meeting	Weekly	Implementation and reporting by Ensys, Review by MECC&T	100.0 per week
Stakeholder engagement meeting	Main issues discussed & meeting minutes of the previous meetings. Main incidents occurred during the past weeks and actions taken to resolve them. Details of the stakeholder grievances	Project area1 & 2	Holding meetings	Weekly during first month and fortnightly during the rest of the months	Implementation and reporting by Ensys, Review by MECC&T	100.0 per week

	received and their details.					
Operational phase						
Adjusting the angles of the installed panel if any glare issue is reported by MCAA.	Contingency plan	Project area-1	Adjusting the panels	Once	Implementation and reporting by Ensys, Review by MECC&T	Approximately 45,000.0 (once)
Power generation	Amount of power generated	Project area 1 and 2	Via document /Meeting	Monthly for 5 years	Implementation and reporting by Ensys, Review by MECC&T	100.0 (monthly)
Any issues on the roof of the building where roof panels are installed	Water leaks, excessive noise etc	Project area 2	Via interviews with residents of the buildings	In every 3 months during the first year	Implementation and reporting by Ensys, Review by MECC&T and EPA	100.0 (monthly)
System Maintenance	Maintenance frequency and cost	Project area 1 and 2	Maintenance work	As required	Implementation and reporting by Ensys, Review by MECC&T and EPA	20,000.0 (once)
Human Resource Development and Handover process	Training programs conducted for STELCO staff	-	Undertaking trainings and handover process	Annually for 5 years during the last 5 years of the 15 year period	Implementation and reporting by Ensys, Review by MECC&T and STELCO	2000.0 (once)

14 ENVIRONMENT MANAGEMENT PLAN

14.1 Introduction

The aim of this Environmental Management Plan (EMP) is to measure, manage and mitigate adverse environmental impacts associated with the proposed development project. This EMP has been developed under the framework of Regulation 2012/R-27. This EMP will establish a framework for the project proponents to manage and control predicted impacts of the proposed project. It will include environmental monitoring, reporting, implementing measures to manage, avoid and mitigate negative impacts of the proposed project. It will further highlight the grievance redress mechanism for the project.

Additionally, the EMP will provide evidence of compliance to legislation, policies, guideline and requirements of EPA applicable to the proposed project.

14.2 Scoping of the EMP

14.2.1 Environmental impacts and Mitigation Measures

Major environmental impacts and relevant mitigation measures for the project have been given in the report.

14.2.2 EMP Management team

The below named parties are involved in undertaking the EMP of the project;

- Project Proponent – Ensys
- Contractor – Ensys
- Environmental Consultant - Foresight Surveyors Pvt Ltd completed the ESMP.
- Environmental Regulator - Environment Protection Agency (EPA)

14.2.3 Specific Roles of the Management Team

14.2.3.1 Project Proponent – Ensys

As the proponent of the project, Ensys is responsible for;

- Undertaking and executing all project related activities
- Monitoring project activities, allocating a dedicated staff to oversee and manage the project from proponent's side (Project Manager/Coordinator)
- Preparation of ESMP
- Submission of environmental monitoring report as required by EPA
- Ensure project activities are carried out in accordance to the EMP
- Report to Environmental Consultant any incidents beyond regular monitoring
- Record and rectify any environmental or health and safety incident immediately

14.2.3.2 Project Contractor – (Ensys)

The contractor of the project should be responsible for;

- Executing all project related activities as per the agreement with Project Proponent
- Monitoring project activities, allocating a dedicated staff to oversee and manage the project from contractor's side (Project Manager/Coordinator)
- Managing all project related activities and appoint a dedicated staff on site to oversee (Supervisor, Construction Foremen)
- Undertake project activities in accordance to EMP
- Report to Project Proponent any incidents beyond regular reporting
- Report any environmental or health and safety incident immediately to Project Proponent, rectify if possible

14.2.3.3 Environmental Consultant

- Preparation of EMP
- Monitoring of performance of project activities relative to the EMP
- Review the EMP to ensure desired outcomes are achieved
- Amendments to EMP as per results of reviews
- Preparation of Environmental Monitoring Report to the Proponent

14.2.4 Specific responsibilities of the key team members

14.2.4.1 Proponent's Project Manager/Coordinator

- Proponent must identify the project manager/coordinator of the project and provide his/her contact details to the key team members.
- Ensure that the project is carried out as per the approved design and EIA report.
- Must conduct daily/weekly update meetings and site visits.
- Must be experienced and familiar with the industry regulations.
- Ensure that environment monitoring reports and required project reports are shared with relevant authorities on time.
- Must be the main contact of the grievance redress mechanism.

14.2.4.2 Contractor's Project Manager/Coordinator

- Contractor must identify the project manager/coordinator of the project and provide his/her contact details to the key team members.
- Ensure that the project is carried out as per the approved design and EIA report.
- Ensure that project is carried out as per the relevant laws and regulations of Maldives.
- Ensure that project staff are provided with PPE equipment.
- Ensure that project staff are made aware of the relevant regulations, policies, standards and emergency evacuation plans of the site.
- Must consult with proponent and solve the project issues timely.
- Ensure that the site supervisor and sand pump operator sends daily work progress reports and incident reports.
- Advise and instruct the site supervisor and the sand pump operator.
- Ensure that Covid related mitigation measures are properly followed.
- Prepare reports and documents to be submitted to the client.

14.2.4.3 Contractor's Site supervisor

- Must report to the project manager directly.
- Ensure that the project is carried out as per the approved design and EIA report.
- Ensure that project staff are in good health and are provided with PPE equipment.
- Ensure that site machineries are properly maintained and operated by relevant personals.
- Update the contractor's project manager daily. Share daily progress reports with the project manager.
- Must maintain a site log where project milestones and incident reports are presented.
- Any issue/complain received must be immediately shared with project manager.
- Must plan the project work as per the instructions of the project manager.
- Ensure that project staff are familiar with emergency evacuation plans.
- Ensure that project site is fenced and relevant sign boards are erected to keep unauthorised people away.
- Must have a copy of the EIA report and follow the mitigation measures.

14.2.4.4 Environmental Consultant or Health, Safety, Social and Environmental Officer (appointed by the contractor)

- Directly report to the project manager.
- He may or may not be site based, however, the vested duties must be taken care of.
- Ensure that the project activities comply with the approved EIA and relevant laws and regulations.
- Ensure that environment monitoring is carried out and significant environmental impacts are properly managed.
- Immediately inform the project manager if any of the impact is not properly mitigated.
- Prepare documents and environmental reports to be submitted to the proponent.
- Ensure the health and social wellbeing of the project staff are maintained.
- Ensure that project staff maintain a healthy life style.
- Ensure that specific measures as highlighted by HPA and related government authorities are taken to stop the spread of vector-borne dieses such as covid.
- Ensure that arrangements are in place to attend staff in case of health emergency.

15 CONCLUSION

The current project proposed by the GoM under the ASPIRE program, it is aimed to develop the capacity to generate 5.6 Megawatt of electricity by a Solar Photovoltaic System in the Greater Male' region. The project is managed by MECC&T on behalf of the GoM. Within MECC&T, the Project Management Unit (PMU) will be responsible for the day-to-day implementation. The State Electric Company (STELCO) is envisaged to purchase renewable energy from private suppliers produced under ASIPRE program. The Maldives Energy Authority (MEA) establishes tariffs, issues guidelines and regulations to ensure the reliability, security of the grids, and also ensures the rights and obligations of consumers and service providers are safeguarded.

The project is awarded by the GoM on a long term contract of 15 years to Ensys Co., Ltd. Ensys will design, build, finance, own and operate the system for a period of 15 years after which the operation will be transferred to the GoM. Ensys is a foreign company based in Thailand, who has been providing services in the fields of electricity, power, energy, mechanical and environmental engineering for the past 25 years. On behalf of GoM, STELCO will take over the operation of the project after the Ensys.

The project is proposed on the pavement area of the link road between Male'-Hulhumale, southern side pavement area of Boashimaa Hinhun in Hulhumale and on roof top of 8 residential buildings in Hulhumale phase-1.

In pavement areas, the PV modules are fixed over an elevated roof structure in such a way that it covers and shades the pavement whereas in selected buildings, they will be fixed over the existing roof. The total length of the line along the pavement, including the island (empty space at the middle of the widest part of the link road) is 3,510m. The line will include a total of 10,691 panels with a capacity of 495 Wp by each link. Hence, the total installed capacity along the road side will be 5,292,045 Wp. Additional 720 panels will be installed on the roof top of the 8 selected residential buildings whose total capacity will be 356,400 Wp. Therefore, the installed total capacity under the proposed project would be 5,648,445 Wp.

There are very few and limited risk factors associated with this project that could possibly have both financial, environmental and fatal implications given that the mentioned safety attires are worn by the workers and safety measures are properly taken in handling machineries and hazardous items. The major social impact envisaged from the project is the restriction to vehicle movement due to part of road closure during the construction stage in link road and Boashimaa Hingun. Since the proposed project site is not seen to have any significant terrestrial life, no considerable risk on biodiversity has been identified. However, unavoidable and short-term risks such as waste generation and typical minor construction related impacts are associated with the construction stage of the project.

Effective impact mitigation measures are to be undertaken during the construction and operational works. The construction work of the project should be completed within the shortest possible time to mitigate the negative impacts due to construction. A schedule that highlights the times of road closure will be made public before the events of closing begins. Only a single lane out of the 2 lanes that allow traffic movant in one direction will be closed. Hence, even though slow and restricted, vehicle flow will still be maintained in link road and Boashimaa Hingun.

In order to ensure that the envisaged impacts are within the estimated limits, environment monitoring program outlined in this report has to be followed. Undertaking environment monitoring during construction and operational phase is of uttermost importance for ensuring that the expected impacts are controlled within acceptable limitations. Monitoring has been given for each and every impact identified. Furthermore, there is a proposed Grievance Redress Mechanism (GRM) for the public and stakeholders to raise any projected related issue.

Alternatives to the proposed project in terms of design, technology, and location has been discussed in the report including the 'no-project' option. Although 'No-project' option is not favoured, alternatives to the design have been discussed. Given the prevailing issue of land scarcity in greater Male' area and use of Solar PV system in Maldives, no favourable alternative has been suggested.

Stakeholder consultations were carried out with a large number of stakeholders of the project as highlighted in the approved ToR. The major concerns highlighted in the stakeholder meetings were the possible restrictions on traffic flow in Boashima Hingun and Link road and undertaking construction activities within 10ft buffer area of airport's security fence in Boashimaa Hingun.

No long-term sever environmental or social impact is predicted for the project. However, due to high the socio-economic benefit of the project, it is recommended to undertake the proposed project in the proposed location. Furthermore, developing the renewable energy sector in Maldives is in line with the development goals of the Country. Decreasing the dependency on diesel powered electricity generation in Maldives with the provision of renewable energy throughout the country is one of the development goals of the government.

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17 APPENDICES

17.1 Environmental Screening Decision by EPA

Environmental Protection Agency
އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ

ނަންބަރު:203-ECA/PRIV/2021/96

ސްކްރީނިން ކުރުމަށްފަހު ނިންމިގޮތް

Screening Decision

މިއީ ގްރޭޓަރ މާލެ ރީޖަނުގައި 05 މެގަވޮޓްގެ އިރުގެ އަލިން ހަކަތަ އުފައްދާ ނިޒާމެއް ގާއިމްކުރުމުގެ މަސައްކަތައް ސްކްރީނިން ކުރުމަށްފަހު
ނިންމިގޮތް އެންގުމަށްޓަކައި އެންސިސް ކޯޕްރޭޝަން ލިމިޓެޑަށް ދޫކުރި ރަސްމީ ލިޔުމެކެވެ.

This is an official document issued to **Ensys Co., Ltd.** for communicating the decision made after screening of the project: **Proposed Installation of 5MW Grid-tied Solar Photovoltaic System in Greater Male' Region**

މި މަޝްރޫއުގެ ސަބަބުން ތިމާވެއްޓަށް ނުރައްކާ ބޮޑު އަސަރުތައް ކޮށްފާނެ ކަމަށް ފެނެއެވެ. ވީމާ، ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަޔާންކުރާ ރިޕޯޓެއް ހުށަހަޅާށެވެ. This project is likely to cause significant negative environmental impacts. Hence, please submit an EIA report.	☐
މި މަޝްރޫއުގެ މަސައްކަތުގެކުރިން ތިމާވެށީގެ ފުރަތަމަ ދިރާސާއެއް ހުށަހަޅާށެވެ. Submit an Initial Environmental Examination for this project.	☐
މި މަޝްރޫއުގެ މަސައްކަތުގެކުރިން ތިމާވެށީގެ މެނޭޖްމަންޓް ޕްލޭނެއް ހުށަހަޅާށެވެ. Submit an Environmental Management Plan for this project.	☑
މި މަޝްރޫއުގެ ސަބަބުން ތިމާވެއްޓަށް ނުރައްކާ ބޮޑު އަސަރުތައް ކޮށްފާނެ ކަމަށް ނުފެނެއެވެ. ވީމާ، މަޝްރޫއުގެ މަސައްކަތުގެ ކުރިއަށް ގެންދިއުން އެންމެ ރަނގަޅުކަމުގައި ދަންނަވަމެވެ. This project is unlikely to have a significant negative impact on the environment. Hence, you may proceed with the project.	☐
މި މަޝްރޫއުގެ ސަބަބުން ތިމާވެއްޓަށް ކޮށްފާނެ ނުރައްކާ އަސަރުތައް ކުޑަކުރުމަށް މި އެޖެންސީން އަންގާ ފިޔަވަޅުތަކާއި މަސައްކަތް ކުރިއަށްގެންދާކަން ދަންނަވަމެވެ. The measures stipulated by this agency shall be used to mitigate the negative environmental impacts of the project.	☐

މިއީ ތިމާވެށީގެ ގޮތުން ކުރިވިފައިވާ ސްކްރީނިންގއެކެވެ. ވީމާ، މި މަސައްކަތް ކުރުމަށް ސަރުކާރުގެ އެހެން ކަމާބެހޭ އިދާރާ ތަކުން ހަމަޖެހޭ
ހުއްދަ ހޯއްދަވާފައި ހަމަޖެހުމަށްފަހުގައި ދަންނަވަމެވެ. މިސްކްރީނިން ކުރުމަށްފަހު ނިންމިގޮތުގެ ލިއުމުގައި މުއްދަތަކީ ހަމަވާ ތާރީޚް ކަމަށް
ބަޔާންކުރެވިފައިއޮތީ މިއެޖެންސީއިން ނިންމިގޮތް ފުރިހަމަ ކުރުމަށް ދޭ މުއްދަތެވެ.

This is an environmental screening. Hence, obtain all necessary approvals/permits from other relevant government authorities before commencement of the project activities. The date of expiry stated in this Environmental Screening Decision Statement is the duration given to implement the decision made by this agency.

Screening Institution: **Environmental Protection Agency of Maldives**

ސްކްރީނިންގ ކުރި އިދާރާ: **އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ، ދިވެހިރާއްޖެ**

Date of issue: **18th February 2021**
Date of Expiry: **18th February 2022**

ދޫކުރި ތާރީޚް: 18 **ފެބްރުއަރީ** 2021
މުއްދަތު ހަމަވާ ތާރީޚް: 18 **ފެބްރުއަރީ** 2022

Name: **Mr. Ibrahim Naeem**
Designation: **Director General**

ނަން : **އަލްފާޟިލް އިބްރާހިމް ނަޢީމް**
މަޤާމު: **ޑިރެކްޓަރ ޖެނެރަލް**

Signature:

ސޮއި:

17.2 Terms of Reference (by World Bank group)

Terms of Reference: Environment and Social Management Plan (ESMP) for the Proposed Construction and Operation of 5MW Grid-tied Solar Photovoltaic System in Greater Male' Region, Kaafu Atoll, Maldives

Objective and Scope of Preparation of ESMP

In order to ensure short and long term environmental and social impacts that would arise due to the proposed 05 MW solar PV installation in Hulhule'-Hulhumale link road, Boashimaa Hingun and selected blocks in 1000 housing units are adequately mitigated and monitored, following the screening decision from EPA and the World Bank, an ESMP will need to be developed as per the scope presented below and in accordance with the Environmental and Social Management Framework (ESMF) of the Project and the Environmental Impact Assessment Regulations (2012). Field level verification should be conducted prior to the preparation of the ESMP.

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 and social studies, or otherwise, during the course of preparation of the ESMP report.

Following should be the key components/assessment outline of the ESMP:

1. **Executive Summary:** An executive summary of the significant findings of the report shall be prepared both in Dhivehi and English language. The executive summary shall include summaries of project description and how adverse environmental and social impacts and risks will be resolved. The conclusion of the study must be stated.

Introduction: 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. Identify the donors and the institutional arrangements relevant to this project. Provide details of the proponent, and institutional arrangements for implementation and operations of the proposed development, and environmental and social impacts and risks of similar projects. Include desktop studies and review of similar ESMPs and ESIAs.

2. **Legislative and Regulatory Considerations:** This chapter should cover the legal aspects related to the project. Outline the project's consistency with the existing national, state, regional and local policies and regulations that apply to the project and include reference to relevant statutory and non-statutory provisions, planning policies, guidelines, strategies and agreements as appropriate. Outline the pertinent policies, regulations and standards governing project location, land use, environmental quality, and public health and safety. This should cover regulations and laws relevant to the following key areas; environmental regulations, safety regulations and labor related regulations.

Study Area: Define and justify the proposed project area. Provide A3 size scaled plans and maps with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental and social assessment highlighting the proposed development location and size. The study area should include nearby environmentally and socially sensitive areas (Environmentally Protected Areas / Environmentally Sensitive Areas, roads, houses, mosques, schools, playgrounds, other public spaces etc.). Relevant developments in the area must also be covered including residential areas and all economic ventures and cultural sites. Moreover, existing cable routes, sewer lines, telecommunications lines within the road area needs to be mapped and identified and presented. Need to identify temporary site location for contractor mobilization.

3. **Project Description:** Provide a full description and justification of relevant parts of the project, using maps at appropriate scale where necessary. The following should be provided including all inputs and outputs related to the proposed activities shall be justified.

<u>General Construction and Operations</u>

- Provide a clearly labelled concept design and scaled site plan of the project boundary.
- Submit a detailed description of the components of the project and how the project activities will be undertaken including work methodologies and justifications.
- Provide project schedule and all project inputs including but not limited to equipment, manpower and machinery required. Provide details of the project outputs including but not limited to waste generated from the project and total energy output from the project.
- Describe the construction phase components of the project including temporary site setup, site clearance, levelling works, foundation works, cable laying works, mounting structure works and works undertaken for mounting of PV. Provide detailed construction methodology for each of these components including safety standards that will be followed in line with the labour management procedure developed for the project.
- Provide details of the traffic management procedure that will be followed during construction and operational phase

- Details, types and numbers of labor/workers required during construction/establishment and during operation.
- Housing needs for the construction workforce and operational workforce.
- It is a requirement of Ministry of National Planning and Infrastructure for the structure to be modular enough (for land based PV) to allow access for repair works of the revetment, suggest how and where repair of revetment is required and this will be achieved.
- It is a requirement of Housing Development Corporation (HDC) to allow provision for lighting underneath the panels (for land based PV) and therefore suggest how this has been incorporated to the design.
- Waste disposal and management during construction and operational phase of the project.
- Emergency plan in case of fire, road accidents, spills and any other unforeseen event. This shall identify the procedure that will be followed for different scenarios, the responsible parties and how the emergencies will be attended and the appropriate government institutions for reporting.
- Identify the safety equipment that will be available at the site, including but not limited to fire fighting equipment, safety signage that will be installed at each site, safety equipment that will be available. These requirements need to be identified for construction and operational phase of the project separately.
- Identify how during construction phase, environmental and social aspects are monitored by the contractor/developer and how the requirements of the Environmental Social Management Plan will be implemented.

4. **Existing Environment:** The existing environment study will not require complex data collection and survey analysis techniques since this is an ESMP and not a full ESIA study. However, the following aspects will need to be investigated and provided in the report:

1. Describe the general environment of the proposed project area with the inclusion of relevant images.
2. Describe the significance and sensitivity of the area for undertaking the project, including but not limited to information on any significant environmentally, socially, historically and culturally sensitive sites within the project impact boundary.
3. Demographic information of the project area, including but not limited to population information, employment and key economic activities undertaken.
4. General topography of the area where ground mounted PV is to be implemented.

5. Describe the general climate conditions including temperature, rainfall, wind, waves, evaporation rates, risk of cyclones and storm surges etc.
6. Summarize the key findings of glare assessment that was undertaken for the project, identifying key aspects considered to prevent glare on aircrafts and road users. The glare assessment report should be annexed to the report.
7. Summarize the key findings of structural assessments that was undertaken for the project. Should identify the suitability of each building for the purpose of the project. The full structural assessment reports should be annexed to the report.
8. Summarize the key findings from the geotechnical survey that was undertaken at the site. The full geotechnical report should be annexed to the report.
9. Baseline noise levels at each of the project sites.
10. Information on any vegetation that needs to be removed for the purpose of the project (if any). Including any in the temporary site (s).
11. Traffic information at Male-Hulhumale' link road and Boashimaa Hingun, identifying the peak traffic hours. This can be based on secondary data or a traffic survey can be undertaken if the said data is not available.
12. Information on estimated daily flight operations data for the airport. Should include data for both seaplane operations and normal flight operations. This can be based on data from airline operators and airport operators and civil aviation.
13. Information on any potential vulnerable groups or communities that maybe impacted as a result of the project.

Whenever any physical data is taken, the corresponding geographic coordinates of the location should be provided in the report.

5. **Impact Identification and assessment:** The ESMP should identify all the impacts and risks, direct and indirect, partial and full and permanent and temporary during and after construction, as well as for the operations phase and evaluate the magnitude and significance of each impact and risk. Particular attention shall be given to impacts associated with the following:

a) <u>Physical / Chemical:</u> Investigate the following impacts in detail;

- Impacts on noise pollution and disturbances (both in construction and operations)
- Impacts on groundwater table and quality due to mobilization, construction, operations and maintenance.
- Impacts on ground vibrations if any on nearby infrastructure (eg: road, revetment, utility lines, built structures (residential, commercial, and industrial).
- Impacts on revetment during construction, especially during foundation works.

- Impacts on existing utility lines within the project boundary.
- Impacts on air quality.
- Marine water pollution due to spillage during material transfer.
- Risks associated with the use, storage, transportation and handling of hazardous substances such as chemicals and fuel during the construction and operation stage of the project (if any).
- Aesthetic impacts of the project, especially in relation to land based PV installation.

b) Biological: describe impacts on vegetation and fauna.

- Impact due to vegetation removal.
- Impacts to vegetation and fauna due to improper handling and driving during material transportation.
- Impacts due to material spillage during transfer of construction materials to the project island.
- Identification of environmentally sensitive areas within the project area including potential impacts.

c) Social and Cultural impact - describe impacts of road closure, nearby sensitive areas (mosques, schools etc.), health and safety of surrounding community / contracted labor and sociocultural conflict.

- Identify the persons and their families likely to be affected by the project including those who are vulnerable. This should cover information pertaining to members of families who are residing, practicing any trade, occupation or vocation in the project affected area, including those that reside in the 1000 housing unit apartments.
- Any potential impacts specific to women and children (if any)
- Impacts related to human trafficking and forced labor
- Any potential Gender Based Violence related impacts.

- Any possible impact on the livelihood assets and activities of the people in the project area since roof tops of residential buildings are to be used. Would any additional structural reinforcements be carried out in the buildings prior to the instalment of solar panels?

- Possible cultural and heritage impacts. Including any potential cultural impacts that arise due to foreign labor force mobilization.
- Identify the social impacts/issues such as labour influx and food security. Influx of workers can lead to adverse social and environmental impacts including pressures for resources in local communities.
- Health and safety risks for the construction workers and the staff involved during operations.
- Health and safety risks to residents of the blocks in which PV installation is planned to be installed.
- Any possible impacts on road users and traffic as a result of the project, including impacts due to glare.
- Identify and assess any potential impacts on the operation of the airport due to the increased solar radiation reflection (glare) from the solar panels.
- Access impacts for repair works at revetment.
- COVID19 restrictions and special considerations for the contractor (potential mitigation measures may include daily temperature checks, cleaning procedures, shift roaster, arrangement for social distancing in labor camps, establishment of hand washing facilities at work site and labor camps etc.).
- Fire hazards and risks during both construction and operation phase.

d) Economic / Enhancement Plans: describe any potential benefits or losses to the economy.
   - Employment and other livelihood opportunities.
   - Impacts to the local economy due to purchasing of locally available construction materials.
   - Impacts on electricity price.
   - Cost savings from project interventions.
   - Corporate Social Responsibility (CSR) initiatives planned by the developer during implementation phase (If any)
   - Some of these opportunities can be further developed to draw environmental and social benefits to the local area. The ESMP should identify such opportunities and develop a plan to systematically harness any such benefit.

The methods used to identify the significance of the impacts shall be outlined. One or more of the following methods should be utilized in determining impacts; checklists, matrices, overlays, networks, expert systems and professional judgment. Justification must be provided to the selected methodologies. The report should outline the uncertainties associated with impact prediction and

also outline all positive and negative/short and long-term impacts. Identify impacts that are cumulative and unavoidable.

6. **Project Alternatives:** Describe alternatives including the "no project option" should be presented. Alternatives examined for the project should include alternative designs, methods of foundation for PV structure and technology options which shall be evaluated from an environmental, social and economic perspective. All alternatives must be compared according to commonly accepted standards and norms and international standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options shall be specified for each of the alternative proposed. In addition, alternatives considered to avoid/minimize/mitigate adverse social and environmental impacts needs to be specified in this section.

7. **Mitigation and management of adverse impacts:** Identify possible measures and actions to avoid, minimize or mitigate significant adverse impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures. Mitigation measures should be provided to all individual impacts identified in section 5 under impacts of this ToR. Mitigation measures for both construction and operation phase shall be identified. Provide a cost estimate of the personnel, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. Details of the staff from the developer side responsible for implementation of the Environmental Social Management Plan (ESMP) should be provided. In cases where impacts are unavoidable arrangements to compensate for the environmental and / or social effects should be explained.

Mitigation measures should be presented in a matrix consistent with the format provided below.

Project Activity	**Potential Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Institutional Responsibilities** (Implementation and Supervision)	**Estimated Quantities Required and Material Specifications Recommended**	**Cost Estimates**	**Comments** (e.g. primary, Secondary or cumulative impacts**)**
Detailed design and planning Phase						
Pre-Construction Phase -Site Preparation						
Construction Phase						
Operation and Maintenance Phase						

The proposed ESMP matrix should be translated to Dhivehi language and provided as an Annex to the report.

8. **Grievance Redress Mechanism (GRM):** Should outline the Grievance Redress Mechanism developed for the project and its implementation procedures; persons responsible for addressing the grievances at each level of the GRM and information communication on the GRM specifically to the tenants of the housing units and to the general public. Provide details of the public displays that will be used to advertise the GRM in public places and work sites.

A specific GRM needs to be proposed to the labor force in addition to the project GRM. The GRM should establish clear mechanism to address concerns of the work force.

In addition to the project based GRM, based on the consultations with relevant stakeholders described in section 13 of this ToR, establish a mechanism to quickly report and address the concerns of various stakeholders on the project. This should include the following:

1. Ministry of National Planning and Infrastructure regarding concerns of impacts on revetment.
2. Maldives Police Service regarding accidents at link road.
3. Maldives Civil Aviation Authority regarding glare impacts on aircrafts
4. Utility service providers regarding impacts on utility lines.
5. Directorate of Aviation Security Administration regarding airport safety.

9. **Monitoring and Reporting Plan:**

10.1. Monitoring Program: Identify the critical issues requiring monitoring to ensure compliance with mitigation measures, and present impact management and monitoring plan for glare issues, traffic issues, vegetation clearance (if any), soil, groundwater, noise and air quality, t and grievance redress. Details of the monitoring program should include the physical, biological environmental and social parameters/indicators for monitoring, monitoring indicators to be measured for evaluating the performance of each mitigation measure, frequency of monitoring, monitoring methodologies, documentation procedures, cost commitment from persons responsible for monitoring (with a commitment letter), time frames for monitoring and reporting procedures.

The recommended format for presenting the monitoring program is given below.

Proposed Mitigation Measure	**Parameters to be monitored**	**Location**	**Measurements** (Incl. methods & equipment)	**Frequency of Measurement**	**Responsibilities** (Incl. review and reporting)	**Cost** (equipment & Individuals)

Detailed design and planning Phase						
Pre-Construction Phase						
Construction Phase						
Operation and Maintenance Phase						

10.2. Reporting Procedures and Implementation Schedule: The consultant should propose adequate reporting mechanisms with frequencies for the implementation of the ESMP and the proposed monitoring program.

10.3. Cost Estimates and Sources of Funds: Implementation of mitigation measures mentioned in the ESMP will involve an initial investment cost as well as recurrent costs. The ESMP should include costs estimates for each mitigation measure, which is to be covered under section 9. In addition to this, estimated costs shall be provided (separate for construction and operational phase activities) for specific items and materials that the contractor and the operators would require to implement the ESMP effectively. Such items may include the cost of purchasing PPEs, fire extinguishers, signage, trainings etc.

10. Management of Other On- or Off-Site Environmental Pollution Control and Infrastructure

This section should address management of critical elements of pollution control and infrastructure that are not otherwise included in the mitigation plan because they were considered an essential part of the proposed project.

11. Summary of all Training Recommendations

This section should include programs targeted to increase the capacity of the contractor and the operator in the implementation of the ESMP. The following trainings should be part of the training program to a minimum:

- Strengthening the capacity of the contractor on ESMP implementation and reporting.
- Strengthening the capacity of the contractor on Grievance Redress Mechanism and reporting mechanism.
- General awareness on health and safety of the contractor's work force.
- Contractor's code of conduct.

- Operation and Maintenance training of the Solar PV system.
- Health and Safety training for contractor's workforce both for construction and operation phase. This should cover fire safety training and fire drills as well.

The format below can be used when proposing the training requirements.

Institutional Strengthening Activity	**Position(s)**	**Scheduling**	**Responsibility(is)**	**Cost Estimates**	
Training Activity	**Participants**	**Types of Training**	**Content (modules, Etc.)**	**Scheduling**	**Cost Estimates**

12. **Contingency Plans**

Contingency plans shall be prepared and described to address: a) failure to meet specific performance criteria established by law or necessary for the project to meet its commitments in the ESMP and b) respond to natural and other risks previously identified and mitigated in the ESMP in the event reasonable and feasible mitigation measures to address the risks are inadequate.

- Performance-related Contingency Plans, indicating the steps that will be taken should monitoring indicate that:
  - Environmental standards are not being met
  - Impacts are greater than predicted
  - Mitigation measures and/or rehabilitation are not performing as predicted
- Natural Disaster Risk Response Plan (assumes that risk identification and risk reduction have been addressed in other parts of the assessment
- Other Risks Response Plans (assumes that risk identification and risk reduction have been addressed in other parts of the assessment
- Contingency plans for maintaining service or reducing downtime in the event of accidents or natural catastrophes that disrupt project operation

13. **Stakeholder consultation:** Identify appropriate mechanisms and strategies for providing information on the development project and the GRM to relevant stakeholders. Consultations must be undertaken with all key stakeholders – including communities, government officials etc. As approvals have been attained from all the stakeholders in writing prior to bidding, the consultation should focus on how to address any complications that may arise during project implementation phase. This consultation should be used to develop a mechanism to address and respond to potential

issues immediately and to refine the Grievance Mechanism as highlighted under section 8 of this ToR. The report should include a list of people/groups consulted, their contact details and summary of the major issues discussed and outcomes. The following people or institutions should be consulted.

- Utility Service providers whose services run through the proposed route
- Housing Development Corporation
- Maldives Civil Aviation Authority
- Directorate of Aviation Security Administration
- Ministry of National planning and Infrastructure
- Maldives police service
- Maldives Airports Company Limited
- Ministry of Transport
- Male' City Council

This chapter should provide a summary of the actions taken prior to bidding to secure the sites. Also it should provide details of how the project affected communities (especially tenants of the 1000 housing units) will be provided with project information in a timely manner. This should include information like project schedule, project information sheets, information on grievance redress mechanism etc. A plan of communicating this information to the tenants need to be developed and presented in the report with clear timelines.

The consultant should take into consideration COVID19 safety measures during consultations, follow WHO/WB & GoM guidelines when conducting consultations and explore remote/online options when conducting consultation.

14. **Validation and Disclosure**

The draft executive summary and the ESMP (matrix table in mitigation chapter) in local language should be disclosed in all major stakeholders and the tenants of 1000 housing units. This should be completed prior to or at the time of submitting the report to the EPA and the World Bank for clearance, so the period for public commenting can be sequenced in parallel to the review process. The consultant will assist the project in the disclosure of documents in all major affected settlements and at island and national level. The final cleared version of the report will be disclosed in major project websites and social media platforms with a summary of major findings through the disclosure process reflected as an annex.

15. **Conclusion**

This section shall specify the environmental acceptability of the project, taking into account the impacts and measures identified during the assessment process. It shall also identify any other conditions or external requirements for ensuring the success of the project.

Presentation- The ESMP report, to be presented in digital format, will be concise and focus on significant environmental and social issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The ESMP or EISA report will be organized according to this TOR, in accordance to, but not necessarily limited by, the outline the Environmental Impact Assessment Regulations (2012) and the ESMF of the project. The report shall include Dhivehi translations of the executive summary and the ESMP matrix. All raw data collected, including maps and surveys should be submitted in Raw form to the client in digital format.

17.3 Project area Map

PROJECT AREA

Proposed Installation of 5MW
Grid-Tied Solar Photovoltaic System
in Greater Male' Region
Kaafu Atoll

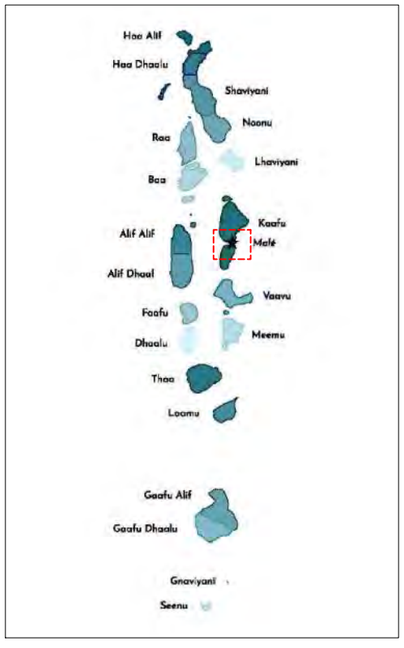
FORESIGHT SURVEYORS 2022

Environment and Social Management
Report

Ellipsoid: WGS84
Projection: UTM Z43 N
Unit: Meter

LEGEND:

- Project area
- Temporary Project site



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Email: info@foresightsurveyors.com
URL: www.foresightsurveyors.com

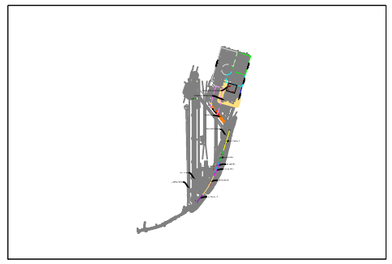
17.4 Survey location Map

SURVEY LOCATION MAP

Proposed Installation of 5MW
Grid-Tied Solar Photovoltaic System
in Greater Male' Region
Kaafu Atoll

FORESIGHT SURVEYORS 2021

Environment and Social Management
Report



Ellipsoid: WGS84
Projection: UTM Z43 N
Unit: Meter

POINT COORDINATES:

A	4°10'56.59" N 73°32'5.50" E
B	4°11'41.84" N 73°32'24.02" E
C	4°12'7.88" N 73°32'21.05" E
D	4°12'20.02" N 73°32'11.64" E
E	4°12'37.53" N 73°32'32.28" E
F	4°12'45.47" N 73°32'29.56" E

Scale 1:15000

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17.5 Topographic Survey Map

TOPOGRAPHIC SURVEY

Proposed Installation of 5MW
Grid-Tied Solar Photovoltaic System
in Greater Male' Region
Kaafu Atoll

FORESIGHT SURVEYORS 2021

Environment and Social Management
Report

Ellipsoid: WGS84
Projection: UTM Z43 N
Unit: Meter

LEGEND:

⊕ Topography data point

Roof top PV installation

Temporary storage site

Lat: 4°12'20.40" N
Lon: 73°32'11.01" E
Z: +1.917

Lat: 4°12'13.47" N
Lon: 73°32'16.501" E
Z: +1.981

South Side

Lat: 4°12'7.88" N
Lon: 73°32'21.05" E
Z: +1.990

New water runway

Lat: 4°11'55.85" N
Lon: 73°32'28.37" E
Z: +2.228

Link Section 1

Lat: 4°11'41.84" N
Lon: 73°32'24.02" E
Z: +1.990

Link Section 2

Island Section

Lat: 4°11'28.29" N
Lon: 73°32'19.63" E
Z: +2.008

Lat: 4°11'17.86" N
Lon: 73°32'16.25" E
Z: +1.808

New runway

Link Section 3

Existing runway

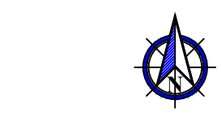
Lat: 4°11'4.14" N
Lon: 73°32'9.59" E
Z: +1.853

Link Section 4

Lat: 4°10'51.01" N
Lon: 73°32'1.71" E
Z: +1.600

Link Section 5

Lat: 4°10'44.00" N
Lon: 73°31'56.14" E
Z: +1.545



Meters
80 0 80 160
1:15000

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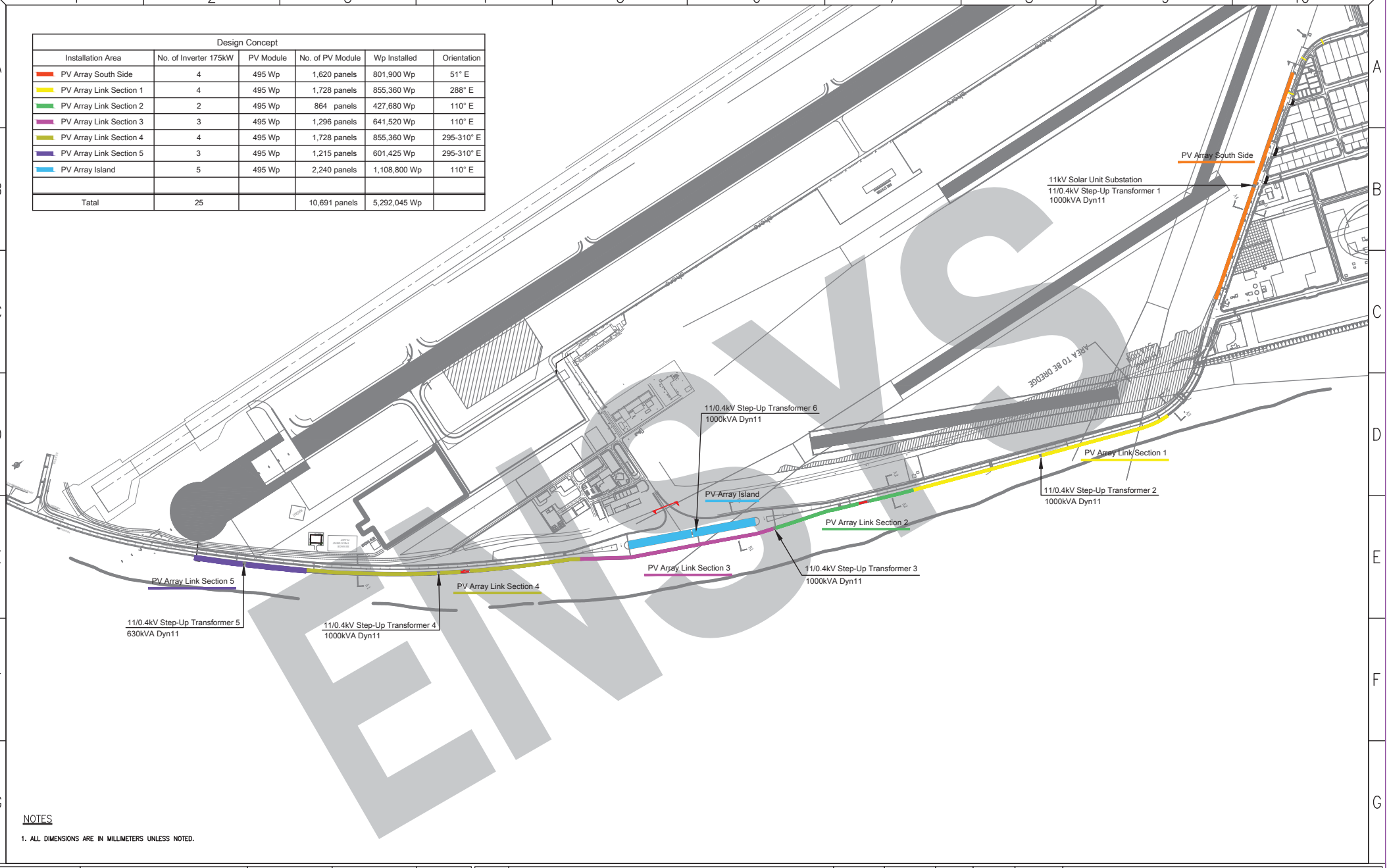
17.6 Project Concept

Design Concept					
Installation Area	No. of Inverter 175kW	PV Module	No. of PV Module	Wp Installed	Orientation
PV Array South Side	4	495 Wp	1,620 panels	801,900 Wp	51° E
PV Array Link Section 1	4	495 Wp	1,728 panels	855,360 Wp	288° E
PV Array Link Section 2	2	495 Wp	864 panels	427,680 Wp	110° E
PV Array Link Section 3	3	495 Wp	1,296 panels	641,520 Wp	110° E
PV Array Link Section 4	4	495 Wp	1,728 panels	855,360 Wp	295-310° E
PV Array Link Section 5	3	495 Wp	1,215 panels	601,425 Wp	295-310° E
PV Array Island	5	495 Wp	2,240 panels	1,108,800 Wp	110° E
Tatal	25		10,691 panels	5,292,045 Wp	



NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

	POSITION	DATE	NAME
DRAWN		05 JAN 21	ENSYS
CHECKED			ENSYS
APPROVED			ENSYS
SCALE	1:5000	REV.	–
SHEET		OF	SIZE A1

PROJECT: ASPIRE PHASE 2

TITLE: PV ON GROUND LAYOUT PLAN

DWG.NO.: ENSYS-EE-DWG-XXX

ENSYS

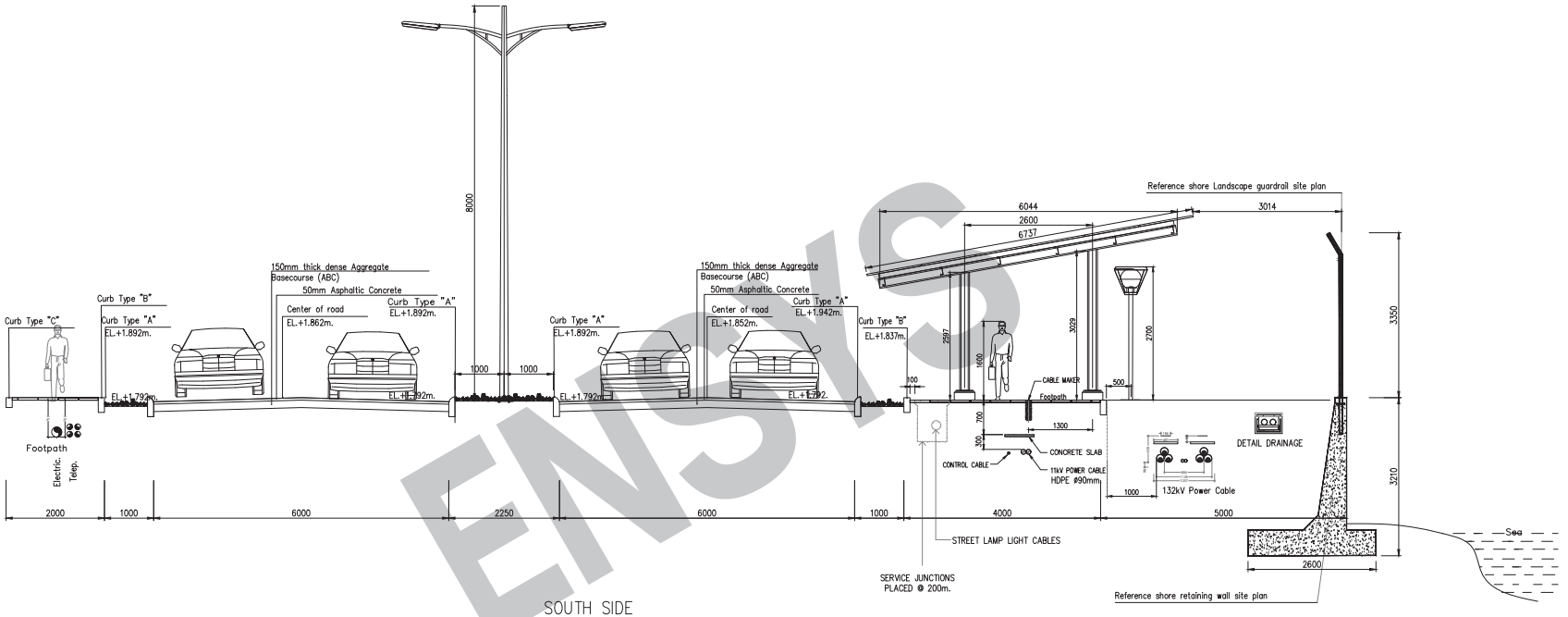
Site Location -2 (residential flats)

BALANCE HOUSING
4°12'40.98"N 73°32'29.77"E
PV MODULE 495W
INVERTER 36kW 8 SETS
720 PANELS OF 8 UNITS
INSTALLED 356,400 Wp

84
92
91
97
98
106
121
135

N

ARCHITECTS									POSITION	DATE	NAME	PROJECT	
STRUCTURAL ENGINEER									DRAWN	10 FEB 21	ENSYS	SOLAR ROOFTOP PROJECT	
ELECTRICAL ENGINEER									CHECKED		ENSYS	TITLE	
SANITARY ENGINEER									APPROVED		ENSYS	SOLAR ROOFTOP BALANCE HOUSING UNITS	
MECHANICAL ENGINEER									SCALE	NTS.	REV. A	DWG.NO.	
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE	INDEX	DESCRIPTION	DATE	NAME	SHEET	OF	SIZE A1	ENSYS-EE-DWG-XXX	ENSYS



SOUTH SIDE
K2+900~K3+500
A4-A4

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

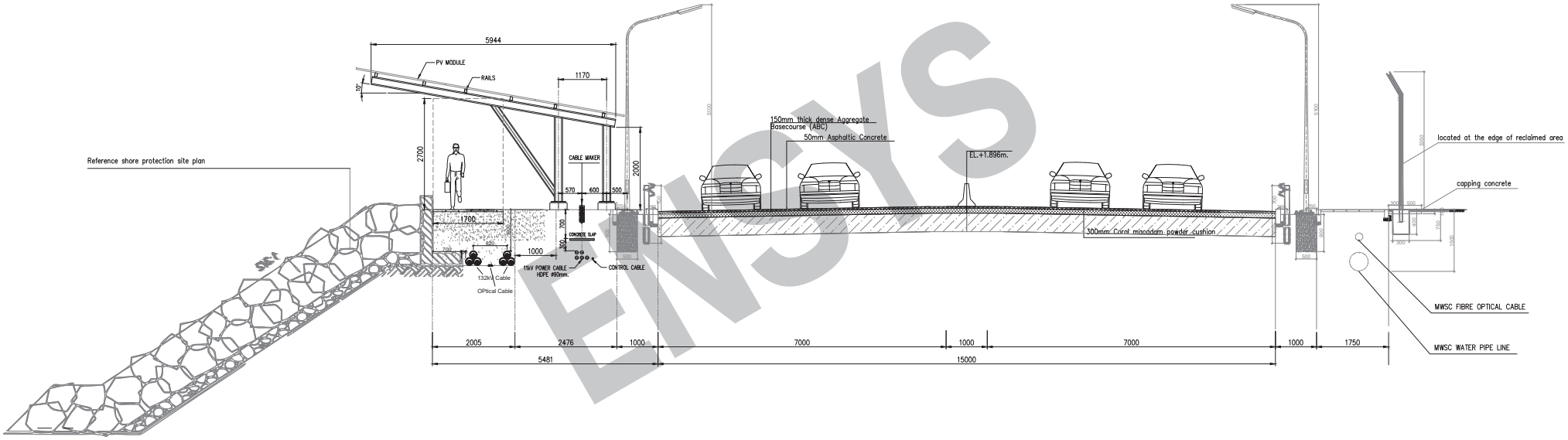
POSITION	DATE	NAME
DRAWN	05 JAN 21	ENSYS
CHECKED		ENSYS
APPROVED		ENSYS
SCALE AS-SHOWN		REV. -
SHEET	OF	SIZE A1

PROJECT: ASPIRE PHASE 2

TITLE: SOUTH SIDE

DWG.NO.: ENSYS-EE-DWG-XXX

ENSYS



LINK SECTION 1 & 4
K0+000~K0+800
A1-A1

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

PRELIMINARY

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

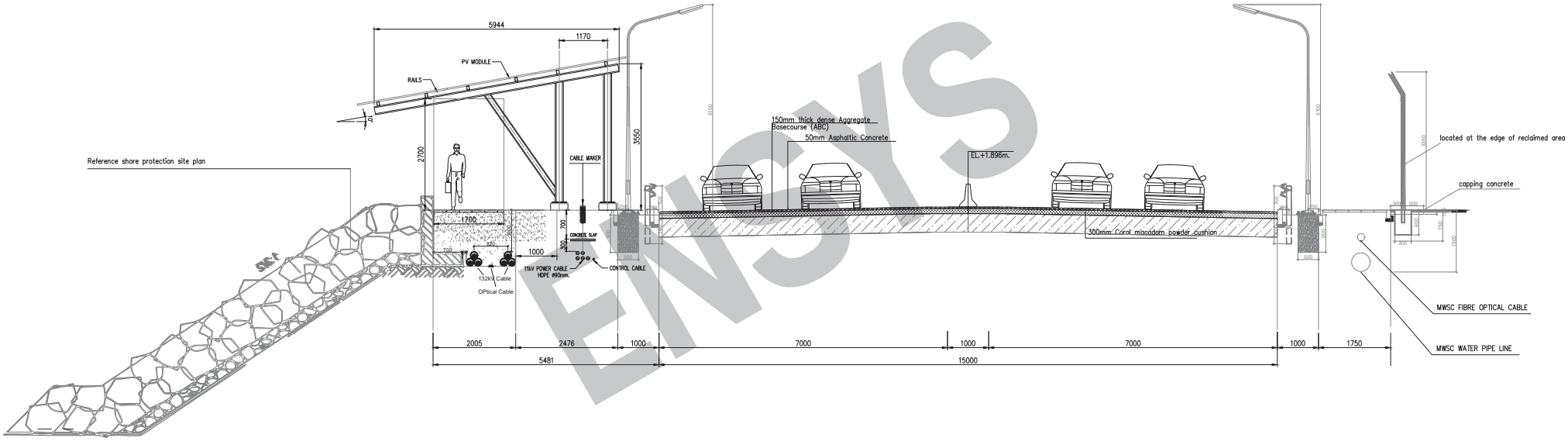
	POSITION	DATE	NAME
DRAWN		05 JAN 21	ENSYS
CHECKED			ENSYS
APPROVED			ENSYS
SCALE	AS-SHOWN		REV. -
SHEET		OF	SIZE A1

PROJECT: ASPIRE PHASE 2

TITLE: LINK SECTION 1 & 4

DWG.NO.: ENSYS-EE-DWG-XXX

ENSYS



LINK SECTION 2 & 3
K0+000~K0+800
A1-A1

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

PRELIMINARY

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

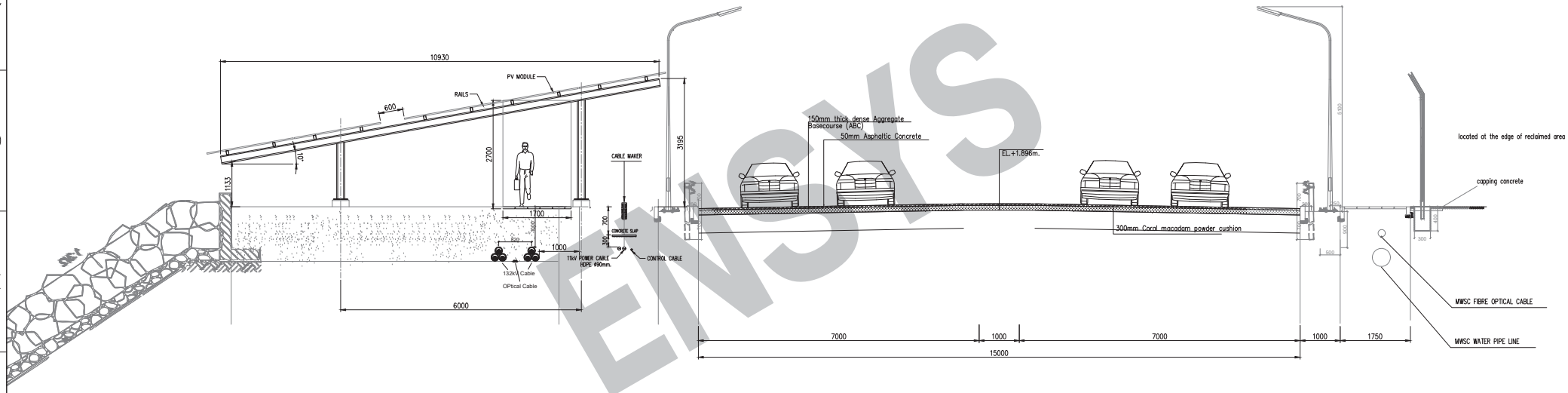
	POSITION	DATE	NAME
DRAWN		05 JAN 21	ENSYS
CHECKED			ENSYS
APPROVED			ENSYS
SCALE	AS-SHOWN	REV.	-
SHEET		OF	SIZE A1

PROJECT: ASPIRE PHASE 2

TITLE: LINK SECTION 2 & 3

DWG.NO.: ENSYS-EE-DWG-XXX

ENSYS



LINK SECTION 5
K0+000~K0+800
A1-A1

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

PRELIMINARY

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

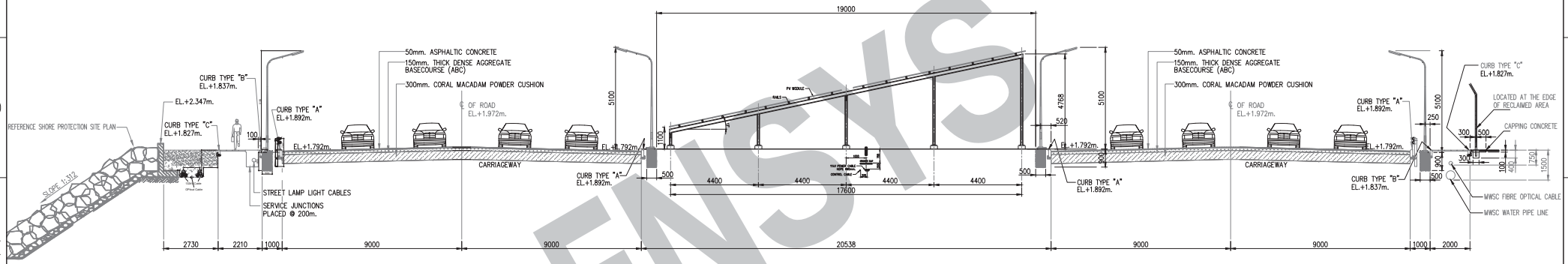
POSITION	DATE	NAME
DRAWN	05 JAN 21	ENSYS
CHECKED		ENSYS
APPROVED		ENSYS
SCALE AS-SHOWN		REV. -
SHEET	OF	SIZE A1

PROJECT: ASPIRE PHASE 2

TITLE: LINK SECTION 5

DWG.NO.: ENSYS-EE-DWG-XXX

ENSYS



ISLAND
K0+800~K1+600
B1–B1

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

PRELIMINARY

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

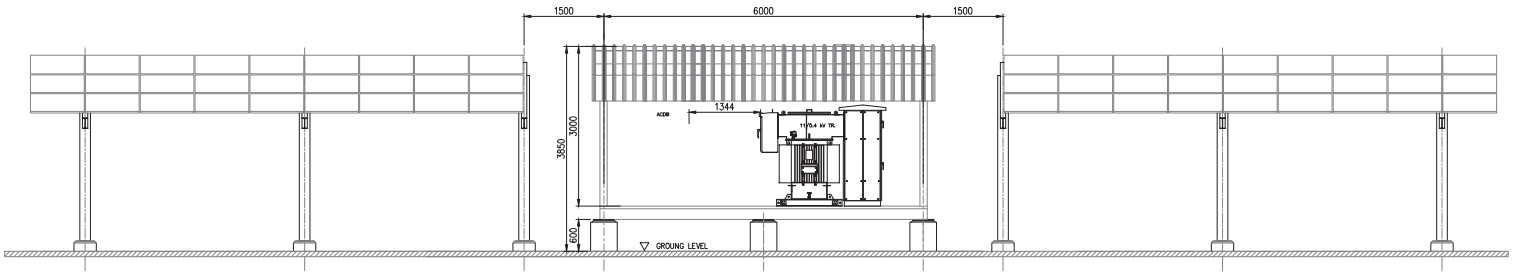
POSITION	DATE	NAME
DRAWN	05 JAN 21	ENSYS
CHECKED		ENSYS
APPROVED		ENSYS
SCALE AS–SHOWN		REV. –
SHEET	OF	SIZE A1

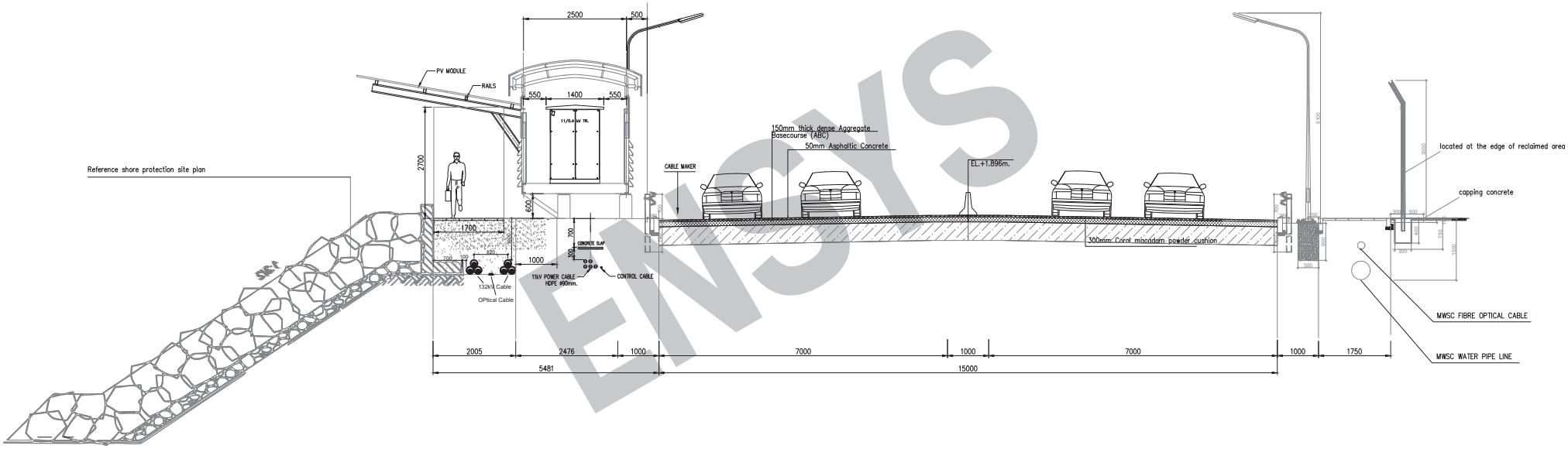
PROJECT: ASPIRE PHASE 2

TITLE: ISLAND

DWG.NO.: ENSYS–EE–DWG–XXX

ENSYS





TRANSFORMER STATION LINK ROAD
K0+000~K0+800
A1-A1

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

PRELIMINARY

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

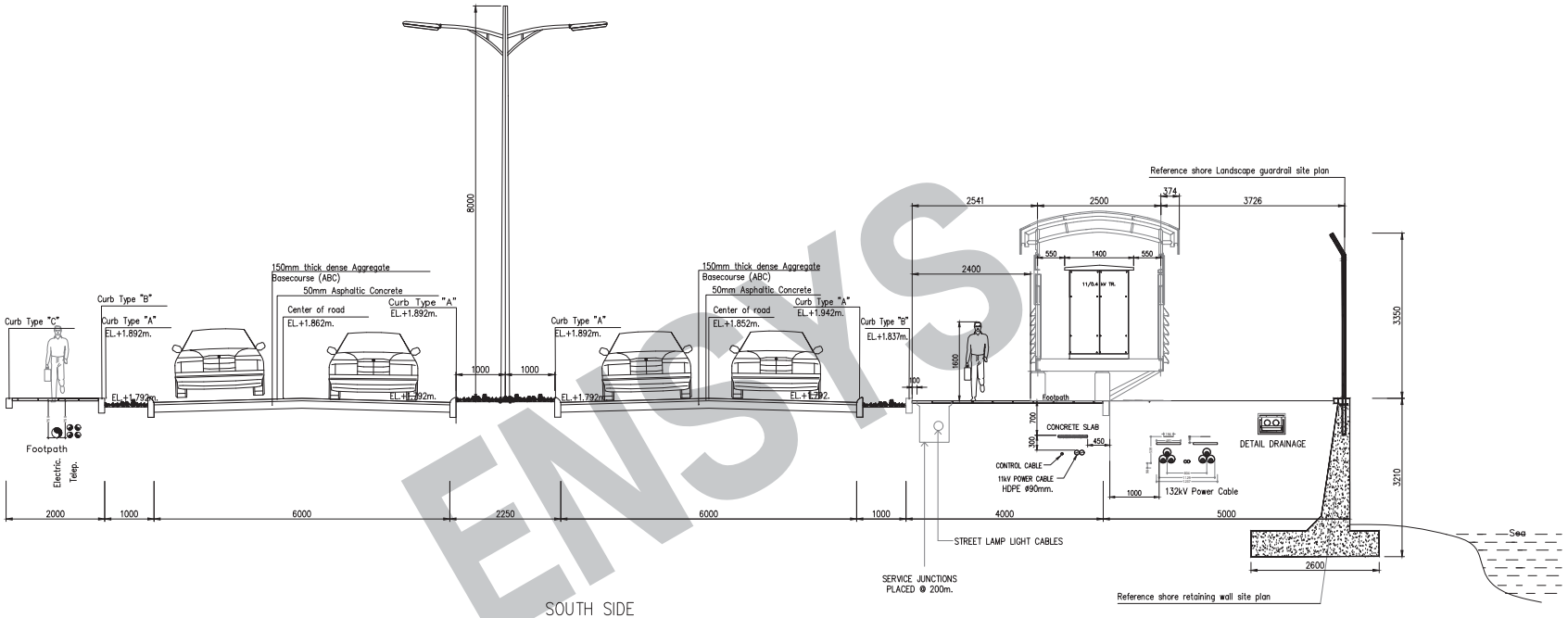
	POSITION	DATE	NAME
	DRAWN	05 JAN 21	ENSYS
	CHECKED		ENSYS
	APPROVED		ENSYS
	SCALE AS-SHOWN		REV.
	SHEET	OF	SIZE A1

PROJECT: ASPIRE PHASE 2

TITLE: TRANSFORMER STATION LINK LOAD

DWG.NO.: ENSYS-EE-DWG-XXX

ENSYS



SOUTH SIDE
K2+900~K3+500
A4-A4

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

PRELIMINARY

ARCHITECTS				
STRUCTURAL ENGINEER				
ELECTRICAL ENGINEER				
SANITARY ENGINEER				
MECHANICAL ENGINEER				
ENGINEER CERTIFICATION	NAME	REGISTER NO.	SIGNATURE	DATE

INDEX	DESCRIPTION	DATE	NAME

	POSITION	DATE	NAME
	DRAWN	05 JAN 21	ENSYS
	CHECKED		ENSYS
	APPROVED		ENSYS
	SCALE AS-SHOWN		REV. -
	SHEET	OF	SIZE A1

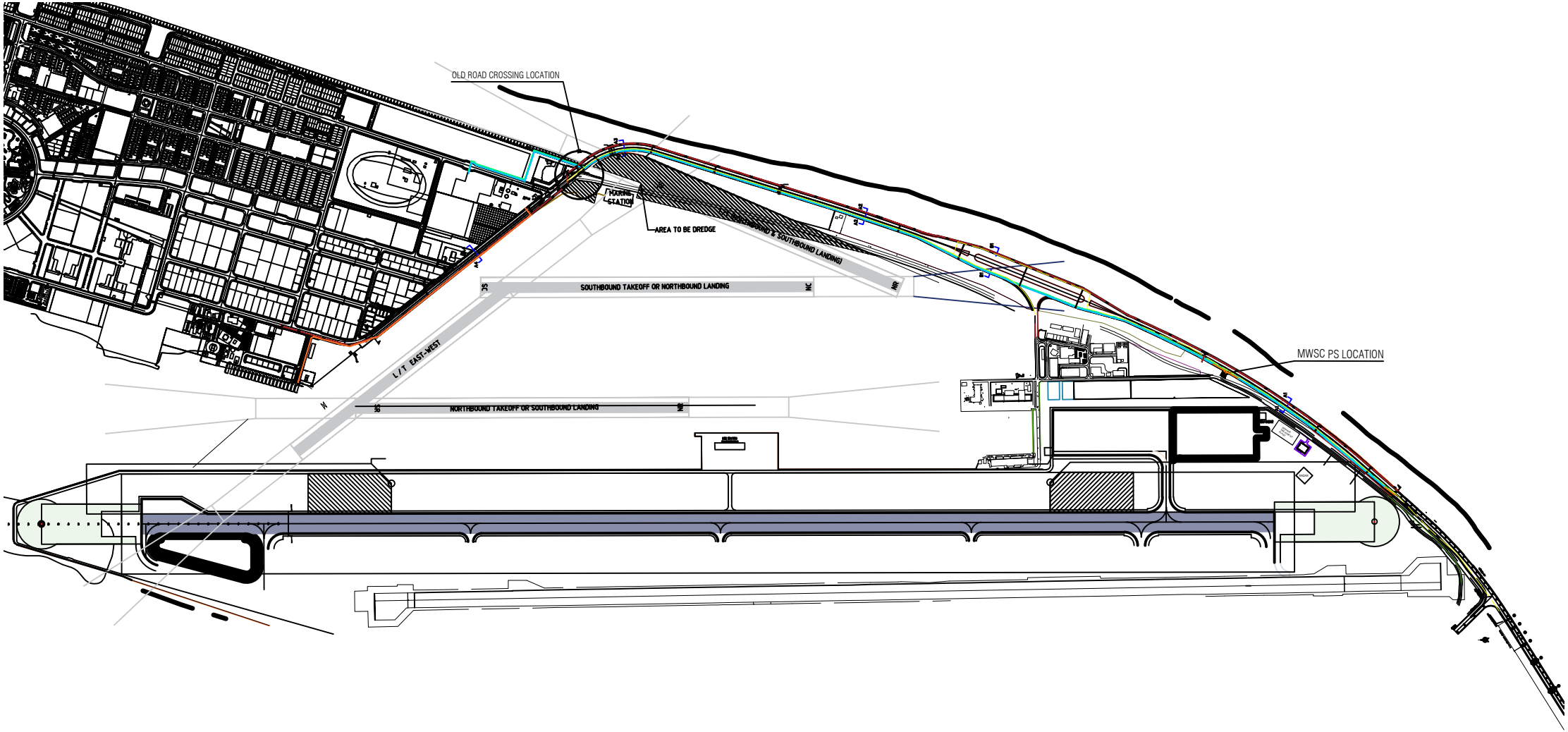
PROJECT: ASPIRE PHASE 2

TITLE: TRANSFORMER STATION SOUTH SIDE

DWG.NO.: ENSYS-EE-DWG-XXX

ENSYS

17.7 Locations of Utility lines in the project area



FIBRE OPTICAL CABLE
DEPTH: 0.75 METERS

WATER PIPELINE -ZONE A
DEPTH: 1.3- 1.5 METERS

WATER PIPELINE -ZONE B
DEPTH: 1.7- 1.8 METERS

STELCO 132KV PIPES

MWSC FUEL PIPELINE ROUTE

DHIRAAGU PROPOSED DUCT

DHIRAAGU EXISTING DUCT

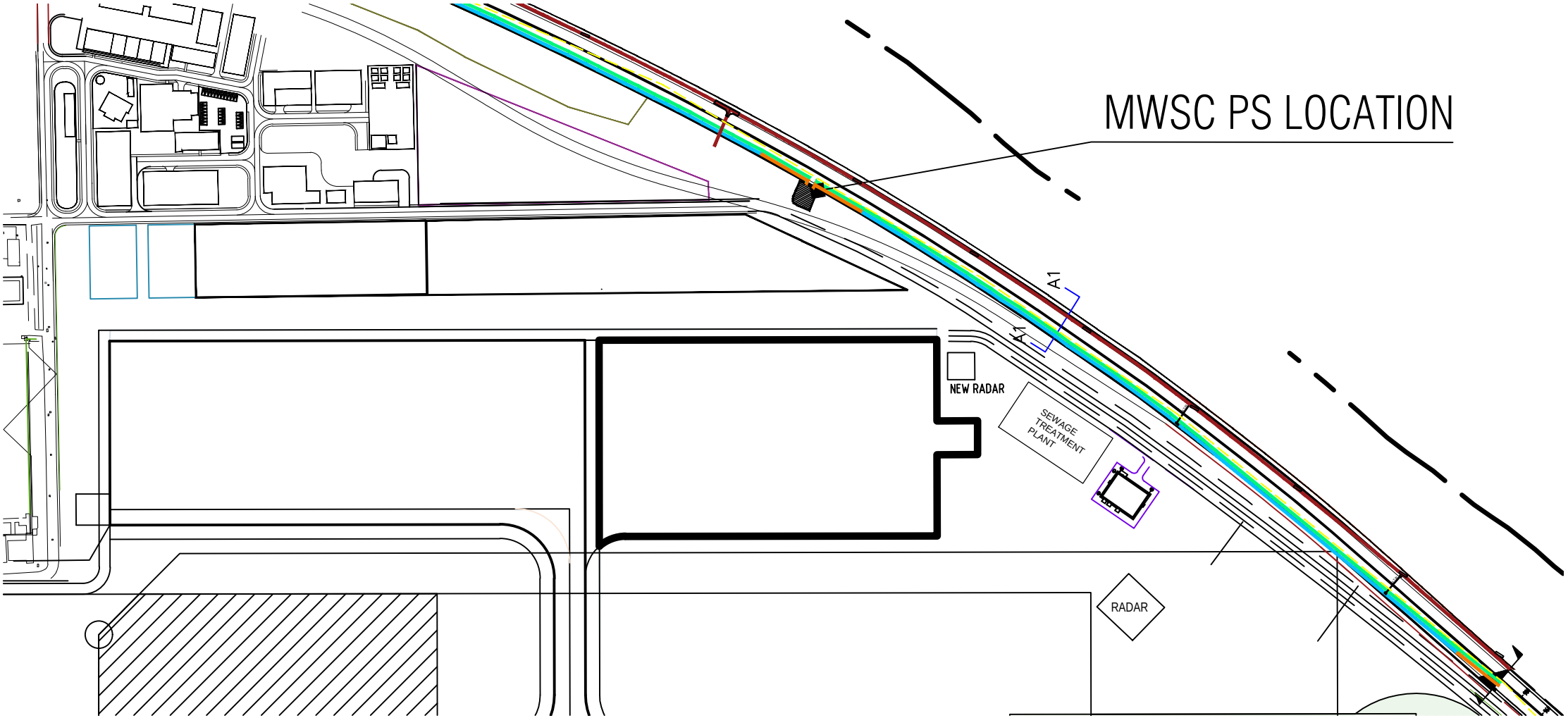
HOUSING DEVELOPMENT CORPORATION
PLANNING AND DEVELOPMENT DEPARTMENT
3RD FLOOR, HDC BUILDING HULHUMALE'
REPUBLIC OF MALDIVES
TEL. +(960)3353535, FAX +(960)3358892
EMAIL : planning@hdc.com.mv

PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: LOCATION MAP

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:

MWSC PS LOCATION



FIBRE OPTICAL CABLE
DEPTH: 0.75 METERS

WATER PIPELINE -ZONE A
DEPTH: 1.3- 1.5 METERS

WATER PIPELINE -ZONE B
DEPTH: 1.7- 1.8 METERS

STELCO 132KV PIPES

MWSC FUEL PIPELINE ROUTE

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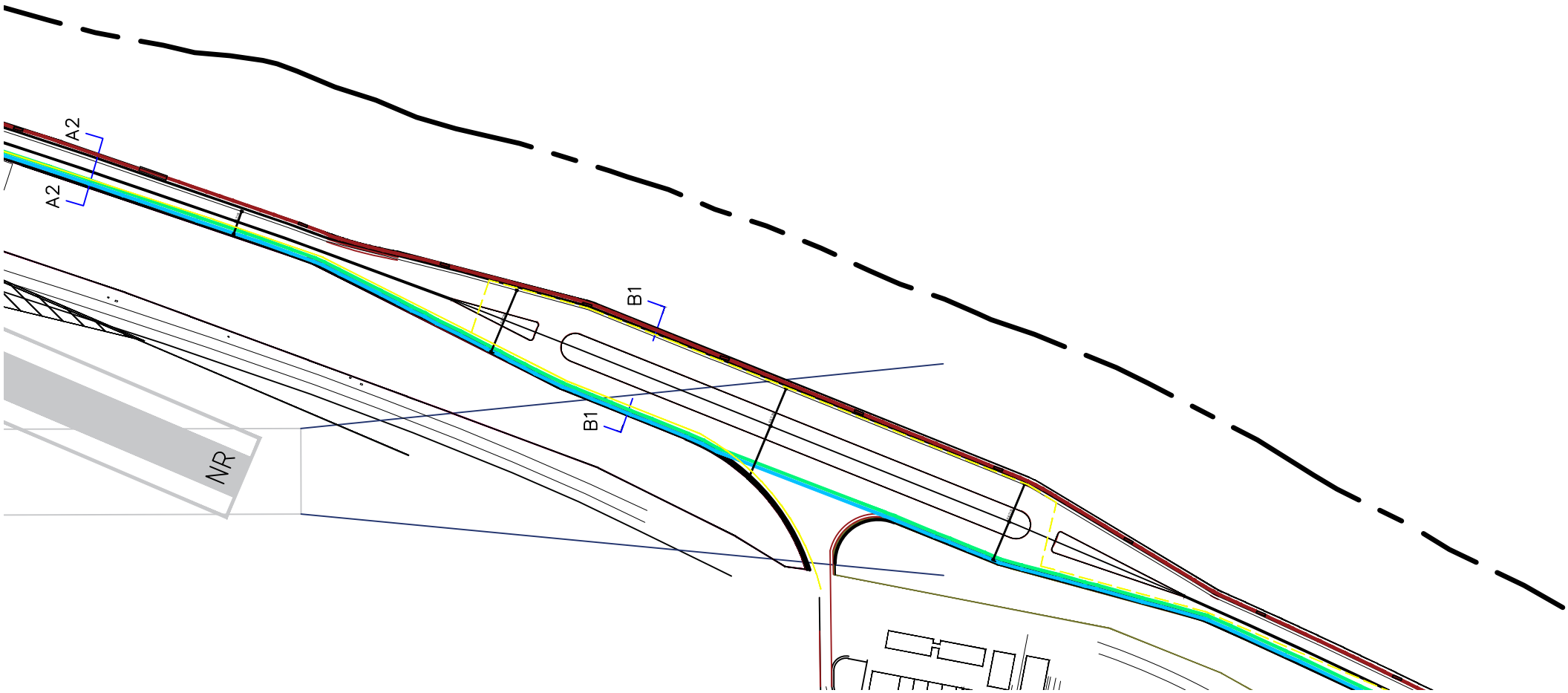
PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: MAP 1

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:



FIBRE OPTICAL CABLE
DEPTH: 0.75 METERS

WATER PIPELINE -ZONE A
DEPTH: 1.3- 1.5 METERS

WATER PIPELINE -ZONE B
DEPTH: 1.7- 1.8 METERS

STELCO 132KV PIPES

MWSC FUEL PIPELINE ROUTE

DHIRAAGU PROPOSED DUCT

DHIRAAGU EXISTING DUCT

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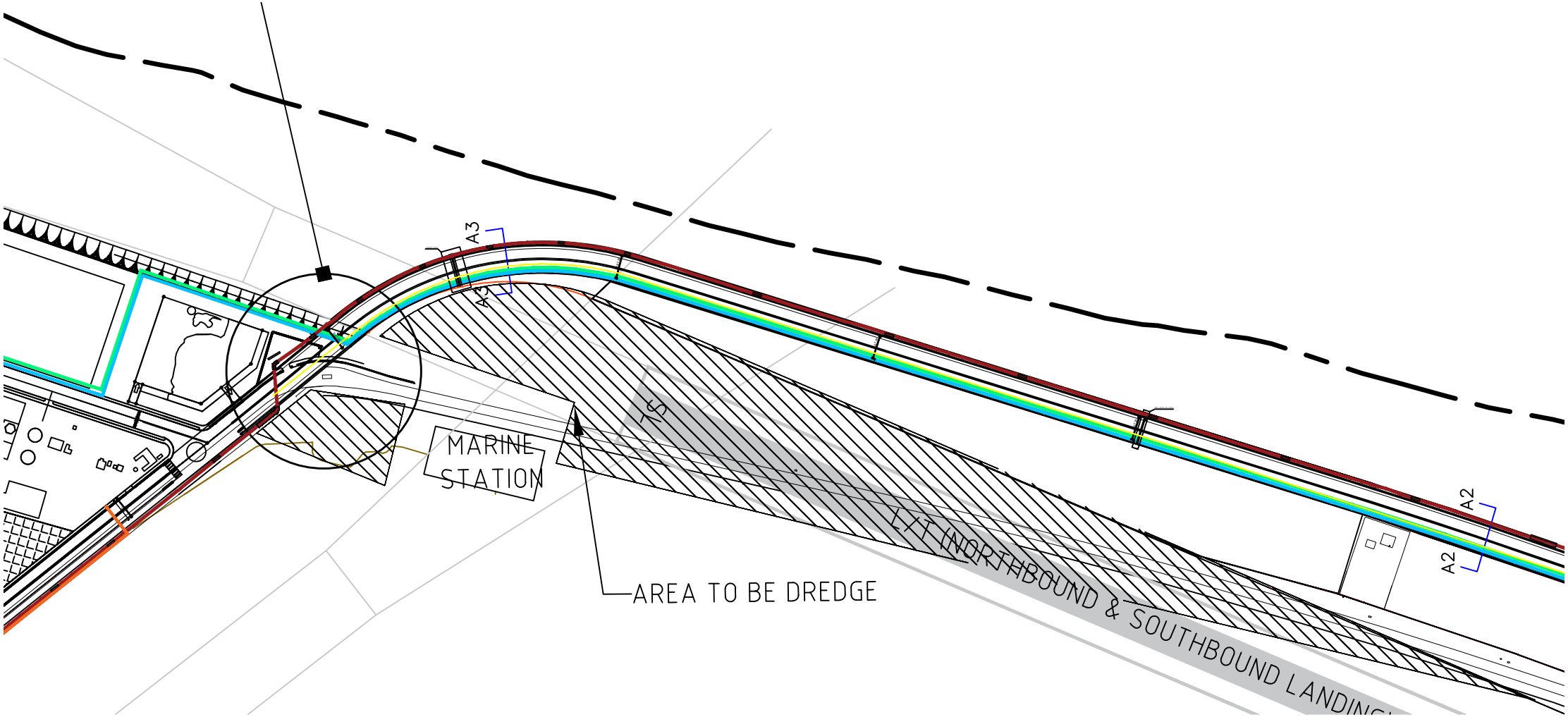
PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: MAP 2

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:



FIBRE OPTICAL CABLE
DEPTH: 0.75 METERS

WATER PIPELINE -ZONE A
DEPTH: 1.3- 1.5 METERS

WATER PIPELINE -ZONE B
DEPTH: 1.7- 1.8 METERS

STELCO 132KV PIPES

MWSC FUEL PIPELINE ROUTE

DHIRAAGU PROPOSED DUCT

DHIRAAGU EXISTING DUCT

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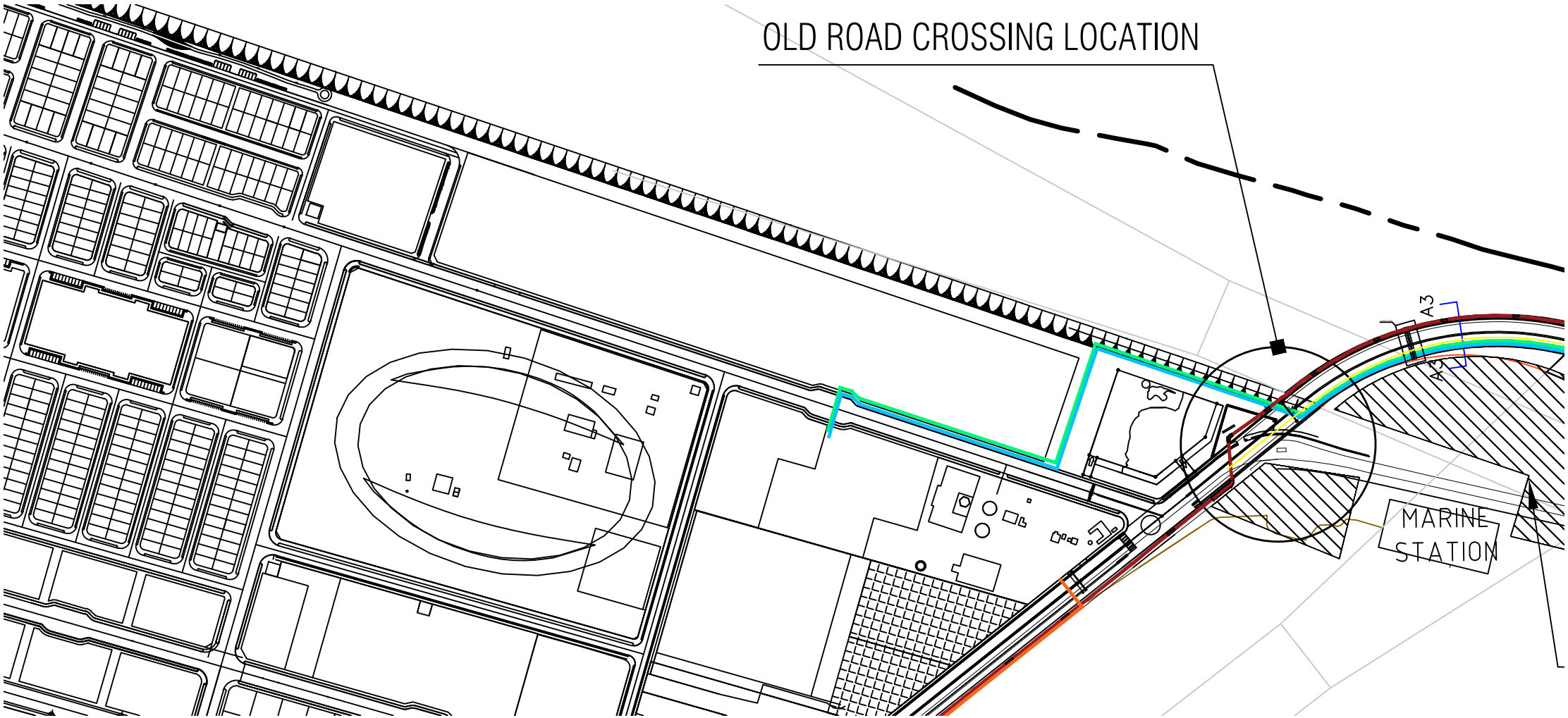
EMAIL : planning@hdc.com.mv

PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: MAP 3

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:

OLD ROAD CROSSING LOCATION



FIBRE OPTICAL CABLE
DEPTH: 0.75 METERS

WATER PIPELINE -ZONE A
DEPTH: 1.3- 1.5 METERS

WATER PIPELINE -ZONE B
DEPTH: 1.7- 1.8 METERS

STELCO 132KV PIPES

MWSC FUEL PIPELINE ROUTE

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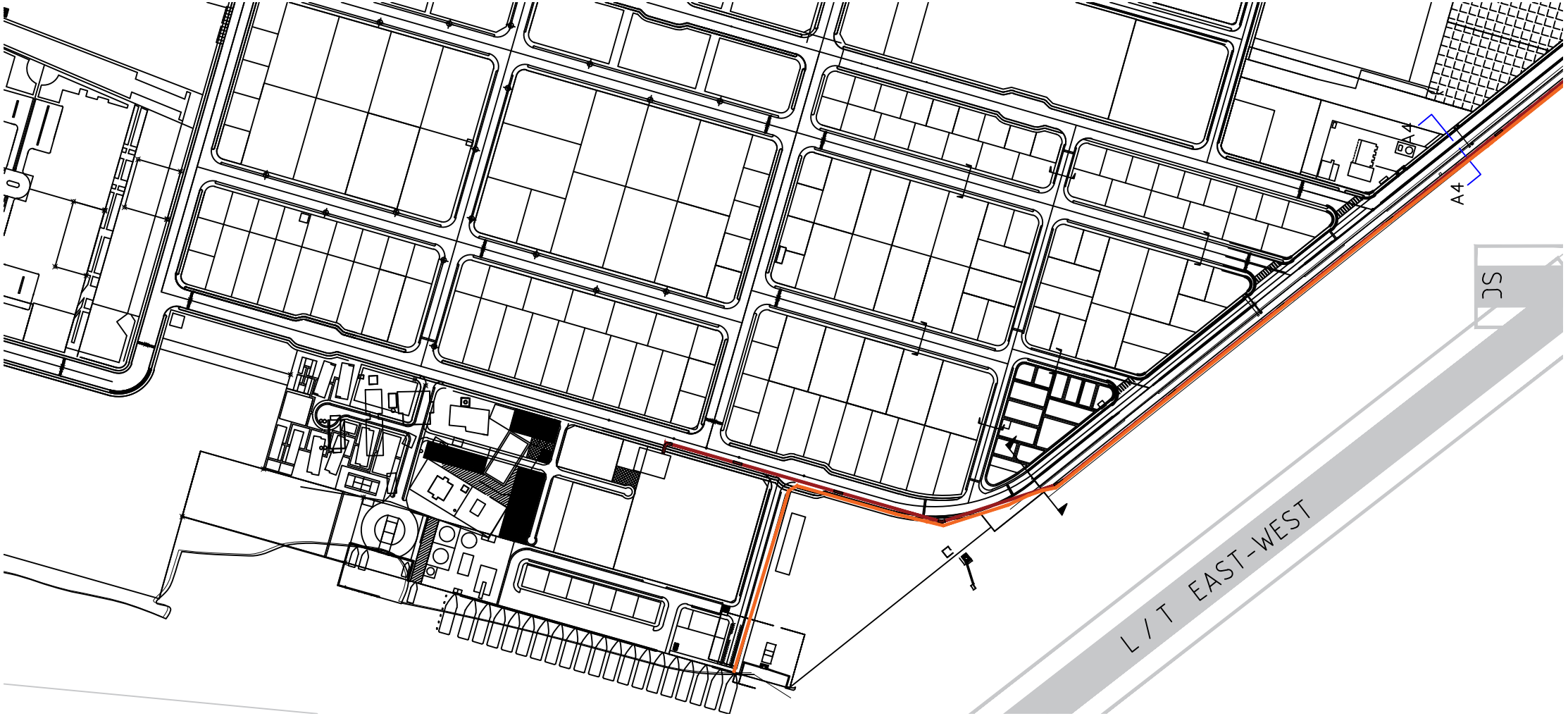
PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: MAP 4

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:



FIBRE OPTICAL CABLE
DEPTH: 0.75 METERS

WATER PIPELINE -ZONE A
DEPTH: 1.3- 1.5 METERS

WATER PIPELINE -ZONE B
DEPTH: 1.7- 1.8 METERS

STELCO 132KV PIPES

MWSC FUEL PIPELINE ROUTE

DHIRAAGU PROPOSED DUCT

DHIRAAGU EXISTING DUCT

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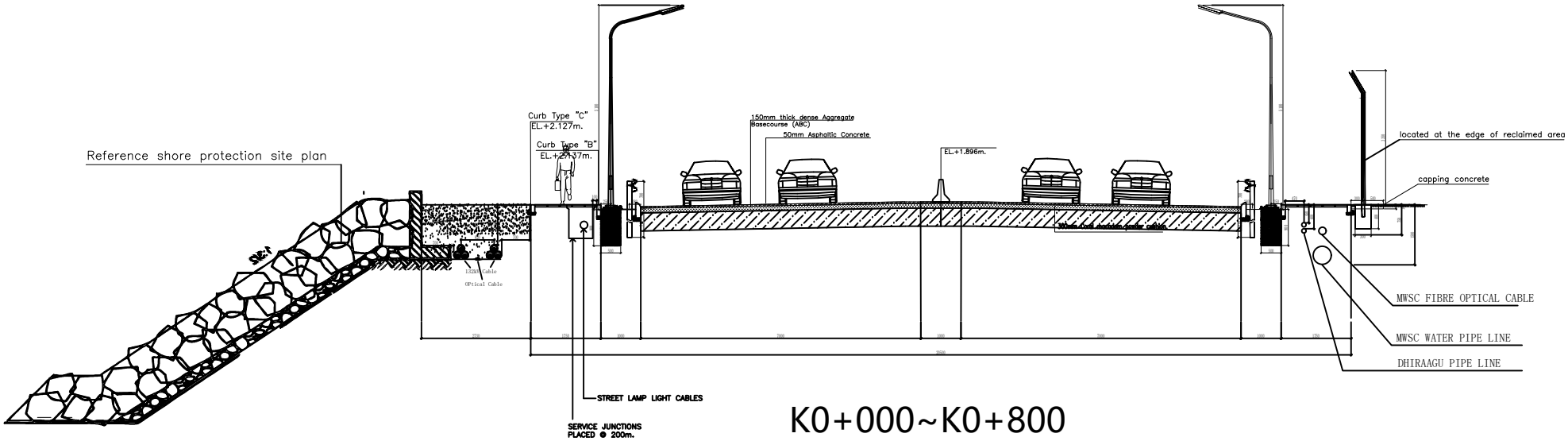
EMAIL : planning@hdc.com.mv

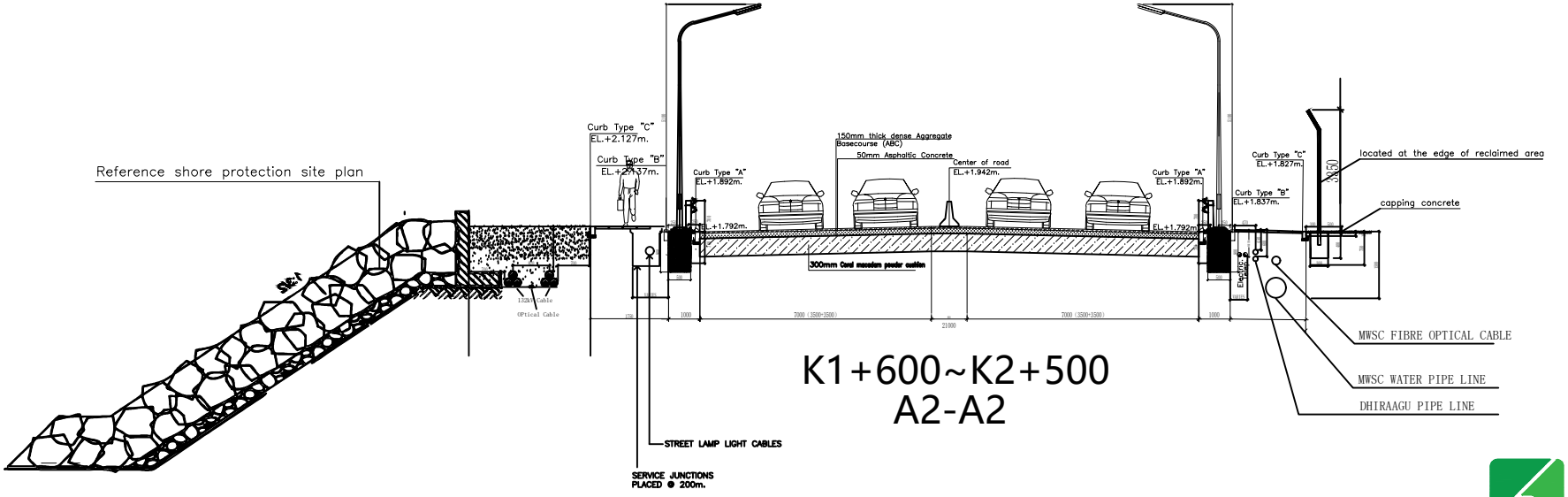
PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: MAP 5

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:



K0+000~K0+800
A1-A1



K1+600~K2+500
A2-A2

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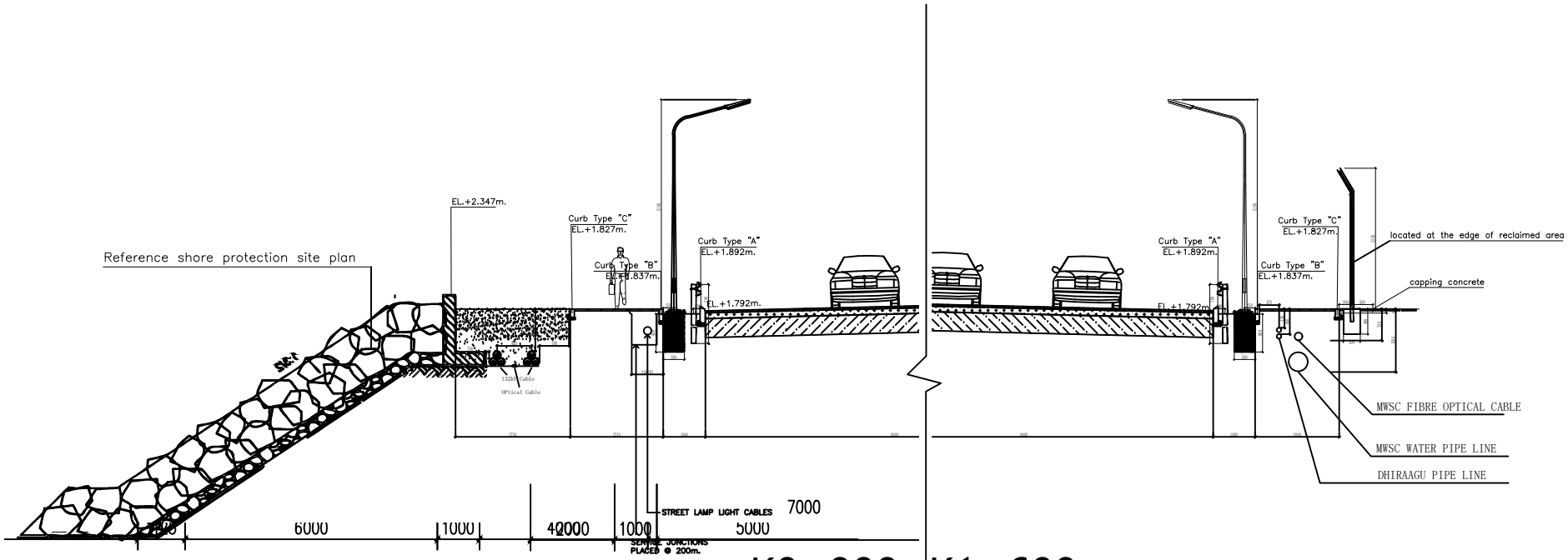
EMAIL : planning@hdc.com.mv

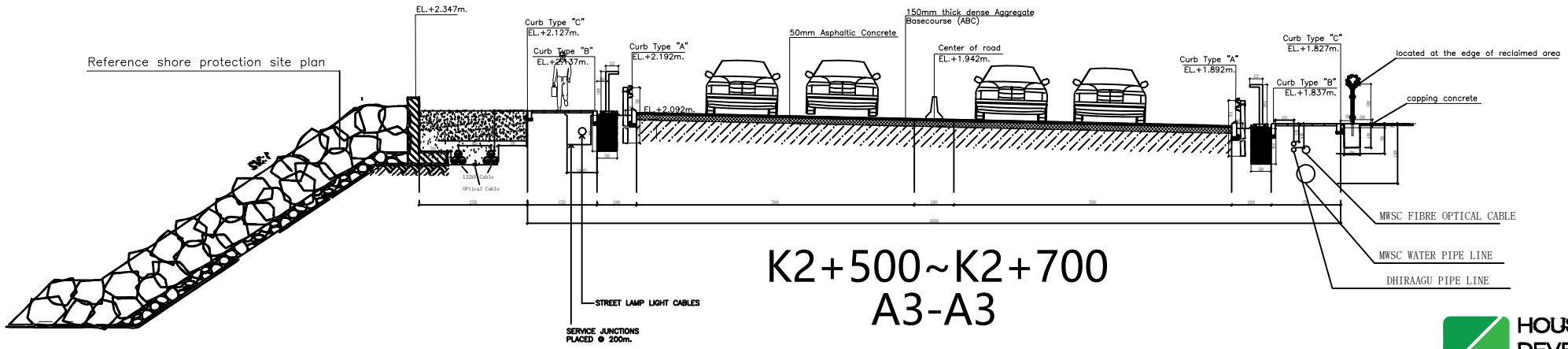
PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: SECTIONS

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:



K0+800~K1+600
B1-B1



K2+500~K2+700
A3-A3

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PLANNING AND DEVELOPMENT DEPARTMENT
3RD FLOOR, HDC BUILDING HULHUMALE'
REPUBLIC OF MALDIVES
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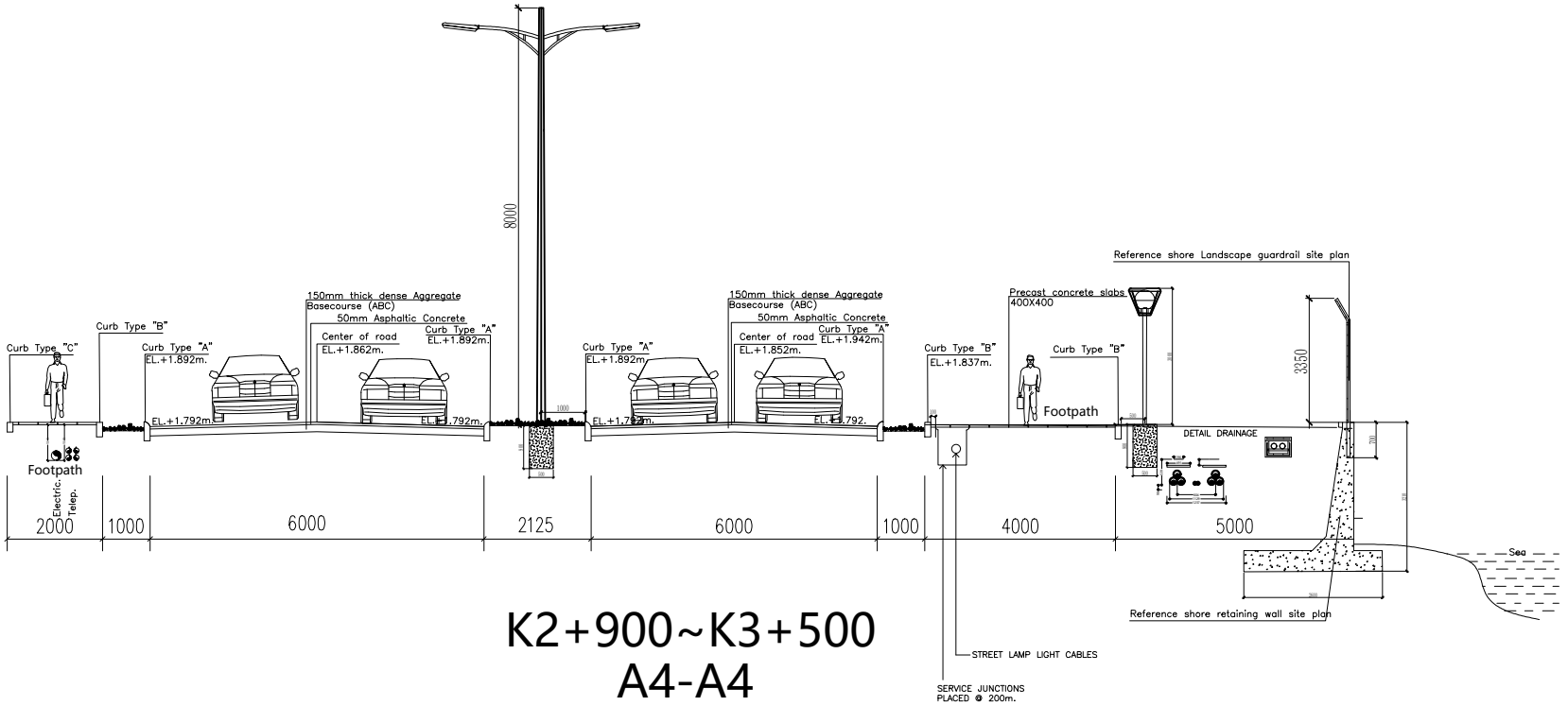
EMAIL : planning@hdc.com.mv

PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: SECTIONS

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:



K2+900~K3+500
A4-A4

PROJECT: HULHUMALE' LINK ROAD SERVICES

DRAWING: SECTIONS

Scale: N.T.S | Drawn by: Samaha | Checked by: Fathhee | Date: 25th February 2021 | Remarks:

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TEL. +(960)3353535, FAX +(960)3358892
EMAIL : planning@hdc.com.mv

17.8 Project schedule

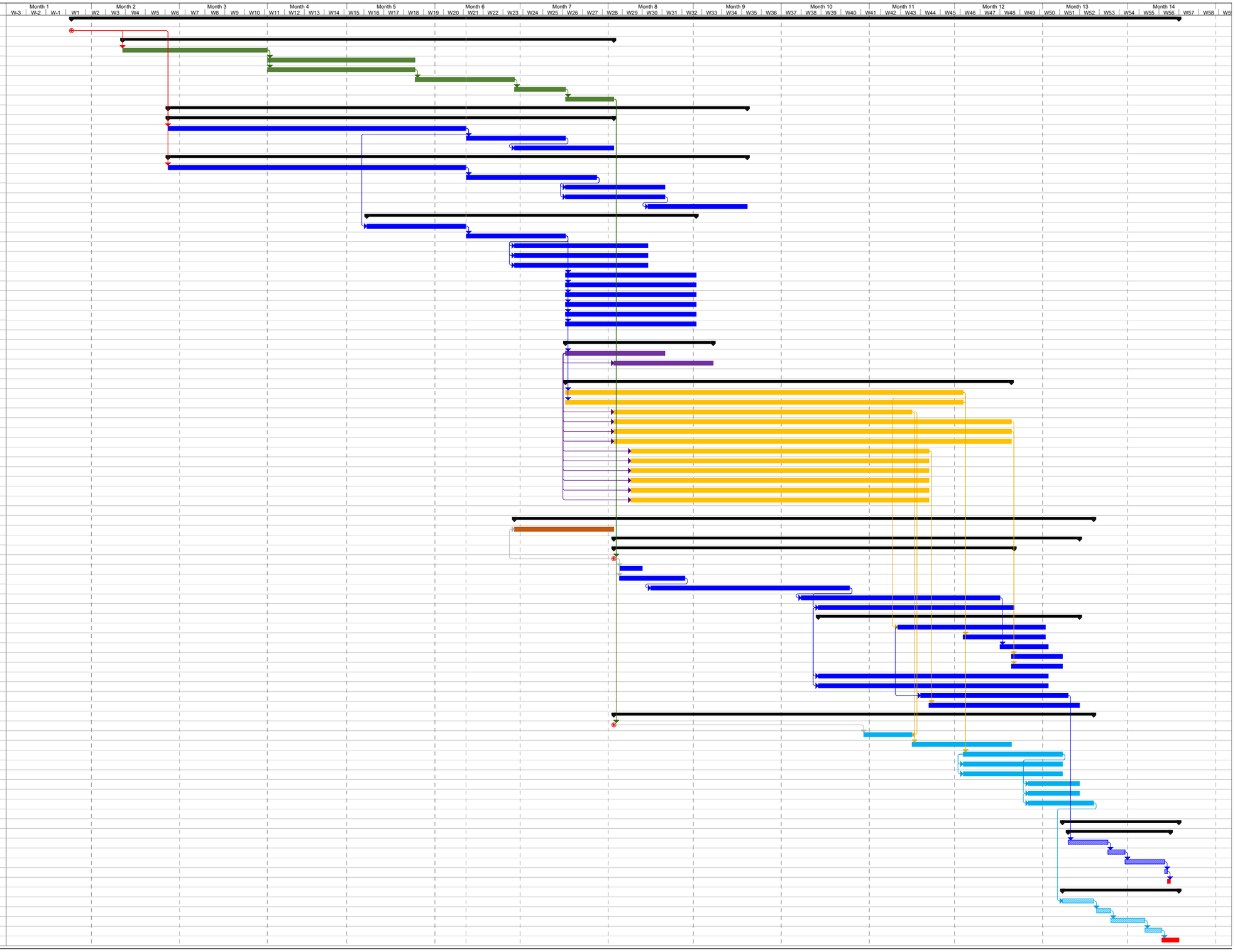
ENSYS

Construction Project Schedule

ASPIRE PROJECT

Installation of 5MW Grid-tied Solar Photovoltaic System in the Greater Malé Region under Design, Build, Finance, Own, Operate, and Transfer Basis

ID	Task Name	Duration
1	**ASPIRE - 5.6MW SOLAR PV SYSTEM PROJECT**	**336 days**
2	**Contract signing**	**1 day**
3	**1) ESIA Work**	**150 days**
4	Application form, Scoping Meeting & ToR approval (in EPA)	45 days
5	EIA field work and assessments	45 days
6	Stakeholder meetings	45 days
7	Final report	30 days
8	EIA Avaluation in EPA and WB	15 days
9	Comments, additional information for EIA and Final Approval	15 days
10	**2) Design & Engineering**	**175 days**
11	**2.1) Calculation & PVSyst simulation report**	**135 days**
12	Solar Glare Hazard Analysis Tool	90 days
13	Certified Solar Yield Analysis	30 days
14	Comments, additional information for Final Approval	30 days
15	**2.2) Civil work**	**175 days**
16	Soil investigation & Report	90 days
17	Caculation for Pile / Fondation work	40 days
18	Pile Layout Plan & Details	30 days
19	Module Mouting Structure Details	30 days
20	Switchgear & Transformer Yard	30 days
21	**2.3) Electrical System Work**	**100 days**
22	PV Module & Inverter (New Model) Documentation	30 days
23	PV Module & Inverter (New Model) for Approval	30 days
24	Single Line & Relaying Diagram	40 days
25	Grid connection system	40 days
26	General Arrangement Drawing	40 days
27	Cabling work / Routing	40 days
28	Grounding system	40 days
29	Inverter station	40 days
30	Communication & Monitoring System Diagram	40 days
31	Main control building	40 days
32	AC&DC Utilities load schedule	40 days
33		
34	**3) Material & Drawings submission for approval**	**45 days**
35	Main equipment (Switchgear / Transformer / MDB)	30 days
36	Auxiliary & Consumable equipments	30 days
37		
38	**4) Procurement & Delivey on site date**	**135 days**
39	PV Modules	120 days
40	Inverters	120 days
41	Mounting Structure	90 days
42	MV Switchgear	120 days
43	Transformers	120 days
44	LV MDB & DB	120 days
45	Communication & Monitoring System	90 days
46	Cable Tray / conduits	90 days
47	Grounding System	90 days
48	DC Cables	90 days
49	AC Cables	90 days
50	Comminication Cable	90 days
51		
52	**5) Construction & Installation Completed**	**175 days**
53	Site office / Storage / Laydown area / Fabrication area	30 days
54	**5.1) PV Solar On-Ground (Link Road)**	**140 days**
55	**5.1.1) Civil Construction**	**121 days**
56	Site handover	1 day
57	Site mobilization	7 days
58	Land preparation	20 days
59	Piling & Concrete foundation work	60 days
60	Transformer yard & Switchgear housing	60 days
61	Mounting structure installation	60 days
62	**5.1.2) Electrical Erection**	**79 days**
63	PV Module Installation	45 days
64	Inverter Installation	25 days
65	LV MDB & DB	15 days
66	MV Switchgear & Metering	15 days
67	Transformers	15 days
68	Grounding system	70 days
69	Underground cabling work	70 days
70	Cabling work	45 days
71	Monitoring & Communication System	45 days
72	**5.2) PV Solar Rooftop Area**	**145 days**
73	Site handover	1 day
74	Site mobilization & preparation	15 days
75	Mounting Structure installation	30 days
76	PV Module Installation	30 days
77	Grounding system	30 days
78	Cabling work	30 days
79	Inverter Installation	15 days
80	LV MDB & Metering	15 days
81	Monitoring & Communication System	20 days
82		
83	**6) Test & Comissioning**	**35 days**
84	**6.1) PV Solar On-Ground**	**31 days**
85	Pre-Commissioning	12 days
86	Connected to Grid	5 days
87	Commissioning	12 days
88	First Synchronisation with Grid	1 day
89	COD	1 day
90	**6.2) PV Solar Rooftop Area**	**35 days**
91	Pre-Commissioning	10 days
92	Connected to Grid	5 days
93	Commissioning	10 days
94	First Synchronisation with Grid	5 days
95	COD	5 days



Revision : 02
Date: 12 April 2021

Task | Milestone | Project Summary | External Milestone | Inactive Milestone | Manual Task | Manual Summary Rollup | Start-only | Progress
Split | Summary | External Tasks | Inactive Task | Inactive Summary | Duration-only | Manual Summary | Finish-only | Deadline

17.9 Evidence of report submission to Male City Council

Firdous Hussain <firdous@foresightsurveyors.com>

ESMP for the 5MW Solar PV Project in Greater Male' area

Firdous Hussain <firdous@foresightsurveyors.com> Mon, Aug 2, 2021 at 9:39 AM
To: secretariat@malecity.gov.mv

To Whom It May Concern,

PFA report.

Rgds
Firdous Hussain
Director
Registered EIA Consultant
Registered Surveyor

Foresight Surveyors (Pvt) Ltd.
3rd Floor | M. Deep Light | Fareedhee Hingun
Male' 20191 | Republic of Maldives

Mobile: +960 7973873
Telephone: + 960 3330567
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Email: firdous@foresightsurveyors.com
URL: www.foresightsurveyors.com

ENGINEERING SURVEY | GPS CONTROL SURVEY | HYDROGRAPHIC BATHYMETRIC SURVEY | TOPOGRAPHIC SURVEY | LAND SURVEY | SURVEY RELATED CONSULTANCY

Please consider the environment before printing this email

ESMP to th eproposed 5MW solar PV System in Greater Male' area.pdf
7787K

17.10 Safeguard measures against Covid19

Guidance Note: ESMP Requirements & COVID19 Special Consideration in Civil Works Contracts

Contractor: Ensys Company Limited

This guidance note includes measures to safeguard the health and safety of the construction workers in response to COVID19 pandemic and their families, people living at or close to the project site, as well as the general public, and includes reporting templates for the implementation of mitigation measures reflected in the ESMP for the proposed project. The paper is prepared by referring to the national and the World's Bank's requirements.

The contactor must ensure that the mitigation measures proposed in this paper are fully implemented and the PMU should closely monitor the project activities to ensure that the contractor adheres to these requirements.

1. PRECONSTRUCTION / PREPARATORY PHASE

1.1. ACTIONS NEEDED PRIOR TO MOBILIZATION

The contractor must take all precautionary measures to ensure that the workers are not at risk or doesn't not carry the risk of infection. As such, the contractor must provide all necessary details related to the project team by using the spread sheet presented in **Annex 1** and submit to the PMU along with the signed declaration presented in **Annex 2.** If expatriate workers are included in the project team, copies of their work permit should be submitted.

The project team shall not include:

- A worker that falls in the high-risk category for COVID19; aged 65 and above, under long term medication or having chronic disease. If high risk staff are included, they are required to be vaccinated.
- A worker that has made contact with a COVID19 positive case.
- A resident of a house put under monitoring or quarantine.
- An illegal immigrant.

Refer to the latest update sheet from the following link for the list of places under monitoring or quarantine.

https://covid19.health.gov.mv/downloads/

The contractor should identify an Environmental and Social focal point to ensure that the mitigation measures presented in the ESMP are being properly implemented and to enforce COVID-19 preventive measures. The focal point can be a work supervisor or a health and safety specialist. This person is responsible for coordinating preparation of the site and making sure that the measures taken are communicated to the workers, those entering the site and the island community. It is also advisable to designate at least one back-up person; in case the focal point becomes ill; that person should be aware of the arrangements that are in place. A health and safety briefing should be provided to the workers prior to mobilization. In addition to this, it is recommended to assign a specific staff to assume cleaning duties.

Furthermore, if the project involves mobilization of a team or a member from an island under COVID19 monitoring to the project island, travel permit from HEOC must be attained (with a negative PCR test) and the PMU notified accordingly.

The contractor must ensure that the project team is fully equipped and geared to take preventive measures against the potential spread of COVID19 and must travel with and carry sufficient quantities of all the required PPEs and cleaning items. Some of such items are listed below:

- Thermometer
- First-aid kit
- General flu medicine
- Masks
- Gloves
- Foot operated lidded dustbins
- Dustbin bags
- Disinfecting liquid such as bleach
- Cleaning equipment (broom, mop etc.)
- Hand sanitizers
- Soap

The contractor is required to submit a full list of such health and safety related items and their respective quantities by using the spread sheet provided in **Annex 3.**

The information presented in this section must be provided to the PMU prior to mobilization.

1.2. MOBILIZATION AND SETTING UP WORK SITE AND ACCOMMODATION

The following guidance should be taken into account when setting up the labor camp:

- Social distancing norms must be facilitated. Each bed must be separated by a distance of at least 3 to 6 feet.
- The accommodation facility must be properly ventilated. It is advisable to keep the windows open.
- A foot operated lidded bin is recommended to be kept at or just outside the accommodation to collect general waste generated by the workers. Foot operated lidded bins should also be kept at the work site and at the kitchen and dining area to collect general waste.
- Hand sanitizers are to be kept at entrance point to the accommodation (wall mounted or kept on top of a table) as well as inside the accommodation facility preferably at each bed side.

- Establish handwashing facilities at the work site and eating or resting areas. Hand Sanitizers can be used as an alternative.
- Ensure handwashing facilities supplied with soap, disposable paper towels and closed waste bins exist at toilets, kitchen and dining area. Alcohol based sanitizer (if available, 60-95%alcohol) can also be used.
- Place posters and signs around the site, with images and text in workers' local languages providing guidance on signs and symptoms of COVID-19, how it is spread, how to protect themselves (including regular handwashing and social distancing) and what to do if they or other people have symptoms. Examples of WASH guidance from the WHO and important contact numbers are provided in **Annex 4 and 5**.

2. CONSTRUCTION PHASE

2.1. CHECKS ON COMMENCEMENT OF WORK

Entry/exit to the work site should be controlled and documented. The following actions are recommended:

- The movement of the workers should be restricted from the labor camp to the work site and from the work site to the labor camp.
- The workers should avoid contact with the general public of the project island.
- Daily temperature checks should be taken and recorded prior to leaving the labor camp and entering the work site. Logs should be maintained and attached to the monthly Health and Safety report.
- Provide daily briefings to workers prior to commencing work, focusing on COVID-19 specific considerations including cough etiquette, hand hygiene and distancing measures, using demonstrations and participatory methods.
- During the daily briefings, remind workers to self-monitor for possible symptoms (fever, cough) and to report to the supervisor or the COVID-19 focal point if they have symptoms or are feeling unwell.
- If there is any symptom of COVID19 (fever, cough), the staff must be immediately isolated, referred to the health center and the concerned authorities must be notified. This staff should not be involved in the project team until cleared by the respective authorities.
- Any other staff who have had close contact with the staff who developed symptoms must be self-quarantined for 14 days and should not be allowed to enter the project site or move about in the project island, even if there are no symptoms. The directions given by the authorities should be strictly followed.

2.2. CLEANING AND WASTE DISPOSAL

- The tools and equipment used by the workers must be cleaned when changing shifts.
- Cleaning staff shall use appropriate PPEs such as masks and gloves.
- The labor camp must be cleaned frequently (at least once a day) including accommodation facility, kitchen, dining area and toilets. The floor, walls and door knobs should be properly cleaned using 1:9 bleach solution. Sheets and linings must be changed at least weekly.
- Any waste produced during the care of ill workers should be collected separately in designated containers or bags and treated and disposed of according to the SOPs of HPA and WHO. This includes placing double bags inside the bins, properly tying and removing the bags when 2/3 are full and disinfected by spraying with 1:9 bleach solution.

2.3. ADJUSTING WORK PRACTICES

Consider changes to work processes and timings to reduce or minimize contact between workers, recognizing that this is likely to impact the project schedule. Such measures could include:

- Changing to a 24-hour work rotation.
- Adapting or redesigning work processes for specific work activities and tasks to enable social distancing, and training workers on these processes.

- Consider changing canteen layouts and phasing meal times to allow for social distancing.
- Consider using of dust masks in addition to the general construction PPEs.

3. MONITORING PLAN

Health and Safety Monitoring Report containing details and photographic evidence of mitigation measures undertaken in response to the COVID19 situation must be prepared according to the format given in the Annex 6 and submitted to the PMU monthly.

Additionally, general construction phase monitoring reports should be produced monthly and submitted to the PMU as per the requirements of ESMP developed for the project.

ANNEX 1: PROJECT TEAM INFORMATION

#	Staff Name	Role	Nationality	ID Card / Work Permit No	Age	Do not fall under COVID19 high risk category	Not a direct contact of a COVID19 positive case	Present location (indicate if in an island under COVID19 monitoring)
1		Work Supervisor						
2		Health and Safety Supervisor						
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

ANNEX 2: CONTRACTOR'S DECLARATION

I / we hereby declare that the information provided in the attached "project team information" sheet and "details of health and safety items to be brought to the facility" sheet is true and accurate. I / we also confirm that the project team does not contain any member with a potential risk of carrying and transmitting COVID19, nor has been in contact with a COVID19 confirmed case, nor has a member that falls under high-risk category or if a high-risk member is included, he/she has been vaccinated.

I / we hereby also provide full assurance and commitment to undertake the preventive measures prescribed in the guidance note on "COVID19 Special Consideration in Civil Works Contracts" and mitigation and monitoring requirements for the construction phase presented in the ESMP for the project. I / we also agree to the timely submission of Health and Safety Monitoring Report and the ESMP Monitoring Report on a monthly basis.

Name:

Designation:

Contact:

Signature:

Stamp:

Date:

ANNEX 3: DETAILS OF HEALTH AND SAFETY ITEMS PROPOSED TO BE USED

#	Item Name	Quantity	Intended Purpose of Use
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

ANNEX 4: WASH GUIDANCE FROM WHO

Source: WHO (2009)

How to Handrub?

RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

Duration of the entire procedure: 20–30 seconds

Apply a palmful of the product in a cupped hand, covering all surfaces

Rub hands palm to palm

Right palm over left dorsum with interlaced fingers and vice versa

Palm to palm with fingers interlaced

Backs of fingers to opposing palms with fingers interlocked

Rotational rubbing of left thumb clasped in right palm and vice versa

Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa

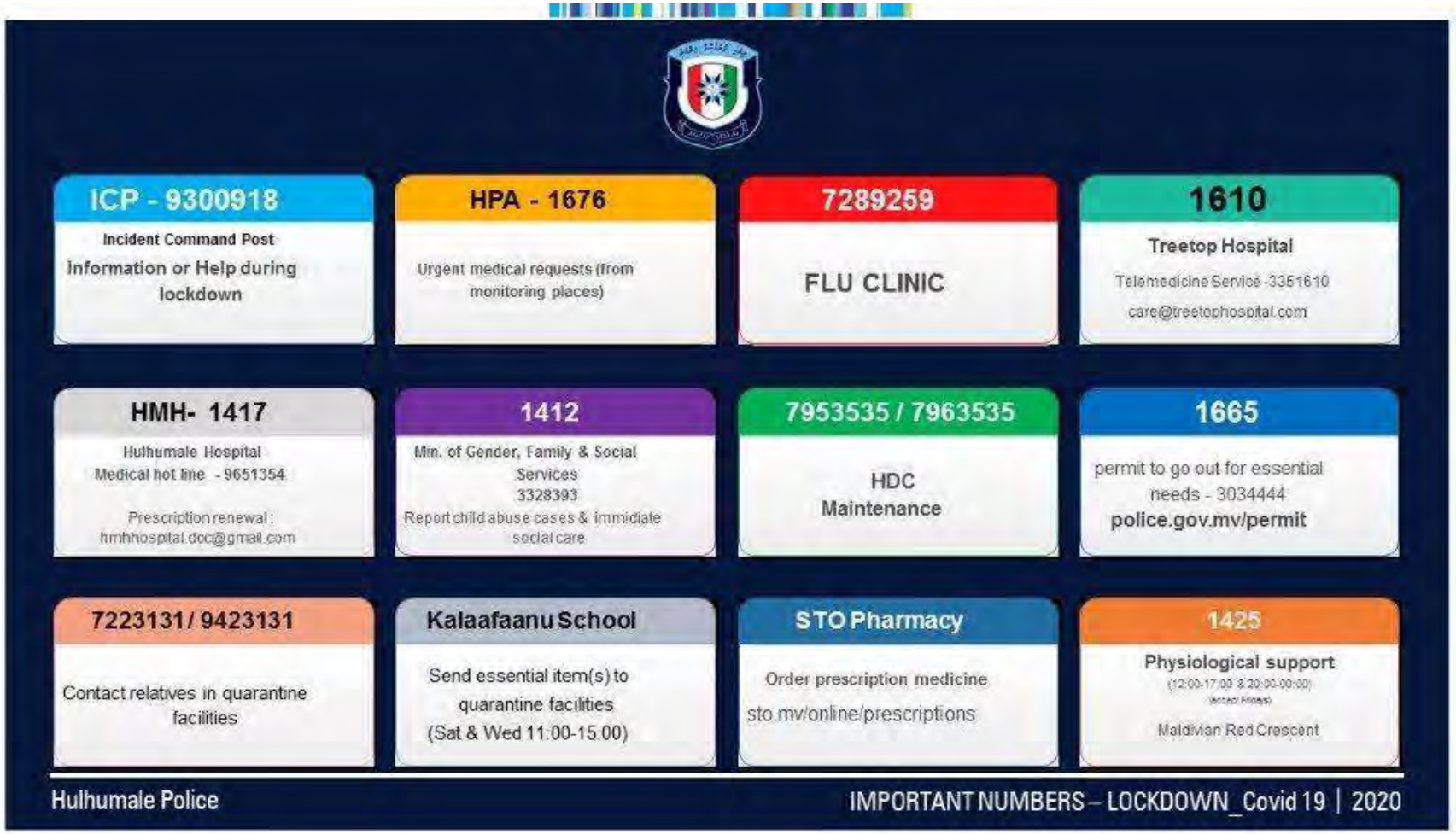
Once dry, your hands are safe

World Health Organization | Patient Safety | SAVE LIVES Clean Your Hands

Close bag with a single overhand knot:

Do not close by crossing tabs ("bunny or dog-ear" method)

ANNEX 5: IMPORTANT CONTACTS



ANNEX 6: HEALTH AND SAFETY MONITORING REPORT TEMPLATE

Project Title: **Report No:**

Proponent: Accelerating Sustainable Private Investment in Renewable Energy Project **Date:**

Contractor: Ensys Co ltd.

Mitigation Measure	Status (√ / X)	Comments / Photographic Reference
Preconstruction Phase		
Actions Needed Prior to Mobilization		
• In general, the project team should not contain any member that falls under the high-risk category. If a high-risk category member is included, he/she should be vaccinated.		
• Sufficient supply of PPEs, cleaning items and other items required to set by the labor camp is brought such as: ➢ Thermometer ➢ First-aid kit ➢ General flu medicine ➢ Masks ➢ Gloves ➢ Foot operated lidded dustbins ➢ Dustbin bags ➢ Disinfecting liquid such as bleach ➢ Cleaning equipment (broom, mop etc.) ➢ Hand sanitizers ➢ Soap		
• Contractor's Declaration is submitted		
Measures for Setting up Labor Camp		
• Social Distancing Norms are facilitated when setting up labor camp. Each bed must be separated by a distance of at least 3 to 6 feet.		
• Accommodation are kept properly ventilated. Windows must be kept open.		

• A foot operated lidded bin is kept at or just outside the accommodation to collect general waste generated by the workers.		
• Foot operated lidded bins are kept at the work site and at the kitchen and dining area to collect general waste. Double bags should be placed inside these bins.		
• Hand sanitizers are to be kept at entrance point to the accommodation (wall mounted or kept on top of a table) as well as inside the accommodation facility preferably at each bed side. Handwashing facilities can be set up as an alternative		
• Establish handwashing facilities at the work site and eating or resting areas. Hand Sanitizers can be used as an alternative.		
• Ensure handwashing facilities supplied with soap, disposable paper towels and closed waste bins exist at toilets, kitchen and dining area. Alcohol based sanitizer (if available, 60-95%alcohol) can also be used.		
• Place posters and signs around the site, with images and text in local languages providing guidance on signs and symptoms of COVID-19, how it is spread, how to protect themselves (including regular handwashing and social distancing) and what to do if they or other people have symptoms.		
Construction Phase		
Checks on Commencement of Work		
• The movement of the workers should be restricted from the labor camp to the work site and from the work site to the labor camp.		
• The workers should avoid contact with the general public of the project island.		
• Daily temperature checks should be taken and recorded prior to leaving the labor camp and entering the work site. Logs should be maintained and attached to the monthly Health and Safety report.		
• Provide daily briefings to workers prior to commencing work, focusing on COVID-19 specific considerations including cough etiquette, hand hygiene and distancing measures, using demonstrations and participatory methods.		

• During the daily briefings, remind workers to self-monitor for possible symptoms (fever, cough) and to report to the supervisor or the COVID-19 focal point if they have symptoms or are feeling unwell.		
• If there is any symptom of COVID19 (fever, cough), the staff must be immediately isolated, referred to the health center and the concerned authorities must be notified. This staff should not be involved in the project team until cleared by the respective authorities.		
• Any other staff who have had close contact with the staff who developed symptoms must be self-quarantined for 14 days and should not be allowed to enter the project site or move about in the project island, even if there are no symptoms. The directions given by the authorities should be strictly followed.		
Clean and Waste Disposal		
• The tools and equipment used by the workers must be cleaned when changing shifts.		
• Cleaning staff shall use appropriate PPEs such as masks and gloves.		
• The labor camp must be cleaned frequently (at least once a day) including accommodation facility, kitchen, dining area and toilets. The floor, walls and door knobs should be properly cleaned using 1:9 bleach solution. Sheets and linings must be changed at least weekly.		
• Any waste produced during the care of ill workers should be collected separately in designated containers or bags and treated and disposed of according to the SOPs of HPA and WHO. This includes placing double bags inside the bins, properly tying and removing the bags when 2/3 are full and disinfected by spraying with 1:9 bleach solution.		
Adjusting Work Practices		
• Changing to a 24-hour work rotation.		
• Adapting or redesigning work processes for specific work activities and tasks to enable social distancing, and training workers on these processes.		

• Consider changing canteen layouts and phasing meal times to allow for social distancing.		
• Consider using of dust masks in addition to the general construction PPEs.		
Grievance Redress Mechanism		
• Project board and posters containing the details of contact person from contractor, island council and PMU are placed in various locations of the project site and the labor camp.		
• Log records of grievances are maintained		

17.11 Approval letters by the government institutions

بسم الله الرحمن الرحيم

HOUSING
DEVELOPMENT
CORPORATION

HDC(161)-P/438/2018/7 :ނަންބަރު

ފިހާރަ ފެށުމާ ގުޅޭ ތަކެތި ގަތުމާ ގުޅޭ ކޮންމެ ވެސް ކަންކަމަށް ކުރިން،

ފާހަގަ ކުރަންވާނީ ތިރީގައިވާ ކަންތައްތަކެވެ.

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بسم الله الرحمن الرحيم

MALDIVES CIVIL AVIATION AUTHORITY
11th Floor, Velaanaage, Ameer Ahmed Magu,Male', 20096, Maldives

ދިވެހިރާއްޖޭގެ ސިވިލް ޏަވާބުދާރީ ބޯޑު
11 ވަނަ ފަންގިފިލާ، ވެލާ ތައްޤާ، ދިވެ ތ ތ ތ

بسم الله الرحمن الرحيم

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މާލެ، ދިވެހިރާއްޖެ

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ފުރިހަމަ ސަލާމަކާއެކު ދަންނަވަމެވެ.

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25 ނޮވެމްބަރު 2018

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މާލެ، ދިވެހިރާއްޖެ.

Ministry of National Planning and Infrastructure
Male', Republic of Maldives

މިނިސްޓްރީ އޮފް ނޭޝަނަލް ޕްލޭނިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ
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ވެދުން ސަލާމަށްފަހު ދަންނަވަމެވެ.

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ތިޔަ މިނިސްޓްރީއިން މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރއަށް ފޮނުއްވާފައިވާ ނަންބަރު: 438/ASPIRE/138/2018/127 (11 އޮކްޓޫބަރ 2018) ގެ ސިޓީއާ ހަވާލާދީ ދަންނަވަމެވެ.

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ޑިރެކްޓަރ ޖެނެރަލް

(އެކްޓިންގ ޕަރމަނަންޓް ސެކްރެޓަރީ)

މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް،

މާލެ، ދިވެހިރާއްޖެ،

17.12 Safety recommendations for handling PV Module

Safety recommendations

PV modules are fragile and number of specific safety instructions must be followed during handling, loading, transfer, unpacking and installation. All the handling instructions provided by the manufacturer must be followed.

Warning

Before installing, wiring, operation, or maintaining PV modules, all safety precautions must be read and understood. Direct current (DC) is generated when the battery surface of the module is exposed to direct sunlight or other light sources, and direct contact with the live parts of the module, such as terminals, may result in death of personnel whether connected to the module or not.

General Safety

- PV module installation is conducted by certified technicians or by people with experience in PV system installation. Operation by personnel who are not familiar with the relevant safety procedures will be risky to the PV modules and to the person.
- Do not allow unauthorized persons to access the installation area or module storage area.
- Do not install modules with damaged glass or damaged back sheet.
- Do not disassemble or move any part of the module.
- Do not artificially direct light on the module.
- Do not connect or disconnect the module when it is energized or connected with an external power supply.
- Installed modules should not be shaded by buildings, trees, chimney etc, at any time of the day.

Handling Safety

- Do not stand, walk on or lean the module directly.
- Do not damage or scratch the front or backside surfaces of the module.
- Do not scratch the output cable or bend it with force. The insulation of output cable can break and may result in electricity leakage or shock.
- Do not use water to extinguish fires of an electrical origin.
- Do not install or handle modules when they are wet or during periods of high wind. At the installation site, take care to keep modules and in particular their electrical contacts, clean and dry before installation. If connector cables are left in damp conditions, then the contacts may corrode. Any module with corroded contacts should not be used.
- N not loosen or unscrew the PV module bolts. This may lead to a reduction of the module's load rating and potential damage from a fall.
- Do not touch the terminal box or the ends of the output cables (connectors) with bare hands under sunlight, regardless of whether the PV module is connected to or disconnected from the system.

Safety measures during loading/transportation and storage

- The modules should be stored in the original package before installation. Protect the package from damage. Unpack the modules as per the recommended unpacking procedures. The whole process of unpacking, transport and storing should be handled with care.

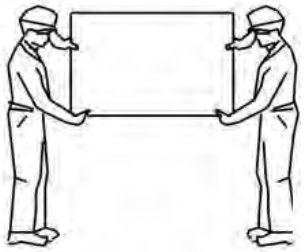
- Do not stand, climb, walk or jump on unpacked pallets of modules.
- Before installation, ensure that all modules and electrical contacts are clean and dry.
- If the modules are required to be stored temporarily, they should be stored under dry and ventilated conditions.
- Unpacking must be carried out by two or more persons at the same time. It is forbidden to use the wires or junction boxes of the modules to carry the modules. Handling the modules requires two or more people with non-slip gloves.
- Do not handle the modules over-head or stack the modules.
- Do not allow the modules to come in contact with sharp-pointed objectives to prevent them from scratches, avoiding a direct impact on the safety of modules.
- Unloaded PV modules must be placed over a level surface.
- Only one layer of stacking is allowed for small truck. Hence, this is the recommended way of stacking for the project. Make sure that the package is fixed with packing straps securely to the shipping platform without movement.
- Do not stack more than two layers during storage in the warehouse.
- Do not expose the modules to rain or moisture. Store the finished product in a well ventilated, waterproof and dry place.
- Do not remove the original packaging if the module requires long-distance transport or long-term storage.
- Normal warehouse storage condition;
    - Moisture ＜85%
    - temperature range from -20°C to + 50 °C
- During unpacking in outdoors, it is not allowed to operate in rainy conditions.
- It is not recommended to transport the modules in windy conditions. The unpacked modules must be tied down to avoid any unwanted movement during transportation.
- Wear protective gloves during unpacking to avoid hand injury and fingerprints on the glass surface.
- Each module shall be handled by two persons. It is not allowed to use the wires or junction boxes of the modules to carry the module. Do not take the module out of the carton by pulling on the long side frame.

Safety measures during installation

- Always wear dry insulation protection equipment such as insulated tools, head gear, insulated gloves, safety belt and safety shoes (with rubber soles).
- Do not wear metallic jewelry which can cause electric shock during installation. Do not install modules under rain, snow or windy conditions.
- Keep the connector dry and clean during installation to avoid the risk of electric shock. It is recommended to install it immediately after unpacking.
- Do not perform any work if the terminals of the PV modules are wet. Please install immediately after unpacking.
- Keep the PV module packed in the carton until installation.
- Use an opaque material to completely cover the PV module surface during PV module installation and wiring.
- Do not unplug the connector if the system circuit is connected to a load.
- Do not stand on the module glass while installing. There is a risk of injury or electric shock if glass is broken.
- Do not work alone (always work as a team of 2 or more people).

- Do not damage the back sheet of PV modules when fastening the PV modules to a support with bolts.
- The cable length of junction box shall be selected according to the installation mode. When wiring, the ties for fixing the cables coils shall be removed. The cable shall be fixed on the installation system (frame or bracket, guide rail) with UV resistant cable ties or wire cards to avoid direct sunlight or immersion in water and mechanical damage of the cable. Otherwise it may cause accelerated aging of the cable or even leakage and fire. Bifacial PV modules should also avoid blocking the solar cells on the back of the module. Open area should minimize arc coil, which can reduce the risk of induced lightning impact on PV module.
- Modules with different color codes are not recommended to be installed in one block or the same rooftop.

Safety marks on outer packaging

<table>
<tr><td>Do NOT step on the package and module
  </td><td>The carton can be recycled
  </td></tr>
<tr><td>Modules shall be stacked as required, not exceeding the maximum number of layers printed on the outer packaging. (n = 2 means no more than two layers and n = 3 means no more than three layers)
  </td><td>One module shall be handled by at least two persons together
  </td></tr>
<tr><td colspan="2">When the carton box is loading and uploading in the transportation. Attention: Prevent collision on the top.
  </td></tr>
</table>

Do NOT discard the modules at will; special recycling is required 	Modules must be kept dry, not expose to rain or moisture 
Modules in carton are fragile, which must be handled with care 	The packaging must be transported upright 

17.13 Geotechnical Assessment Report

(shared separately)

17.14 Glare Assessment Report

(shared separately)

17.15 Structural Assessment Report of the proposed rooftop installation buildings

(shared separately)