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Environmental Impact Assessment for Development of new Power House at G.Dh. Thinadhoo

April 2016

Proponent: FENAKA Corporation Limited

Prepared by;

Mahfooz Abdull Wahhab

Mohamed Ibrahim Jaleel

Ali Shareef

Fenaka Corporation Limited

Ports Complex Building 7th Floor, Hilaalee Magu

Male' 20307, Republic of Maldives

Tel: [960] 300 7555 : ގުޅުވުން

Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް

ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގް 7 ވަނަ ފަންގިފިލާ، ހިލާލީ މަގު

މާލެ 20307 ، ދިވެހިރާއްޖެ

Email: info@fenaka.com.mv : ބ.ޚ.ދ

Website: www.fenaka.com.mv : ވެބްސައިޓް

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Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފުށ، ހިލޮޅިއަގޫ
ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ބ.ޑާކުވ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަދ
ދާދ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ބ.ގުދުރ :
Website: www.fenaka.com.mv ވެބްސައިޓް :

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

ފެނަވަރ ކޯޕަރޭޝަން ލިމިޓެޑ
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފުށ، ހިލާލީ ގަދު
ގާދަ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރަ :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފުނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯރ 7 ވަނަ ފަންގިފިލާ، ހިލޮޅިގަދޫ
ފޯރ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ގ.ދ
Website: www.fenaka.com.mv : ވެބްސައިޓް

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Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ދާކަ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ޚ.ތ
Website: www.fenaka.com.mv : ވެބްސައިޓް

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Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފުނަތަ ގެސް ޕްލާންޓް ލިމިޓެޑް
ފ. ހިލާލީ ދަގު 7 ވަނަ ފަންގިފިލާ، ޕޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ،
ދާދި 20307 ، ދިވެހިރާއްޖެ
ބ.ދ.ތ : info@fenaka.com.mv
ވެބްސައިޓް : www.fenaka.com.mv

بسم الله الرحمن الرحيم

FENAKA CORPORATION LIMITED

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ހިލޫލޭ ބަންދަރު

FNK-F/203/2016/114/

Environmental Protection Agency
Male'
Republic of Maldives

25th April 2016

Dear Mr. Ibrahim Naeem,

Re: Environmental Impact Assessment for Powerhouse Development in G.Dh. Thinadhoo

As per the requirements of the EIA regulation, we hereby confirm our commitment to implement the mitigation measures according to what is proposed in the EIA report attached herewith.

Yours Sincerely

Athhar Haleem

Deputy Director

FENAKA CORPORATION LIMITED

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ހިލޫލޭ ބަންދަރު ހިލޫލޭ 7 ވަނަ ފަންގިފިލާ، ދަށު
ކޯޑް 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބްރޫދުން
Website: www.fenaka.com.mv : ވެބްސައިޓް

بسم الله الرحمن الرحيم

FENAKA CORPORATION LIMITED

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ލިމިޓަރ ކުންފުނި

Declaration of the proponent

As the representative of the proponent of the proposed project I assure that I have read the report thoroughly and that to the best of my knowledge all information provided here is accurate and complete. In addition, I confirm our commitment to making sure that the contractor implements all mitigation measures proposed in the present report and adhere to the monitoring schedule given.

Name: Athhar Haleem

Date: 25th April 2016

Signature:

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފުށ، ހިލާލީ މަގު
ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބްރައުޒް
Website: www.fenaka.com.mv : ވެބްސައިޓް

DECLARATION OF CONSULTANTS

We hereby confirm that the information in this report is accurate to the fullest of our understanding.

Ali Shareef (EIA 19/11)

Mahfooz Abdull Wahhab (Registration no: EIA TA03/15)

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިއުނާ 7 ވަނަ ފަންގިފުށ، ފިލާލީ ފަދ
ދާކ 20307 ، ދިވެހިރާއްޖެ
ގުޅުއްވުން :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

EXECUTIVE SUMMARY

The proposed project aims to provide sustainable electricity supply for G.Dh Thinadhoo by the development of a new powerhouse within the existing FENAKA premises. The project is essentially required because the existing powerhouse was burned down to the extent it can no longer be used due to an accidental fire. The new powerhouse will be constructed using pre-fabricated sheets and blocks. The generators in the temporary facility will be transferred to the new powerhouse and connected to the grid. The new powerhouse is essential as the noise and smoke disturbance from the generators is high. However with the development of new powerhouse it is expected that the noise and smoke disturbance will be reduced greatly. The negative impacts during the construction will be loss of vegetation and risk of groundwater contamination. During operation also there is risk of groundwater contamination. However with proper daily maintenance and following proper chemical handling procedures the risks can be minimized. The positive impacts from the project will be very high as Fenaka Corporation would be able to provide electricity sustainably to Thinadhoo.

ސާރާ ޚުލާސާ

މި މަޝްރޫޢަކީ ގދ.ތިނަދޫގައި މިހާރު ފެނަކައިގެ އިންޖީނުގެ ހުރި ބިންގައި އައު އިންޖީނުގެއެއް އެޅުމަށްފަހު ދެމެހެއްޓެނިވި ގޮތެއްގައި ގދ.ތިނަދޫގެ ރައްޔިތުންނަށް ކަރަންޓުގެ ޚިދުމަތް ފޯރުކޮށްދިނުމަށްޓަކައި ކުރިއަށް ގެންދާ މަޝްރޫޢެކެވެ. މި މަޝްރޫޢު މުހިންމުވެފައިވާ އަލިފާނުގެ ހާދިސާއަކާ ގުޅިގެން ތިނަދޫގެ އިންޖީނުގެ ބޭނުންނުކުރެވޭ ވަރަށް އަނދާފައިވާތީއެވެ. އައު އިންޖީނުގެ އެޅުމަށް ހަމަޖެހިފައިވާ ޕްރީފެބްރިކޭޓެޑް ޝީޓް އަދި ބްލޮކްސް ބޭނުން ކޮށްގެންނެވެ. މިހާރު ބޭނުންކުރަމުންދާ ޖެނަރޭޓަރުތައް އައު އިންޖީނުގެ ނިމުނުމާ އަވަހަށް ބަދަލުކުރެވި ގްރިޑް އާ ގުޅުވުމަށް ވަނީ ހަމަޖެހިފައެވެ. ކުރީގައި ރައްޔިތުންނަށް އަޑުގަދަ ވުމުންނާއި ދުމުގެ ސަބަބުން ދިމާވަމުންދިޔަ އުނދަގޫތައް އައު އިންޖީނުގެ އެޅުމުން ވަރަށް ބޮޑަށް ކުޑަވެގެންދާނެއެވެ. ނަމަވެސް އިމާރާތް ކުރުމުގެ ތެރޭގައާއި އިންޖީނުގޭގެ ޚިދުމަތް ދިނުމުގެ ތެރޭގައިވެސް ބިމުގެ ފެން ތަޣައްޔަރުވުމުގެ ފުރުޞަތު އޮތް ކަން ފާހަގަކުރެވިފައެވެ. އެހެންނަމަވެސް ރަނގަޅަށް ދުވަހުން ދުވަހަށް ބެލެހެއްޓުމާއި ކެމިކަލް ގެންގުޅުމުގައި ތަބާވާންޖެހޭ ގޮތްތަކަށް ތަބާވުމުން މި ނުރައްކާތައް ކުޑަކުރެވޭނެއެވެ. ފެނަކައިގެ މި މަޝްރޫޢުގެ ސަބަބުން ދެމެހެއްޓެނިވި ގޮތެއްގައި ގދ.ތިނަދޫގެ ރައްޔިތުންނަށް ކަރަންޓުގެ ޚިދުމަތް ފޯރުކޮށްދެވިގެންދާނެއެވެ.

1.0 INTRODUCTION

1.1 Purpose of this EIA

The aim of this EIA is to critically analyze the environmental and socio-economic impacts which may arise due to the development of power house in G.Dh. Thinadhoo. After analyzing the impacts it would be then possible to suggest proper mitigation measures to prevent or reduce any negative impacts and to enhance any positive impacts.

1.2 Project background

The powerhouse in Thinadhoo was burned down by an accidental fire on 26th January 2016. The powerhouse was burned to the extent that the building can no longer be used. The fire has greatly reduced the strength of the walls and concrete beams of the building, considering the health and safety of the staff that work in the powerhouse it is not advisable to repair the building and continue operations. Therefore a new powerhouse is proposed to be developed in Thinadhoo.

1.3 Project Objectives

The objective of the project is to build a power house to provide power in a sustainable manner to the people of Thinadhoo with minimum disturbance to residents.

1.4 Proponent

The proponent, Fenaka Corporation Limited was established on 18th June 2012 by a presidential decree under the companies Act of 10/96, as a limited liability company. The company is registered on 1st of August 2012 and it is 100% Government owned utility company with a mandate to provide island communities with electricity, water and sewerage. Today, FENAKA is a multi-disciplinary engineering organization, dealing contracts involved in civil, mechanical, electrical, water and waste water engineering.

1.4.1 Power generation services

Out of a total of 196 inhabited islands in the country, FENAKA Corporation provides electricity services to 152 islands. 24 / 7 sustainable electricity provision was not achieved to outer islands until recently FENAKA corporation started providing the services to the islands. In its short history the company has carried out numerous projects for the betterment of the service provision, one such example is the 77 Genset project which aided in the sustainable service provision. Furthermore, as electricity services were provided by the island communities themselves in the past, the location, infrastructure and operations were not ideal. This causes negative impacts and disturbance to the communities and the environment. Therefore, every year the company carries out a number of projects in power house relocation, refurbishment and generated set upgrading throughout the country.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ފާ. 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބްރޫ.ދ
Website: www.fenaka.com.mv : ވެބްސައިޓް

Electricity is mainly generated through diesel, however the Company is now slowly shifting towards renewable energy as a form of power generation. The company is also an important implementing partner in the mega projects of the Governments renewable energy. Some of these projects include;

- Preparation of outer islands for Sustainable energy development (POISED), funded by Asian Development Bank
- Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE), funded by the World Bank

1.4.2 Water and Waste water services

At FENAKA Corporation, safe water is provided to the public after desalinating sea water into potable drinking water through the process of reverse osmosis. Water produced and distributed by the Company adheres to the standards set by Environment Protection Agency (EPA) in the Maldives. Currently the company operates fully fledge system with complete RO plants, distribution networks and pipe distribution to households in 4 islands, which includes; GDh. Thinadhoo, GDh. Gahdhoo, Ha.Ihavandhoo and Ha.Thuraakunu. Out of the 3 islands, two of them are operated on the principles of Integrated Water Resource Management (IWRM) where conjunctive use of water is practised, whereby 25% of the total demand is catered by rainwater by catchment from public roof tops. This is in line with the countries global commitments of the Sustainable Development Goals where the adaptation of IWRM principles is a specified goal. Other than the fully fledged systems, the company also have standalone RO plants, some with community tap bay systems where services are mainly to the fishing vessels and any other need of the community.

Other than service provision, the company also implements one of the largest water projects of the nation, which is the provision of water supply services to the Allied islands of Addu City. The project is nearing completion and is expected to be completed within this year.

FENAKA operates the sewerage system of around 28 islands by means of a gravity collection system and effluent is discharged to the open ocean by means of pump stations and sea outfalls. Furthermore, the company has recently successfully completed the design and construction of sewer systems in TH.Buruni and Th.Madifushi and the sewer project for L.Maamendhoo is ongoing. Moreover, the construction of sewer services of Hithadhoo central area is also carried out by Fenaka Corporation.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ، ގުޅުވުން
Fax: [960] 332 7555 ، ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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ދަތުރ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ، ބ.ޓެލިތ
Website: www.fenaka.com.mv ، ވެބްސައިޓް

1.5 Consultants

This EIA report has been compiled by Mahfooz Abdull Wahhab and Mohamed Ibrahim Jaleel who are registered temporary EIA Consultants. The report was reviewed and edited by Ali Shareef, who is a registered EIA consultant with a number of years of experience and has been involved in numerous projects in the Maldives such as resort development project, sewerage system, RO plants, reclamation, shore protection and harbour projects.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ޚ.ތ
Website: www.fenaka.com.mv : ވެބްސައިޓް

2.0 STUDY AREA

Thinadhoo is located in the western edge of Huvadhoo Atoll, hence the island is exposed to strong swell waves during the South-West monsoon.

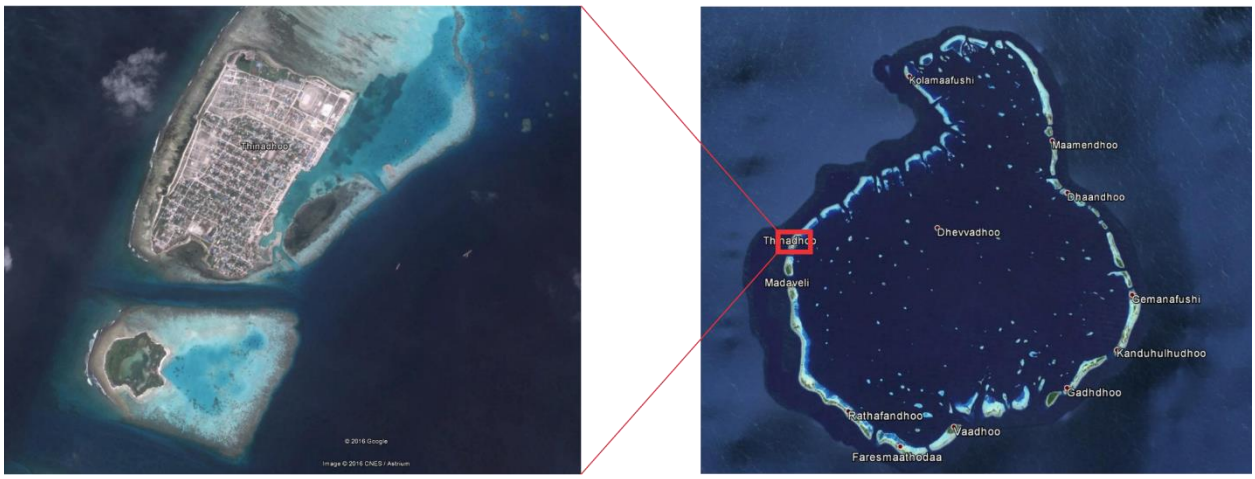

Figure 1: location of Thinadhoo, G.Dh Atoll

To the North of Thinadhoo lies an extensive reef flat measuring about 6 km in length and 1 km in width. To the South lies an uninhabited island *Kafanaa* on a separate reef flat system. Between the reef flat systems there is a small channel no wider than 140 m.

The study area for this proposed project consist of the entire Thinadhoo Island. Figure below shows the study area boundaries.

There is an environmentally sensitive area beyond the study area boundary; *Kafanaa*, a wetland on the neighboring island to the south 760 meters from the project site.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފޮށި
ފ.ކޮ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުޅުއްވުން : 3007555 (960)
Email: info@fenaka.com.mv
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Figure 2: study area

2.1 Relevant development in the area

Construction of housing units are ongoing and is expected to be completed in the near future.

A coastal protection project is proposed to be carried in the Southern side of the island. The project involves the reclamation of the embayment area in the southern side of the island according to the EIA report for the proposed coastal protection on the south side of Thinadhoo Island, G.Dh Atoll, Maldives.

Installation of a desalination plant is proposed to undertake during April 2016.

According to G.Dh Thinadhoo Council an installation of an antennae is proposed to the right of the powerhouse area in the near future.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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3.0 PROJECT DESCRIPTION

3.1 Proposed Works

The current project is looking at the development of a new power house in the existing Fenaka premises. The location of the new proposed powerhouse is shown on the figure below. The powerhouse will be constructed from pre-fabricated sheets and blocks. The project also involves the transfer of the existing temporary generators to the new powerhouse.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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ބ.ގުދުރަ : info@fenaka.com.mv Email:
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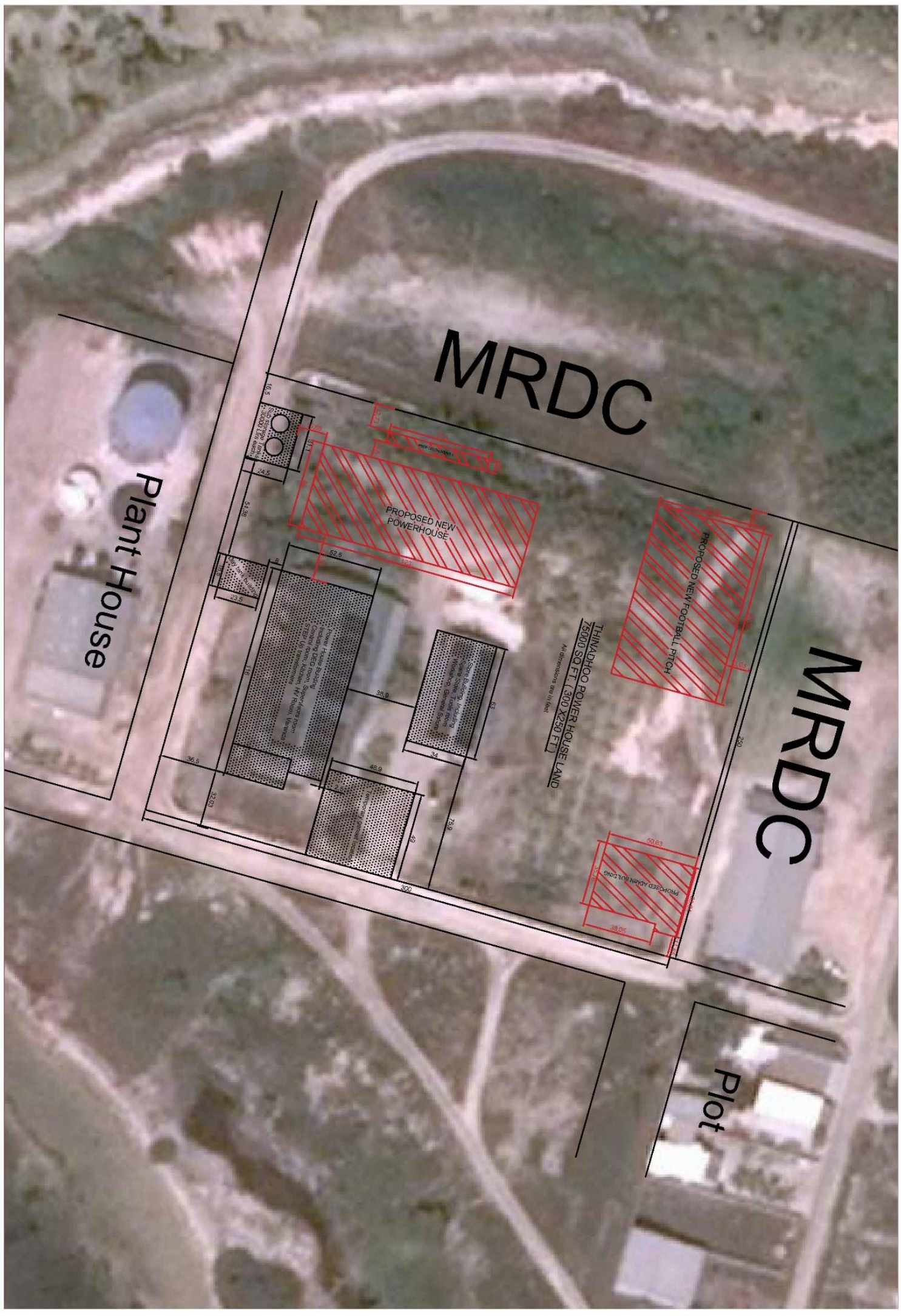
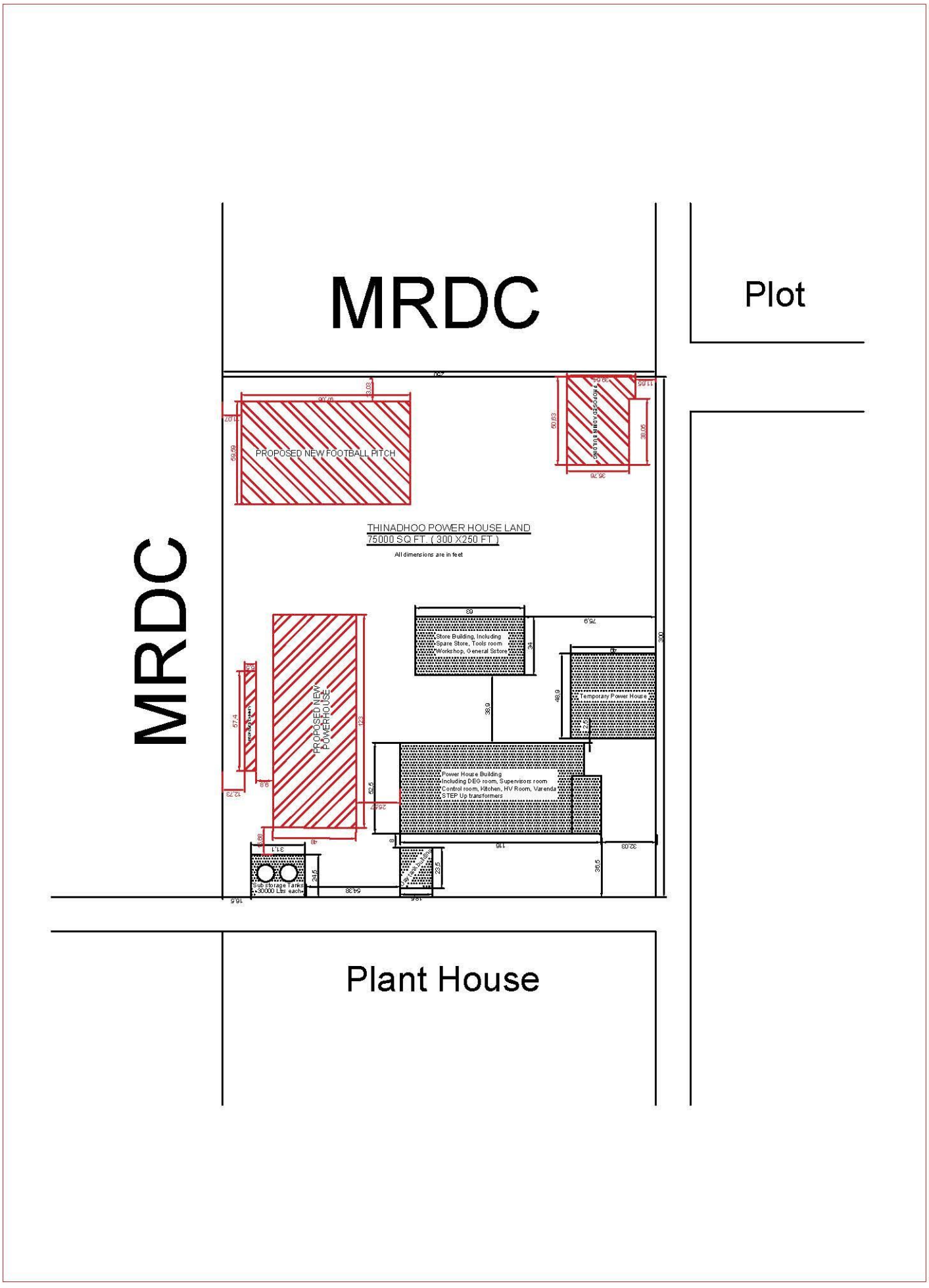


Figure 3: site plan of the project



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Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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ފްލޯ 7 ވަނަ ފަންގިފުށ، ހިލާލީ ގަދު
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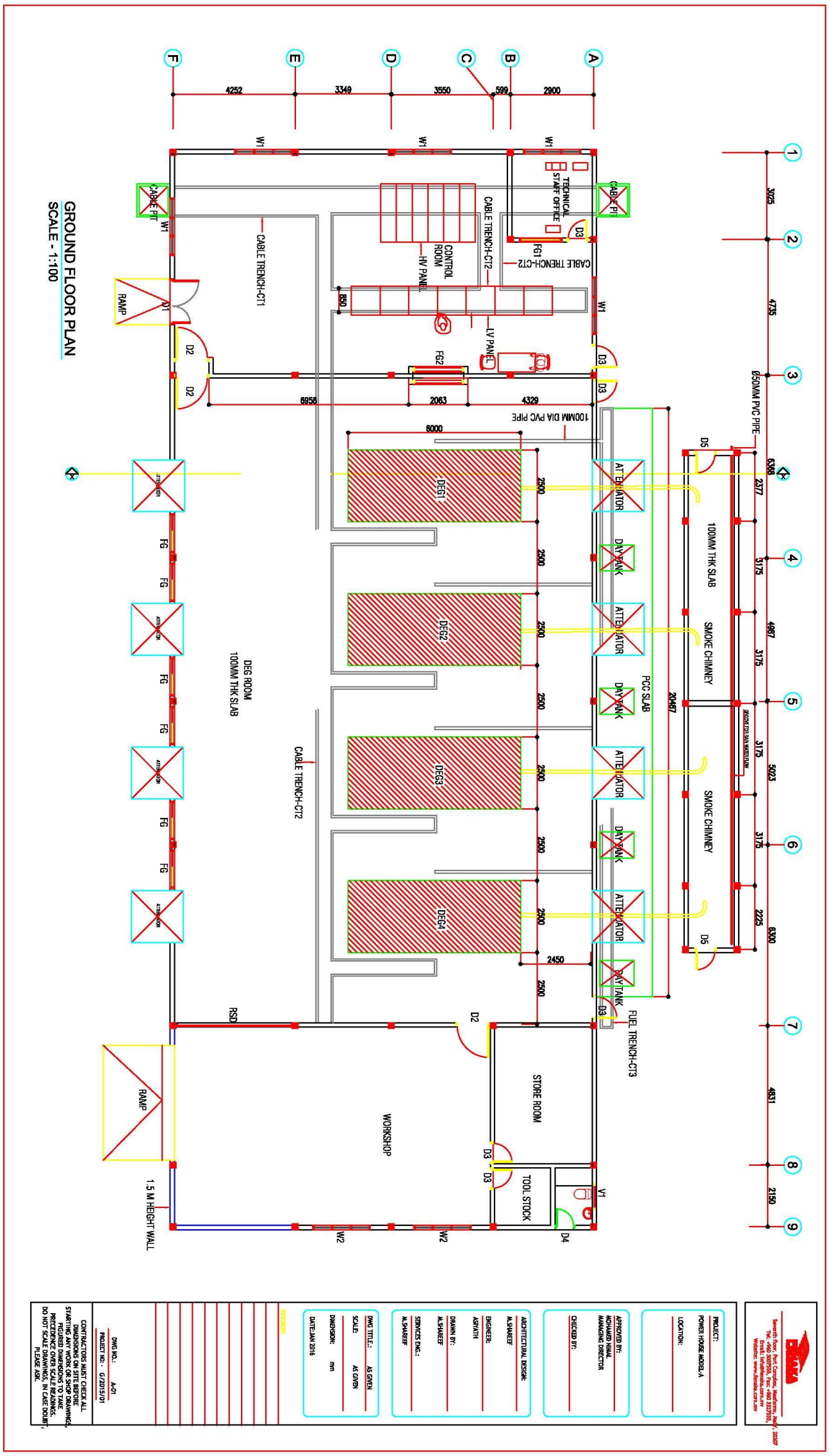

Figure 4: floor plan of powerhouse

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Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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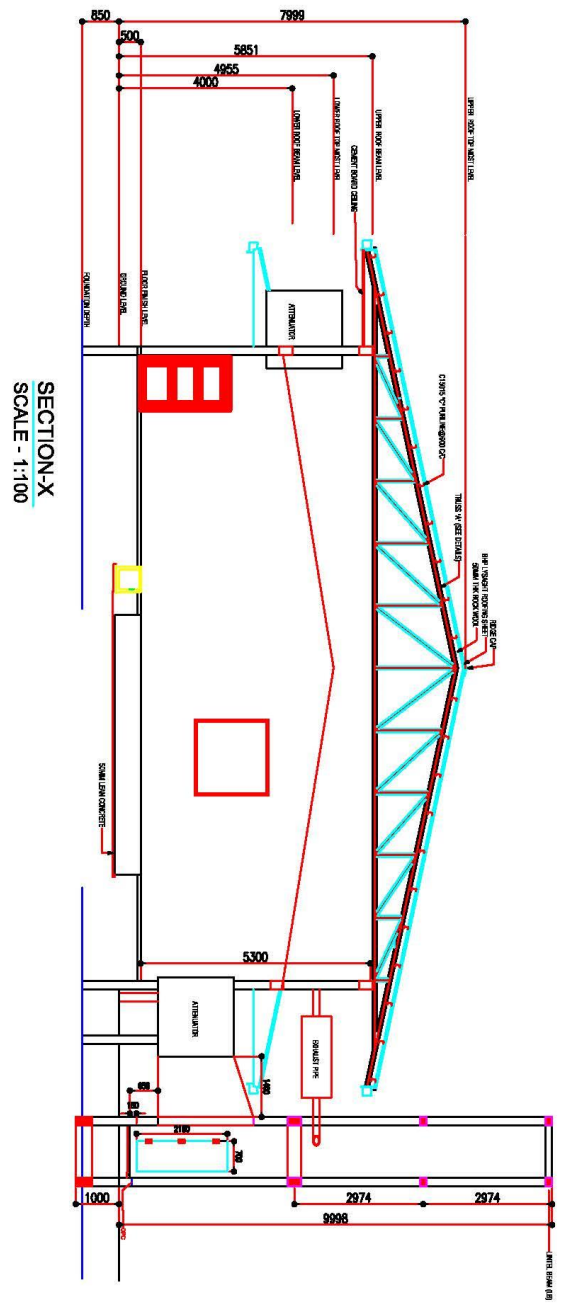

Figure 5: sectional elevation of powerhouse

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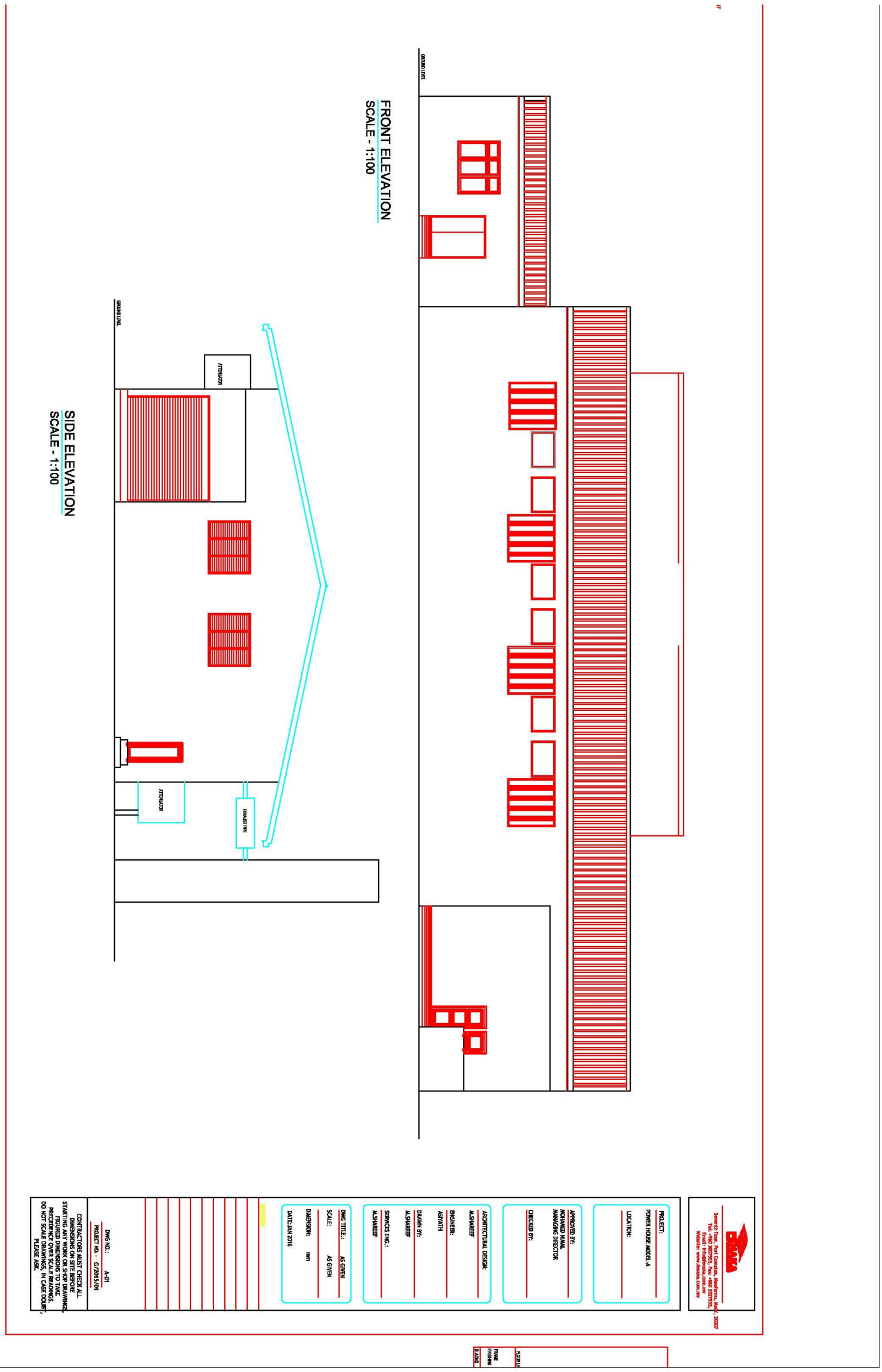

Figure 6: front and side elevation of powerhouse

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Male' 20307, Republic of Maldives
Tel: [960] 300 7555
Fax: [960] 332 7555
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv

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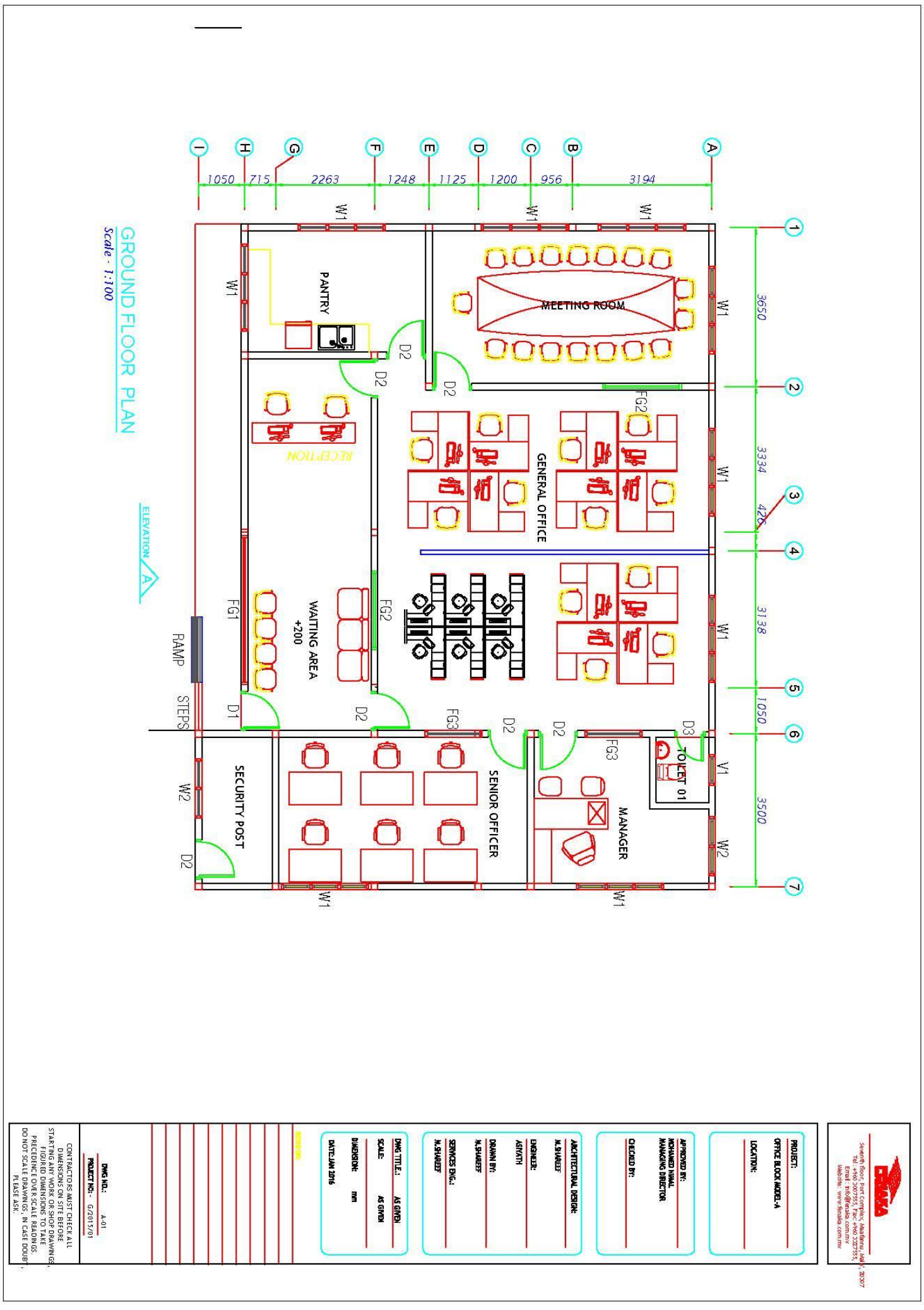

Figure 7: floor plan for admin building

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Male' 20307, Republic of Maldives
Tel: [960] 300 7555
Fax: [960] 332 7555

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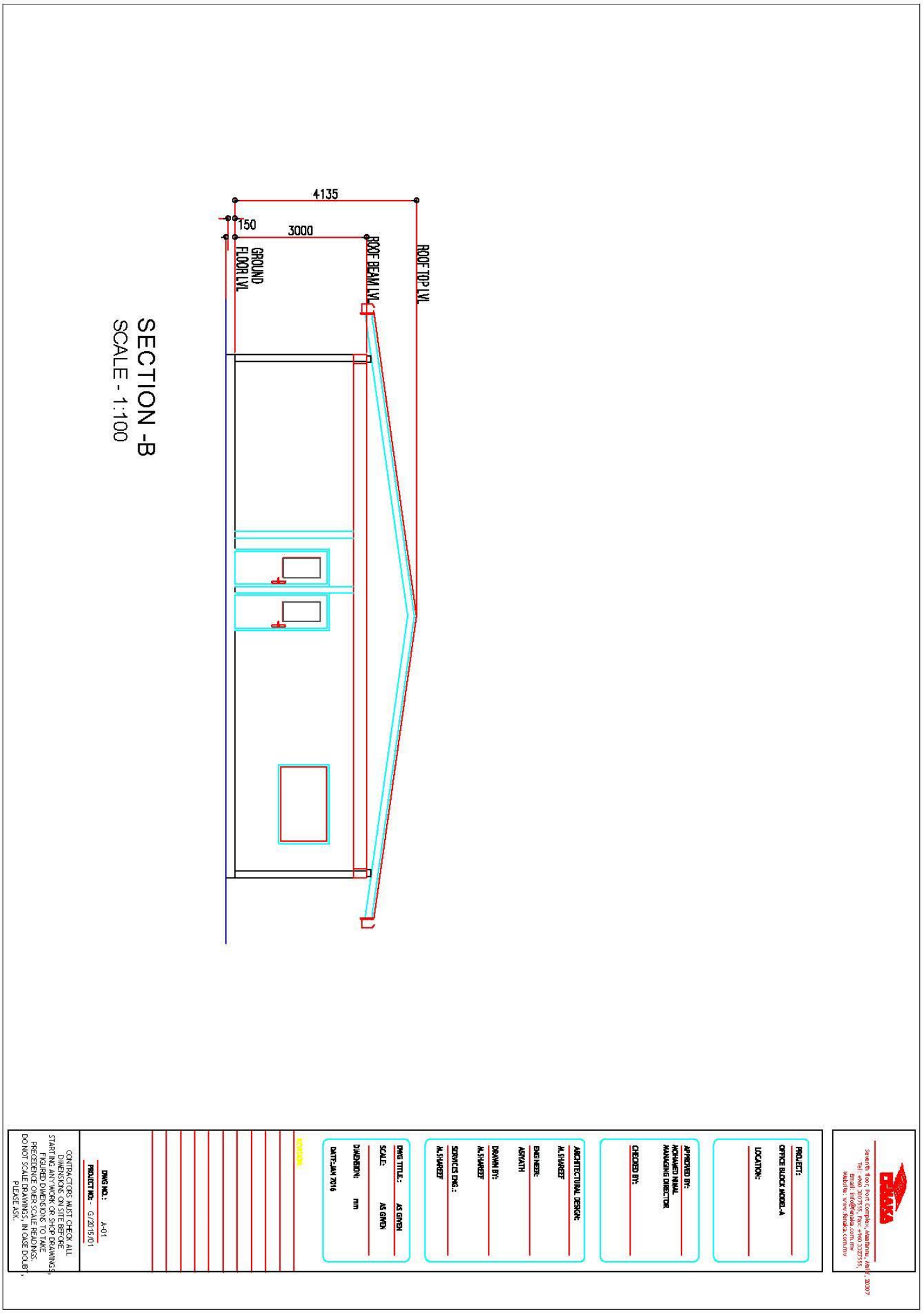

Figure 8: sectional elevation of admin building

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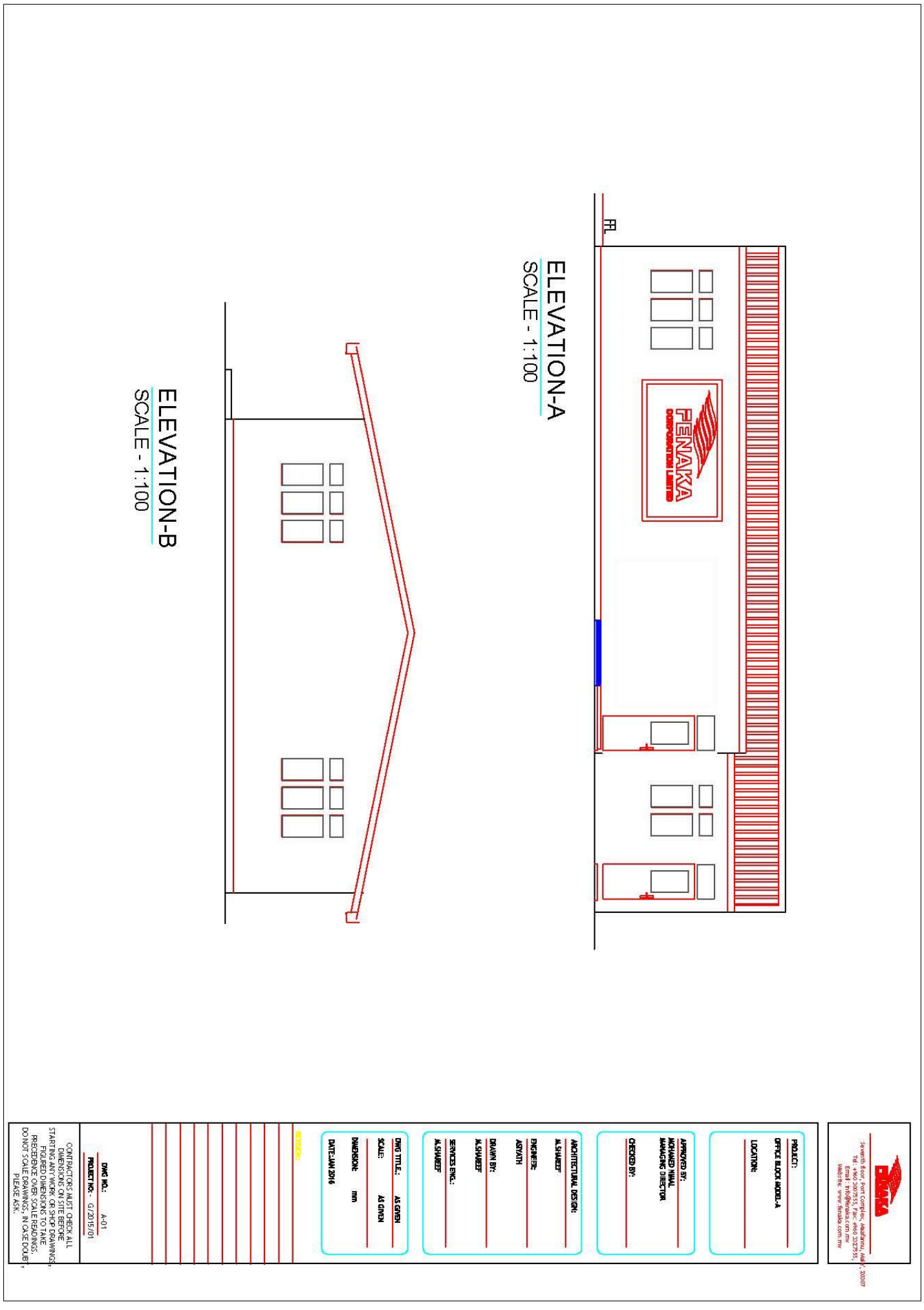

Figure 9: front elevation of admin building

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Tel: [960] 300 7555 ގުޅުވުން :
Fax: [960] 332 7555 ފެކްސް :

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Email: info@fenaka.com.mv ބ.ވުމުވ :
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3.1.1 Construction of new power house

The powerhouse will be constructed from pre-fabricated sheets and blocks.

3.1.1 Construction of Admin building

In addition to the generator house of the facility, an administrative building with a service area would be built.

3.1.2 Transfer of generators and panel boards

The existing generators will be lifted from its existing place using a crane and then transferred into the power house. New panel boards will be installed at the new power house. The output from the generators will be connected to the existing distribution grid.

3.2 Generators

2 new generators are proposed to be installed. The details of the generators are shown below.

Table 1: details of generators proposed to be installed

Generator	Details
Generator 1	1250kVA/ 1000 KW prime rated diesel generator set. 0.8 P.F, 415 Volts, 3 Phase, 4 wires, 50 Hz at 1500 r.p.m. Powered by Cummins orgin(**uk,usa**)engine model no. KTA50 G3 and coupled with 1000KW Stamford Alternator.
Generator 2	1562kVA/ 1250 KW prime rated diesel generator set. 0.8 P.F, 415 Volts, 3 Phase, 4 wires, 50 Hz at 1500 r.p.m. Powered by Cummins orgin(**uk**) engine model no. KTA50 G8 and coupled with 1250KW Stamford Alternator.

The existing capacity of the generators is 3120 KW. An Air cooling system will be utilized by all the generators for cooling of the systems.

3.3 Powerhouse

3.3.1 Design

The design of all steel structures will be performed in accordance with BS 449 and BS 5950. Grade 43C steel will be used or similar approved. Bolts, nuts and washers will comply with BS 4190, BS 4320 / BS 4395. All welding consumables such as electrodes, filler rods, fluxes will comply with BS 5135.

Structures will be designed for the most critical combinations of dead loads, imposed loads, equipment loads, wind loads, seismic loads and temperature loads.

All walls and roof at the power house building will have galvanized profiled sandwich steel sheet cladding with paint system applied for marine environment.

It is expected that the design will mitigate the noise propagation outside the building. All walls and roof will provide delta 35 dB noise reduction.

3.3.2 Fabrication

Cutting, holing, assembly, and bolting will be carried out in accordance with BS 5950. All structural steel will be pre-assembled in the workshop to such an extent to ensure proper site erection.

3.3.3 Delivery and Handling

All structural steel works will be protected from damage during handling, transport, unloading and storage. Particular attention will be given to stiffen free ends and to prevent any permanent distortion. All bolts, nuts, washers and small articles will be suitably packed and identified. All structural steel will be stored on thick timbers to prevent any dirt or accumulation of water under the steel.

3.3.4 Erection

In general erection of the steel structures will comply with BS 5950.

Steel packing plates will be provided where necessary to ensure that the total remaining gap between the connected parts does not exceed 2 mm. All non-matching holes required for new connections will be formed by drilling and in no case will be done by burning.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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ދާކަ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ބ.ޚ.ދ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

Welding will be used only for shop fabrication and bolting which will be used for field connections. Welding on site will be done in exceptional circumstances. Metal arc welding will be carried out in accordance with BS 5135.

Non-shrink grout will be used between the column plates and the concrete foundation. The minimum distance between the base plate and the concrete (thickness of grout) will be 35 mm. The surface of the concrete base will be free from oil, grease or any loose material. Pouring of grout will be continuous operation to maintain the hydrostatic head and to ensure the flow of the grout is not stop and to eliminate any air becoming trapped under the base plate.

3.3.5 Painting

The following painting specification will be applied in order to achieve the desired result. Carbon steel such as structural steel, purlins, fittings, etc. will be treated at site to achieve desired protection.

- Thorough cleaning to remove oil, grease, dirt and other contaminants
- De-rusting of all mechanical damage according to set standards
- Touch up with 2 pack self-priming aluminium containing high build epoxy with solids by volume content of not less than 85% (Dry film thickness >75 microns)
- Intermediate coat, with 2 pack epoxy polyamide, dry film thickness>120 microns
- Finish coat, 2 pack epoxy polyamide, dry film thickness >50 microns
- Total system minimum dry-film thickness: 260 microns

3.3.6 Doors and Windows

Aluminium doors, windows and glass walls as well as aluminium frames will be anodized in accordance with BS 1615 or BS 3987. Sections of aluminium profiles will not be less than 50 mm deep and 2 mm thick. Door and window elements will be fixed to the structure by means of separate rectangular hollow galvanized steel or aluminium frame.

For air conditioning rooms, the aluminium windows will have double glazing. Glass wall on the wall, between the control room and Gen set room will have triple glazed.

All doors will have design to mitigate noise and heat by using necessary insulation material or techniques.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލޮޅިގަޑޫ
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3.3.7 Roof and Wall Cladding system

All the wall and roofs will have insulated sandwich cladding. The roof and wall cladding will be multi-layered protected metal system consisting of a galvanized steel substrate, heavy epoxy base coat and high build exterior weather coat of polyurethane.

It is expected that the design will mitigate the noise propagation outside the building. All walls and roof will provide delta 35 dBa noise reduction.

The cladding will be sealed with a non-drying, non-corrosive permanently elastic preformed metal sealing tape capable of performing in a temperature up to 100 deg C.

The external weathering sheet will be secured to the galvanized sub-girths or structural support with stainless steel hexagon headed self-tapping screws, each with an integral EPDM (Ethylene Propylene Die Memonoma) washer bonded to a dished aluminium washer.

Flashings required in connection with the external weather skin will be formed from > 0.5mm thick material similar as claddings material.

Profiled filler pieces will be provided at all terminal positions on the roof and side wall areas. The fillers will be of polyethylene form and be immune to birds and insect attack.

3.3.8 Lighting, small power, air conditioner and fans

All electrical installation at the building will comply with BS Standards. All electrical equipment, appliances and fittings and cable use will meet the standards. Furthermore the electrical design of the building will be in accordance with MEA standards.

Lights and sockets used for gen set hall will be industrial type, design for hot and harsh environment. For outdoor application, on gable end walls and corridors, only outdoor lights will be used. For all the rooms except gen set hall, lights design for office application can be used.

Control room and Technical staff room will be fitted with air conditioners and ceiling fans. Store room and tool room will be fitted with air conditioners. Workshop will have ceiling fans.

Power sockets will be available on all walls of the rooms including gen set hall.

The mean illumination level will be as follows;

- Inside the Gen set hall: 300 Lux
- Control room / SWG room: 350 Lux
- All other room: 250 Lux

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުވުން :
Fax: [960] 332 7555 ފެކްސް :

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ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ދާދި 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދަނ :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

- Corridors / walls: 200 Lux

3.3.9 Safety Precautions

The safety precautions to be applied during the erection of the steel structures will be in accordance with BS 5531. All necessary precautions will be taken to protect personal and property from hazards due to falls, injuries, toxic fumes, or other harm. All painting and corrosion protection work, including inside the building will be performed under strict safety conditions.

3.3.10 Emergency power mechanism

- Movable Backup gen-sets with containerized generator and control panel.

3.2.11 Measures to increase power efficiency

- Efficient diesel generator governor system and running time
- Scheduled maintenances (de-carbonizing, top overhaul, full overhaul and filter changes) at manufacturer recommended running intervals

3.2.12 Safety components

- Safety boards
- Fire safety system
- Security camera system
- Lightning protection system

3.2.13 Fuel Management

- 60,000 Liters (30,000 x 2) fuel storage tanks, with reinforce concrete retaining wall will be constructed as fuel storage tanks. The retaining wall will ensure that it will contain the volume of fuel during emergency spills.
- Fuel to be transferred directly from transport vessel (from harbor) to fuel tank at power house by bowser. Bowser will be loaded at the harbor using a horse from the barge.
- Lubricant oil consumption : average 800 Liters per month

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555
Fax: [960] 332 7555

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ދަގު
ދަތ 20307 ، ދިވެހިރާއްޖެ
ބ.ގަ.ދ : info@fenaka.com.mv
ވެބްސައިޓް : www.fenaka.com.mv

3.4 Admin building

3.4.1 Design

The design of all steel structures will be performed in accordance with BS 449 and BS 5950. Grade 43C steel will be used. Bolts, nuts and washers will comply with BS 4190, BS 4320 / BS 4395. All welding consumables such as electrodes, filler rods, fluxes will comply with BS 5135.

Structures will be designed for the most critical combinations of dead loads, imposed loads, equipment loads, wind loads, seismic loads and temperature loads.

All walls and roof at the admin building will have galvanized profiled sandwich steel sheet cladding with paint system applied for marine environment.

It is essential that the design will mitigate the noise propagation outside the building. All walls and roof will provide delta 20 dB noise reduction.

3.4.2 Fabrication

Cutting, holing, assembly, and bolting will be carried out in accordance with BS 5950. All structural steel will be pre-assembled in the workshop to such an extent to ensure proper site erection.

3.4.3 Delivery and Handling

All structural steel works will be protected from damage during handling, transport, unloading and storage. Particular attention will be given to stiffen free ends and to prevent any permanent distortion. All bolts, nuts, washers and small articles will be suitably packed and identified. All structural steel will be stored on thick timbers to prevent any dirt or accumulation of water under the steel.

3.4.4 Erection

In general erection of the steel structures will comply with BS 5950.

Steel packing plates will be provided where necessary to ensure that the total remaining gap between the connected parts does not exceed 2 mm. All non-matching holes required for new connections will be formed by drilling.

Welding will be used only for shop fabrication and bolting will be used for field connections. Welding on site will be done in exceptional circumstances. Metal arc welding will be carried out in accordance with BS 5135.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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ދަތުރ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ގުދުރ
Website: www.fenaka.com.mv : ވެބްސައިޓް

Non-shrink grout will be used between the column plates and the concrete foundation. The minimum distance between the base plate and the concrete (thickness of grout) will be 35 mm. The surface of the concrete base will be free from oil, grease or any loose material. Pouring of grout will be continuous operation to maintain the hydrostatic head and to ensure the flow of the grout is not stop and to eliminate any air becoming trapped under the base plate.

3.4.5 Painting

The following painting specification will be applied in order to achieve the desired result. Carbon steel such as structural steel, purlins, fittings, etc. will be treated at site to achieve desired protection.

- Thorough cleaning to remove oil, grease, dirt and other contaminants
- De-rusting of all mechanical damage according to set standards
- Touch up with 2 pack self-priming aluminium containing high build epoxy with solids by volume content of not less than 85% (Dry film thickness >75 microns)
- Intermediate coat, with 2 pack epoxy polyamide, dry film thickness>120 microns
- Finish coat, 2 pack epoxy polyamide, dry film thickness >50 microns
- Total system minimum dry-film thickness: 260 microns

3.4.6 Door and Windows

Aluminium doors, windows and glass walls as well as aluminium frames will be anodized in accordance with BS 1615 or BS 3987. Sections of aluminium profiles will not be less than 50 mm deep and 2 mm thick. Door and window elements will be fixed to the structure by means of separate rectangular hollow galvanized steel or aluminium frame.

For air conditioning rooms, the aluminium windows will have double glazing. All doors will have design to mitigate noise and heat by using necessary insulation material and techniques.

3.4.7 Roof and Wall Cladding system

All the wall and roofs will have insulated sandwich cladding. The roof and wall cladding will be multi-layered protected metal system consisting of a galvanized steel substrate, heavy epoxy base coat and high build exterior weather coat of polyurethane.

The cladding will be sealed with a non-drying, non-corrosive permanently elastic preformed metal sealing tape capable of performing in a temperature up to 100 deg C.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފުނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ މަގު
ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ބ.ޑާކު
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

The external weathering sheet will be secured to the galvanized sub-girths or structural support with stainless steel hexagon headed self-tapping screws, each with an integral EPDM (Ethylene Propylene Die Memonoma) washer bonded to a dished aluminium washer.

Flashings required in connection with the external weather skin will be formed from > 0.5mm thick material similar as claddings material.

Profiled filler pieces will be provided at all terminal positions on the roof and side wall areas. The fillers will be of polyethylene form and be immune to birds and insect attack.

3.4.8 Lighting, small power, air conditioners and fans

All electrical installation at the building will comply with BS Standards. All electrical equipment, appliances and fittings and cable use will meet the standards. Furthermore the electrical design of the building will be in accordance with MEA standards.

Sockets will be installed on all the walls of each room at office building. The desired illumination will be made by installing many light fixtures in each room. For outdoor application, on walls and corridors, only outdoor lights will be used. Air conditioners and fans will be installed in all rooms including main hall.

The mean illumination level will be as follows;

- Inside the rooms / hall : 300 Lux
- Corridors / outside walls : 200 Lux

3.4.9 Safety Precautions

The safety precautions to be applied during the erection of the steel structures will be in accordance with BS 5531. All necessary precautions will be taken to protect personal and property from hazards due to falls, injuries, toxic fumes, or other harm. All painting and corrosion protection work, including inside the building will be performed under strict safety conditions.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުވުން :
Fax: [960] 332 7555 ފެކްސް :

ފެނަަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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ފ.ނ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރ :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

3.5 Project inputs and outputs

Table 2:eastimated quantities of project inputs and outputs

Inputs	Outputs
Generators - Fuel (6000-6500 liters per day)	Electricity (700 – 1350 KW per day) Waste oil: average 800 liters per month Greenhouse gases
Workforce (Supervisors, Managers, Construction workers etc.) - 2 managers - 3 supervisors - 3 technician - 12 construction workers	Waste - 1.2 m^3 flow per day
Machineries and equipment's - 1 crane Fuel - 80 liters per day	Greenhouse gases, effluents

3.6 Construction method

3.6.1 Workforce

The workforce required for the construction shall be stationed within the island in existing houses. G.Dh.Thinadhoo has all the utility services such as water, sewer and electricity networks, therefore there is no requirement to do additional work to provide the services to the workforce.

3.6.2 Materials and machinery required for construction

The material required for construction which is not available locally, shall be imported and shipped from Male' to the site.

The equipment's required for the project are a crane and general construction tools. Some of these are available at the company and others would be sourced from available shops.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުއްވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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ގުޅުއްވުން ، 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ.ބ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

3.6.3 Mobilization

The cranes required for the project will be carried to Thinadhoo via a barge. Other materials and workforce will be transported in a ferry.

3.6.4 Establishment of temporary project facilities

No temporary project facilities will be required to build as the required housing for the workforce will be provided from the residential houses in Thinadhoo. Waste generated will be temporarily stored in the existing house in the Fenaka premise and transferred to the waste management center in the island in a weekly basis.

3.6.5 Proposed timeline for project activities

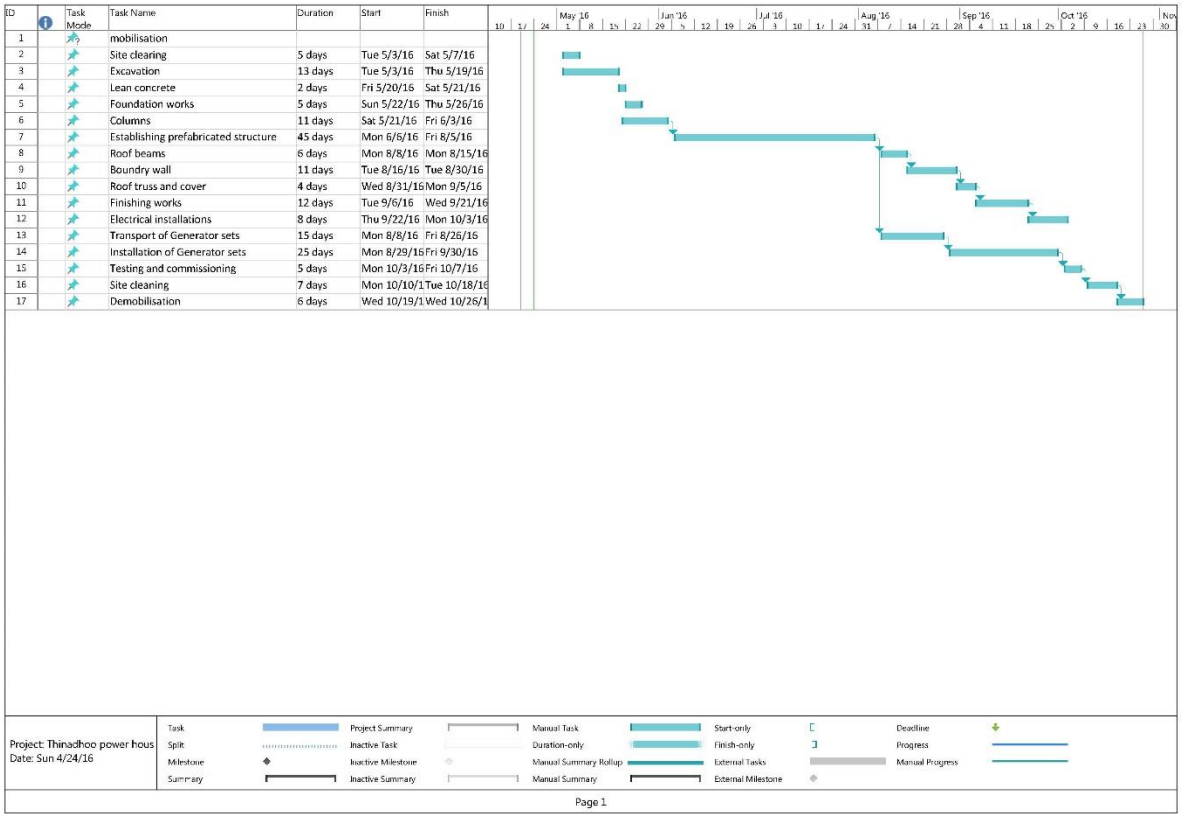

Figure 10: proposed timeline for project activities

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ބ.ޚ.ތ :
Website: www.fenaka.com.mv ވެބްސައިޓް :

4.0 EXISTING ENVIRONMENT

4.1 General Climate

As most of the islands of Maldives is located within and in very close proximity to the equator, all islands experience monsoonal climate. Towards the North the effect of Seasons are more apparent and hence experience infrequent torrential rain, while towards the South the effect of seasons are negligible and experience frequent rain.

Maldives experiences two distinctive monsoons; the North-East Monsoon or dry monsoon which last from January to March and the South-West monsoon or wet monsoon which lasts from May to November. In both seasons the temperature varies slightly despite the huge difference in rainfall.

4.2 Temperature

As the Maldives consists of small islands surrounded by sea even hot days are tempered by cooling sea breezes and mild evening temperatures. Therefore thought the year there is little change in temperature. However the daily temperatures fluctuates between 31 ^{0}C in daytime and 23 ^{0}C at night. However there were rare temperature anomalies recorded; on 19th May 1991 the highest temperature ever recorded in Maldives was recorded at Kahdhoo Meteorological office - 36.8 ^{0}C and on 11th April 1978 the lowest temperature was recorded in National Meteorological Center- 17.2 ^{0}C.

Looking closely at the monthly maximum and minimum temperatures from four different meteorological centers, it becomes clear that there is a very small fluctuation in the maximum and minimum temperatures throughout the year. However as expected there is a considerably huge variation in the maximum and minimum temperature for Hanimadhoo. From February to May, the minimum temperature for Hanimaadhoo rose from 24.5 ^{0}C to 26.5 ^{0}C.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފިލާލީ ބަންދަރު 7 ވަނަ ފަންގިފިލާ، ސިލްވާ ގަދު
ކޮޅު 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދަނު :
Email: info@fenaka.com.mv
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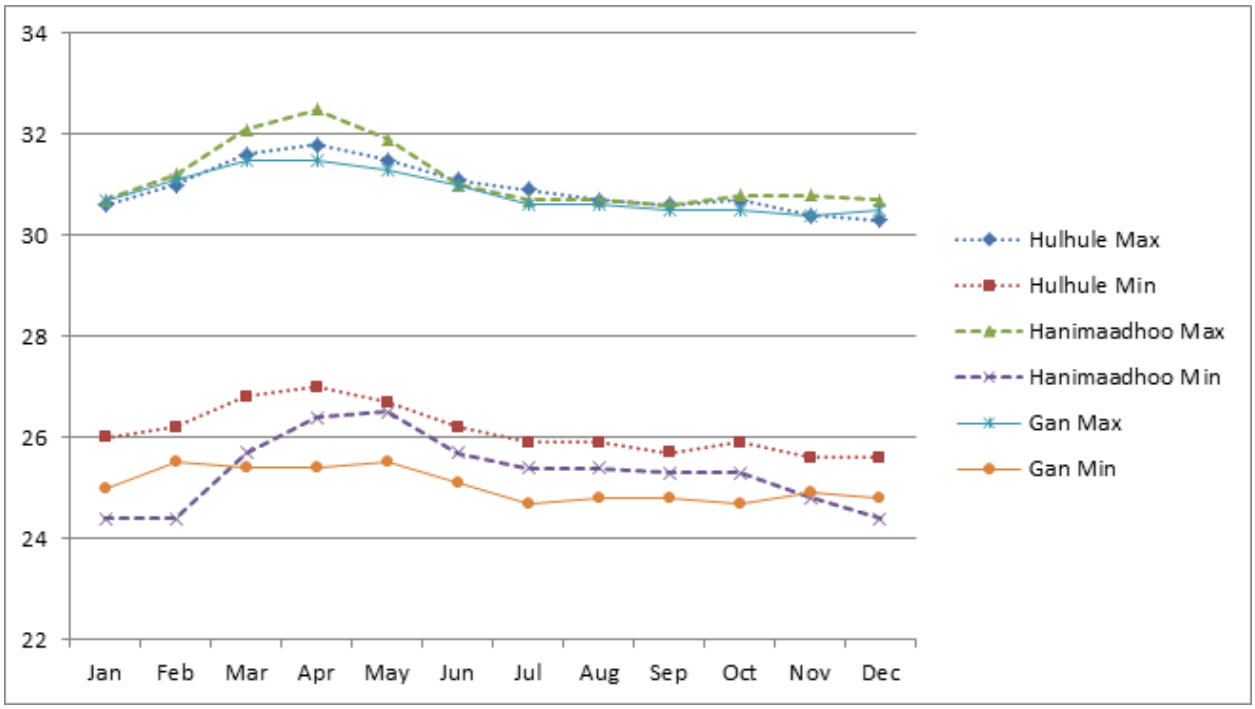

Figure 11: monthly maximum and minimum temperatures(^{0}C) for Maldives throughout the year. Data since 2000, adopted from the National Meterological Centre.

4.3 Rainfall

During the South-West monsoon, from mid-May to December heavy rainfall is experienced to all atolls. The highest rainfall ever recorded during a 24 hour period was on 9th July 2002 at Kaadedhdhoo Meteorological office, which was 219.8 mm of rainfall.

Looking at rainfall data since 2000, heavy rainfall is experienced (between 200mm and 250mm of rainfall) from May to December. Lowest rainfall is between February and March, where rainfall is between 25mm and 80mm.

There is a considerable difference in the rainfall pattern between the North and the rest of Maldives during May to July and October to December. For North rainfall is higher during May to July which is at 250mm while for other areas 170mm of rainfall, during October to December rainfall for North declines from 225mm to 100mm while rainfall for other areas remains between 210mm and 240mm.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555
Fax: [960] 332 7555

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ދަގު
ދާދި 20307 ، ދިވެހިރާއްޖެ
ގުޅުއްވުމަށް :
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Website: www.fenaka.com.mv
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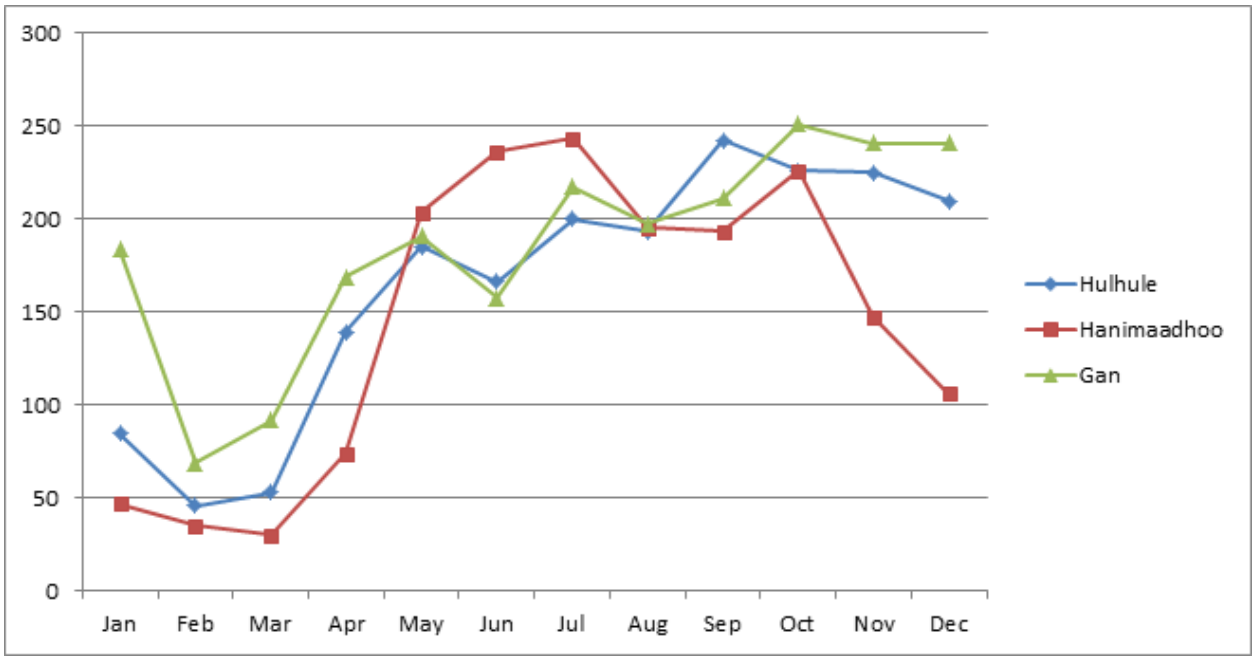

Figure 12: rainfall (mm) data since 2000, adopted from the National Meterological Centre

4.3.1 Specific rainfall data at G.Dh Thinadhoo

Since Thinadhoo is in very close proximity to kaadedhdhoo, the rainfall data for Kaadedhdhoo would be almost the same for Thinadhoo.

Monthly rainfall variations in Thinadhoo follows the same pattern as of the Southern atolls. Highest rainfall is in May and November.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފޮށި ކޮމްޕްލެކްސް
ފޯ. ބ. 20307 ، ދިވެހިރާއްޖެ
ޕޯ.ބ. : ޖ
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

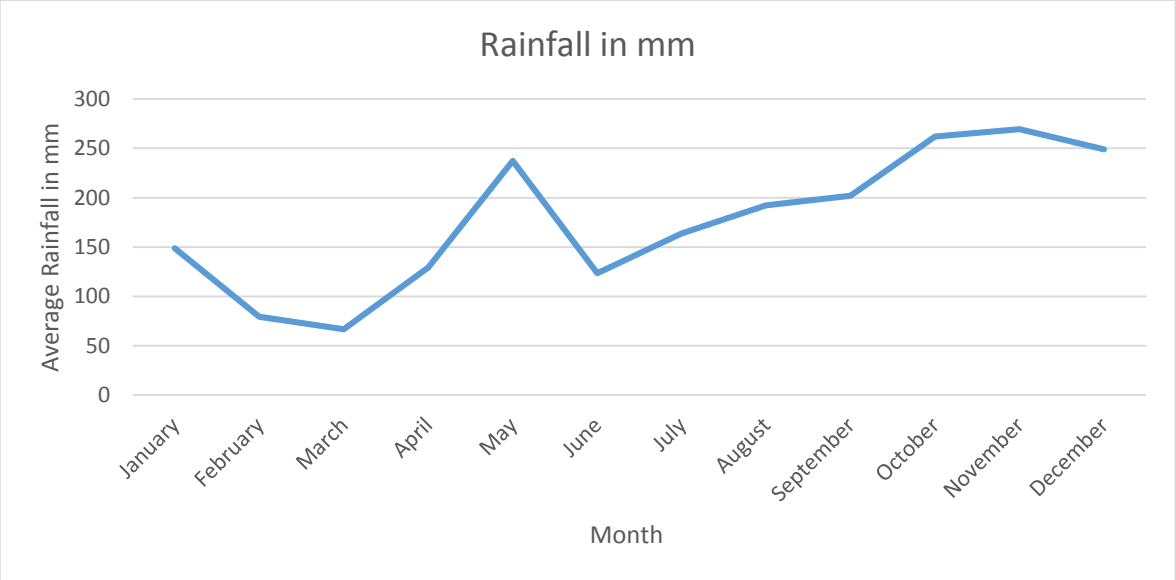

Figure 13: monthly rainfall variations at G.Dh Thinadhoo

The yearly rainfall for Thinadhoo seems to be in a cyclic manner like the rest of the Maldives. The cycle is about 10 years where average rainfall increases from 2000mm/year reaches a peak of 2500mm/year and decreases up to 1500mm/year, and again increasing up to 2500mm/year.

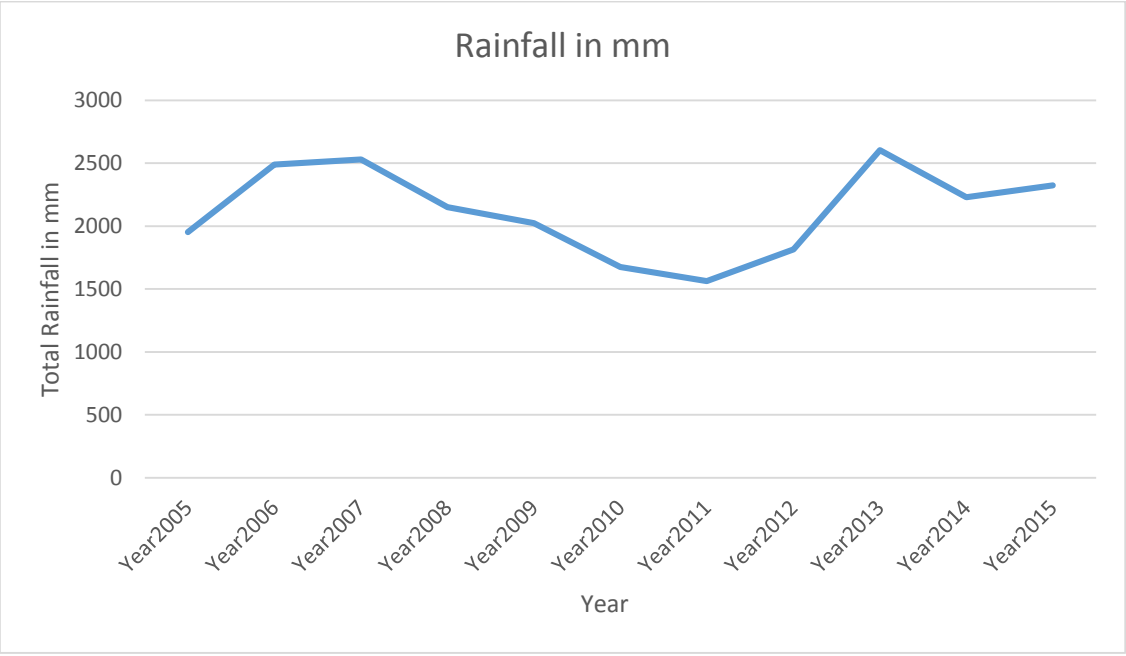

Figure 14: annual variations in rainfall at G.Dh Thinadhoo

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަވަރ ކޯޕަރޭޝަން ލިމިޓެޑ
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ދަތުރ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރ :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ; ވެބްސައިޓް

4.4 Insolation

As the Maldives lye within the equator, it received plentiful of sunlight everyday throughout the year. Highest insolation is received between February and April with a peak of 12 hours of daylight. For North, insolation is lower than for the other areas between May and July; 7 hours of insolation for North while for other areas the lowest sunshine was 8.5 hours.

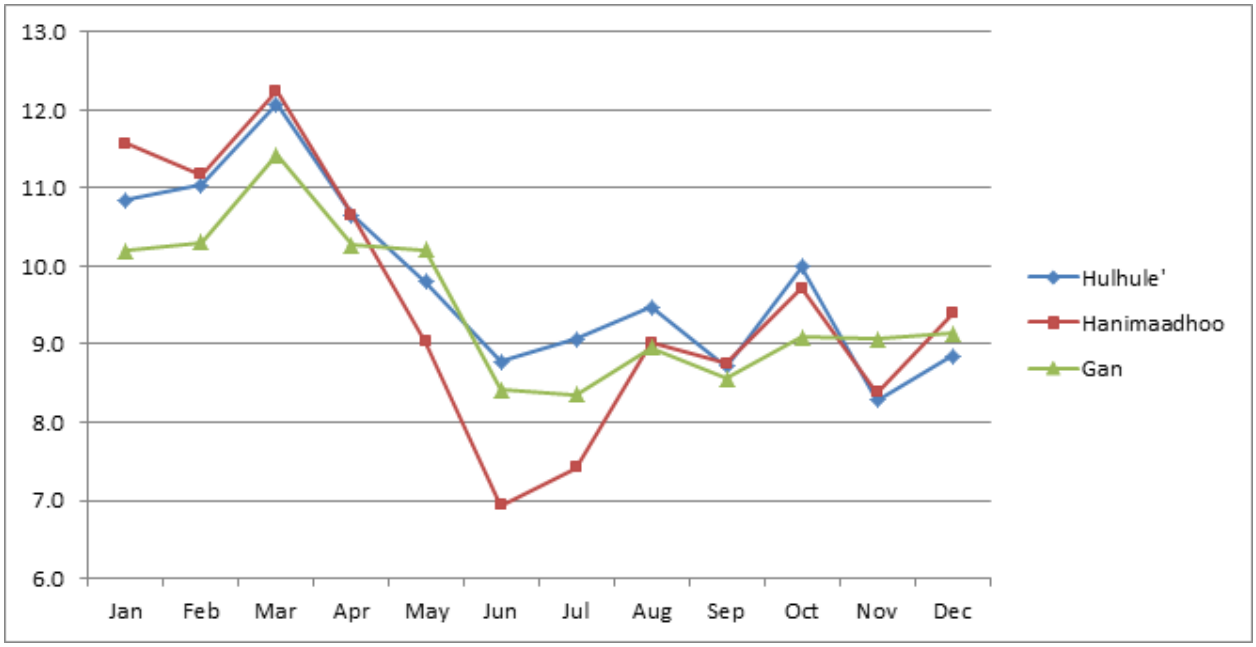

Figure 15: average daily insolation (hours) for different areas

4.5 Wind

The following figure shows wind pattern from year 2003 to 2008, adopted from EIA report for development of B. Voavah as a luxury tourist resort (2015). The blue vectors represent wind direction in the NE monsoon and green vectors represent wind direction in the SW monsoon. As can be seen from the vectors during the SW monsoon wind predominately blows from the SW and during NE from the NE.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފ ހިލާލީ ދަގު 7 ވަނަ ފަންގިފިލާ، ކޮމްޕްލެކްސް ބިލްޑިންގ، ކައުދަ
ދާއިރާ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ޓެލިގ
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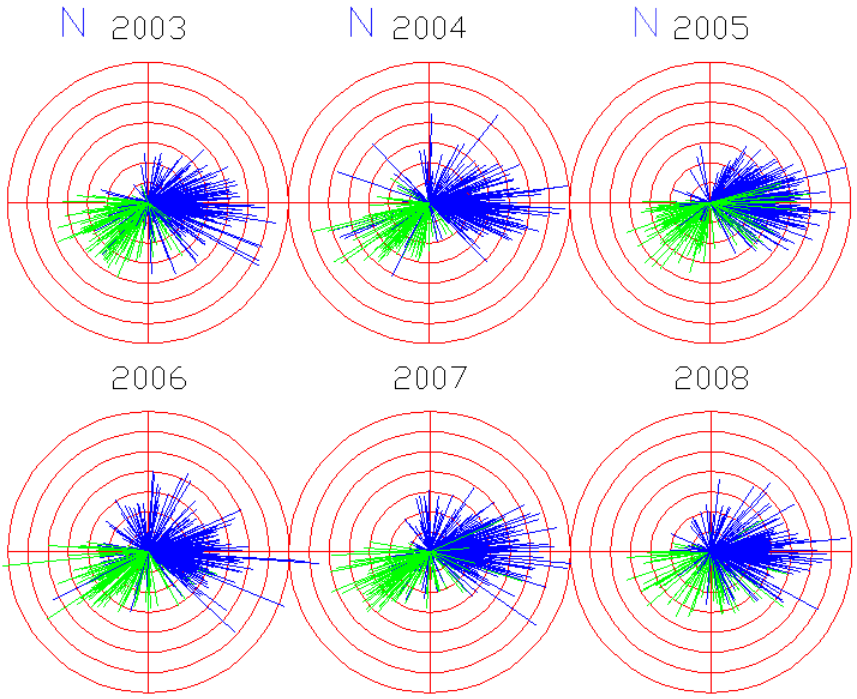

Figure 16: wind vectors from 2003 to 2008.

4.6 Waves

The following figure shows waves data gathered by Young (1999) for a ten year period for each world regional zone. This data was adopted from EIA report for development of B. Voavah as a luxury tourist resort (2015). In this research by Young Wave height was measured by satellite (Radar Altimeter), whereas a global wave model was used to precise wave directions. It indicates that dominant swell waves during the SW monsoon comes from SW and during NE monsoon from the NE. The peak wave height according to this model is in June with 1.8 meters. This corresponds with the roughest weather days for Maldives, which is roughly June and July.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފުރަތަމަ ފަންގިފިލާ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ދާކ. 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ޚ.ތ
Website: www.fenaka.com.mv : ވެބްސައިޓް

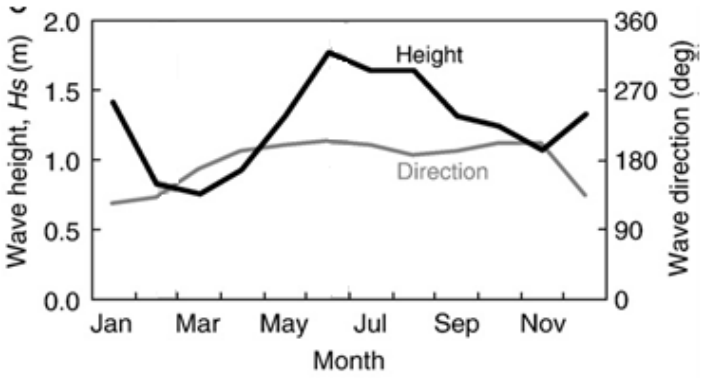

Figure 17: Ten year mean monthly wave height and direction for the central Maldives. Source: Young (1999).

4.7 Hazard Vulnerability

The coastal area near the powerhouse is subjected strong wave action during monsoon season. There has been severe flooding and erosion of the area in the recent past during rough weather. In some instances, desalination plant premise was inundated. Further, the outer wall of the FENAKA premise has been greatly damaged due to the result of being battered by strong waves.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފ ހިލާލީ ދަނޑު 7 ވަނަ ފަންގިފިލާ، ކްރީ ކޮމްޕްލެކްސް ބިލްޑިންގ،
ގުޅުވުން ، 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ީ.ލ.ދ
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Figure 18: erosion at the corner of the desalination plant premise walls

During rainy seasons the powerhouse premise and the road get flooded. However the flooding is not so severe that the water reaches the inside of the powerhouse.

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Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފުށ، ހިލާލީ ގަދު
ދާދި 20307 ، ދިވެހިރާއްޖެ
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Figure 19: flooding during rainy season at powerhouse area

4.8 Water Quality

4.8.1 Sampling method

One water sample was taken from an existing well within the powerhouse premise. Water from the well was collected by dipping a bucket into the well. Water sampling bottle was rinsed 3 times from the well water.

Water sample was collected in a 1.5 mL plastic bottle on 04th April 2016. The bottle was chilled and transferred to Male', which was later tested at MWSC laboratory.

4.8.2 Sampling location

Following table shows the locations from which water samples were taken.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަރަ ކޮޕަރޭޝަން ލިމިޓެޑް
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ފޯ. ކޯ. 20307 ، ދިވެހިރާއްޖެ
ބަ.ގު. : info@fenaka.com.mv
ވެބްސައިޓް : www.fenaka.com.mv

Table 3: geocordinates of water sample location

Location	Longitude	Latitude
Powerhouse	72.99261255027722	0.5244835145853928

Figure 20: water sample location

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Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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ފާ.ބ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރަ : Email: info@fenaka.com.mv
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4.8.3 Results

Table 4: water sample results

Location	Powerhouse	Optimal Range	Reference
Conductivity(µs/cm)	6420	<1500 µs/cm	EPA
pH	7.34	6.5-8.5	EPA
Salinity (‰)	3.5	NA	EPA
Temperature(^{0}C)	23.4	NA	EPA
Turbidity (NTU)	0.401	<5NTU	EPA
Total Petroleum Hydrocarbon (mg/L)	0.07	NA	EPA

Only pH and Turbidity is within the optimal range. Conductivity is beyond the optimal range. Further, hydrocarbons are present at a concentration of 0.07 mg/L.

Previous data on water quality

In a study done in 2010 during the EIA surveys for the G.Dh Thinadhoo Wastewater collection, treatment and disposal system by the Ministry of Housing and Environment, found that ammonium was detected in 90% of wells with an average concentration of 4.3mg/L. Nitrate was found in 60% of wells with an average value of 7.2mg/L. Phosphate was detected in 95% of wells with an average of 0.68 mg/L.

During the EIA surveys for the G.Dh Thinadhoo 300m^3/day Desalination plant it was found that the conductivity of water in the reclaimed area is higher than the EPA recommended range (1702 microSiemens/cm). Further, Sulphate (108 mg/L) and Nitrates (17.2 mg/L) was also found at high levels.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުވުން :
Fax: [960] 332 7555 ފެކްސް :

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4.9 Vegetation

4.9.1 Method

The vegetation cover at the proposed powerhouse location was determined visually. All the trees within the site were counted. The geo-coordinates of the proposed powerhouse location is shown in table 5.

4.9.2 Results

There are 57 *Cocos nucifera L*. within the vicinity of the proposed powerhouse location, out of which an estimated 20 *Cocos nucifera L*. will have to be removed. There is a considerable cover of *Panicum maximum, Lippia nudiflora* and on the ground with a few *Launeaea sarmentosa*. Further, one *Casaurina equisetifolia, Hibiscus tiliaceus* and *Terminalia catappa* tree needs to be removed.

Table 5: geocordinates for proposed powerhouse location

Location	**Longitude**	**Latitude**
Proposed powerhouse	72.99260325262722	0.5246153982880835

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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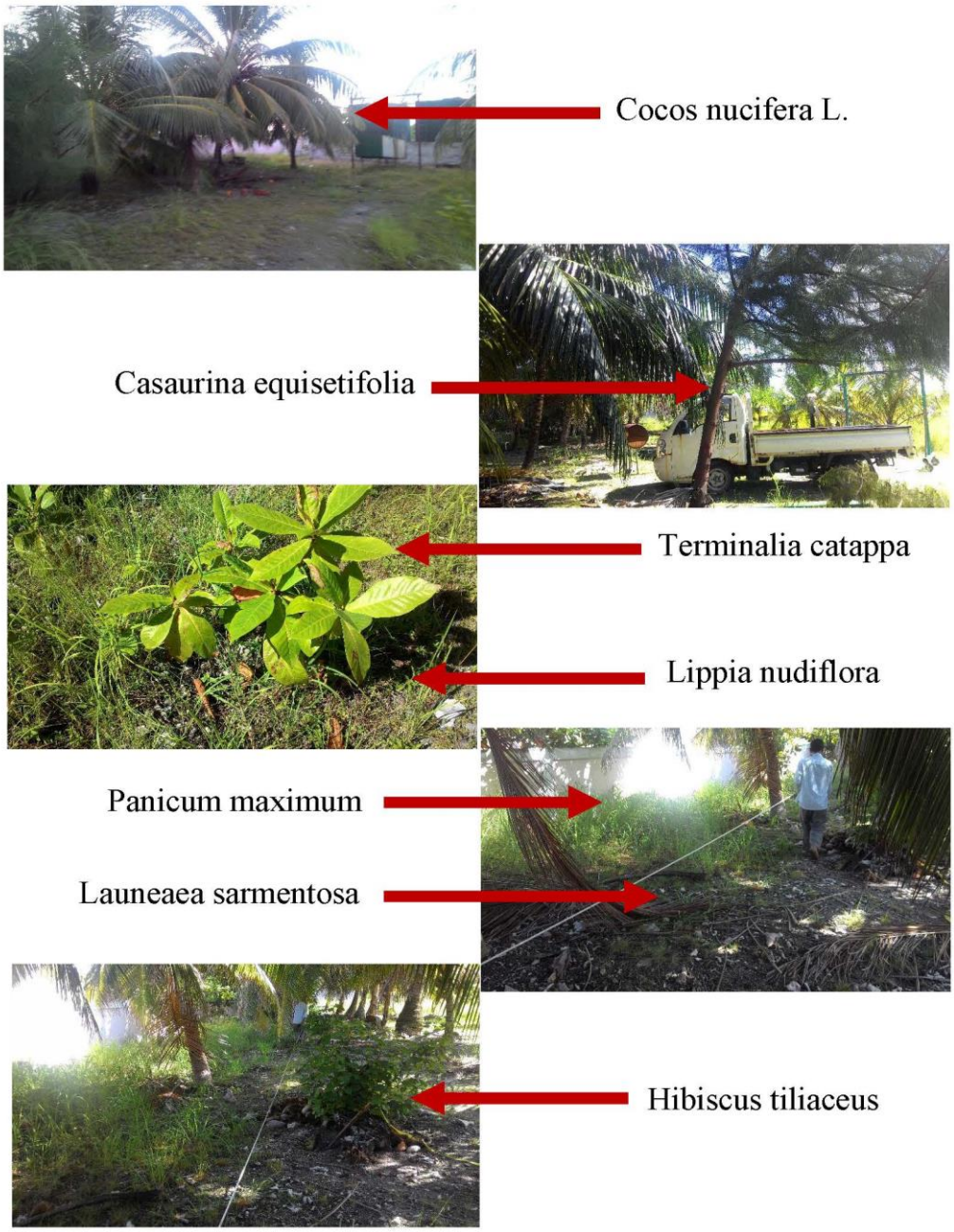

Figure 21: vegetation near proposed powerhouse

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Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

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ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
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4.9.1 Dhivehi names for the vegetation

Table 6: Dhivehi and scientific names for plants

Scientific Name	**Dhivehi Name**
Panicum maximum	*Onuhui*
Casaurina equisetifolia	*Fithuroanu*
Cocos nucifera L.	*Ruh*
Terminalia catappa	*Midhili*
Hibiscus tiliaceus	*Dhiggaa*
Launeaea sarmentosa	*Kulhlhaa filaa*
Lippia nudiflora	*Huni gondi*

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޮމްސް ޓާޓްލްޑިން ހިލާލީ ދަގު 7 ވަނަ ފަންގިފަށ، ދަށުގެ ދަތ
ފ.ކ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ވ.ދ
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4.10 Noise level

4.10.1 Method

Noise level was measured using a hand held decibel meter. The maximum and minimum readings were recorded at the powerhouse and near the closest residential area. The geo coordinates of the locations are shown below.

Table 7: geocordinates of noise level measurement locations

Location	Longitude	Latitude
Powerhouse 1	72.99278461679171	0.525053582048661
Powerhouse 2	72.99254778715314	0.525053582048661
Powerhouse 3	72.99307523687308	0.5243081178376194
Powerhouse 4	72.99319753451118	0.524738681774777
Haashge 5	72.99349857747193	0.5253819028107845
Fathihugali 6	72.99311964503562	0.5254930096518305
Malasge 7	72.9929625057601	0.525561366819073

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފުނަދޫ ކާބަލްއަޅުވައިނުމުގެ ލިބެންވާ
ފުރަތަމަ ބަންދުގެ ހިލާލީ ދަގު 7 ވަނަ ފަންގިފިލާ، ދިވެހި ރާއްޖެ
ގ.ކ. 20307 ، ތިލަދުންމަތީ
ބ.ދ.ކ : info@fenaka.com.mv
ވެބްސައިޓް : www.fenaka.com.mv

Figure 22: noise level measurement locations

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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ދާކ 20307 ، ދިވެހިރާއްޖެ
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4.10.2 Results

Table 8: results of noise level measurements

	Noise level (db)	
Location	**Minimum**	**Maximum**
Powerhouse 1	58.4	60.2
Powerhouse 2	58.7	60.3
Powerhouse 3	68.2	70.5
Powerhouse 4	76.7	77.8
Haashge 5	58.2	59.4
Fathihugali 6	48.0	49.7
Malasge 7	53.9	54.7

Noise level within the vicinity of the temporary generators is very high. It is because the generators are not inside a powerhouse that the noise level within the nearest residential area also considerably high.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޮރިޔާ ކޮންޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަހަ
ފ.ކ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

5.0 LEGISLATIVE AND REGULATORY CONSIDERATIONS

5.1 Law on general public services (4/96)

Under this law the general public services are electricity, telephone, water and sewerage services.

Article 3 states that any party can provide general public services only after getting registered in the competent authority and according to its regulations.

Article 4 states that any public service must be provided after a contract agreement has been made between the service provider and the customer. The agreement must be made according to the regulations put forward by the competent authority.

Article 5 states that a transfer of service between customers must be made only after a contract has been made between the customers according to the service providers regulations. If the customer fails to comply with the agreement, the service provider can discontinue service only after approval from competent authority.

Article 7 states that the service provider can permanently discontinue its services according to regulation mentioned in article 3 of this law. However temporary discontinuation can be made after giving prior notification to the customers and according to the agreement made between the service provider and the customer.

Article 8 states that the tariffs for the services must be approved from the competent authority prior to implementation. Further, any amendments to tariff structure also must be approved from the competent authority before implementation.

Article 9 states that any damage made to service provider's facilities by anyone, he can be charged with 10 prison penalty or banishment. Further any action against this law (excluding what is mentioned in article 9(a) of this law) can be charged between MVR 100 to MVR 5000 by the competent authority.

5.2 Law on Environmental Protection and Preservation of the Maldives (4/93)

The Maldives law of environmental protection and preservation was enacted to protect the environment and its resources for the current and future generations.

Article 2 states that the instructions for environmental protection will be given from the competent authority and everyone must respectfully follow these instructions.

Article 3 states that all matters relating to environmental protection and preservation must be handled by the Ministry of planning, human resource and environment.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
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Email: info@fenaka.com.mv ބ.ޓެލިތ :
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Article 4 states that Ministry of planning, human resource and environment must declare protected sites and species and formulate the regulations to manage them. If any other party wants to declare a protected site or species they must be registered in the Ministry of planning, human resource and environment and managed according to regulations made by the Ministry.

Article 5 states that any projects which pose significant impacts to the environment, an Environmental Impact Assessment report has to be made and submitted to the Ministry of planning, human resource and environment. The projects which require Environmental Impact Assessment and the regulation must be made by Ministry of planning, human resource and environment.

Article 6 states that if any project is found to cause significant adverse impacts, Ministry of planning, human resource and environment have the right to stop the project.

Article 7 states that any waste, oil or hazardous gas must not be dumped into any part of the Maldives, however if strictly needs to be disposed it should be disposed off in an area designated by the Government. If such hazardous gas, waste or oil is to be disposed by combustion, it should be done in a way it does not impact people's health and environment.

Article 8 states that any hazardous waste must not be disposed into any part of the Maldives. Before trans-boundary transfer of such waste, approval must be taken from the Ministry of Transport and Communication by writing to the Ministry at least 3 months beforehand.

Article 9 states that anybody who violates this law or any regulation under this law punishable to no more than MVR 100 million according to the offence. The fine will be done by the Ministry of planning, human resource and environment.

Article 10 states that any offence to this law or any regulation under this law or any action resulting in environment damage, the price for such damages can be taken through the judicial processes.

5.3 1st addendum to Environmental Protection and Preservation of the Maldives (4/93) law no 12/2014

Article 3 and 11 of the Environmental Protection and Preservation Act (4/93) of Maldives is amended as follows;

In article 3 all matters relating to environmental protection and preservation must be handled by the Ministry charged with implementation of environmental policy.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފާރުގެ ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފުށ، ހިލާލީ ގަދު
ފާ.ކ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ބ.ޚ :
Website: www.fenaka.com.mv ވެބްސައިޓް :

5.4 Environmental Impact Assessment Regulation 2012

The EIA Regulation, which came into force in 2007, has been revised and the revised EIA Regulation 2012 is currently in force since May 2012. The Regulation sets out the criteria to determine whether a development proposal is likely to significantly affect the environment and is therefore subject to an EIA. Schedule D of the EIA Regulations defines the type of projects that would be subject to Environmental Impact Assessment. Harbors, dredging and land reclamation is among those. The main purpose of this Regulation is to provide step-by-step guidance for proponents, consultants, government agencies and general public on how to obtain approval in the form of an Environmental Decision Statement.

With the 2nd addendum to the environmental impact assessment regulation 2012 in 30th August 2015, there were some procedural changes made to the EIA process. The most important was the shifting of tourism related development projects EIAs to the Ministry of Tourism. Other than that slight changes were made to the process such as the finalization of the ToR during the scoping meeting(article 11(b)) and changes in the fees for the review processes under three different categories (article 7(c)).

Under article 8(a) the decisions for a screening form is as follows;

1) Environment Management Plan
2) Initial Environmental Examination
3) Environmental Impact Assessment
4) Approval to go forth with the screened project
5) Approval to go forth with the project according to the mitigation measures proposed by EPA

Under article 9(b) the decisions for an IEE is as follows;

1) Environmental Impact Assessment report if the project is anticipated to have major environmental impacts
2) Environment Management Plan
3) Approval to go forth with the project if the project is not anticipated to have major environmental impacts

Under article 10 two reviewers are required to review the Environmental Management plan. The reviewers are to be selected according to article 13(b) of the regulation.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުއްވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ފ.ކ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

Since the development of new powerhouse is in the inclusive list, an EIA report needs to be submitted to the competent authority before the implementation of the project. An EIA application form was submitted to the EPA and a scoping meeting was held on 24th March 2016. During the meeting the ToR for the project was issued. The EIA report is this document and will be submitted to EPA for approval.

5.5 Waste management regulation

The waste management regulation dictates the principles needed to follow when handling waste. The aim is to minimize adverse impacts to the environment and human health from waste.

Article 6 states that the waste management hierarchy is as follows;

1. Waste collection
2. Waste transportation by land or air
3. Treatment of waste
4. Storage of waste
5. Management of waste site
6. Landfill
7. Management of hazardous waste

The island councils are required to make a waste management plan and submit it to the competent authority. This plan must be reviewed at least every five years.

Article 8 states that hazardous waste are specified in annex (J) and under no circumstance should it be burned or disposed off in any area of the Maldives. While transporting hazardous waste, it must be in a closed container without any leaks. Further a sign must be on the container, specifying that it is hazardous waste. The import of any hazardous waste to Maldives is an offense.

Article 9 states that depending on the type and volume of waste, if it poses any threat to human health and the environment, the competent authority has the right to declare that particular type of waste as special waste. The current list of special waste is in the annex (B) of this regulation. Under no circumstance should special waste be imported to Maldives, burned, transported, recycled, recovered or treated without prior approval from the competent authority. In order to get the approval, the form in annex (F) of this regulation must be filled and submitted with an administrative fee of MVR 500 to the competent authority. Further, special waste must be stored only in designated places by the competent authority, the design conditions of the storage facility is specified in annex (C) of this regulation.

Article 10 states that the principles regarding extended producer responsibility must be declared and gazette within one year after this regulation comes into force.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ފާސް 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ބ.ޚ.ތ :
Website: www.fenaka.com.mv ވެބްސައިޓް :

Article 11 states that waste generated at islands must be disposed off in areas specified for the purpose or areas approved by competent authority. Disposal of waste to following areas is prohibited under this regulation and is an offense;

- Mangroves
- Island Lagoon
- Reef
- Lagoon(falhu)
- Finolhu
- Beach
- Vegetation line
- Harbor
- Park
- Road

Approval to dispose waste to areas not approved by competent authority will be given under following circumstances;

1. Waste is disposed as a measure to protect human health
2. Situation created by natural disaster or a state of emergency

Approval to manage waste at household level is not required for the following actions;

1. Waste segregation at household
2. Composting at household

Article 12 states that anybody responsible for public sites must place and manage a dustbin. The waste in these dustbins must be managed according to this regulation. Disposal of waste to public sites (besides the dustbin) is an offense.

Article 13 states that any sea vessel must have mechanism to store waste until it reaches a harbor. Upon arrival at a harbor the boat captain must take the waste to an area designated for waste disposal. However biodegradable waste such as kitchen waste and fish mulch can be disposed at sea.

Article 14 states that a waste management system must be established at all harbor's by the operator. A proper system must be in place to manage waste oil and other wastes segregated. Further, the operator must maintain information mentioned in annex (E.) and the records must be made available to competent authority upon request.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފުނަރަ ކޮޅަދެއްކުމުގެ ލިޔުން
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގް 7 ވަނަ ފަންގިފިލާ، ދަގު
ފާ.ކ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރަ :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

Article 15 states that any party who wants to commercially recycle and recover waste, approval must be taken from the competent authority by submitting the form in annex (F) and proposal according to annex (D) of this regulation.

Article 16 states that approval must be taken from the competent authority for the following waste management works

1. Waste collection
2. Transportation of waste by land and sea
3. Waste treatment
4. Storage of waste
5. Management of waste disposal sites
6. Landfill
7. Handling of hazardous waste

The number of waste management approvals for a particular area or areas will be decided by the competent authority based on the following;

1. Waste generation
2. Economic gains from waste management actions
3. Environmental protection requirements for the area

Article 17 states that the parties who get approval to manage waste must operate according to the competent authority's directions under article 6 of this regulation. Any action not mentioned in the article 6 can be actioned by prior discussion and approval from the competent authority in order to protect health and environment. Such actions by the island council or city council must be advertised publicly.

Article 18 states that the approval for waste management must be given for a set duration. The proponent must apply for renewal of the approval before 3 months of approval due date. Approval will be renewed only if the proponent actions were according to the conditions of the given original waste management approval.

Article 19 states that if a proponent wishes to do more than one of the works mentioned in article 16(a) of the regulation, they can submit a single form for all the works.

Article 20 states that if a proponent wishes to transfer the waste management approval to another party, then they must submit the form in annex (G) and submit any further information the competent authority requests. Within 30 days of submission of the form, the competent authority will issue the approval.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުއްވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފުނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފުރަތަމަ ބާވަތުގެ ޕޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފުޅާ، ހިލާލީ މަގު
ދާދި 20307 ، ދިވެހިރާއްޖެ
ކ. ގުޅުއްވުން ؛
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

Article 21 states that if a proponent wishes to terminate an approval, they must submit the form in annex (H) of this regulation. The approval will be terminated after the competent authority has ensured that the waste management actions have been done according to the regulations by the proponent.

Article 22 states that an administrative fee (mentioned in annex-J of this regulation) has to be paid to the competent authority while applying for waste management approval.

Article 23 states the proponent can take a fee from the customer given that the fee structure is approved from the competent authority. The proponent can make a distinction in the maximum price for houses and business category. The declared fee structure must be advised publicly to the customers.

Article 24 states that the competent authority must maintain a record of the approvals given.

Article 25 states that when transporting waste the best practices outlined in article 6 of this regulation must be strictly followed. Waste generated at inhabited islands and islands given for commercial use must be transported to the regional waste management facility.

Article 26 states that the parties given approval to transport waste must abide by the following;

1. Before transporting waste to a particular site, they must ensure that the type of waste is allowed to be disposed to the site
2. Records of waste transportation must be maintained according to annex (E) of this regulation and these records must be provided to competent authority when they are requested.

Transport of waste to disposal site from households by another party without giving a fee, is excluded from this article.

Article 27 states that before transport of hazardous out of Maldives, approval must be taken from the competent authority by submitting the form in annex (G) of this regulation before 3 months of the transportation date. When applied for this approval, the competent authority will respond according to the following;

1. Rejection, if the activity is against any principles made by the competent authority under article 6 of this regulation or any international treaties signed by Maldives
2. Resubmission of form, if there is missing information or if the credibility of the information submitted is questionable.
3. Approval, if the activity is accordance with the principles made by the competent authority under article 6 of this regulation and international treaties signed by Maldives.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފުނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަގު
ދާދި 20307 ، ދިވެހިރާއްޖެ
ބ.ގުޅުއްވުން :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

Approval given under this regulation does not mean that any other approval required from other countries will not be required.

Article 28 states that before transport of hazardous waste through any area of Maldives, approval must be taken from the competent authority by submitting the form in annex (L) of this regulation before 3 months before waste arrive in Maldivian waters. When applied for this approval, the competent authority will respond according to the following;

1. Rejection, if the activity is against any principles made by the competent authority under article 6 of this regulation or any international treaties signed by Maldives
2. Resubmission of form, if there is missing information or if the credibility of the information submitted is questionable.
3. Approval, if the activity is accordance with the principles made by the competent authority under article 6 of this regulation and international treaties signed by Maldives.

Approval given under this regulation does not mean that any other approval required from other countries will not be required. Any vessel that enters Maldivian waters through the approval in this article must not dock in any area of the Maldives. Further if a need arises to inspect the vessel, the party who got the approval must arrange it.

Article 29 states that the party in charge of the management of waste disposal sites must take the approval from the competent authority according to the article 6(a) of this regulation. The management must submit the form in annex(E) of this regulation every 4 months. If the people who come to dispose waste does not go against the principles set by the waste disposal site management, refusing to accept their waste is an offense. The waste disposal site managers must publicly advertise the service hours and rules.

Article 30 states that the competent authority must maintain the records of administrative decisions.

Article 31 states that the competent authority must inspect the waste management sites. Inspection shall be done according to an inspection schedule made by the competent authority. The official from the competent authority may present his monitoring license and then do the monitoring of the site. After inspection of a site, the competent authority must compile an inspection report according to annex (M) and send it to the managers of the site within 7 days. The inspection report must contain any corrective actions to be taken with the due dates for the actions. The managers of the site must implement any corrective actions on specified in the inspection report on due time.

Article 32 states that the competent authority must maintain a database containing information about waste generation (at island level, regional level and country level), type of waste and treatment processes.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ބަގަ
ފ.ދ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރ : Email: info@fenaka.com.mv
ވެބްސައިޓް : Website: www.fenaka.com.mv

Article 33 states that the competent authority must submit a report based on the information on the database mentioned in article 32 annually.

Article 34 states that not following any action mentioned in this regulation is an offense. Further doing any of the following is punishable under EPPA 4/93 article 9(b). The penalty for these offenses will be determined according to annex-(N).

- Import of special category waste or hazardous waste to Maldives
- Transport or treatment of special category waste without prior approval from competent authority
- Disposal of waste to any site which is not approved for waste disposal from competent authority
- Refusing to allow customers to dispose their waste when they have not gone against any rules set by the waste management site managers.
- For any works requiring approval carrying out the works without approval from competent authority
- Managing waste against the principles set under this regulation
- Handling waste against the principles set under this regulation
- Transport of hazardous waste out of Maldives without prior approval from competent authority
- Managing waste against the conditions of a given waste management approval
- Failure to provide information or providing wrong information by any party given approval for waste management
- Failure to manage a public site according to article 12(a) of this regulation by the party responsible for the management of the public site

Doing any of the following is punishable under EPPA 4/93 article 9(a).

- Disposal of waste to an area under article 11(b) of this regulation
- Disposal of waste to a public site (other than the dustbins specified for waste disposal in the area)

The fines for the offenses under this regulation will be decided by the Ministry. The fines will have to be paid to the respective island or city council in the area where the offense was done.

Article 35 states that the competent authority has the right to terminate any approval given under article 16(a) of this regulation with reference to the following;

1. The competent authority finds enough evidence for the incompetence of the waste managers.
2. The works are against this regulation or any other laws

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުއްވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފުނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަހަ ކޮމްޕްލެކްސް
ގުޅުއްވުމަށް 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދިއްދޫ ؛
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

3. Failure to correct the problems mentioned in the inspection report submitted according to article 31 of this regulation

Article 36 states that the arbitration for a decision by competent authority must be made in writing to Ministry within 10 working with a full justification. The reply for the arbitration must be informed within 30 working days by the Ministry.

5.6 Regulation on provision of electricity to Male' and islands

This regulation is made in accordance to article 3 of law on general public services (number 4/93).

Article 1 states that electricity service can be given only after the service provider is registered in MEA.

Article 2 states that an agreement has to be made between the service provider and the customer for the provision of electricity services.

Article 3 states that any MEA approved electricity service provider can give their ownership to another party only after getting approval from MEA. If any customer wants to change ownership then they must get the approval from the electricity service provider and also make an agreement.

Article 4 states that if a customer breaches the agreement in any way, electricity services must be discontinued after getting approval from MEA.

Article 5 states that for any reason electricity services can only be completely discontinued after getting approval from MEA. However temporary discontinuation of services for the purpose of maintenance work or in accordance with the agreement made between service provider and customer is acceptable under this regulation. In such a case also the customer must be notified in advance. Nonetheless emergency discontinuation of electricity is excluded.

Article 6 states that the tariff for electricity must be approved from MEA.

Article 7 states that the regulations under the agreement between electricity service provider and customer must be approved from MEA.

Article 8 is about the technical specifications of powerhouse. The following is stated under this article;

- The engine must be mounted on a foundation and anti-vibration should be also mounted between the engine and the foundation.
- The exhaust pipe must be 24 feet high from ground if the power house is 14 feet high. For powerhouse higher than 14 feet, the exhaust must be at least 4 feet higher than from the highest point of the roof.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލޮޅި މަގު
ދަގު 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ބ.ޓެލިގ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

- The power house must be constructed and maintained in a fire resistant manner with walls fabricated and iron roofing.
- The powerhouse must be constructed 200 feet away from the nearest residential area. If there is not enough space available in an island then MEA will declare the area for powerhouse construction.
- The ventilation of the powerhouse must be such that when all the engines are operational the difference in temperature inside and outside the powerhouse must be less than 10 ^{0}C compared to ambient temperature.
- Power house construction, fuel storage and handling must be in accordance with pertinent regulations. If there is not pertinent regulation such an activity must be done after consulting with the relevant Ministry and there decision must be submitted to MEA.
- Firefighting equipment must be in accordance to NSS specifications.
- Powerhouse must be wired according to article 12 of this regulation.
- Fire safety notifications must be pasted on easily seen areas of the powerhouse.
- Emergency lights must be mounted such that works inside powerhouse can be done during a power outage.

Article 9 is about the technical specifications of control room, switch board, and distribution feeder. The following is stated under this article;

- Control room and distribution feeder must be in accordance to MEA approved drawings.
- Switch board and panel board must be constructed to MEA standards and must be tested from MEA and approval must be obtained. Wiring details must be submitted.
- Switch board rear end and sides must be closed in way people do not get electrocuted.
- The switch board must include and fulfill the following;
    - Incoming breaker: must be capable of taking 10% – 50% of generated rated current
    - Incoming indication light
    - Phase neutral and phase voltage must be visible
    - Three phase ampere must be visible
    - Able to see generator frequency
    - Able to see generator kilowatt
    - Able to generator energy
    - Earth float protection
    - Breakers capable of handling load for outgoing feeders
    - If there is more than one generator, synchronizing panel or change over switch with capacity to handle 125% of largest generator
- Drawings of panel wiring must be pasted in control room or any other visible area.
- Drawings for First aid instructions must be pasted on control room and engine room.
- Firefighting equipment's must be readily available to staff in control room

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފާރިޔާ ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފުށ، ހިލާލީ ގަދު
ފޯށ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ.ބޮ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

Article 10 is about the technical specifications of the distribution system. The following is stated under this article;

- At any point on the distribution, voltage must not be less 10% of generated voltage
- If distribution is to be made via overhead cables then the drawings must first approved from MEA. The poles can be either metal or wood with a diameter of 4 inches.
- The distance between two poles must be a maximum of 75 feet. The poles must be 1.5 feet from the wall of residential houses.
- The cables must be at least 14 feet from the ground. The distance between the must not be closer than 1 feet.
- Insulation must be in between the cables and the poles. The cables must be capable of handling 25% more of normal load.
- If there are any building as high as the power lane, then the lane must be insulated extending up to 5 feet from the building. After installation of lane it must be maintained to prevent tress from falling over.
- Works must be done on a live lane with proper safety equipment's like insulated gloves, insulated boots, and safety helmets.
- Work must not be done alone on a live lane. While working on a ladder, the ladder must be secured properly.
- If the distribution system is to be under the ground then the cable technical standard is BS6346 or international accepted standard.
- While laying the cable care must be taken not to damage the outer insulation of the cable. Cable should be buried on 1/3rd of the road at depth of 2.5 feet.
- After laying the cable, before backfilling sand must be laid up to 6 inches height and a tape notifying a cable is below must be laid.
- Cable joints must be done by MEA approved personals. The joint should be made by using heat shrink or resin.
- The distributions box's single line diagram must be approved from MEA and the box should be constructed in accordance to the diagram.
- The distribution box must be weather proof. The box must be constructed with a non-conductive material and its inside must have holes for air circulation.
- The distribution box must be secured with bolts 3 feet above the ground from the bottom of the box. The house connection cable from the distribution box must be inside a pipe or duct.
- The house connection supplies inside the distribution box must be properly secured such that it does not produce any sparks.
- Every distribution box must have a caution notice saying "Danger 400 V".

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުއްވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްڈިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ މަގު
ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ބ.ޓެލިމ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

Article 11 is about the technical specifications of the house connections. The following is stated under this article;

- The wiring of the houses must be in accordance with article 12 of this regulation.
- At any customer house, there has to be overload protection (cut out fuse MCB, MCCB), earth float protection (ELCBLR) and isolation (main switch) must be installed.
- To all electricity service provided places, a supply drawing must be made. No connection must be made without a drawing.
- Electricity service must be provided with the installment of a meter. The meter must be tested from an MEA approved place. ELCB must also be installed in this manner.

Article 12 is about the wiring standards. The following is stated under this article;

- Electrical wiring must be done by MEA approved professionals.
- Color codes for single phase wiring is; red for phase, black for neutral, green or green with yellow stripes for earth.
- Color codes for three phase wiring is; red for first phase, yellow for second phase, blue for third phase, black for neutral, and green or green with yellow stripes for earth.
- While three phase wiring, if the colored cables are not available sleeving must be inserted on both ends of the cable to identify the color codes.
- For three phase wiring, the load must be balanced to the 3 phases.
- The earth for a building must be connected using an appropriate thickness for the building. Main earth to the ground must be extruded from the specified area from the main switch or D-Board. A lug must be installment before connection of earth cable to earth rod. Earth must be fixed inside a closable junction measuring 8”x8”.
- In all wiring a D-board, main switch and ELCB must be installed. ELCB must be installed after testing from MEA approved place. In single phase places there must be a minimum of one socket with 2 lightings. In three phase places there must be a minimum of 3 socket with 6 lightings.
- ELCCB rating if single phase;
    - trifing - current 30 mA
    - 240V rated current – 30A to 63A
    - 2 pole
- ELCCB rating if three phase;
    - trifing - current 30 mA
    - 440V or 380V
    - 40A – 63A

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male’ 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުއްވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފެނަ ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ދަފްތަ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ.ބޮކްސް
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

- 4 pole
- If a lower rated ELCCB is to be used then its trifing current must not be higher than 30mA.

- All cables to D-board must have a phase and earth cable. The CB or fuse installed must be appropriate to the circuit. It should not be higher than required.
- Only basbar should be used in D-board. Loofing of the cable shall not be done instead of using basbar. Three phase D-board basbar link must be installed with appropriate gap between two phases.
- If cable diameter is 3/029 or 1.5 mm^2, circuit must have 5 lightings(fans can be included). However the load from this circuit must not exceed 500W. In socket circuits the cable diameter must be higher than 7/029 or 2.5 mm^2. The circuit must have 2 sockets if cable used has a diameter of 7/029 or 2.5 mm^2.
- While wiring if 2 or more gang switch is used, not more than one phase shall be connected to the switches(inside the same box).
- In a single phase circuit, instead of 30A main switch a, an MCCB rated higher than 2 pole 40A should not be installed. If three phase circuit, instead of 60A switch , an MCCB rated higher than 60A 4/3 pole should not be installed. If main switch is to be installed on D-board it should be between 5 and 6 feet from ground.
- All cables must be inside a condute pipe or protective piping like plastic pipe. If cables are not inside a pipe it should be secured using cable ties.
- Current for Air condition, freezer, and other higher load appliances must be given from points which is wired on separate circuit.
- Wiring to machineries must be done using appropriate cables via starter or main switch. Starter or main switch must be installed in a nearby area to workplace from where it can be operated easily.
- The installed D-board edge must be no higher than 6 feet.
- Water proof switches must be used in wet places like the toilets. If another type of switch is to be installed it must be in an area where water cannot reach.
- When using sockets without switches, there has to be a switch. Generally sockets without switch is not approved.
- Wirings in huge buildings, between phase neutral, phase earth, neutral earth resistance must be a minimum of 1 mega ohms. For wiring of less than 5 points if the resistance is 1 mega ohms it will not be accepted. For these type of places the resistance must be 10 mega ohms.
- If a customer wants to use a back up generator during an emergency, current shall be used using change over switch. Change over switch must be capable of cutting phase and neutral. Further the rating must be appropriate to the load of the place.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަދ
ދާކ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕ.ވ.ދ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

- If a customer wishes to add new wiring to existing MEA approved wiring, then it shall be done by MEA approved personel after wire testing. MEA unapproved wiring must not be connected to D-board.
- If a wiring done by a personel is found to be wrong, the responsibility must be taken by the person who signs on the wire testing form.

Article 13 states that the staff in powerhouses must be properly trained personals for the job. The highest responsible person in the powerhouse must have an MEA approved level of training. All staff in powerhouse must be trained for firefighting. Besides staff other people should not be allowed inside the engine room. Control room staff must have completed the basic fire extinguish and prevention course by Ministry of Defense and National Security.

Article 14 states that all MEA approved wiring professionals must follow this regulation. Wiring done against this regulation will not be accepted. Further, during wire testing if it comes to MEA notice that wiring done by a particular person has many issues his/her license maybe terminated.

Article 15 states that places wired before 1st January 1997 shall be advised to correct its wiring during a given time upon inspections by MEA.

Article 16 states that any breaches to this regulation are punishable by a fine of MVR100 to MVR5000.

5.7 Guideline for power system approval

The guideline for power system approval highlights the set of information required to be submitted to MEA for the approval process. Which includes details about the generation system, generator control panel and distribution panel, fuel system, distribution network, electric cable, firefighting system and lighting protection, environmental impact assessment of the generation facility, tariff and rules and regulations of powerhouse for consumers.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލޫޢީ ދަގު
ގުޅުވުން ، 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ.ބ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

6.0 POTENTIAL IMPACTS AND MITIGATION

The impacts from any project can be categorized into two broad categories; impacts during construction and impacts during operation. Impacts during construction are the potential impacts which might arise during the construction of new powerhouse. Impacts during operation are the potential impacts which might arise during the operation of the new powerhouse.

6.1 Impact identification methodology

The potential impacts were identified by looking in to the proposed works under this project and comparing it with the environmental setting. An impact matrix with reference to magnitude, extent or location, duration, reversibility and likelihood was used to determine the significance of the impacts. Further, expert judgment, field surveys and other similar EIA reports were used as a reference. Table below shows the characteristics of impacts against which it was analyzed.

Table 9: impact characteristics, where 5 is of highest significance.

Characteristic	**Impact significance**					
	0	1	2	3	4	5
Type	Direct/indirect					
Nature	Negative/ positive					
Magnitude	Negligible	low		moderate		High
Extent/location		small area covered		moderate area covered		large area covered
Duration		very short	Short	intermittent	Long-term	continuous
Reversibility			reversible			irreversible
Likelihood	none	low probability		moderate		high probability

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފުނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފ ހިލާލީ ދަގު 7 ވަނަ ފަންގިފިލާ، ކޮމްޕްލެކްސް ބިލްޑިންގ، ކ ދ
ފ.ނ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ފ.ގ
Website: www.fenaka.com.mv : ވެބްސައިޓް

6.2 Limitations in impact prediction

While all attempt has been made to accurately predict the potential impacts from this project, there are unforeseen uncertain factors which might causes deviations in the impacts outlined herein. For instance a natural phenomenon.

Further there is the limitation in our knowledge itself about the environment. Even though thorough brainstorming was done to assess the potential impacts there might always be some impact which is not accounted for because it has not been noticed.

In addition there is an information gap; there is limited information about the condition of the marine environment prior to anthropogenic disturbances. This makes it very difficult to ascertain a baseline.

6.3 Impacts during Construction

During construction the primary impact zone would be the powerhouse premise shown on figure below. This would include impacts on quality of air, water and terrestrial environment. The secondary impact zone would extend up to the desalination plant house and nearest residential area. This would be impacts on air quality.

Figure 23: impact zone during construction. Orange; is primary impact zone and yellow; is secondary impact zone

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފ ހިލާލީ ދަގު 7 ވަނަ ފަންގިފިލާ، ކްރޮސިންގ ބަދ
ފ.ކ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ޕޯ.ޑިވިއް
Website: www.fenaka.com.mv : ވެބްސައިޓް

6.3.1 Impacts on Air quality

Cranes will be used to lift the generators and move them to the desired location inside the powerhouse. Operation of other general tools during the construction of the power house will require electricity. As the electricity will be supplied from the existing grid of Thinadhoo no additional generators will be required to run. Therefore the fuel burned daily will be very less. Fuel will only be consumed during the operation of the crane during the transfer of the generators. It is estimated that 150 liters of oil maybe expended for this purpose.

Combustion of any type of fuel releases greenhouse gases to the atmosphere, however the volume of greenhouse gases released during the construction phase of this project is insignificant when compared to the amount of greenhouse gases produced in other countries. Further as the site is near the coast, it is expected that any waste gases would not remain stagnant to cause any health implications to the public. Any waste gases produced would be localized to the plant house area for a very short time.

The significance of the impacts to air quality was considered low as the magnitude of the impact is low and hence is not expected to cause any significant adverse impacts to the environment and the community.

Mitigation measures

Daily maintenance of machinery

6.3.2 Impacts on water quality

Pre-fabricated construction utilizes very hazardous chemical. If these chemical are spilled on to the ground, there is high risk that it will contaminated the groundwater near the power house. Further there is risk of oil spills from the operation machinery.

Even though the likelihood of this happening are slim, due to its irreversibility the impact is of high significance.

Mitigation measures

Daily maintenance of machinery.

Following chemical handling procedures.

Emergency oil spill cleanup crew on standby during construction.

Follow waste management regulation highlighted in the legal section of this report.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފުނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފ ހިލާލީ ދަނޑި، ޕޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފުށ، ދަށ
ގުޅުއްވުން : 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ގ.ވ
Website: www.fenaka.com.mv : ވެބްސައިޓް

6.3.3 Impacts from Waste

It is expected that the waste generated would be minimal, considering the entire power facility will be constructed using pre-fabricated sheets and blocks. It is expected that packaging waste and hazardous chemical waste will be the main type of waste generated.

Any waste generated would be localized to the plant house area and people working in powerhouse. Although the solid waste from packaging waste would be immediately levitated, once the waste is transported to the waste management center, the hazardous chemical waste generated pose a high risk to the workers. Therefore the impacts from waste is of moderate significance.

Mitigation measures

Solid waste managed according to waste management regulation.

Waste segregation and stored in closed labelled containers before transfer to waste management center.

Health and safety materials made available to workers specifying instructions on how to handle hazardous waste and how to act during a chemical spill to a person.

6.3.4 Impacts on terrestrial environment

It is proposed that only the building footprints will be cleared, the vegetation in all other area will be left. Any small trees which can be replanted will be replanted in another area within the Fenaka premises. However it is estimated that 20 *Cocos nucifera L*. will have to be removed. The trees would be removed in such a way that minimal damage would be caused to the root system of the tree so that it could be replanted elsewhere.

Impacts on terrestrial environment inside the powerhouse premise will be considerable as an estimated 20 out of 57 of *Cocos nucifera L*. will be removed. The trees removed will be thrown away as green waste. As the magnitude of vegetation clearance is moderate the impact is of moderate significance.

Mitigation measures

Replanting any small trees within the powerhouse footprint in other areas.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފާރިހާ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ މަގު
ދަތުރު 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރު ؛
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

6.4 Impacts summary

Following table shows the impacts summary during the construction phase.

Table 10: summary of impacts during construction

Impact	Impact Characteristics							
	Type	Nature	Magnitude	Extent/location	Duration	Reversibility	Likelihood	Significance
Air quality -GHG emissions	Direct	Negative	Negligible	Localized to power house area	Short-term	reversible	High	Low
Water quality -oil spills -chemical spills	Direct	Negative	Low	Localized to power house area	Short-term	Irreversible	Low	High
Impacts from Waste -solid waste generation -hazardous chemical waste generated	Direct	Negative	Low	Localized to power house area and work force	Short-term	reversible	High	Moderate

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން :
Fax: [960] 332 7555 ފެކްސް :

ފުނަރަ ގެއްލުވަންދާ ތަކެތި
ފ.ހިލާލީ ދަގު 7 ވަނަ ފަންގިފިލާ، ޕޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ،
ދާދި 20307 ، ދިވެހިރާއްޖެ
ބ.ދާދި :
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv ވެބްސައިޓް :

Terrestrial environment -loss of vegetation	Direct	Negative	Moderate	Localized to power house premise	Long-term	Irreversible	High	Moderate

6.5 Impacts during operation

During operations primary impacts would be to the powerhouse. While the secondary impacts would be to the entire Thinadhoo island community as the positive impacts will spread to the entire community.

Figure 24: impact zone during operations. Orange; primary impact zone and green; secondary impact zone

6.5.1 Impacts on water quality

During the operation and maintenance of the generators there is a small risk of water contamination by accidental spills. Impacts from any spills will be localized to powerhouse area and will be irreversible.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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ފުރަމާސް ކޮމްޕްލެކްސް ހިލާލީ ދަތުރުގެ 7 ވަނަ ފަންގިފުށ، ދަގު
ފ.ނ 20307، ދިވެހިރާއްޖެ : ލިޔުންތަކ
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv : ވެބްސައިޓ

Even though the likelihood of an oil spill occurring is low due to the irreversibility of the impact it is of high significance.

Mitigation measures

Regular maintenance of machinery.

Following chemical handling procedures.

Staff training on emergency oil spill cleanup.

Emergency response plans made for powerhouse operation.

Oil spill cleanup materials made available to the powerhouse.

6.5.2 Impacts on air quality

The operation of the power house is not expected to increase the impacts on air quality as already existing generators will be run at the powerhouse. The operation of the 3120 KW generators will produce smoke and greenhouse gases. However as the power house is 200 feet away from the nearest residential house and the location of powerhouse near the coast, it is expected that the smoke will not impact the community in anyway during the NE monsoon. However during SW monsoon smoke maybe blown towards the eastern corner of the island. Even though smoke maybe blown towards the residential houses, it is expected that the disturbance to residents will be minimal as the smoke will be diluted and also will be high above ground as the chimneys of the powerhouse will be 28 feet high.

Due to the low magnitude and location of powerhouse (near coast away from residential area), the impacts on air quality is considered to be of low significance.

Mitigation measures

Regular maintenance of generators.

Chimneys constructed according to MEA standard

6.5.3 Noise disturbance

With the operation of new powerhouse the noise level around the area will be decreased considerably. Currently the generators are operated in a temporary facility but with the operation of new powerhouse the generators will be operated inside a sound proof powerhouse. The powerhouse is located 200 feet away from the nearest residential house, hence noise disturbance

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފޮށި ކޮމްޕްލެކްސް
ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޮސްޓް
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

to community will be negligible. However the noise level inside the powerhouse will be very high. Therefore the staff working inside the powerhouse will need to wear noise cancellation headphones.

No birds are prevalent within 200 feet radius of the powerhouse. Hence it is expected that the noise from the powerhouse will not disturb any wildlife.

Even though the significance of noise disturbance to community and wildlife is negligible the noise disturbance to staff working in the powerhouse is high.

Mitigation measures

Wear noise cancellation headphones while inside plant house.

6.5.4 Socio-economic impacts

The new powerhouse will increase the reliability of electricity service of the island. Since the generators in Thinadhoo is currently in temporary facility any severe weather events pose risk of damage to the generators and discontinuation of electricity services. However with the development of new power house, the generators will be inside a protected house.

Since this impact is a positive long-term impact to the entire island community, it is of high significance.

6.5.5 Health

There are health implications to the staff working in the powerhouse during operations. During the operation and maintenance of the generators and other machinery they will come in contact with grease, oil, grit and other hazardous chemicals. If proper personal protection wears are not worn it will have adverse impacts to the health of staff. However there is little risk if the proper personal protections are worn and established chemical handling procedures are followed.

Mitigation measures

Following chemical handling procedures.

Wear essential personal protection attire at all times.

Health and safety manuals made for the plant.

Staff trainings on chemical handling.

Emergency response plans made for plant operation.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފޯރޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ގަދު
ފޯ.ބ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުވެރި : info@fenaka.com.mv
ވެބްސައިޓް : www.fenaka.com.mv

6.5.6 Impacts from Waste

Waste oil generated from the generators pose risk to environment if it is not managed properly. It is estimated that an average of 800 liters per month is generated. Currently waste oil is given freely for the locals.

Mitigation measures

Waste oil must be stored in closed labelled containers

6.5.7 Fire hazard risk and safety

Thinadhoo power facility has already experienced a fire hazard and this project resulted due to this. During the operation, the risk of fire is always there and will cause a considerable damage to the physical and social environment. Depending on the degree of fire, the impact could be low to very high.

Mitigation measures

The new facility will have firefighting equipment within the power plant house and within the administrative building. In addition, signs for the emergency procedures will have to be in the vicinity clearly marking where the exits and firefighting equipment's are.

6.6 Impacts summary

Following table shows the impacts summary during the operational phase.

Table 11: summary of impacts during operation

Impact	Impact Characteristics							
	Type	**Nature**	**Magnitude**	**Extent/location**	**Duration**	**Reversibility**	**Likelihood**	**Significance**
Water quality -oil spills	Direct	Negative	low	Localized to power house area	Long-term	Irreversible	low	high

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަދ ސެނިލެއިޓިންގ ލިމިޓެޑ
ފިލުވަރަށް ސާވިސަސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ދާއިރާ ދަ
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Air quality -GHG emission	Direct	Negative	Low	Localized to power house area	Long-term	reversible	High	Low
Noise disturbance -noise disturbance to staff	Direct	Negative	Low	Localized to power house inside	Long-term	Reversible	High	High
-noise disturbance to wildlife	Direct	Negative	Low	Localized to power house area	Long-term	Reversible	High	low
-noise disturbance to community	Direct	Negative	Low	Localized to power house area	Long-term	Reversible	High	Negligible
Socio-economic - reliability of electricity services	Indirect	Positive	High	Entire Island community	Long-term	Reversible	High	High
Health	Direct	Negative	Subjective of the	Powerhouse	Short-term	Irreversible	Low	High

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Ports Complex Building 7th Floor, Hilaalee Magu
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Fax: [960] 332 7555 ؛ ފެކްސް

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-health implications to staff			scale of spill					
Waste -waste oil	Direct	Negative	Moderate	Powerhouse	Continuous	Reversible	Low	High
Fire hazard risk and safety	Indirect	Negative	High	Entire Island community	Continuous	Reversible	Low	High

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Fax: [960] 332 7555 : ފެކްސް

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7.0 ALTERNATIVES

7.1 No project scenario

The no project scenario means that the new power plant will not be installed in Thinadhoo. This would lead to reduced reliability of electricity services to the island. FENAKA would not be able to provide electricity service sustainably to the community and will lead to a loss of credibility of the company. Further the noise and smoke disturbance to the staff working will remain high.

7.2 Alternative location for powerhouse

Considering the current land area already given to FENAKA and the location of the existing panel boards and fuel storage, the proposed powerhouse location is the most feasible.

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Fax: [960] 332 7555 : ފެކްސް

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ފޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ، 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަހަ
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8.0 MONITORING

Monitoring is one of the most essential aspects of EIAs, as only through monitoring can the predicted impacts be confirmed. For negative impacts monitoring allows for the mitigation of these impacts which will allow the prevention or minimization of the negative impacts. For positive impacts monitoring will allow us to determine if the positive impacts are as perceived in the beginning of project allowing to determine the overall success for the project and measures for improvement. Further it will allow us to find any unforeseen impacts. Finally it will allow us to determine if the mitigation measures are working and hence allow us to proposed new mitigation measures.

The baseline data collection for the construction of new powerhouse was conducted on April 2016. Baseline surveys are conducted to determine the reference range, so that comparisons can be made during the monitoring to determine the change.

All monitoring activities must be done under supervision of a registered EIA consultant. The details of the monitoring program are given in the table below.

Table 12: environmental monitoring plan

Parameter	Phase	Method	Indicators	Frequency	Cost / MRF
Groundwater quality	Operation and Construction	Test of groundwater parameters	Hydrocarbons	Every 3 months during construction and every 6 months during operation	800
Noise level	Operation	Noise level measurement using decibel meter	Noise level	Before and after operation	3500

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Ports Complex Building 7th Floor, Hilaalee Magu
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Tel: [960] 300 7555 ގުޅުވުން :
Fax: [960] 332 7555 ފެކްސް :

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8.1 Monitoring schedule

Monitoring reports must be submitted to EPA as specified in the monitoring schedule below.

Table 13: monitoring schedule

Description	**Date**
EIA Decision statement issued	April 2016
Monitoring report during construction- 1	June 2016
Monitoring report during construction - 2	August 2016
Monitoring report during construction - 3	November 2016
Monitoring report after project completion- 4	December 2016
Monitoring report after project completion - 5	December 2017
Monitoring report after project completion - 6	December 2018
Monitoring report after project completion - 7	December 2019
Monitoring report after project completion - 8	December 2020

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Tel: [960] 300 7555 : ގުޅުއްވުން
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9.0 STAKEHOLDER CONSULTATIONS

9.1 Public Consultation

The following table shows the details of individuals consulted during the field visit to Thinadhoo.

Table 14: details of individuals consulted

Name	House	Contact
Faarooq Ali	Garden	7918211
Khalid Ibrahim	Thaazaage	7781325
Ahmed Saeedh	Saavan	9993043
Naseem Moosa	Gangaa	7908078
Ahmed Naseer	Vinsten	7783402
Aishath Zamaau Zameer	White Chalk	7681783
Ahmed Azman	Scarnet	7794797
Ibrahim Shahid	Maleyshaa	9958156
Mohamed Thakurufaanu	Opium	-
Ibrahim Anwar	Maaranga	7848077

Following are the issues, concerns and suggestions highlighted by the general public;

- Shortage of gas for cooking
- Electricity price is high, it should be same price as Male'
- Development of new powerhouse is a good project
- Water, sewerage and electricity services are good
- Design the new powerhouse with reference to future demands, for instance powerhouse should have space for new generator placement
- The fire accident at the powerhouse is purposely done by someone, that is a very bad act
- What the community needs most is road development
- New powerhouse must have firefighting systems installed

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Fax: [960] 332 7555 ފެކްސް :

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- The fuel storage must be designed in such a way that it can contain the leak(the full volume of tank)
- New fuel storage is required
- New powerhouse must have good security; cameras installed.

9.2 Meeting with the island council

Following table shows the list of personnel participated in the consultation with G.Dh Island Council.

Table 15: attendees of council meeting

Name	Organization
Ibrahim Assad	Vice President, Thinadhoo Council
Ahmed Nasheer	President, Thinadhoo Council
Gusayyu Abdulla	Member, Thinadhoo Council
Almas Zuhair	Member, Thinadhoo Council
Mahfooz Abdull Wahhab	Consultant

Following are the issues, concerns and suggestions highlighted by council;

- Waste oil and filter discarding to the East of powerhouse from FENAKA.
- The new powerhouse must have security cameras, fences and guard people. Further it should have provision for fire safety, for example fire horses.
- MNDF recommended a fire horse to be placed on roadside of powerhouse.
- There is an existing playground near to the powerhouse. The powerhouse staff can use this playground. However there is still a football pitch to be constructed inside the powerhouse premise. Therefore the council urged to use the land given to FENAKA more wisely.
- Council suggested it would be good to spread out the buildings to prevent spread of accidental fires.
- The tariff for current is too high especially for the business category.
- Schools and hospitals are public places and yet they are billed under business category.
- Coordination with council and FENAKA is poor.
- Bill handing over by FENAKA is not very responsible. The staff may just slide the bill under the door and leave.

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Fax: [960] 332 7555 ފެކްސް :

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- Lighting of the roads are done by the council. The council does not have the necessary expertise for the job. Therefore 2 staff were appointed for the maintenance. Since FENAKA has the expertise it would be good that FENAKA takeover this responsibility.
- No CSR is done by FENAKA, council suggested it would good if FENAKA takes initiative and place dustbins for waste collection in the island.
- Currently what the community needs most is waste management. Council has plans to start composting and are in the process of tendering an incinerator.

9.3 Consultations with working staff on site

Following table shows the list of individuals consulted.

Table 16: details of staffs that were consulted.

Name	Designation	Contact
Musthafaa Hassan	Technical Manager	9996762
Abdul Saththar	Senior Supervisor	7979950
Mohamed Abdullah	Technician	7730748
Nizar Ali	Engineer	9911644

All staff agreed that the proposed location is the best for the construction of the new powerhouse. Following are the issues highlighted by the staff;

- Soot from the temporary generators causes breathing difficulty
- High noise level is very disturbing.

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Fax: [960] 332 7555 ؛ ފެކްސް

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10.0 CONCLUSION

Works presented in this EIA does not pose a huge environmental risk, while the benefits of this project outweigh the risks associated. However, during the construction and operation, the mitigation measures and good environmental conduct must be followed strictly to avoid any potential impacts.

It is expected that the development of powerhouse will greatly increase the electricity security at Thinadhoo. Furthermore the project will allow sustainable provision of electricity to the residents of Thinadhoo by FENAKA. This will undoubtedly improve the public perception of the company.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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ފްލޭގްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަދ
ދާކ 20307 ، ދިވެހިރާއްޖެ
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Website: www.fenaka.com.mv : ވެބްސައިޓް

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Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުއްވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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ފާރުގެ ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފުށ، ހިލާލީ ގަދު
ދާކަ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބ.ޓެލިގ
Website: www.fenaka.com.mv : ވެބްސައިޓް

APPENDICES

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

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LIST OF ABBREVIATIONS

MEE	Ministry of Environment and Energy
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
MEA	Maldives Energy Authority
NSS	National Security Service (currently known as Fire and Rescue)
NE	North East
SW	South West
mA	milli ampere
ELCCB	Earth leakage circuit breaker
ELCB	Earth leakage circuit breaker
V	Voltage
A	Ampere
CB	Circuit breaker
MCCB	Molded case circuit breaker
mm	millimeter
W	Watt
MW	Mega Watt
CSR	Corporate Social Responsibility

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Terms of Reference (ToR)

بسم الله الرحمن الرحيم

VISIT MALDIVES YEAR 2016

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Environmental Protection Agency EPA

203-EIARES/FNK/2016/28

Terms of Reference for Environmental Impact Assessment for Power Plant Development in GDh. Thinadhoo

The following is the Terms of Reference (ToR) following the scoping meeting held on *24th March 2016* for undertaking the **EIA of the Proposed Power Plant Development at *Thinadhoo island, Gaaf dhaalu Atoll.***

While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the EIA report.

1. **Introduction and rationale** – Describe the purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed.. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary. Identify the donors and the institutional arrangements relevant to this project. .

2. **Study area** – Submit a minimumA3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds site, sensitive species nursery and feeding grounds). Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – Identify and number tasks of the project including preparation, construction and decommissioning phases. The following tasks shall be completed:

   Task 1. Description of the proposed project – Provide a full description and justification of the relevant parts of the project, using maps at appropriate scales where necessary. The following should be provided (all inputs and outputs related to the proposed activities shall be justified):

   The main activities works are:
   - Land clearance for infrastructure installation;
   - Project management (include scheduling and duration of the project and life span of facilities; communication of construction details, progress, target dates, construction/operation/temporary labour accommodation, access to site, safety, equipment, waste management (including construction waste, fuel waste etc) and material storage, fuel management and emergency plan in case of spills).

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951 ގުޅުއްވުން
Fax: [+960] 333 5953 ފެކްސް

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ގްރީން ބިލްޑިންގ، 3 ވަނަ ފަންގިފިލާ، ހަނދުވަރޭ ހިންގުން
ދަތުރ، ދިވެހިރާއްޖެ، 20392
Email: secretariat@epa.gov.mv ލިޔުންތަކ
Website: www.epa.gov.mv ވެބްސައިޓ

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ގުޅުއްވުން
Fax: [960] 332 7555 ފެކްސް

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ދަތުރ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ލ.ވ.ލ
Website: www.fenaka.com.mv ވ.ސ.ވ

بسم الله الرحمن الرحيم

VISIT MALDIVES YEAR 2016

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Power plant design

- Location and capacity of generators and facility;
- Access to power plant;
- Sound attenuation measures;
- Emergency power supply plan;
- Consideration of energy efficiency in power generation

Fuel Management

- Volume required for plant operation;
- Rate of waste lube oil generation its collection, storage and disposal;
- Fuel storage tank details (size, location,);
- Pipeline drawings and specifications especially leakage proofing;
- Measures of fuel containment
  Method of fuel transport from harbour to storage

Hazard vulnerability

- Fire, electrical and explosion hazard
- Vulnerability of area to flooding and storm surge.

Health and safety

- Availability of basic first aid facilities
- Availability of safety gears
- Fire fighting capability of powerhouse operators or fire warden.

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

The baseline data will be collected before construction and from at least two benchmarks. All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points, reef transects, vegetation transects and manta tows sites for posterior data comparison. Submit all raw data collected for the purpose of the project along with the soft copy.

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

Information should be divided into the categories shown below:

**There is a description of the specific data collection requirements attached in the appendix of this TOR template.*

Hydrography/hydrodynamics (use maps)

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents and along shore currents;

Tel: [960] 300 7555
Fax: [960] 332 7555
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv

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Environmental Protection Agency EPA

Ecology

- Terrestrial surveys: including bird and turtle nesting sites, vegetation biodiversity and abundance;
- Landscape integrity, and
- Ground water quality parameters including temperature, pH, salinity, turbidity and grease and oil test (see appendix for parameter healthy ranges);

Socio-economic environment

- Demography: total population, sex ratio, density, growth and pressure on land and marine resources;
- Income situation and distribution
- Land use planning, natural resource use and zoning of activities (approved);
- Community needs;

Absence of facilities in the country to carry out the water quality tests will not exempt the proponent from the obligation to provide the necessary data. The report should outline the detailed methodology of data collection utilized to describe the existing environment.

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project.

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages – The EIA report should identify all the impacts, direct and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

Impacts on the natural environment

- Impacts of noise, vibration and disturbance;
- Impacts on ground water table and quality due to construction operations and accidental fuel spillages;
- Impacts on unique or threatened habitats or species (coral reefs, sea turtles etc.), and
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment

- Noise impacts to local residents;
- Changes in electricity prices, if any;
- Advantages of reliable electrical power supply;
- Population access to power (will access to power improve?)
- Employment and economic opportunities and diversification;
- Impacts on human health;
- Impacts from ground water contamination, if any;
- Impact equity (economic activities, employment, income);
- Social destabilization of the island community, and
- Monitoring of socioeconomic and demographic development.

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951 ގުޅުއްވުން
Fax: [+960] 333 5953 ފެކްސް

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ފިލާވަޅު ކާބަފާ ގަބޫލުކުރާ ދާއިރާ، ދިވެހިރާއްޖެ
ފޯނު: 20392
Email: secretariat@epa.gov.mv ޕޮސްޓް
Website: www.epa.gov.mv ވެބްސައިޓް

Fe ފެ
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Ma ފ
Tel: [960] 300 7555 ގުޅުއްވުން
Fax: [960] 332 7555 ފެކްސް

Email: info@fenaka.com.mv ޕޮސްޓް
Website: www.fenaka.com.mv ވެބްސައިޓް

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Environmental Protection Agency EPA

Construction related hazards and risks

- Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);
- Risk of accidents and pollution on workers and local population, and
- Impacts on social values, norms and belief due to construction workers on local population.
- Potential damage to surrounding buildings during construction

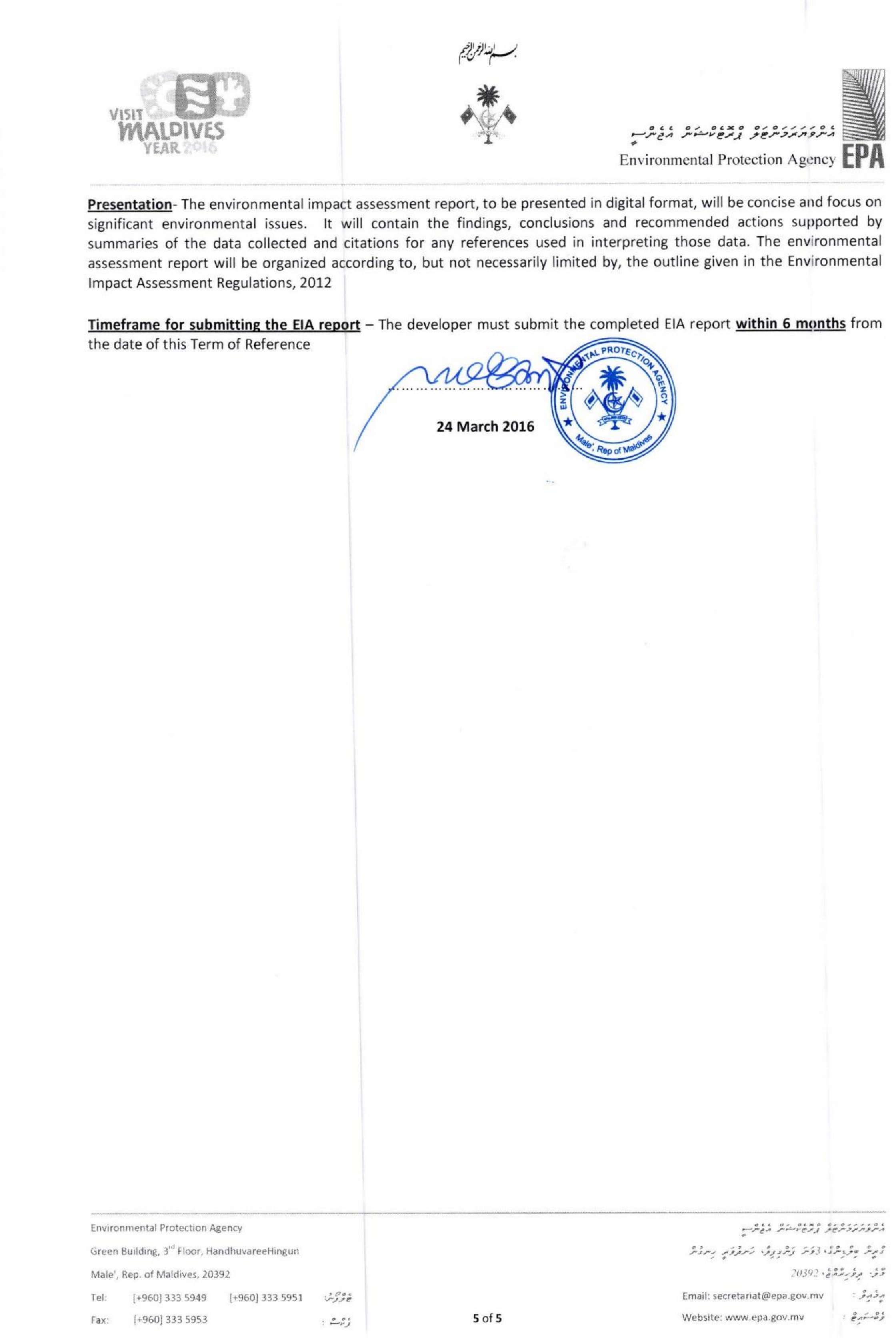
The methods used to identify the significance of the impacts shall be outlined. One or more of the following methods must be utilized in determining impacts; checklists, matrices, overlays, networks, expert systems and professional judgment. Justification must be provided to the selected methodologies.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

Task 5. Alternatives to proposed project – Describe alternatives including the *"no action option"* should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This should include alternative location and design of facility that includes environmental, social and economic factors. The report should highlight how the location was determined. 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 should be specified for each component of the proposed project. Comparison of alternatives should be provided in terms of short-term, medium-term and long term costs and environmental impacts and benefits in order to decide the best alternative.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures Mitigation measures to avoid or compensate habitat destruction caused will have to be considered. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures during construction and operation shall also be included. An Environmental management plan for the proposed project, identifying responsible persons, their duties and commitments shall also be given. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given. Efficiency of the generator sets and power distribution and consumption should be increased as a mitigation measure.

Task 7. Development of monitoring plan– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan. Ecological monitoring will be submitted to the EPA to evaluate the damages during construction, after project completion and on a yearly basis for five years thereafter. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

Task 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation) – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders, government authorities such as Ministry of Housing, Transport and Environment, Planning Council, Tourism Ministry, Finance Ministry, government agencies, NGOs, engineers/designers, development managers, staff and members of the general public. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes. If any forms are used for public consultation, it shall be approved by the relevant government authorities and annexed.



Environmental Protection Agency
EPA

Presentation- The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations, 2012

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

24 March 2016

Water sample results from MWSC

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

WATER QUALITY TEST REPORT
Test Report No: 300771/2016/25

Date: 12/04/2016

Customer Informations : ***Fenaka Corporation Limited***
Port Complex Building,
Hilaaly Magu,
Male',
Rep of Maldives

Sample Description / Location~	G. Dh. Thinadhoo	TEST METHOD	UNIT
Sample Type~	Powerhouse		
Sampled Date~	Waste water		
Sample Received Date	4/4/2016		
Test Requisition Form No.	5/4/2016		
Sample No.	900163135		
Date of Analysis	822519		
PARAMETER	5/4/2016-6/4/2016 **ANALYSIS RESULT**		
Physical Appearance	Clear	Visual	-
Conductivity	6420	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 22nd edition)	µS/cm
pH	7.34	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 21st edition)	-
Salinity	3.50	Method 2520 B. (adapted from Standard methods for the examination of water and waste water, 22nd edition)	‰
Temperature	23.4	Electrometry	°C
Total Petroleum Hydrocarbon (TPH)	0.07	UV Fluorescence	mg/L
Turbidity	0.401	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

Keys:
µS/cm: Micro Siemens per centimeter, **‰:** Parts Per Thousand, **mg/L:** Milligram Per Liter, **°C:** Degree Celcius, **NTU:** Nephelometric Turbidity Unit
LoQ: Limit of Quantification

Checked by:	Approved by:
Afnan Farooq Laboratory Executive	Mohamed Eyman Senior Technical Officer

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

**********END OF THE REPORT**********

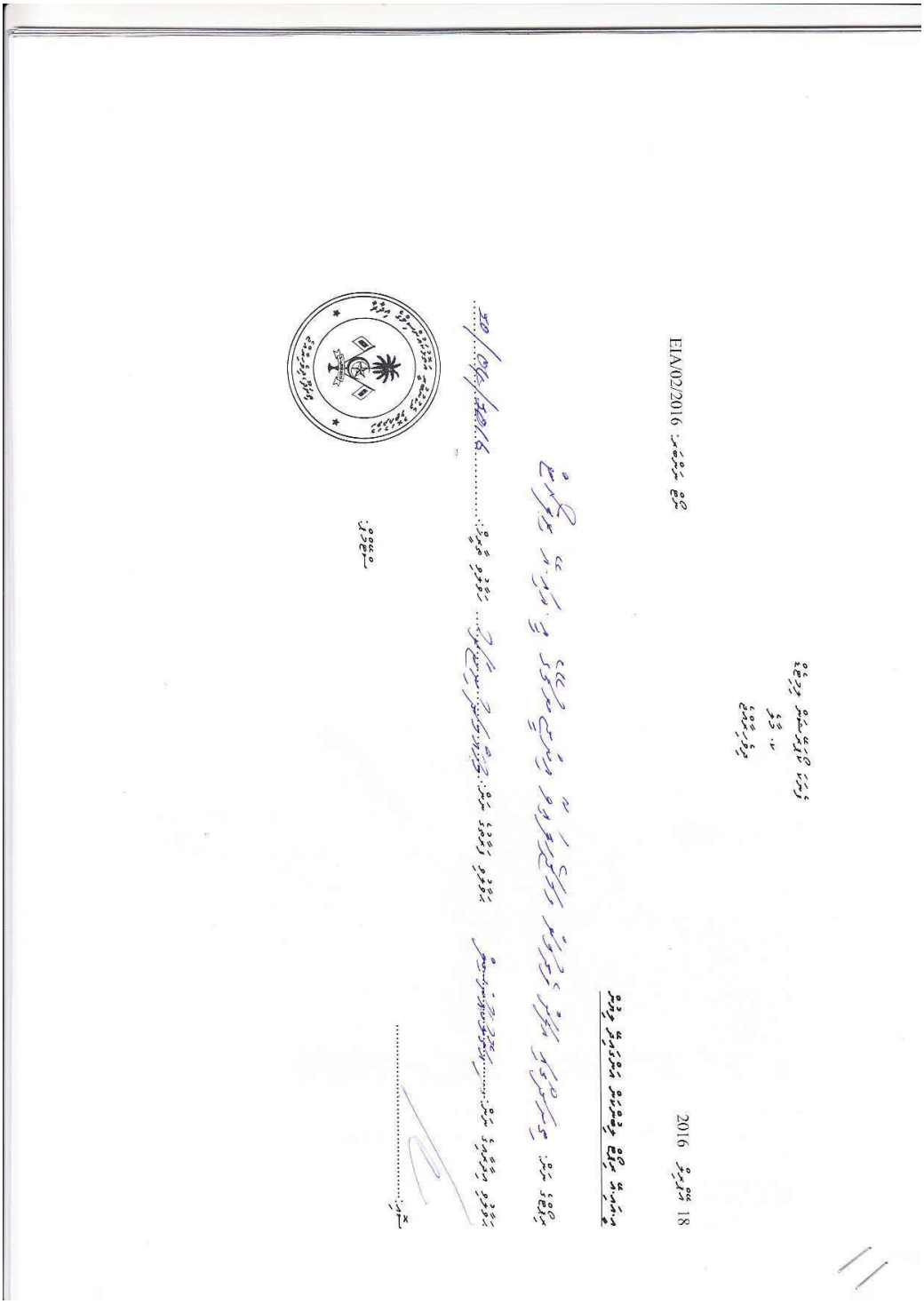
Page 1 of 1

WQA/LAB/F-14, Rev 05

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555
Fax: [960] 332 7555

ފެނަކަ ކޯޕަރޭޝަންސް ލިމިޓެޑް
ފިލާލީ ބަންދަރު 7 ވަނަ ފަންގިފިލާ، ދަގެ ފ ދ
ފ.ކ 20307 ، ދިވެހިރާއްޖެ
ގުޅުއްވުމަށް : 300 7555
ފެކްސް : 332 7555
ޕ.ބ.ދ : info@fenaka.com.mv
ވެބްސައިޓް : www.fenaka.com.mv

EIA report receival receipt from G.Dh Atoll Council



Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555
Fax: [960] 332 7555

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ފޯޓްސް ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލޮޅިގަނޑު
ދަތުރ 20307 ، ދިވެހިރާއްޖެ
ތ:
Email: info@fenaka.com.mv
Website: www.fenaka.com.mv

Environmental Impact Assessment Team

The EIA was carried out by a team led by Ali Shareef (ETA 19/11). Supporting members of the team include Mahfooz Abdull Wahhab (Registration no: EIA TA03/15) and Mohamed Ibrahim.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
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ފ.ކ 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރ : info@fenaka.com.mv
ވެބްސައިޓް : www.fenaka.com.mv

CURRICULUM VITAE OF MAHFOOZ ABDULL WAHHAB

PERSONAL DETAILS

Name: Mahfooz Abdull Wahhab
Nationality: Maldivian
Gender: Male
Date of Birth: 10th December 1992

Present address for communication: No Chance
K. Villingili
Malé
Republic of Maldives
Tel: (960) 9994467 (M)
Email: mahfoozabdullwahhab@gmail.com

EDUCATIONAL QUALIFICATION

SECONDARY EDUCATION:

High School Diploma
2008-2010 Centre for Higher Secondary Education, Male', Maldives

GCE O' level
2005-2007 Dharumavantha School, Malé, Republic of Maldives

TERTIARY EDUCATION:

Bachelor of Environmental Management
2012-2014 Maldives National University, Male', Maldives

OTHER QUALIFICATIONS

- PADI Advance Open water Diver
- Certificate II in Information Technology
- Registered EIA consultant

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފޯރު ކޮމްޕްލެކްސް ބިލްޑިންގ،
ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބްރޫދު
Website: www.fenaka.com.mv : ވެބްސައިޓް

PROFESSIONAL EXPERIENCE

EIA for the coastal modification and protection measures of B. Voavah, January 2016. The project was to determine the environmental impacts arising from the coastal modification and protection works around B. Voavah. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

Survey of sewer system in H.Dh Nolhivaranfaru, December 2015. The survey was to determine the condition of the sewer system in Nolhivaranfaru. I was involved in the inspection of the manholes, pump stations and sea outfall.

EIA for the partial renovation and upgrade works of Six senses Laamu, L. Olhuveli, October 2015. The project was to determine the environmental impacts arising from the renovation works at Six senses Laamu jetties and Villas. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for the partial renovation and upgrade works of Four Seasons Kuda Huraa, August 2015. The project was to determine the environmental impacts arising from the renovation works at Kuda Huraa water villas and walkway jetties. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for the relocation of Trees from B.Kihaadhoo to B.Voavah, August 2015. The project was to relocate 50 trees from B.Kihaadhoo housing plots to B.Voavah which is going to be developed as a Luxury Tourist Resort. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for the development of B.Voavah as a Luxury Tourist resort, July 2015. The project was to determine the environmental Impact arising from the development of B.Voavah as a tourist. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for Coral Frame Project at Maalifushi, Thaa Atoll, May 2015. The project aims to rehabilitate the coral reef of Maalifushi by deploying coral frames around the reef. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

Coral Frame Project at Kanifushi, Kaafu Atoll. Monitoring of the coral frames in April 2015 under the project.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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ފާރުގެ ކޮމްޕްލެކްސް ބިލްޑިންގ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފަހަ
ފޯރ 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ.ބޮ
Website: www.fenaka.com.mv ؛ ވެބްސައިޓް

Coral Frame Project at Kuda Huraa, Kaafu Atoll. Monitoring of the coral frames in March 2015 under the project.

EIA for Coral Frame Project at Kanuhuraa, Lhaviyani Atoll, October 2014. The project aims to rehabilitate the coral reef of Kanuhuraa by deploying coral frames around the reef. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

Coral Frame Project at Kanuhuraa, Lhaviyani Atoll. I was involved in the launching of the project in August 2014. This involved transplantation of corals to the frames and its consecutive deployment in Kanuhuraa reef. In addition, the initial monitoring of the frames after transplantation.

Coral Frame Project at Landaa Giraavaru, Baa Atoll. Monitoring of the coral frames in August 2014 under the project.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުއްވުން
Fax: [960] 332 7555 : ފެކްސް

ފެނަކަ ކޯޕަރޭޝަން ލިމިޓެޑް
ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ފޯރު
ފޯ. ކ. 20307 ، ދިވެހިރާއްޖެ
ބ.ގުދުރަތު : info@fenaka.com.mv Email:
ވެބްސައިޓް : www.fenaka.com.mv Website:

CURRICULUM VITAE OF MOHAMED IBRAHIM JALEEL

Curriculum Vitae of **MOHAMED IBRAHIM JALEEL**

1.	**NAME**	:	Mohamed Ibrahim Jaleel
2.	**DATE OF BIRTH**	:	9 May 1991
3.	**CITIZENSHIP**	:	Maldivian
4.	**PERSONAL ADDRESS**	:	V.Edhuruvehi Male'
5.	**TELEPHONE NO.**	:	(960)9768999
	E-MAIL ADDRESS	:	Mohamed.ibrahimjaleel@hotmail.com
	EDUCATION	:	General Certification of Education, (GCE) Ordinary Level. In 2007 (Science stream) General Certification of Education (Edexcel), in Advance Level. In 2010 (Science stream) Certificate in Project Management from Clique collegue Bachelor's Degree on Environmental Management from the Maldives National University. Post Graduate Diploma in Research Studies
6.	**OTHER TRAINING**	:	Graphics designing short course from IBI Took part in lecture series held by IUCN Maldives on various conservation issues and opportunities in the Maldives Training on preparation of EMMP under the MGCC project of USAID Training workshop on IWRM concepts under the GEF project, Kenya, Nivasha Took part in the development of the Maldives National Strategic Action Plan as focal point from Water and Sewer sector
7.	**LANGUAGE & DEGREE OF PROFICIENCY**	:	

	Speaking	Writing	Reading
English	Excellent	Excellent	Excellent
Dhivehi	Mother tongue	Mother tongue	Mother tongue

8.	**MEMBERSHIP IN CIVIC AND PROFESSIONAL SOCIETIES**	:	
9.	**Referees**	:	• Hussain Hameez – Director, Fenaka Corporation. • Ahmed Zahid – Managing Director of Sandcays Pvt. Ltd. (7781535) • Aishath Ali – Registrar of the Maldives National University (7786167) • Shaheeda Adam Ibrahim – Director General of Water and Sanitation department, MEE. (3018381)

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުވުން
Fax: [960] 332 7555 : ފެކްސް

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ދާދި 20307 ، ދިވެހިރާއްޖެ
Email: info@fenaka.com.mv : ބްރޯޝާ
Website: www.fenaka.com.mv : ވެބްސައިޓް

10. EMPLOYMENT RECORD :

FROM: **Jan 2016** EMPLOYER POSITION HELD AND DESCRIPTION OF DUTIES	TO: **Present** **Classy pool Pvt, Ltd** **Environmental Engineer.** • Overseeing all the EIA related projects of the company
FROM: **May 2015** EMPLOYER POSITION HELD AND DESCRIPTION OF DUTIES	TO: **Present** **Fenaka Corporation, Utilities Services Division** **Assistant Director.** • Overseeing all the water and sanitation related projects under the company • Overseeing all the water and sewer systems operated under the company.
FROM: **Jan 2015** EMPLOYER POSITION HELD AND DESCRIPTION OF DUTIES	TO: **May 2015** **Ministry of Environment and Energy, Water and Sanitation Department** **Assistant Director.** • Overseeing all the donor related water and sewerage projects. • Manage and supervise the implementation of project work on a daily basis. • Administrative and Policy related works of the sector.
FROM: **Feb 2014** EMPLOYER POSITION HELD AND DESCRIPTION OF DUTIES	TO: **January 2015** **Sandcays Pvt. Ltd.** **Research assistant.** Assisting in environmental research, environmental surveys and monitoring, drafting of EIA/ESIA reports and other documentation.
FROM: **2011** EMPLOYER POSITION HELD AND DESCRIPTION OF DUTIES	TO: **2011** **Ministry of Health and Gender** **Child care supervisor** (full time). Monitoring and reporting the actions of the child care officers and the needs of the children in Kudakudhinge hiyaa. Carrying out and planning various activities that are necessary for the growth and development of the children. Formulating the annual and the monthly schedule for the children and the child care workers. Attending to emergencies and accidents that occur within the kudakudhinge hiya sector.
FROM: **2011** EMPLOYER POSITION HELD AND DESCRIPTION OF DUTIES	TO: **2012** **Maldives National University** **Admission and Registration officer**. Carrying out the respective works of the admission and registration section of the Maldives National University.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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މާލެ 20307، ދިވެހިރާއްޖެ
ގުޅުވުން ؛ ބ.ގުޅ
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12. RELEVANT WORK EXPERIENCE

Project Name	:	**Study and EIA for proposed Reclamation and Resort Development on K. Tholhimarahura**
Client	:	**J Lagoons pvt. Ltd.**
Period	:	**Sep** 2014 Time Spent: 4 week
Position Held	:	Research assistant
Duties	:	Assisted in drafting/compiling of report
Project Name	:	**Study and EIA for proposed STP for Alimatha Aquatic Resort, Vaavu Atoll**
Client	:	**Alimatha Aquatic Resort**
Period	:	**Aug** 2014 Time Spent: 3 week
Position Held	:	Research assistant
Duties	:	Assisted in drafting/compiling of report
Project Name	:	**Survey and EIA for proposed STP for Mayaafushi Island Resort, Alif Alif Atoll**
Client	:	**Mayaafushi Island Resort**
Period	:	**Aug** 2014 Time Spent: 3 week
Position Held	:	Research assistant
Duties	:	Assisted in drafting/compiling of report
Project Name	:	**Study and EIA for proposed STP for Diggiri Tourist Resort, Vaavu Atoll**
Client	:	**Dhiggiri Tourist Resort**
Period	:	**Aug 2014** Time Spent: **3 week**
Position Held	:	Research assistant
Duties	:	Assisted in surveying activities and drafting/compiling of report.
Project Name	:	**Survey of Ensis RO plant Registration, Hulhumale'**
Client	:	**Ensis Pvt. Ltd.**
Period	:	**Aug 2014** Time Spent: **2 days**
Position Held	:	Research assistant
Duties	:	Assisted in surveying activities
Project Name	:	**Study and EIA for proposed Resort development project in Kanbaalifaru, Shaviyani Atoll**
Client	:	**Kanbaalifaru Investments Pvt. Ltd.**
Period	:	**June 2014** Time Spent: **4 weeks**
Position Held	:	Research assistant
Duties	:	Assist in the drafting/compiling of the EIA report based on previous work
Project Name	:	**Study and EIA for the proposed Water Supply system in HA. Thuraakunu**
Client	:	**Upper North Province Council**
Period	:	**June 2014** Time Spent: **3 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in the drafting/compiling of the EIA report based on previous work
Project Name	:	**Study and EIA for the Aa.Thoddoo water supply project**
Client	:	**MWSC**
Period	:	**May 2014** Time Spent: **1 week**
Position Held	:	**Research assistant**
Duties	:	Responsible for the survey equipment, assisted in all surveying activities
Project Name	:	**As built Survey of B. Kihaadhufaru Resort**
Client	:	**Ibsun pvt.ltd**
Period	:	**May 2014** Time Spent: **1 week**
Position Held	:	**Research assistant**
Duties	:	Responsible for the survey equipment, assisted in all surveying activities
Project Name	:	**Survey of H.Marvel EIA**
Client	:	**Adam Saleem**
Period	:	**May 2014** Time Spent: **1 day**
Position Held	:	**Research assistant**
Duties	:	Assisted in survey of the EIA report based on previous work
Project Name	:	**Study and EIA for proposed Coastal protecton of Paradise Island Resort, North Male' Atoll**
Client	:	**Diza Travels and Trade Pvt.Ltd**
Period	:	**April 2014** Time Spent: **4 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in the drafting/compiling of the EIA report based on previous work
Project Name	:	**Study and EIA for proposed Resort development project in Maareha, Gaaf Alif Atoll**
Client	:	**Moving International Pvt.Ltd**
Period	:	**April 2014** Time Spent: **4 weeks**

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Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 ؛ ގުޅުވުން
Fax: [960] 332 7555 ؛ ފެކްސް

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ގުޅުވުން ؛ [960] 300 7555
ފެކްސް ؛ [960] 332 7555
Email: info@fenaka.com.mv ؛ ޕޯ.ޑ.ބ
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Position Held	:	**Research assistant**
Duties	:	Assist in the drafting/compiling of the EIA report based on previous work
Project Name	:	**ESIA for five schools under Enhancing Education Development Project**
Client	:	**Ministry of Education**
Period	:	**February 2014** Time Spent: **4 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in compiling socio-economic profiles of islands and review of ESIA report
Project Name	:	**EIA for proposed harbour rehabilitation in Holudhoo, Noonu Atoll**
Client	:	**Maldives Transport and Contacting Company (MTCC)**
Period	:	**March 2014** Time Spent: **4 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in the drafting/compiling of the EIA report based on previous work
Project Name	:	**EIA for proposed harbour Construction in Dhangethi, Alif Dhaal Atoll**
Client	:	**Maldives Transport and Contacting Company (MTCC)**
Period	:	**March 2014** Time Spent: **2 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in drafting/compiling the EIA report
Project Name	:	**EIA for proposed Airport Development at Dh.Kudahuvadhoo**
Client	:	**Reollo Investments**
Period	:	**March 2014** Time Spent: **4 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in drafting/compiling the EIA report. Carried out monitoring surveys in the implementation phase.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ٹیلیفون
Fax: [960] 332 7555 : ފެކްސް

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ދާކަ 20307 ، ދިވެހިރާއްޖެ
ޕ.ވ.ދ : Email: info@fenaka.com.mv
ވެބްސައިޓް : Website: www.fenaka.com.mv

MOHAMED IBRAHIM JALEEL

Project Name	:	**Survey for L. Maamendhoo Sewerage project**
Client	:	**Fenaka**
Period	:	Time Spent: **1 weeks**
Position Held	:	**Research assistant**
Duties	:	Carried out the survey for the initial concept design of the project, which included taking the block level survey of as built and the levels (elevation) survey for the island.
Project Name	:	**OFID (Phase 1) Provision of Water Supply Facilities 04(Four) Island and Sewerage Facilities in 05 (Five) Island, Maldives**
Client	:	**OFID**
Period	:	Time Spent: **2 weeks**
Position Held	:	**Research assistant**
Duties	:	Team leader responsible for overseeing all the project activities and issues
Project Name	:	**EMP for the proposed project to update the STP in Dhiggiri Resort**
Client	:	**Aqua Solutions**
Period	:	Time Spent: **2 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in drafting/compiling the EIA report. Carried out monitoring surveys in the implementation phase.
Project Name	:	**Survey and EMP for the proposed project to update the STP in Mayaafushi Resort**
Client	:	**Aqua Solutions**
Period	:	Time Spent: **2 weeks**
Position Held	:	**Research assistant**
Duties	:	Assist in drafting/compiling the EIA report. Carried out monitoring surveys in the implementation phase.
Project Name	:	**Survey and EIA for the proposed Phase (2) of Niyaama Resort**
Client	:	**Niyaama Resort**
Period	:	Time Spent: **4 weeks**
Position Held	:	**Research assistant**
Duties	:	Was involved in the survey activities and carried out all the respective works of drafting/compiling the EIA report.
Project Name	:	**OFID Loan phase 2 – Water Supply and Sewerage Project (04 Island Sewerage, 10 Island Water Supply Facilities and 29 Island RO Installation and Storage Enhancement)**
Client	:	**OFID**
Period	:	Time Spent: **To April 2015**
Position Held	:	**Assistant Director**
Duties	:	Managing the project as team leader, preparation and review of bids and proposals, evaluation reports and drafting of contract documents.
Project Name	:	**IDB – Sanitation in Five Island Project**
Client	:	**IDB**
Period	:	Time Spent: **To May 2015**
Position Held	:	**Assistant Director**
Duties	:	Managing the project as team leader, preparation and review of bids and proposals, evaluation reports and drafting of contract documents.
Project Name	:	**Water supply project (UNOPS) in Lh. Hinnavaru with the inclusion of awareness component (CHEMONICS)**
Client	:	**USAID**
Period	:	Time Spent: **To May 2015**
Position Held	:	**Assistant Director**
Duties	:	Team leader responsible for overseeing all the project activities and issues
Project Name	:	**KUWAIT FUND water supply project in Gn.Fuvahmulah**
Client	:	**KUWAIT FUND**
Period	:	Time Spent: **To May 2015**
Position Held	:	**Assistant Director**
Duties	:	Managing the project as team leader, preparation and review of bids and proposals, evaluation reports and drafting of contract documents.
Project Name	:	**National water awareness campaign**
Client	:	**MEE**
Period	:	Time Spent: **To May 2015**
Position Held	:	**Assistant Director**
Duties	:	Team leader responsible for overseeing all the programme activities and resolve any setbacks.

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުވުން
Fax: [960] 332 7555 : ފެކްސް

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ބ.ގުދަތު : Email: info@fenaka.com.mv
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Project Name	:	**Establishment of water supply services in all the islands of Addu city**
Client	:	**MEE**
Period	:	Time Spent: **To present**
Position Held	:	**Assistant Director**
Duties	:	Responsible for overseeing all the project activities and issues

Project Name	:	**Design and Built of Sewer Systems in the islands of Th.Buruni, Th.Madifushi**
Client	:	**MEE**
Period	:	Time Spent: **To present**
Position Held	:	**Assistant Director**
Duties		Responsible for overseeing all the project activities and issues

Project Name	:	**Design and Built of Sewer Systems in the islands of L.Maamendhoo**
Client	:	**MEE**
Period	:	Time Spent: **To present**
Position Held	:	**Assistant Director**
Duties	:	Responsible for overseeing all the project activities and issues

Project Name	:	**Provision of Sewer service to – housing units in L.Fonadhoo**
Client	:	**MEE**
Period	:	Time Spent: **To present**
Position Held	:	**Assistant Director**
Duties		Responsible for overseeing all the project activities and issues

Project Name	:	**Provision of Sewer service in Addu city, Hithadhoo, central area**
Client	:	**MEE**
Period	:	Time Spent: **To present**
Position Held	:	**Assistant Director**
Duties		Responsible for overseeing all the project activities and issues

13. CERTIFICATION:

I, THE UNDERSIGNED, confirm that to the best of my knowledge, this CV correctly describes me, my qualifications and my experience

Mohamed Ibrahim Jaleel

Fenaka Corporation Limited
Ports Complex Building 7th Floor, Hilaalee Magu
Male' 20307, Republic of Maldives
Tel: [960] 300 7555 : ގުޅުވުން
Fax: [960] 332 7555 : ފެކްސް

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ފްލޯ 7 ވަނަ ފަންގިފިލާ، ހިލާލީ ދަގު
ފޯ. ކ. 20307 ، ދިވެހިރާއްޖެ
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