As there is a four storey building proposed to be built on site, dewatering will be required from this location (minor dewatering). Dewatering will lead to thinning of freshwater lens of islands, however, groundwater on Maniyafushi is already brackish with high salinity and conductivity. Groundwater extracted during dewatering will disposed at nearby areas on the island.

9.3.7 Risk on health and safety

Health and safety risks are associated with any construction project such as this. There is a robust health and safety guideline highlighted in the ESMP (attached in Appendix 7) formulated for this project. Given that the ESMP is followed, it is expected to minimize the risks of accidents and jeopardizing the health and safety of the workers.

9.4 Operational impacts

9.4.1 Impact on seawater quality

No research was found on the impacts of intensive sea cucumber or grouper farming on seawater quality. Aqua culture, in general, is expected to increase the particulate organic matter produced at the grow-out pen areas which will eventually increase the concentrations of chlorophyll a and daytime dissolved oxygen in the bottom layers. It is also expected that the ammonia and phosphate levels may increase in the farming area than in the control area (Huang, 2005). It is important to monitor potential changes to seawater quality at the area through implementation of a scheduled monitoring programme identified in Section 12 of the report.

Moreover, the hatchery discharge is an open system therefore the chances of contamination is minor. Algae and feed production will be a closed system but the water will be changed by up to 25% per day in order to minimise contamination of marine environment.

9.4.2 Impact on marine environment

Very little research has been done on the impacts of sea cucumber culture on the environment. Plotieau et. al. (2013) conducted a study on impacts of intensive sea cucumber farming on sediment. Results of this study shows that two years of intensive farming had an effect on the composition and grain size of the sediment, whereby fine fraction of the sediment and its carbonate proportion was reduced after two years of intensive farming. Furthermore, the study suggested that the number of bacteria and the concentration of microscopic organisms decreased significantly in the pens where intensive farming was carried out. Hence they

recommend a method whereby the pen areas are left unused for culture for a period of time between culture cycles.

In terms of marine habitat, the sites monitored in Maniyafushi were in general composed of low coral cover. Most dominant substrate at all sites was coral rock ranging from 68.71% to 52.51%. Site R1 at the southern side of the island had the highest live coral cover at 14 %. Control site had a live coral cover of 2.35 % whereas at site R3 where the sewer and hatchery discharge is located had the lowest live coral of 0.34 %. Site R3 also consisted of forms of macroalgae such as Halimeda. This could be attributed to the presence of effluent discharge at this location.

The location anticipated to have the highest significant impact is site R3 where the hatchery and sewer effluent is diposed off. However, it is not anticipated to cause any more significant impacts than already is from the already established discharge outfalls.

9.4.3 Impacts on landscape integrity and scenery

The island is already being used by the MRC as a mariculture island and most of facilities are already established on the island. Additionally, no vegetation will be removed under the proposed development. Therefore, it is not expected cause further impacts on landscape integrity and scenery of the island.

9.4.4 Socioeconomic impact

The proposed project is envisaged to have a high positive impact on the socioeconomic environment as it is targeted for the local communities with the interest of sea cucumber and grouper farming as a source of income. There is a huge demand for grouper and sea cucumber export industry and this project will open opportunities for a new means of income for interested parties. Moreover, this will also create job opportunities for many, particularly for those who are unskilled. Therefore, expected average value of impact is 1.

9.4.5 Risk of introduction of alien species

The only non-native species to be used in the project is the sandfish species to be harvested in the project. However, sandfish had already been introduced to the Maldives and can no longer be considered an alien species. Therefore, there is no risk of introduction of alien species associated with the proposed project.

9.4.6 Impact Analysis

An analysis of the impacts due to the project was done using the Leopold matrix. Impacts are assessed according to probability of impact, significance of impact, magnitude of impact and duration of impact. Tables 18 to 21 gives the assessment for the impacts, and these are further discussed above with their scoring.

As evident from Tables below, most impacts envisaged during the construction phase have a low impact on the environment, while impact envisaged during operational phase is envisaged to be moderate to high, based on literature review. Key impact is the changes to the ecosystem due to long term use of the hatchery system at the given areas. High impact is also envisaged on the economy nationwide.

Table 18. Assessment of Probability of impact from project activities

	Envisaged impact factors	Construction phase					Operational phase
		Trampling by workers	Construction of sea-pens	Solid waste disposal	Building(s) construction/ demolition	Dewatering	Grow-outs
Physical components	Seawater quality	V	V	M	M		V
	Land			M	I	I	
	Coastal zone	V	V		I		
	Erosion				V		
	Air				M		
	Noise				M		
	Groundwater quality					I	
Biological components	Ecosystem quality	I	I	M			I
	Diversity of flora		I		M		
	Diversity of fauna						
Socio-cultural components	Landscape				I		
	Land use				I		
	Economy						I
	Cultural heritage						
	Accidents	V	M	M	M		M

Table 19. Assessment of significance of impact from project activities

	Envisaged impact factors	Construction phase					Operational phase
		Trampling by workers	Construction of sea-pens	Solid waste disposal	Building(s) construction/ demolition	Dewatering	Grow-outs
Physical components	Seawater quality	P	P	P	P		P
	Land				I	P	
	Coastal zone	P	P		I		
	Erosion				I		
	Air				P		
	Noise				P		
	Groundwater quality					I	
Biological components	Ecosystem quality	P	P	P			P
	Diversity of flora		P		I		
	Diversity of fauna						
Socio-cultural components	Landscape				I		
	Land use				I		
	Economy						N
	Cultural heritage						
	Accidents						

Table 20. Assessment of duration of impact due to project activities

	Envisaged impact factors	Construction phase					Operational phase
		Trampling by workers	Construction of sea-pens	Solid waste disposal	Building(s) construction/ demolition	Dewatering	Grow-outs
Physical components	Seawater quality	P	P	P	P		D
	Land				L	L	
	Coastal zone	P	D		L		
	Erosion				L		
	Air				P		
	Noise				P		
	Groundwater quality					L	
Biological components	Ecosystem quality	P	D	P			D
	Diversity of flora		D		L		
	Diversity of fauna						
Socio-cultural components	Landscape				L		
	Land use				L		
	Economy						D
	Cultural heritage						
	Accidents						

Table 21. Assessment of magnitude of impact due to project activities

	Envisaged impact factors	Construction phase					Operational phase	Sum	Average
		Trampling by workers	Construction of sea-pens	Solid waste disposal	Building(s) construction/ demolition	Dewatering	Grow-outs		
Physical components	Seawater quality	1	1	1	1	0	2	6	1.00
	Land	0	0	0	2	2	0	4	0.67
	Coastal zone	1	0	0	3	0	0	4	0.67
	Erosion	0	0	0	3	0	0	3	0.50
	Air	0	0	0	1	0	0	1	0.17
	Noise	0	0	0	1	0	0	1	0.17
	Groundwater quality	0	0	0	0	3	0	3	0.50
Biological components	Ecosystem quality	2	1	1	0	0	3	7	1.17
	Diversity of flora	0	1	0	1	0	0	2	0.33
	Diversity of fauna	0	0	0	0	0	0	0	0.00
Socio-cultural components	Landscape	0	0	0	2	0	0	2	0.33
	Land use	0	0	0	2	0	0	2	0.33
	Economy	0	0	0	0	0	4	4	0.67
	Cultural heritage	0	0	0	0	0	0	0	0.00
	Accidents	0	0	0	2	0	0	2	0.33
Cumulative values of IF according to environmental factors		4	3	2	18	5	9	41	6.83
Average		0.27	0.20	0.13	1.20	0.33	0.60		

10 Alternatives

The proposed project involves the construction and establishment of a research and demonstration facility of sea-cucumber and grouper hatchery at Maniyafushi of Kaafu Atoll. The location of the project has been identified by the proponent. Since the island already has an acceptable facility on this island, the location is ideal for this project as this will as extension of the current facility and the proponent will be able to well-establish the current resources under the available budget. To change the project location means having to construct all the resources which is neither environmentally, nor economically feasible.

Nevertheless, specific locations for construction of grow-out pens in the island lagoon is a considerable option.

10.1 Considered alternatives

10.1.1 Location of seapen construction

Proposed locations: two pens on the southeastern lagoon and two more on the southeast side outside the reef flat

Alternate locations: Anywhere on the northwestern side of the lagoon

Selected type: The jetty to access the island is located at the southeastern side of the lagoon which will make it easier for the transfer boats to move the pens back and forth

10.1.2 The no-project scenario

The no-project scenario is also an available option. If this option is selected, the environmental impacts due to the project will be avoided. Impacts during construction phase are minor, although impacts due to operation of the proposed facility are envisaged to be moderate (based on literature). The economic impact due to the project is also envisaged to be high, as the project has a high success rate and all income earned will go to the individual community groups trained during each project. Due to this, and given that environmental impacts due to farming although envisaged to be moderate are not too clear, the continuation of the project is considered feasible. However, it is crucial that the monitoring programme given in the report is followed to identify impacts to the environment and to initiate mitigation measures necessary to decrease these impacts.

11 Mitigation Plan

Mitigation measures that are explored below (Table 22) emerged out of the discussions and consultations during work on this report with the project proponent and based on literature. Mitigation measures are proposed to reduce or eliminate the severity of any predicted adverse environmental effects and improve the overall social and environmental performance of the project.

Mitigation measures are discussed both for the construction and operation stage of the project. During the construction stage it is important to take measures to minimize impact on environment due to methods used.

Commitment from the proponent for carrying out the proposed mitigation and monitoring plan is given in the declaration of the proponent.

Table 22. Identified possible impacts and their relevant mitigation measures

Possible Impacts	Mitigation measures	Location	Time frame (Phase)	Impact intensity	Institutional responsibility	Cost (MRF)
Noise and air pollution	• Avoid unnecessary operation of machinery and equipment • Limit use of heavy machinery to project site only	Project development plot	During construction	Minor, short term impact	Project proponent/ contractor	N/A
Oil spills from power house	• Follow fuel handling regulation of MNDF. • Have emergency clean-up gear on standby	Powerhouse area	During construction and operation	Moderate, long term	Project proponent/ contractor	N/A
Risk of accidents and health and safety of workers	• Strictly follow the ESMP in Appendix 7 of this report • Have emergency vessels on standby to transfer injured staff to Male' in case of accidents	Project development plot	During construction	Minor, short term impact	Project proponent/ contractor	N/A
Contamination of seawater	• Follow regular water change routines of closed hatchery system • Extend sewer outfall beyond the reef system	Sea outfall	During construction and operation	Moderate, long term	Project proponent/ contractor	N/A
Physical damage to reef habitat	• Avoid trampling on areas outside of project boundary	Project development plot	During construction	Minor, short term impact	Project proponent/ contractor	N/A
Sedimentation / siltation on the reef and lagoon	• Avoid trampling on areas outside of project boundary	Project development plot	During construction	Minor, short term impact	Project proponent/ contractor	N/A
Impact on sediment and seawater quality due to intensive farming	• Carry out monitoring programme as scheduled and review results • Implement mitigation measures identified then based on results of monitoring programme	Project development plot	During operation	Moderate, long term	Project proponent/ contractor	N/A

12 Monitoring Program

Monitoring is the systematic collection of information over a long period of time. It involves the measuring and recording of environmental variables associated with the development impacts. Monitoring is needed to;

- Compare predicted and actual impacts
- Test the efficiency of mitigation measures
- Obtain information about responses of receptors to impacts
- Enforce conditions and standards associated with approvals
- Prevent environmental problems resulting from inaccurate predictions
- Minimize errors in future assessments and impact predictions
- Make future assessments more efficient
- Provide ongoing management information
- Improve EIA and monitoring process

Impact and mitigation monitoring is carried out to compare predicted and actual impacts occurring from project activities to determine the efficiency of the mitigation measures. This type of monitoring is targeted at assessing human impacts on the natural environment. Impact monitoring is supported by an expectation that at some level anthropogenic impacts become unacceptable and action will be taken to either prevent further impacts or re-mediate affected systems. Mitigation monitoring aims to compare predicted and actual (residual) impacts so that effectiveness of mitigation measures can be determined.

Monitoring works have been identified for the operational phase of the project, due to the small scope of the construction phase. Monitoring works during the operational phase will be carried out according to the monitoring programme in Table 23. Cost for the monitoring (data collection) activities will be covered by the proponent (commitment to carrying out and financing the mitigation and monitoring work is given in the Proponents Declaration on Page vi).

Table 23. Monitoring programme for construction phase of the project

Monitoring parameter	Frequency or timing	Cost
Shoreline mapping using precision GPS (high tide line and Low tide line)	Every six months (this would give a clear picture of shoreline changes over long term and seasonal shifts) for two years	MRF 10,000 per survey
Seawater quality tested for • Nitrates • pH	Every six months for the duration of the project	MRF 10,000.00

• Dissolved Oxygen • Nitrogen Ammonia • Salinity • Temperature • Total Dissolved Solids • Turbidity		

The EIA monitoring report structure provided in the EIA report bylaw 2012 (2012/R-27) shall be used for the monitoring report preparation. Monitoring reports will be submitted at the intervals as specified in Table 23 for monitoring work during operational phase of the project.

13 Conclusion and recommendation

The environmental impacts associated with proposed project are considered minor to moderate. This conclusion is based on the evaluation of various components of the proposed project. The proposed project site for grow-out pens is located at the sout eastern side of the island where smaller pens are already established. The island has very few vegetation which will be retained during construction of buildings on the island.

The project consists of construction of 2 four storey buildings, therefore, dewatering would be required for foundation works. However, groundwater characteristic analysis of Maniyafushi shows that the groundwater lens is highly saline on this island.

As the size of the island is considerably small, one of the buildings is close to high tide line of the island. Therefore, it is highly recommended to put in coastal protection structures on this side of the island to prevent erosion and damage to the building. The proponent states that under the currently available budget, such structures cannot be accommodated, however, the consultant recommends arrangement of funding for shore protection measures as soon as possible.

The impacts of proposed activities on sea water quality once the project becomes operational has to be closely monitored as outlined in Table 23 of this report.

While the no project scenario has been considered, the option was concluded to be not feasible as it will take away the opportunity for the island communities to venture into a highly economically rewarding field.

Therefore, with due consideration to the environmental components identified above and the extent of the project activities and their likely and predicted impacts identified, the consultant concludes that the project components and designs are feasible and appropriate mitigation measures have been considered to correct and minimize unfavorable environmental changes.

Acknowledgements

The consultant acknowledges the contribution provided by the team members in this report for the valuable contribution to the report and at the field. The consultant also acknowledges the assistance provided by MRC.

CVs of team members are given below.

Mariyam Shujaa-ath Abdul Fathah
Musaafaa, Lh. Naifaru
Mobile: 9696169
Email: mariyam.shujaath@gmail.com

EDUCATION

2015
Bachelor of applied science (Honours) - University of Canberra, Australia.

- Title: Metal contamination and mercury speciation in fish of the Maldives.
- First class honours.
- Course GPA: 7.0 out of 7.0.

2012-2014
Bachelor of Environmental science - University of Canberra, Australia.

- Majored in Environmental Chemistry and Analytical Chemistry.
- Course GPA: 5.833 out of 7.0.

2008-2010
College – Edexcel General Certificate of Education.

2005-2007
University of Cambridge general certificate of Education (GCE).

1998-2004:
Primary Education-Madhrasathul Ifthithaah (Maldives).

IELTS overall band score: 8.0 out of 9.0

OTHER TRAININGS

Participated in training course on Managed Aquifer Recharge (MAR) under the Enhance Climate Resiliency and Water Security in the Maldives (Maldives GCC) Project funded by USAID

Course work on Project Management, Cyrix College, Maldives

LANGUAGES AND DEGREE OF PROFICIENCY

Divehi- mother tongue
English- fluent

COUNTRIES OF WORK EXPERIENCE

Maldives
Australia

EMPLOYMENT RECORD

2016 to present- Assistant Director, Utilities Services Division, FENAKA Corporation Ltd., Male', Maldives.

- Water quality monitoring for water and sewer branches registered under FENAKA.
- Providing Environmental consultancy for the Company.
- Compiling Environment Impact Assessment reports for projects carried out by the company.
- Overseeing 29 desalination plants and 32 sewerage systems registered under FENAKA Corporation
- Overseeing water and sewerage related projects operated under the company.
- Project management of sewerage related projects of the company.
- Conduct environmental research, environmental surveys and environmental monitoring for the company.
    - Referee
        - Hussein Hameez
            - Director
            - Utilities Services Division, FENAKA Corporation Ltd.
            - Email: hussein.hameez@fenaka.com.mv
            - Telephone: 7774602

March 2016 to June 2016- Land and Marine Environmental Resource Group Pvt. Ltd., Male', Maldives.

- Providing environmental consultation to developing and developed resort hotels.
- Compilation of Environment Impact Assessment reports for Government and private development projects
- Assisting in environmental research, environmental surveys and environmental monitoring
- Field survey to collect data for EIA.
    - Referee
        - Mohamed Aslam
            - Director
            - Land and Marine Environmental Resource Group Pvt. Ltd.
            - Email: mohamed.aslam@lamer.com.mv
            - Telephone: 7782866

2015- Research student-Eco chemistry laboratory, University of Canberra Australia.

- Completed honours project on metals and mercury speciation in fish of the Maldives.

- Experienced analytical methods in sampling metals of the fish.
- Mercury speciation analysis techniques.
- Data analysis and statistical methods.
- Web based research work and literature reviews about metals in fish of the Maldives.
- Did research on health related issues on eating fish of the Maldives and able to give consumption advisories about which fish and how much to consume.
- Currently preparing research papers on metals in fish of the Maldives
    - Referees
        - Professor Bill Maher (primary supervisor)
            - Professor in Applied Science
            - University of Canberra, Australia
            - Email: Bill.Maher@canberra.edu.au
            - Telephone: (02) 6201 2531
        - Dr. Simon Foster (secondary supervisor)
            - Assistant professor in Environmental Sciences
            - University of Canberra, Australia
            - Email: Simon.Foster@canberra.edu.au
            - Telephone: (02) 6201 2540

2014- Volunteer research student - Fresh water laboratory-University of Canberra, Australia.

- Field work to Corin, Bendora, cotter and Googong Rivers.
- Experienced fresh water biological assessment methods and water sampling.
- Sorting macroinvertibrates.
- Processing macroinvertibrates and algae in the laboratory.
- Writing scientific reports.Writing scientific reports.
- Writing scientific reports.
    - Referee
        - Dr. Evan Harrison
            - Technical officer and project manager
            - Institute for Applied Ecology, University of Canberra, Australia
            - Email: Evan.Harrison@canberra.edu.au
            - Telephone: (02) 6201 2400

August 2010 to December 2011- Assisstant cashier, Bank of Maldives

- Handling cash
- Interacting with consumers face-to-face.
- Providing information to customers face-to-face.
    - Referee
        - Mrs. Dheena Mohamed
            - Assistant manager
            - Bank of Maldives, Lh, Naifaru

- Telephone: 6620319

2015 (Casual) Barista/ waitress- Donut King, Mustang Avenue, Majura Park, ACT 2609, Australia.

- Serving customers
- Taking orders and handling cash
- Often took up the manager's position at the absence of the manager
    - Referee
        - Mark
            - Area manager
            - Telephone: +61 407 616 784

DETAILED TASKS

Work undertaken that best illustrates capability to handle the tasks assigned:-

Report preparation for biological response to flows downstream of Corin, Bendora, Cotter and Googong Dams.
Location: ACT, Australia
Year :2014
Client: ACTEW Water, Australia
Position Held: Researcher/surveyor (intern)
Duties Rendered: Assisted in field work to rivers and in processing macroinvertebrates and algae in the laboratory. Data analysis and writing scientific reports.

Environment Impact Assessment report for resort development works at GDh. Havoddaa, Maldives
Location: GDh. Havoddaa
Year : 2016
Client: Crystal Plaza Resorts Pvt. Ltd.
Position Held: Environment Officer
Duties Rendered: Assessment of beach environment of the project site and assisted in compilation of the EIA report.
Environment Impact Assessment report for harbour extension works at GDh. Fares-Maadhoda, Maldives
Location: GDh. Fares-Maathoda
Year : 2016
Client: Ministry of Housing and Infrastructure
Position Held: Environment Officer
Duties Rendered: Assessment of beach environment of the project site and assisted in compilation of the EIA report.

Environment Impact Assessment report for backfilling of lake and boundary wall reconstruction at K. Funadhoo, Maldives
Location: K. Funadhoo
Year : 2016
Client: State Trading Organization Plc. (STO)
Position Held: Environment Officer
Duties Rendered: The study involved groundwater analysis at the backfill area and identification of potential environmental impact areas related to the proposed project boundary area. As such, a mitigation plan was proposed to decrease the identified impacts.

Environment Impact Assessment report for retrofitting of berthing facility and fuel storage capacity at K. Funadhoo, Maldives
Location: K. Funadhoo
Year : 2016
Client: State Trading Organization Plc. (STO)
Position Held: Environment Officer
Duties Rendered: The study involved identification of potential environmental impacts expected to arise from the project and proposing the most cost effective and environmentally less destructive methodologies of implementing the project.

Environment Impact Assessment report for development of sewerage system at Lh. Naifaru, Maldives
Location: Lh. Naifaru
Year : 2016
Client: Ministry of Environment and Energy
Position Held: Environment Officer
Duties Rendered: Preparation of the EIA report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental impacts.

Environment Impact Assessment report for reclamation of Enboodhoo Lagoon to artificially create new islands for resort development, Maldives
Location: Enboodhoo Lagoon
Year : 2016
Client: Dream Islands Development Pvt. Ltd.
Position Held: Environment Officer
Duties Rendered: The study involved thorough surveying of the Lagoon to identify potential reclamation and burrow areas for the creation of new islands using the bathymetric data as well as proposing the most suitable dredging methodologies based on the depths of burrow areas. Identifying methodologies with the least adverse impacts on the environment in addition to being the most cost effective were major components of the this study.

Environment consultancy for reclamation of Enboodhoo Lagoon to artificially create new islands for resort development, Maldives

Location: Enboodhoo Lagoon
Year : 2016
Client: Dream Islands Development Pvt. Ltd.
Position Held: Environment Officer
Duties Rendered: Part of the project management team to advice the client on island designs and coastal protection based on existing oceanographic conditions, island modeling and bathymetry as well as to ensure ways of least environmental impacts and that the design conforms to EPA guidelines.

Environment Impact Assessment report for relocation of powerhouses at Th. Omadhoo, Sh. Lhaimagu, Dh. Hulhudheli, R. Rasmaadhoo, HA. Maarandhoo, HA. Uligamu and Sh. Bileffahi, Maldives
Location: *Th. Omadhoo, Sh. Lhaimagu, Dh. Hulhudheli, R. Rasmaadhoo, HA. Maarandhoo, HA. Uligamu and Sh. Bileffahi*
Year : 2016
Client: FENAKA Corporation Ltd.
Position Held: Deputy Manager (EIA Consultant)
Duties Rendered: Preparation of the EIA report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental impacts.

Environmental Impact Assessment Report for water production and distribution facility at HA. Hoarafushi, HDh. Hanimaadhoo and GA. Villingili
Location: HA. Hoarafushi, HDh. Hanimaadhoo and GA. Villingili
Year: 2016
Client: Ministry of Environment and Energy
Position held: EIA consultant
Duties rendered: Preparation of the EIA report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental impacts.

Project management for design and built basis for sewerage collection network, sewage pumping stations and sea outfall pumping station and allied work in the island of L. Maamendhoo
Location: L. Maamendhoo
Year: 2016-2017
Client: Ministry of Environment and Energy
Position held: Project Manager
Duties rendered: Monitoring project progress and responsible for overseeing project activities and solve issues. Arrange inspection trips to review project activities.

Project management for provision of sewerage facilities in Hithadhoo (central area), Addu city
Location: S. Hithadhoo
Year: 2016 (ongoing)

Client: Ministry of Environment and Energy
Position held: Project Manager
Duties rendered: Monitoring project progress and responsible for overseeing project activities and solve issues. Arrange inspection trips to review project activities. Arrange resources for the project and resolve issues.

Project management for consultancy services for survey, design of sewerage facilities in F. Biledhoo, GDh. Madaveli, R. Innamaadhoo and Sh. Feevah, Maldives
Location: F. Biledhoo, GDh. Madaveli, R. Innamaadhoo and Sh. Feevah
Year: 2017 (ongoing)
Client: Ministry of Environment and Energy
Position held: Project Manager
Duties rendered: Monitoring project progress and responsible for overseeing project activities and solve issues. Assign tasks to the technical and team and arrange resources. Communicate with the client and report work progress.

CURRICULUM VITAE

Name:	**Fathimath Farah Amjad (Ms)**
Address:	G. Male' Hiya 2 (11-04), Ameenee Magu, Male' 20082, Rep. of Maldives
Telephone:	+ (960) 768-8861
E-mail:	fara.a@outlook.com
Nationality:	Maldivian
Date of Birth:	April 30th, 1990

ACADEMIC QUALIFICATION

Maldives National University, Male', Maldives	**Bachelor of Environmental Management** (June, 2015 - Present)
Maps College, Male', Maldives	**The Association of Business Executives, UK- Diploma in Marketing Management Level 4** (January 2013 – June 2013)
UCSI University, Kuala Lumpur, Malaysia	**Foundation in Built Environment** (January 2010 – April 2011)
Male' Centre of Technology, Male', Maldives	**Advanced Certificate in Residential Drafting** (January 2007 – August 2007) **Certificate in Autocad 3D** (July 2007 – August 2007)
Aminiya School, Male; Maldives	**Cambridge GCE & GCSE O' Levels** (2003 – 2005)

EMPLOYMENT

Maldives Energy and Environmental Company, Malé, Maldives

Research Assistant (October, 2015 – Present)

Duties:

- Conducting marine, terrestrial and socio-economic surveys for EIA reports, with the assistance of the EIA consultant.
- Design of layouts, maps and other data for reports.
- Input and sectional writings for EIA reports.
- Communication with government authorities, island and atoll councils and other relevant parties regarding ongoing projects at the company.

Renewable Energy Maldives, Male', Maldives

Project/Monitoring Assistant, Draftsperson (March, 2014 – September, 2015)

Duties:

- Regular monitoring and data management of all installed PV solar systems.
- Designing and drafting of technical and electrical layouts. I. e. Roof layouts, Waste-to-energy incinerator design, etc.
- Regular communication with suppliers regarding equipment for PV installations and various DC products.
- Communication with customers, government authorities and

other relevant establishments on various matters regarding PV systems, equipment clearance and site installations.
- Drafting proposals and bid documents.
- Designing promotional materials such as brochures and banners.
- Assisting the engineer in the preparation of energy audit reports, data collection, analysis and site surveying.

[Independent Projects]

Freelancing (2012 – 2012)
- Designing and digital drafting of residential and small scale commercial structures.

Arcade Pvt Ltd,
Male', Maldives

Draftsperson (January, 2009 – May, 2009)
Duties:
- Designing exterior and interior layouts of buildings.
- Drafting of architectural, structural, plumbing and electrical drawing sets for a number of residential and commercial buildings under guidelines from the civil engineer.
- Preparation of digital 3d models on request.

Hulhumale' Development Corperation,
Malé, Maldives

Customer Services and Data Collection (3 month contract; August, 2008 – November 2008)
Duties:
- Collecting and processing data.
- Communication with customers.

Gedor Consultancy,
Malé, Maldives

Draftsperson (January, 2008 – July, 2008)
Duties:
- Drafting architectural and structural drawings with the guidance of the head architect and engineer.
- Worked in the designing and drafting phase of a number of resort projects, residential, commercial and government buildings.

Design House Pvt Ltd,
Malé, Maldives

Draftsperson Trainee (June, 2007 – September, 2007)
Duties:
- Draftsperson training while undergoing the residential drafting course at Male' Centre of Technology.

COMMUNICATION

Languages: English, Dhivehi.

- Good oral and written communication skills.
- Good in scientific and formal report writing.

OTHER QUALIFICATIONS AND SKILLS

Scuba Diving

- Emergency First-Aid Responder (Pending)
- PADI Advanced Open Water Diver, 2014
- PADI Open Water Diver, 2014
  (80+ logged dives)

AFFILIATIONS AND TRAININGS

Memberships

- **Assessor** at **Green Fins**, an initiative by UNEP, internationally coordinated by Reef-World Foundation, UK which aims to protect and conserve coral reefs by establishing and implementing a comprehensive management approach to promote a sustainable diving and snorkelling tourism industry.
- **Certified Eco-Diver** at **Reef Check Foundation,** an international non-governmental organization dedicated to the conservation of reefs by collecting data from volunteer/citizen scuba diver teams in over 90 countries.

Voluntary work

- Citizen-Scientist at **IUCN Maldives - Project Regenerate**, aimed at regenerating and sustainably managing the coral reef eco systems of Maldives.
- Marine cleaner at **NGO Save the Beach** and **'Project Damage Control'**, working at coastal and marine clean up events at Villimale' and Male' area, conducting community awareness programs, litter audits and reef monitoring programs.

Workshops & Trainings

- **'Turtle Watch Maldives'** protocol trainings conducted by **Marine Research Centre Maldives**; for survey conduction and data submission guidelines.
- **Maldives Coral Bleaching Protocol** trainings conducted by **Marine Research Centre Maldives** and **IUCN-Maldives**, recording base line data and the extent of bleaching damage.

Participations & Events

- **'Kill the COTS'**; an event organised by **Divers Association of the Maldives** and several dive schools in the central region to tackle the nation-wide outbreak of Crown of Thorns starfishes.

REPORTS

- Saleem, A., **Amjad, F.**, Hammadh, A. and Naeem, S. (2015). Environmental Monitoring Report: L. Mahakanfushi & Baresdhoo Integrated Resort Project Phase: Mahakanfushi Harbour, Entrance Channel and Causeway Works. Monitoring Report No.1.

REFEREES

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Appendices

Appendix 1 List of abbreviations

CBD – Convention on Biological Diversity
EIA – Environmental Impact Assessment
ESMP - Environmental and Social Management Plan
EPA – Environmental Protection Agency
HPA- Health Protection Agency
MEE – Ministry of Environment and Energy
MRC- Marine Research Center
MoFA – Ministry of Fisheries and Agriculture
NBSAP - National Biodiversity Strategy and Action Plan
NEAP III – Third National Environment Action Plan
ToR – Terms of Reference
UNDP – United Nations Development Programme
UNEP – United Nations Environment Programme

Appendix 2 Terms of Reference (ToR)

بسم الله الرحمن الرحيم

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Environmental Protection Agency

EPA

NO: 203-EIARES/30/2017/28

Terms of Reference for the Environmental Impact Assessment for the Construction and Operation of Maniyafushi Field Station at Maniyafushi, Kaafu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on *14/12/2017* for undertaking the EIA of the Construction and Operation of Maniyafushi Field Station at Maniyafushi, Kaafu Atoll. **The proponent of the Project is Ministry of Fisheries and Agriculture.**

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

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

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

3. **Scope of work** – The report should be categorized into the following components.

   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 of the project development components shall cover but not limited to:

   1. Construction of various infrastructure components, to include all land based and shore based facilities, structures such as service related infrastructure (e.g. power generation, water supply, waste disposal),
   2. Duration of construction related activities,
   3. Estimated number, types and sources of materials
   4. Labor requirements and (local) labor availability;
   5. Housing of construction workforce,
   6. Operational aspects of the facility,
   7. Description of safety measures during the construction and operation.

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Website: www.epa.gov.mv

އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ
ގްރީން ބިލްޑިންގ، 3ވަނަ ފަންގިފިލާ، ހަނދުވަރީހިނގުން
މާލެ، ދިވެހިރާއްޖެ، 20392
ފޯނު :
ފެކްސް :
އީމެއިލް :
ވެބްސައިޓް :

Task 2. Description of the existing environment – Assemble, evaluate and present the environmental baseline studies/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.

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.

The baseline data will be collected before construction. 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. Information should be divided into the categories shown below:

Climate/hydrology/hydrodynamics

- Wind, waves patterns associated with project location in the context of available secondary data.
- Tidal information relevant to site, including tidal ranges and currents;
- Wave climate and wave induced current based on available climatic data;
- Wind induced (seasonal) currents;

Geology and geomorphology

- Description of land/island characteristics of the proposed development site (use maps); this should include shoreline maps showing vegetation line, low tide line, high tideline, areas of coastal erosion and accretion and reef line,
- Characteristics of infrastructure as access to the facility (e.g. harbor and access channel)

Ecology

- Description of existing landscape setting and changes to the existing setting because of the proposed development,
- Description of marine environment in terms of reef benthic community, fish community
- Seawater quality measuring these parameters: temperature, pH, salinity, turbidity (SS), phosphate, nitrate, ammonia from points of all types of waste water discharge from the facility
- Groundwater characteristics of the island.

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Include permits and approvals from the relevant institutions (where applicable).

Task 4. Potential impacts of the proposed project– The EIA report should identify all the impacts (direct, indirect and cumulative) and evaluate the magnitude and significance, this shall include:

1. Impacts on surrounding habitats where the effluents from the facility are disposed
2. Impacts on landscape integrity/scenery.
3. Impacts on employment and income, potential for local people to have (temporary or long term) job opportunities;
4. Pollution of the natural environment (e.g. oil spills, discharge of waste during the construction and operation of the facility

5. Health and safety risks associated with the proposed works.
6. Impact associated with the introduction of aliens species (if any).

The methods used to identify the significance of the impacts shall be outlined. 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.

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 alternatives for environmental, social and economic considerations. The report should highlight how the location for the outfall was determined. All alternatives must be compared according to commonly accepted standards as much as possible.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. Mitigation measures must also be identified for both construction and operation phase. Cost of the mitigation measures, equipment and resources required to implement those measures should be specified. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included.

Task 7. Environmental monitoring plan - Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present environmental impact management and monitoring plan for coastal modification and sediment movement around the island. 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 – EIA report should include a list of people consulted and what were the major outcomes. Identify appropriate mechanisms to supply stakeholders and the public with information about the development proposal and its progress. Major stakeholder consultation shall include Environmental Protection Agency, Kaafu Atoll Council, Maldives Food and Drugs Authority and Health Protection Agency and other relevant Authorities/Parties/NGO.

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 f or any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the EIA Regulations, 2012 and relevant amendments.

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

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 06 months from the date of this Term of Reference.

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14.12.2017

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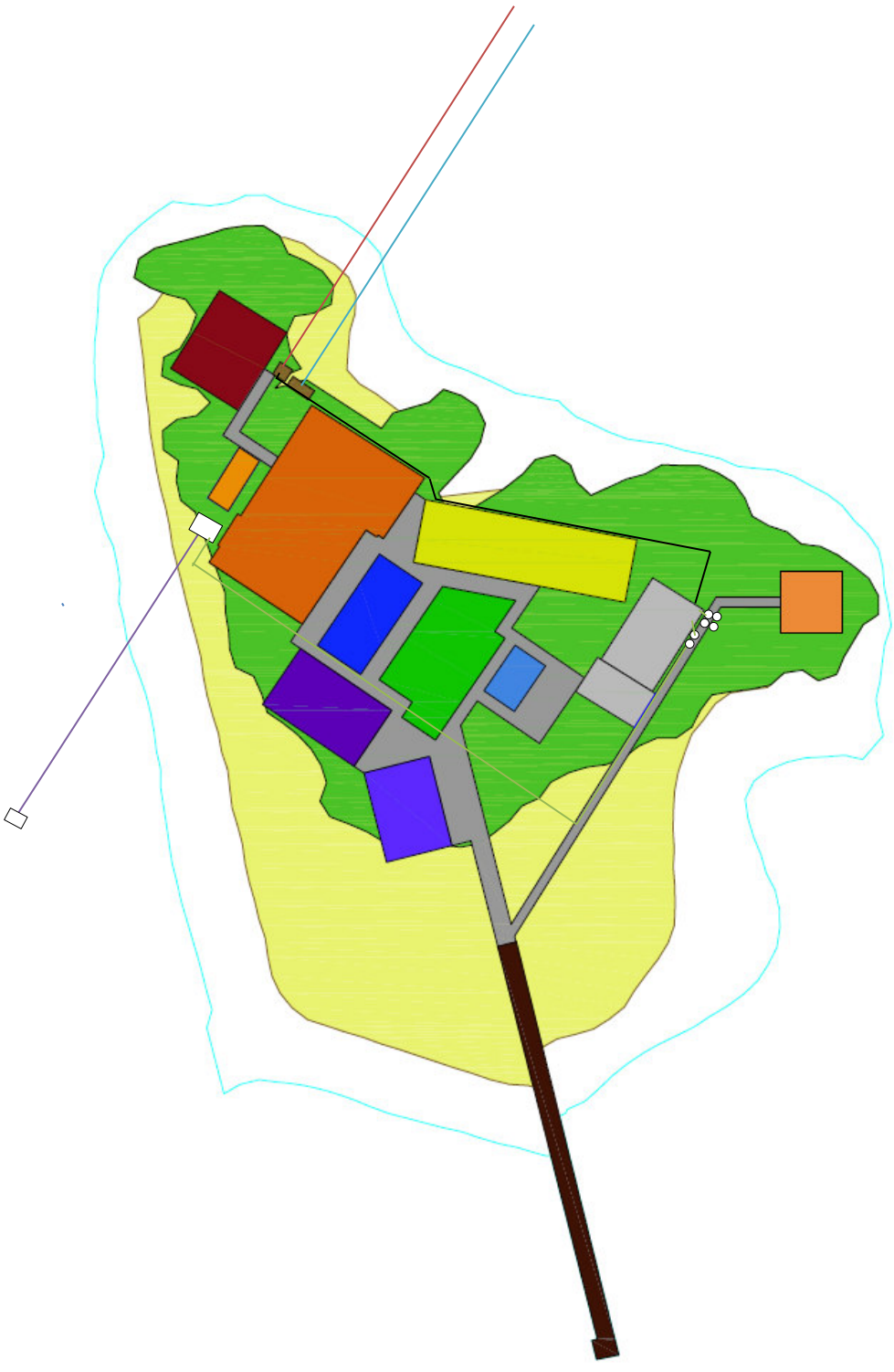
Appendix 3 Land Use Plan of Maniyafushi


LEGEND :
Open / Green Space
Accomodation Block
Warehouse
Powerhouse
Waste yard
Brood Stock Facility
Mosque
Vegetation (Existing)
Jetty
Laboratory
Green House
Toilets
Sewerage Junction Box
Hatchery (Existing)
Road / Paved area
Beach
High tide line
Low tide line
Seawater intake pipeline
Waste seawater discharge pipeline
RO intake pipeline
RO discharge pipeline
Sewage discharge pipeline

Appendix 4 Powerhouse building and distribution map

K.MANIYAFUSHI POWER SYSTEM UPGRADING PROJECT

BASIC DESIGN STUDY REPORT

May 2017

STATE ELECTRIC COMAPANY LIMITED
MALE'
MALDIVES

TABLE OF CONTENTS

1 INTRODUCTION 3
2 BASIC CONCEPT OF THE PROJECT 4
3 OUTLINE OF THE BASIC PLAN 4
3.1 Load Forecast 4
3.2 Generator Set Sizing and main Control Panel Board 4
3.3 Voltage Drop 5
3.4 Power House Building 5
3.5 Fuel tank 5
3.6 Fire System 5
4 PROJECT EFFECTS 6

ANNEX 1: Site Plan
ANNEX 2: Build up area and unit load
ANNEX 3: Distribution Map
ANNEX 4: Schematic Diagram
ANNEX 5: Feeder Voltage drop calculations
ANNEX 6: DB load calculations
ANNEX 7: Control Panel details
ANNEX 8: Fuel tank and fuel lines.
ANNEX 9: Lightning protection
ANNEX 10: Powerhouse Layout

1 INTRODUCTION

K.Maniyafushi Island located 17 kilometers SW from the Capital City Male' with just over one hectare of land area is used by the Ministry of Fisheries and Agriculture as a mariculture island.
The island already consists of the necessary infra-structure which allows it to function as its core establishment.
However the existing electric power system is insufficient for its full operation and also for the planned upgrading works.
This document includes the power consumption for the future buildings and its equipment's which are anticipated to come in a near future by the Ministry.

2 BASIC CONCEPT OF THE PROJECT

Based on the data provided by the ministry and through analysis of the data, the basic concept of the proposal is to construct a new power plant along with a suitable and reliable distribution system that can cater for the existing and future demands at an optimum cost. The concept also emphasizes on providing reliable and cost effective power to the island. With this concept in mind, the capital investment is brought to a minimum.

3 OUTLINE OF THE BASIC PLAN

3.1 Load Forecast

The load forecasts for staff accommodation and hatchery and other such infrastructure areas are developed for 10 years but for street light and lighting for public spaces are considered constant. Refer Annex 2 for detailed calculations.

3.2 Generator Set Sizing and main Control Panel Board

For continuous operation of power system minimum four generator sets shall be installed. The power house and control panel shall be large enough to accommodate the diesel generator sets sizes for the 10 year period. The panel board is a synchronizing panel board with automatic load sharing for two generator sets.

3.3 Voltage Drop

Main distribution cables are selected to limit the voltage drop to maximum 5% for the 10 year period and up to 2% for the consumer cables. Existing consumer and road light cables shall be used where possible and make joints where necessary to connect new/ existing distribution boxes. Refer Annex 5 for detail calculations.

3.4 Power House Building

Existing power house insufficient for the installation of additional generators and control panel thus a new powerhouse building is designed and constructed. The new powerhouse will be equipped with sound attenuators and rockwool insulated roofs to minimize noise. Refer Annex 10 for basic design of a new power house.

3.5 Fuel tank

A fuel storage tank with a capacity of 3,600 liters shall be constructed within the powerhouse premises. Refer Annex 8.

3.6 Fire System

Fire extinguishers shall be installed at suitable locations of the powerhouse and in the premises. A fire alarm system with smoke and heat detectors shall be installed within the powerhouse.

4 PROJECT EFFECTS

With the commissioning of the upgraded power system, reliable and cost effective power will be delivered to the consumers throughout the day. Generating capacity of the power station would be further upgraded only on demand. With this strategy, the consumers on the island will benefit from low cost and reliable power for their consumption.

This project, if implemented as planned, will consolidate the infrastructure of the island and is an important means for developing K.Maniyafushi further. Stable, reliable and cost-effective electricity to this island will improve the life span of the general electrical appliance and as well as the most expensive machineries used in the island. .

ANNEX 1:

Site Plan

Key

A Accommodation/office block
- a Reception
- b Office
- c Mess room
- d Kitchen
- e Classroom

B Mosque (Existing)

C Store

D Microalgae mass culture

E Microalgae stock culture

F Zooplankton culture/Enrichment

G Wetlab/aquariums/Ground floor On-farm feed preparation station

H Larvae nursing/incubation Packing station

I Quarantine room

J Pump station

K Broodstock maintenance

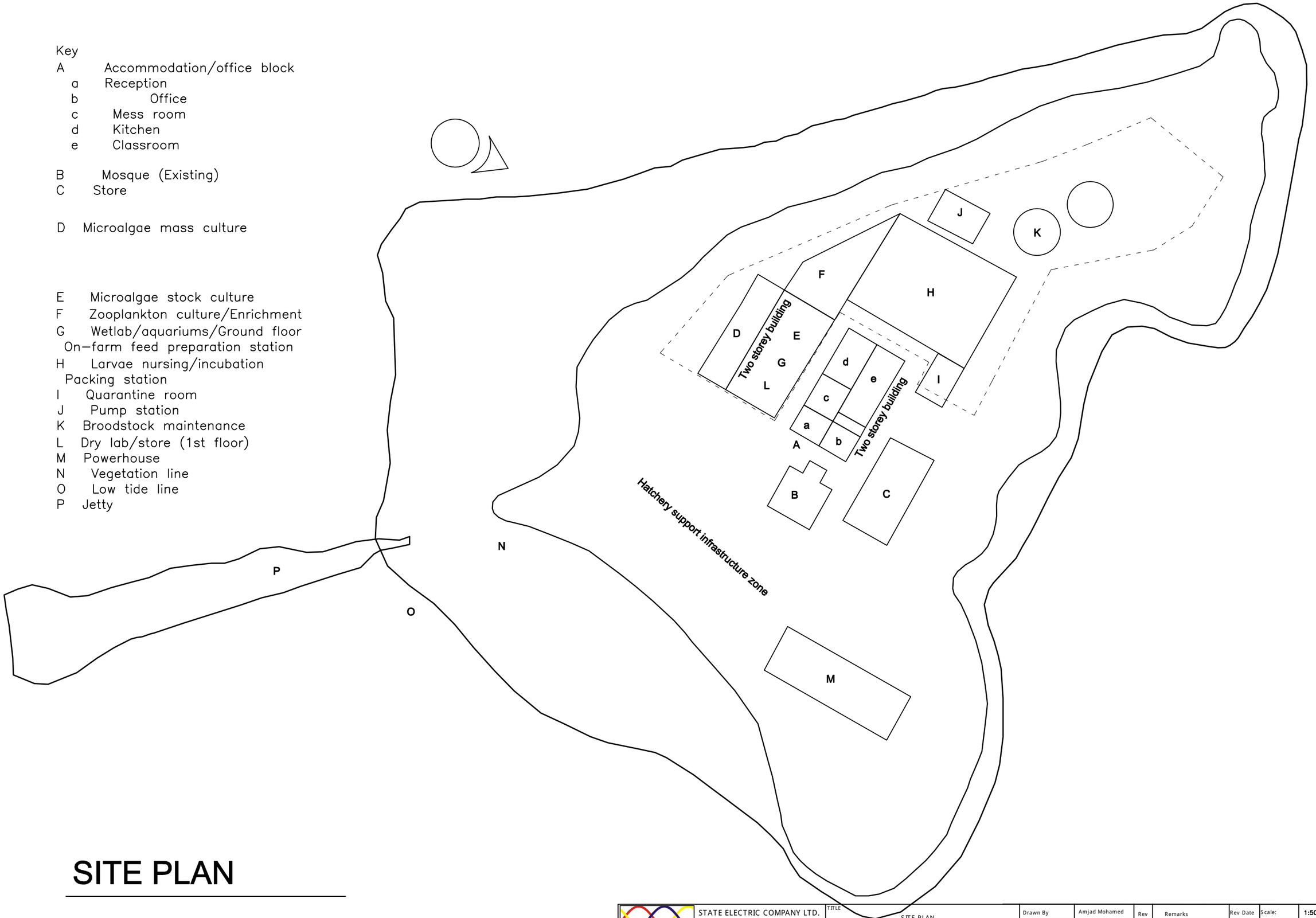
L Dry lab/store (1st floor)

M Powerhouse

N Vegetation line

O Low tide line

P Jetty



SITE PLAN

STATE ELECTRIC COMPANY LTD.
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TITLE	SITE PLAN	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale: 1:500
		Checked By	Ahmed Shafeeu	00		-	Drawing No NA
PROJECT	MANIYAFUSHI POWER SYSTEM	MEA Licence No.	MTIL/97/0016				Date 03/05/2016
		Signature					Sht No 01 of 01 Next Sht 0

ANNEX 2:

Build up Area and Unit Load

Build Up Area & Unit Load

Maniyafushi

Kaafu Atoll, Maldives

ITEM	BUILDING / FACILITY	NO	UNIT	kW	TOTAL kW	UNIT AREA (sqm)	TOTAL AREA (sqm)
1	Staff Accomodation	1	units	14	14		
2	Reception	1	units	2	2		
3	Office	1	units	1.95	1.95		
4	Mess room	1	units	3.5	3.5	152.50	153
5	Kitchen	1	units	6.35	6.35		
6	Class room	1	units	3.58	3.58		
7	Laundary	1	units	4.4	4.4		
8	Mosque	1	units	1.08	1.08	50.60	51
9	Store	1	units	0.62	0.62	96.00	96
10	Micro algae mass culture						
11	Micro stock culture	1	units	65.15	65.15	299.50	300
12	Zooplankton culture / Enritchment						
13	Wetlab / Aquariums						
14	Dry lab / store	1	units	13	13		
15	Larvae nursing / incubation / Packing	1	units	10	10	279.60	280
16	Quarantine Room	1	units	4	4	27.60	28
17	Pump station	1	units	6	6	36.20	36
18	Broodstock Maintenance	1	units	1.5	1.5	69.20	69
19	Powerhouse / desalination plant	1	units	23.5	23.5	141.00	141
	TOTAL	**16**	***units***	**160.63**	**160.63**	**1152.2**	**1152**
	TOTAL BUILT UP AREA						**1,152.20**
	TOTAL LAND AREA						**9,715.00**
	TOTAL BUILT UP PERCENTAGE						**11.86%**

ANNEX 3:

Distribution Map

Key

A Accommodation/office block
- a Reception
- b Office
- c Mess room
- d Kitchen
- e Classroom

B Mosque (Existing)

C Store

D Microalgae mass culture

E Microalgae stock culture

F Zooplankton culture/Enrichment

G Wetlab/aquariums/Ground floor
On-farm feed preparation station

H Larvae nursing/incubation
Packing station

I Quarantine room

J Pump station

K Broodstock maintenance

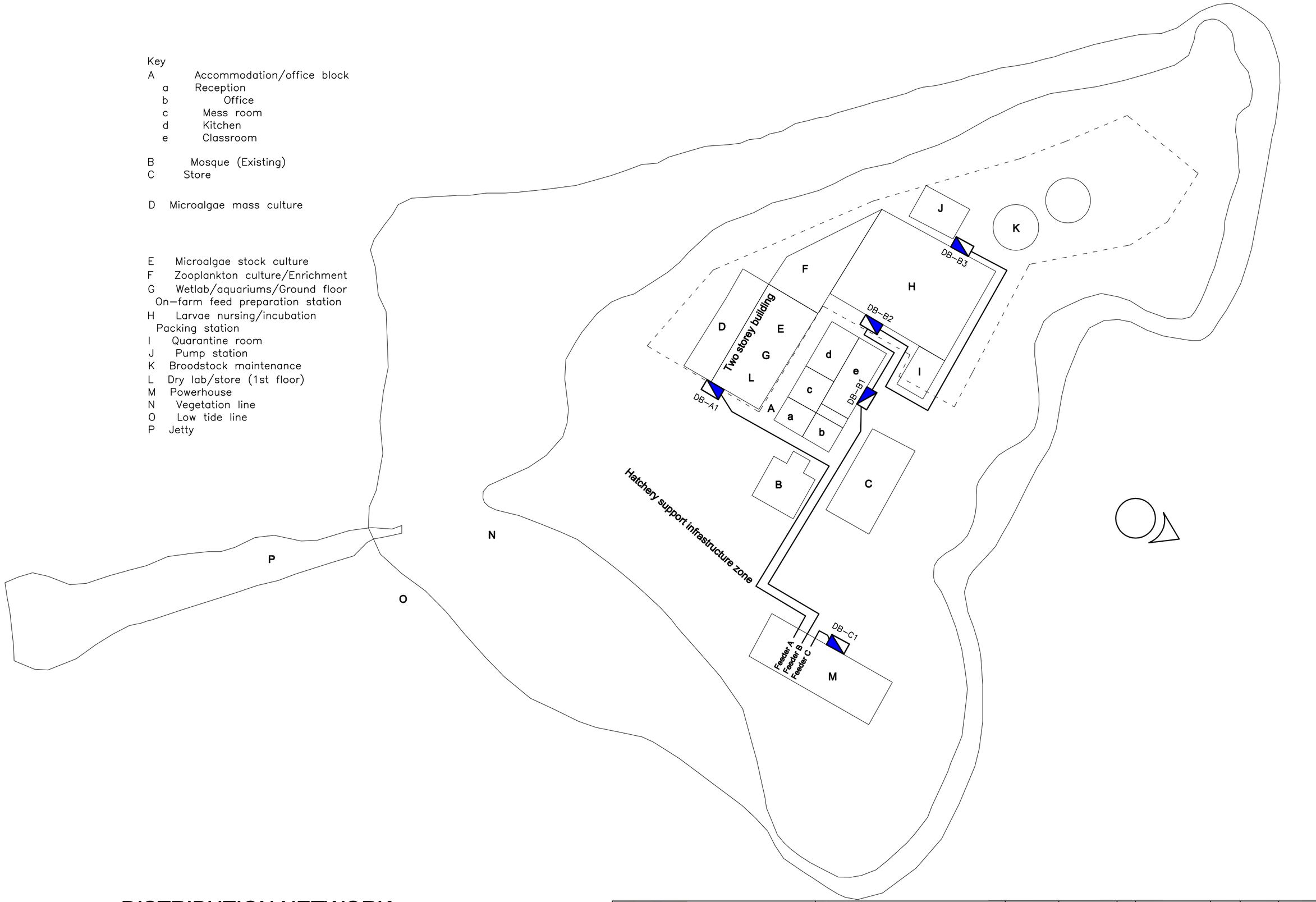
L Dry lab/store (1st floor)

M Powerhouse

N Vegetation line

O Low tide line

P Jetty



DISTRIBUTION NETWORK

STATE ELECTRIC COMPANY LTD.
Amaeenee Magu, Male', Maldives.
Phone : 332 0982
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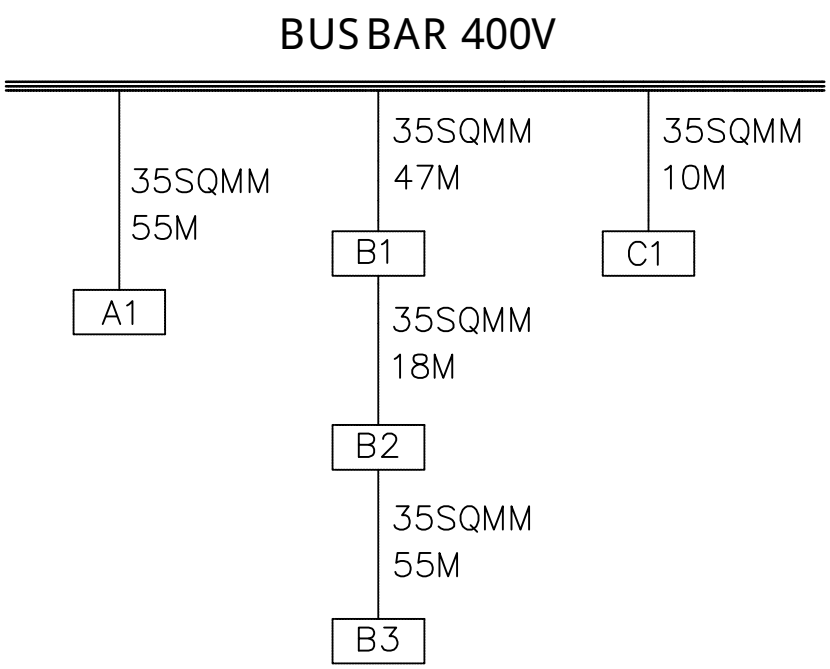
E-mail : admin@stelco.com.mv

TITLE	DISTRIBUTION MAP	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale: 1:500
		Checked By	Ahmed Shafeeu	01	added DB, added 2 gensets	5/10/17	Drawing No NA
PROJECT	MANIYAFUSHI POWER SYSTEM	MEA Licence No.	MTIL/97/0016				Date 03/05/2016
		Signature					Sht No 01 of 01 Next Sht 0

ANNEX 4:

Distribution Schematic Diagram



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Fax : 332 7036
E-mail : admin@stelco.com.mv

TITLE	CHRSQHAT SHNM RBGDL @SHB CH@FQ@L	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date
		Checked By	Ahmed SHafeeu	01	added DB, added 2 gensets	5/10/17
PROJECT	L @MHX@ET RGHONV DQ RX RSDL	MEA Licence No.	MITL/97/0016			
		Signature				

Scale:	NA		
Drawing No	NA		
Date	03/05/2016		
Sht No	01 of 01	Next Sht	0

ANNEX 5:

Feeder Voltage Drop Calculations

VOLTAGE DROP CALCULATION

Feeder A

Voltage Drop Calculation sheet for Underground LV Copper Cables.(BS 6346)

Distance															PH-A1	Voltdrop	%
Sections			13	12	11	10	9	8	7	6	5	4	3	2	1	400 Volts	
Length (km)			**0**	**0**	**0**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.055**		
Cab.size	16		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.43		
Cab.size	25		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.26		
Cab.size	35		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**8.99**	**8.99**	**2.25**
Cab.size	50		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.62		
Cab.size	70		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.66		
Cab.size	95		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.51		
Cab.size	120		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.86		
Cab.size	150		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.37		
Cab.size	185		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.04		
Cab.size	240		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72		
Cab.size	300		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.55		
Cab.size	400		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.31		
Kilowatts			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**78.15**		

Section No.	KVA drop Per Km.	Terminal Voltage		Terminal Amps. Section	Load
1	5.37	V1	380.00	I1	148.60
2	0.00	V2	400.00	I2	148.60
3	0.00	V3	400.00	I3	148.60
4	0.00	V4	400.00	I4	148.60
5	0.00	V5	400.00	I5	148.60
6	0.00	V6	400.00	I6	148.60
7	0.00	V7	400.00	I7	148.60
8	0.00	V8	400.00	I8	148.60
9	0.00	V9	400.00	I9	148.60
10	0.00	V10	400.00	I10	148.60
11	0.00	V11	400.00	I11	148.60
12	0.00	V12	400.00	I12	148.60
13	0.00	V13	400.00	I13	148.60
14	0.00	V14	400.00	I14	148.60
15	0.00	V15	400.00	I15	148.60
		V16	400.00		
Total	5.37				

VOLTAGE DROP CALCULATION

Feeder B

Voltage Drop Calculation sheet for Underground LV Copper Cables.(BS 6346)

Distance													B2-B3	B1-B2	PH-B1	Voltdrop	%
Sections			13	12	11	10	9	8	7	6	5	4	3	2	1	400 Volts	
Length (km)			**0**	**0**	**0**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.055**	**0.018**	**0.047**		
Cab.size	16		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.99	1.85	8.37		
Cab.size	25		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.13	2.42	5.02		
Cab.size	35		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.69	1.77	3.68		
Cab.size	50		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**4.93**	**1.31**	**2.71**	**8.95**	**2.24**
Cab.size	70		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.47	0.92	1.91		
Cab.size	95		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.62	0.69	1.44		
Cab.size	120		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.13	0.56	1.17		
Cab.size	150		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.76	0.47	0.97		
Cab.size	185		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.52	0.40	0.84		
Cab.size	240		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28	0.34	0.70		
Cab.size	300		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.31	0.64		
Cab.size	400		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.26	0.54		
Kilowatts			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**11.5**	**10**	**37.48**		

Section No.	KVA drop Per Km.	Terminal Voltage		Terminal Amps. Section	Load
1	2.20	V1	380.00	I1	71.27
2	0.23	V2	393.69	I2	89.62
3	0.79	V3	395.09	I3	110.65
4	0.00	V4	400.00	I4	110.65
5	0.00	V5	400.00	I5	110.65
6	0.00	V6	400.00	I6	110.65
7	0.00	V7	400.00	I7	110.65
8	0.00	V8	400.00	I8	110.65
9	0.00	V9	400.00	I9	110.65
10	0.00	V10	400.00	I10	110.65
11	0.00	V11	400.00	I11	110.65
12	0.00	V12	400.00	I12	110.65
13	0.00	V13	400.00	I13	110.65
14	0.00	V14	400.00	I14	110.65
15	0.00	V15	400.00	I15	110.65
		V16	400.00		
Total	3.22				

VOLTAGE DROP CALCULATION

Feeder C

Voltage Drop Calculation sheet for Underground LV Copper Cables.(BS 6346)

Distance															PH-A1	Voltdrop	%
Sections			13	12	11	10	9	8	7	6	5	4	3	2	1	400 Volts	
Length (km)			**0**	**0**	**0**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.010**		
Cab.size	16		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12		
Cab.size	25		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67		
Cab.size	35		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.49**	**0.49**	**0.12**
Cab.size	50		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36		
Cab.size	70		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25		
Cab.size	95		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19		
Cab.size	120		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16		
Cab.size	150		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13		
Cab.size	185		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11		
Cab.size	240		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09		
Cab.size	300		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08		
Cab.size	400		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07		
Kilowatts			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**23.5**		

Section No.	KVA drop Per Km.	Terminal Voltage		Terminal Amps. Section	Load
1	0.29	V1	380.00	I1	44.68
2	0.00	V2	400.00	I2	44.68
3	0.00	V3	400.00	I3	44.68
4	0.00	V4	400.00	I4	44.68
5	0.00	V5	400.00	I5	44.68
6	0.00	V6	400.00	I6	44.68
7	0.00	V7	400.00	I7	44.68
8	0.00	V8	400.00	I8	44.68
9	0.00	V9	400.00	I9	44.68
10	0.00	V10	400.00	I10	44.68
11	0.00	V11	400.00	I11	44.68
12	0.00	V12	400.00	I12	44.68
13	0.00	V13	400.00	I13	44.68
14	0.00	V14	400.00	I14	44.68
15	0.00	V15	400.00	I15	44.68
		V16	400.00		
Total	0.29				

ANNEX 6:

DB Load Calculations

Feeder A

DB REF	DB-A1
MAIN INCOMING SWITCH RATING	100A TPN
SIZE OF INCOMING CABLE	1x 4C x 35sqmm XLPE/SWA/PVC

S/N	Item	Unit Load (kW)	Units	Total Con P(kW)	Demand Factor	Diversity Factor	Total Act P(kW)	Total Load (A)	MAIN CABLE LENGTH
1	Micro algae mass culture	1	1	65.15	1.00	0.70	45.61	82	**55**
2	Micro stock Culture								
3	Zooplankton culture / enrichment								
4	Wetlab / aquarium								
5	Dry lab / store	1	1	13	1.00	0.70	9.10	16	
				78.15			**55**	**99**	

Feeder B

DB REF	DB-B1
MAIN INCOMING SWITCH RATING	80A TPN
SIZE OF INCOMING CABLE	1x 4C x 50sqmm XLPE/SWA/PVC

S/N	Item	Unit Load (kW)	Units	Total Con P(kW)	Demand Factor	Diversity Factor	Total Act P(kW)	Total Load (A)	MAIN CABLE LENGTH
1	Staff Accomodation	14	1	14	1.00	0.70	9.80	18	**47**
2	Reception	2	1	2	1.00	0.70	1.40	3	
3	office	1.95	1	1.95	1.00	0.70	1.37	2	
4	Mess room	3.5	1	3.5	1.00	0.70	2.45	4	
5	Kitchen	6.35	1	6.35	1.00	0.70	4.45	8	
6	Class room	3.58	1	3.58	1.00	0.70	2.51	5	
7	Laundary	4.4	1	4.4	1.00	0.70	3.08	6	
8	Mosque	1.08	1	1.08	1.00	0.70	0.76	1	
9	Store	0.62	1	0.62	1.00	0.70	0.43	1	
				37.48			**26**	**47**	

DB REF	DB-B2
MAIN INCOMING SWITCH RATING	63A TPN
SIZE OF INCOMING CABLE	1x 4C x 50sqmm XLPE/SWA/PVC

S/N	Item	Unit Load (kW)	Units	Total Con P(kW)	Demand Factor	Diversity Factor	Total Act P(kW)	Total Load (A)	MAIN CABLE LENGTH
1	Lavae nurse / incubation / packing	10	1	10	1.00	0.70	7.00	13	**18**
				10.00			**7**	**13**	

Feeder B

DB REF	DB-B3
MAIN INCOMING SWITCH RATING	63A TPN
SIZE OF INCOMING CABLE	1x 4C x 50sqmm XLPE/SWA/PVC

S/N	Item	Unit Load (kW)	Units	Total Con P(kW)	Demand Factor	Diversity Factor	Total Act P(kW)	Total Load (A)	MAIN CABLE LENGTH
1	Quarantine Room	4	1	4	1.00	0.70	2.80	5	**55**
2	Pump station	6	1	6	1.00	0.70	4.20	8	
3	Brood stock maintenance	1.5	1	1.5	1.00	0.70	1.05	2	
				11.50			**8**	**15**	

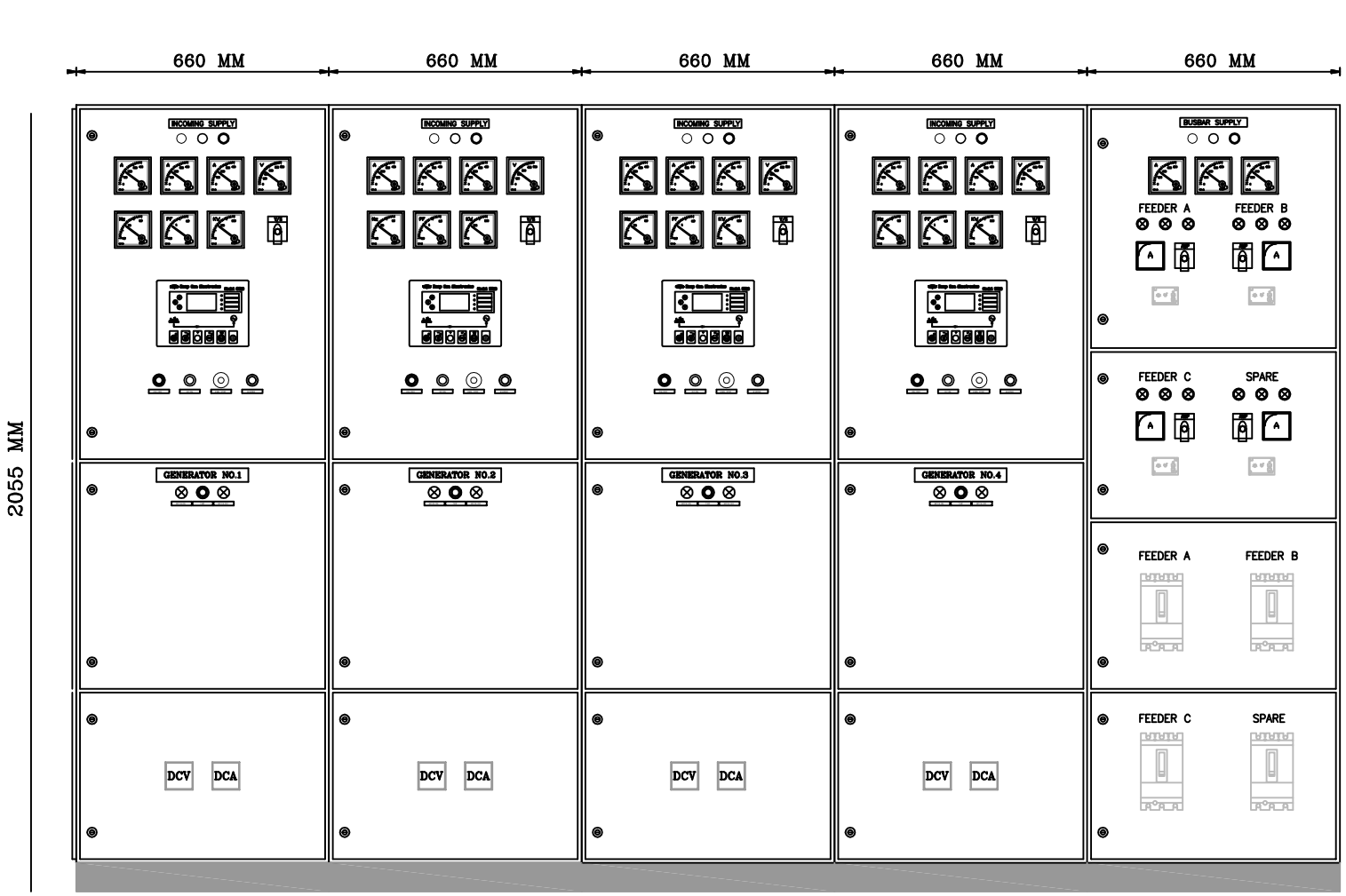
Feeder C

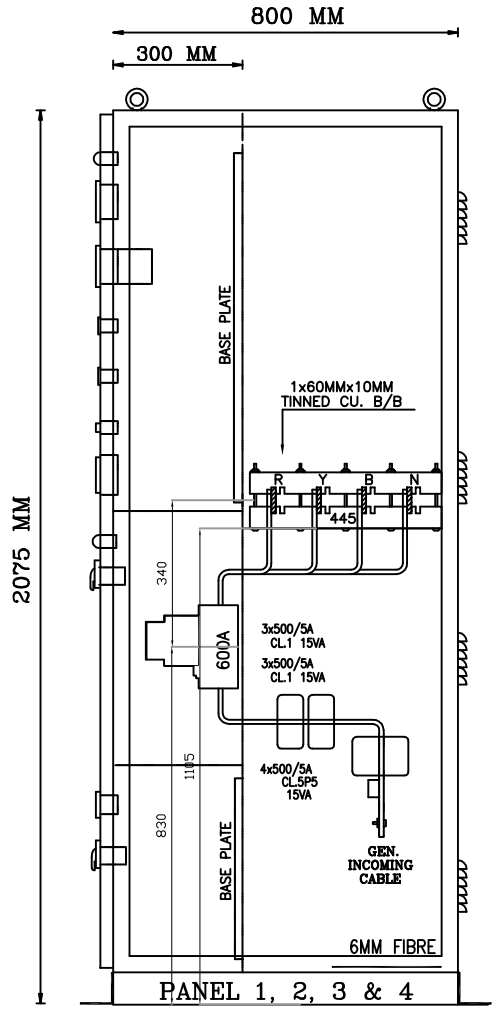
DB REF	DB-C1
MAIN INCOMING SWITCH RATING	63A TPN
SIZE OF INCOMING CABLE	1x 4C x 50sqmm XLPE/SWA/PVC

S/N	Item	Unit Load (kW)	Units	Total Con P(kW)	Demand Factor	Diversity Factor	Total Act P(kW)	Total Load (A)	MAIN CABLE LENGTH
1	Powerhouse	23.5	1	23.5	1.00	0.70	16.45	30	**10**
				23.50			**16**	**30**	

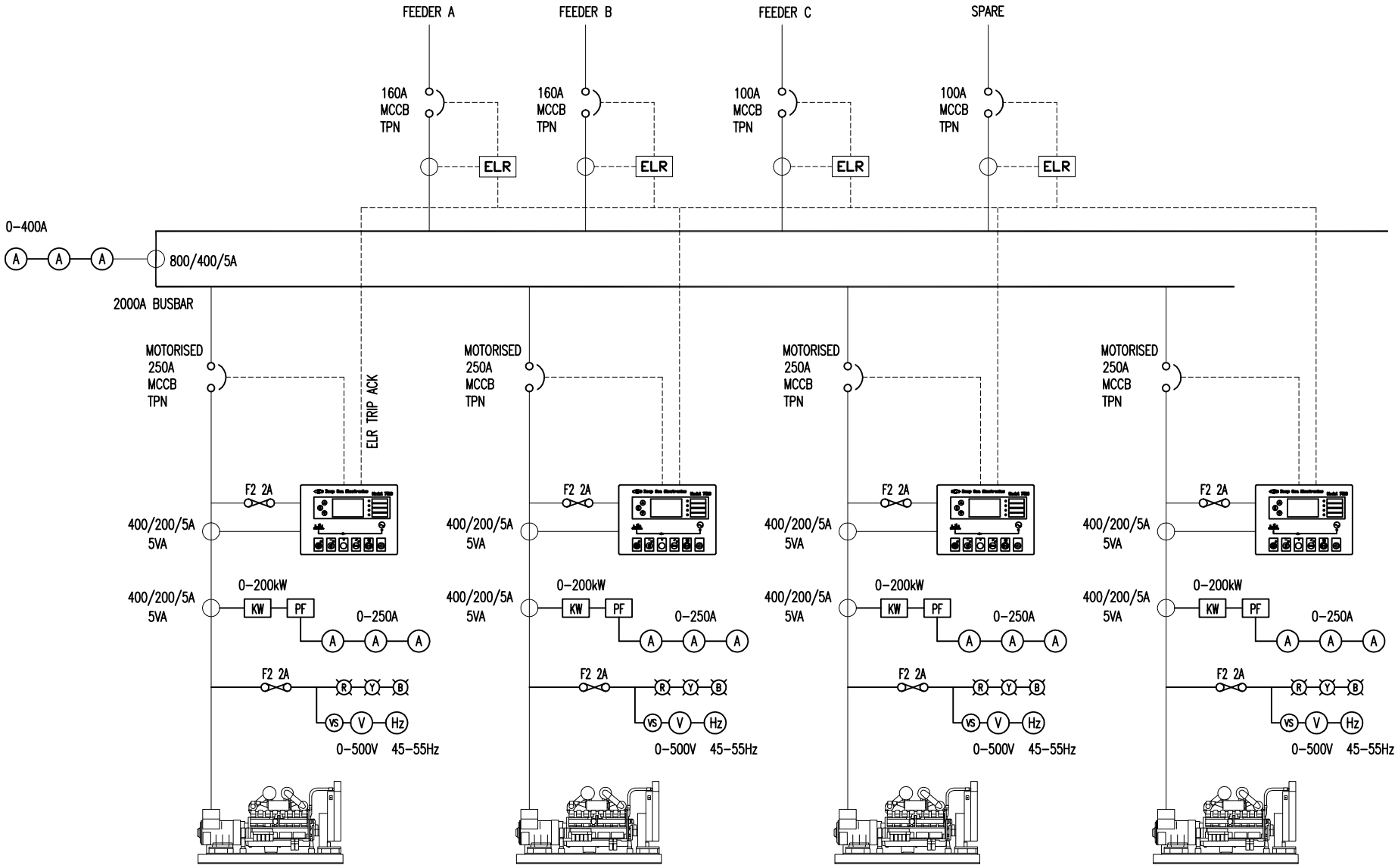
ANNEX 7:

Control Panel Details





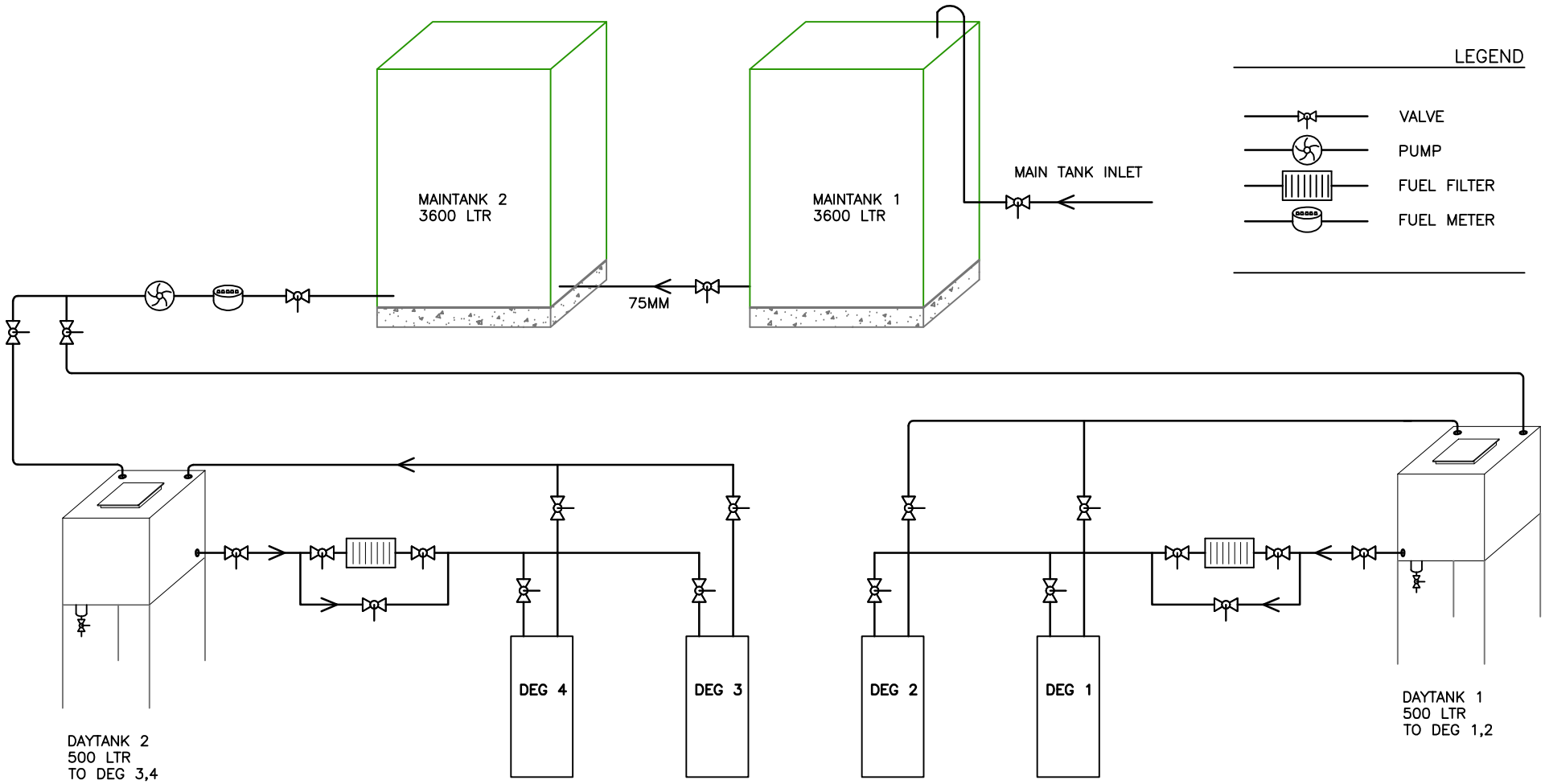
STATE ELECTRIC COMPANY LTD. Amaeenee Magu, Male', Maldives. Phone : 332 0982 Fax : 332 7036 E-mail : admin@stelco.com.mv	TITLE O@MDK EQNMS UHDV O@MDK RDBS HNM UHDV PROJECT L @MHK@ET RG HONV DQ RX RS DL	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale:	NA
		Checked By	Ahmed Saif	01	added DB, added 2 gensets	5/10/17	Drawing No	NA
		MEA Licence No.	MEB/2004/385				Date	03/05/2016
		Signature					Sht No	02 of 02 Next Sht 0



STATE ELECTRIC COMPANY LTD. Amaeenee Magu, Male', Maldives. Phone : 332 0982 Fax : 332 7036 E-mail : admin@stelco.com.mv	TITLE: PANEL SINGLE LINE DIAGRAM PROJECT: MANIYAFUSHI POWER SYSTEM	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale:	NA	
		Checked By	Ahmed Shafeeu	01	added DB, added 2 gensets	5/10/17	Drawing No	NA	
		MEA Licence No.	MTIL/97/0016				Date	03/05/2016	
		Signature					Sht No	01 of 02	Next Sht 2

ANNEX 8:

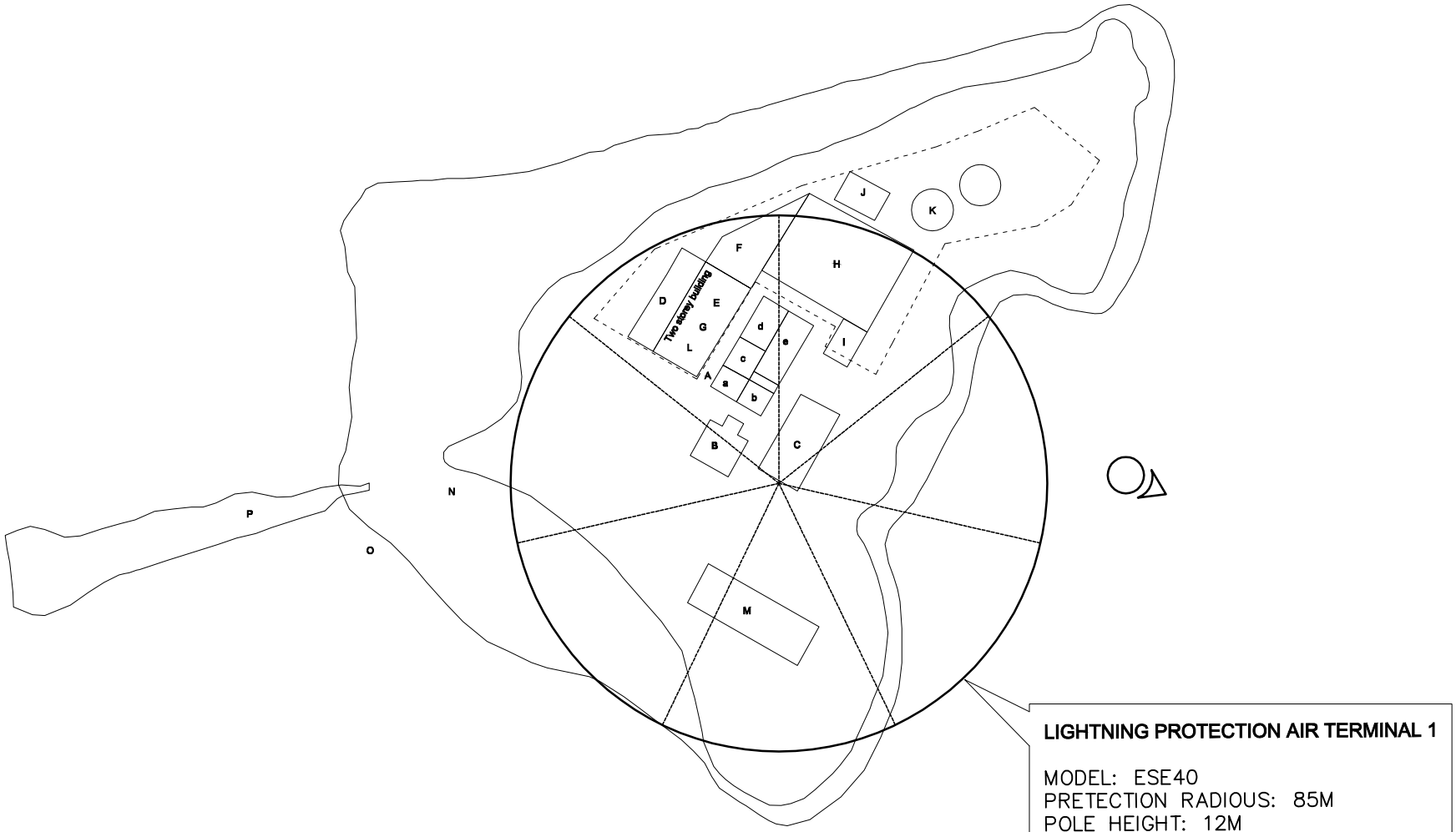
Fuel Tank and Fuel Lines



STATE ELECTRIC COMPANY LTD. Amaeenee Magu, Male', Maldives. Phone : 332 0982 Fax : 332 7036 E-mail : admin@stelco.com.mv	TITLE: FUEL SYSTEM SCHEMATIC DIAGRAM PROJECT: MANIYAFUSHI POWER SYSTEM	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale: NA
		Checked By	Ahmed Shafeeu	01	added DB, added 2 gensets		Drawing No NA
		MEA Licence No.	MTIL/97/0016				Date 03/05/2016
		Signature					Sht No 01 of 01 Next Sht 0

ANNEX 9:

Lightning Protection Layout



LIGHTNING PROTECTION AIR TERMINAL 1

MODEL: ESE40
PRETECTION RADIOUS: 85M
POLE HEIGHT: 12M
LOCATION: FREE STANDING MAST

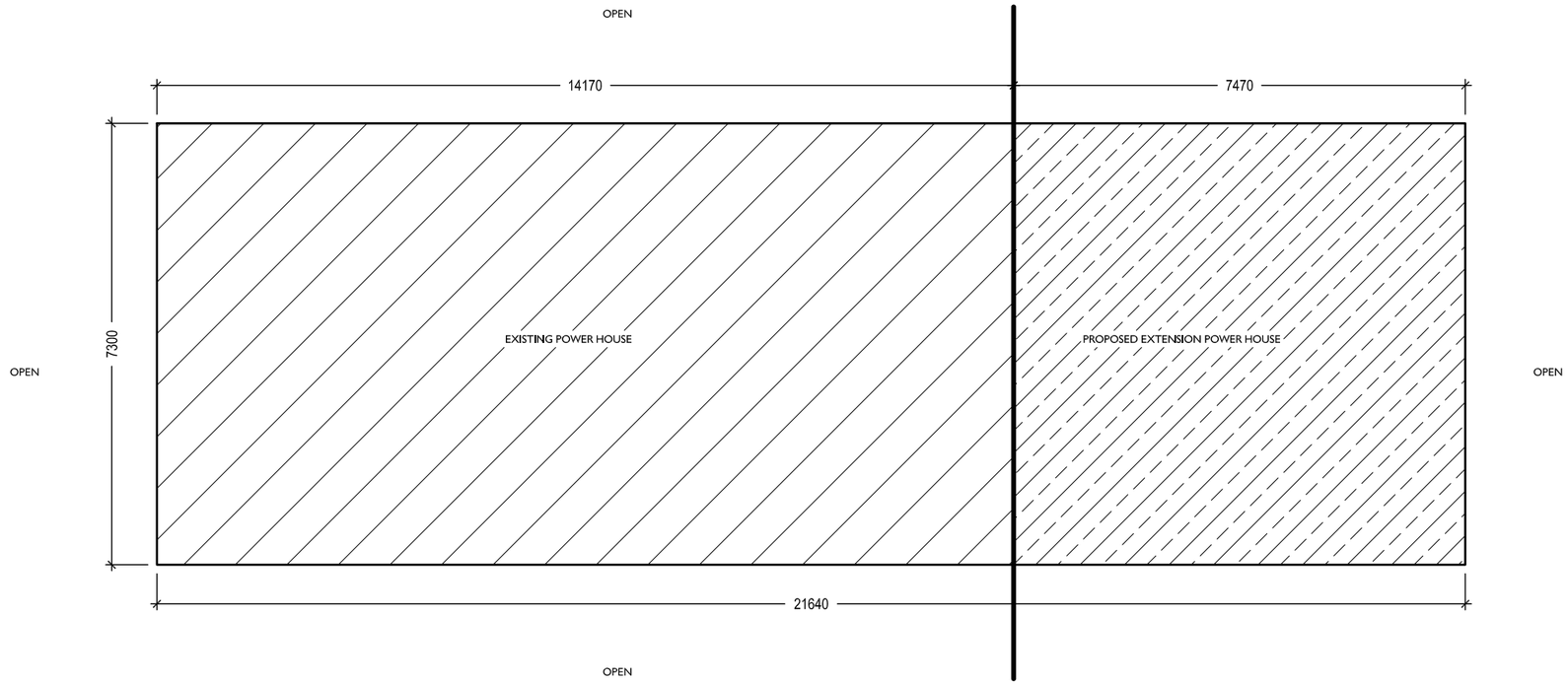
LIGHTNING PROTECTION LAYOUT

STATE ELECTRIC COMPANY LTD.
Amaeenee Magu, Male', Maldives.
Phone : 332 0982
Fax : 332 7036
E-mail : admin@stelco.com.mv

TITLE: LIGHTNING PROTECTION LAYOUT	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale:	1:1000
	Checked By	Ahmed Shafeeu	00		-	Drawing No	NA
PROJECT: MANIYAFUSHI POWER SYSTEM	MEA Licence No.	MTIL/97/0016				Date	03/05/2016
	Signature					Sht No	01 of 01 Next Sht 0

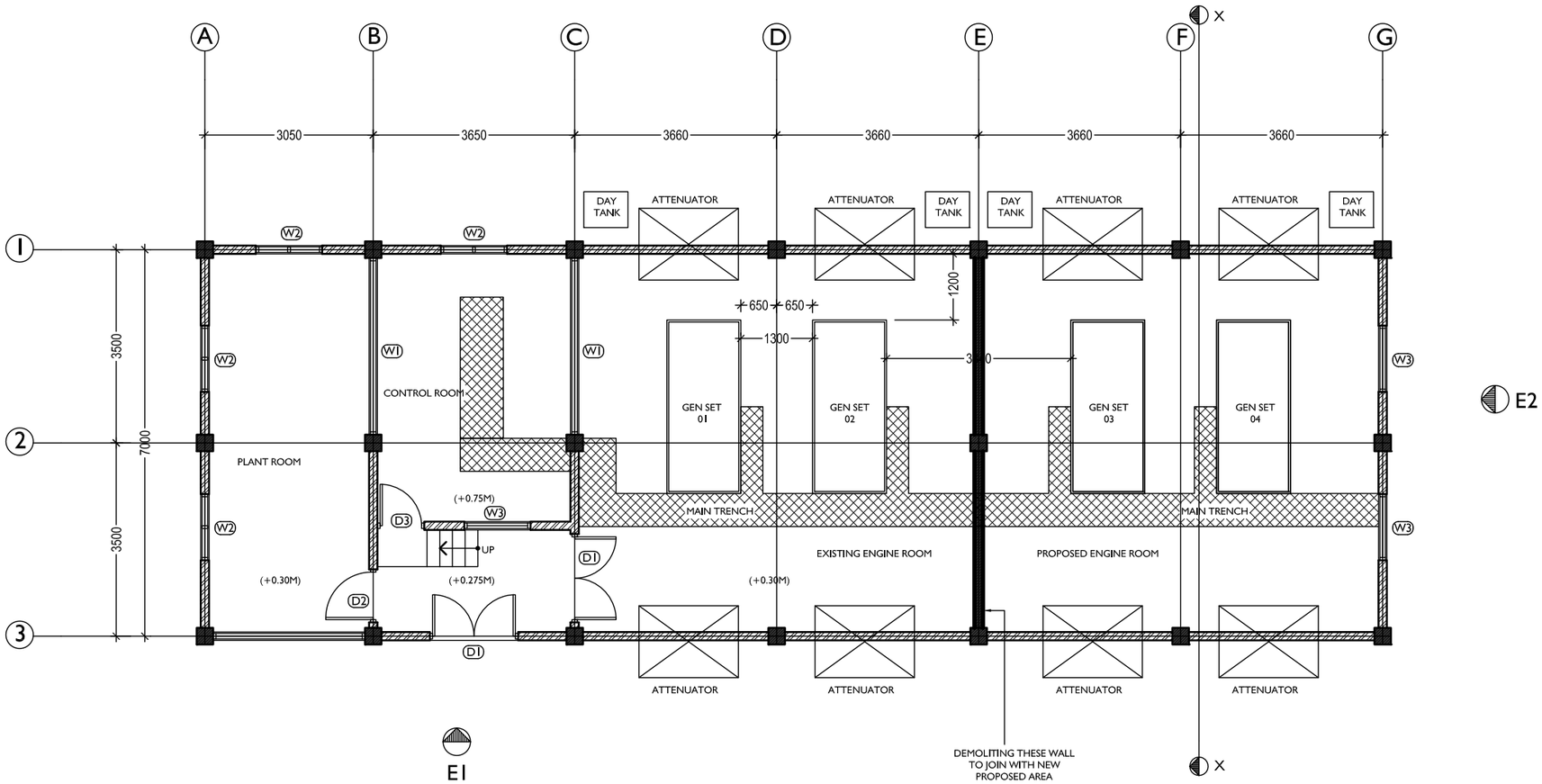
ANNEX 10:

Powerhouse Layouts



SITE PLAN 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS	DRAWING TITLE: 01- SITE PLAN
			1		SCALE : 1:100 / DATE : 31 AUGUST 2017
			2		



DEMOLITION PLAN 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS	DRAWING TITLE: 02- DEMOLITION PLAN
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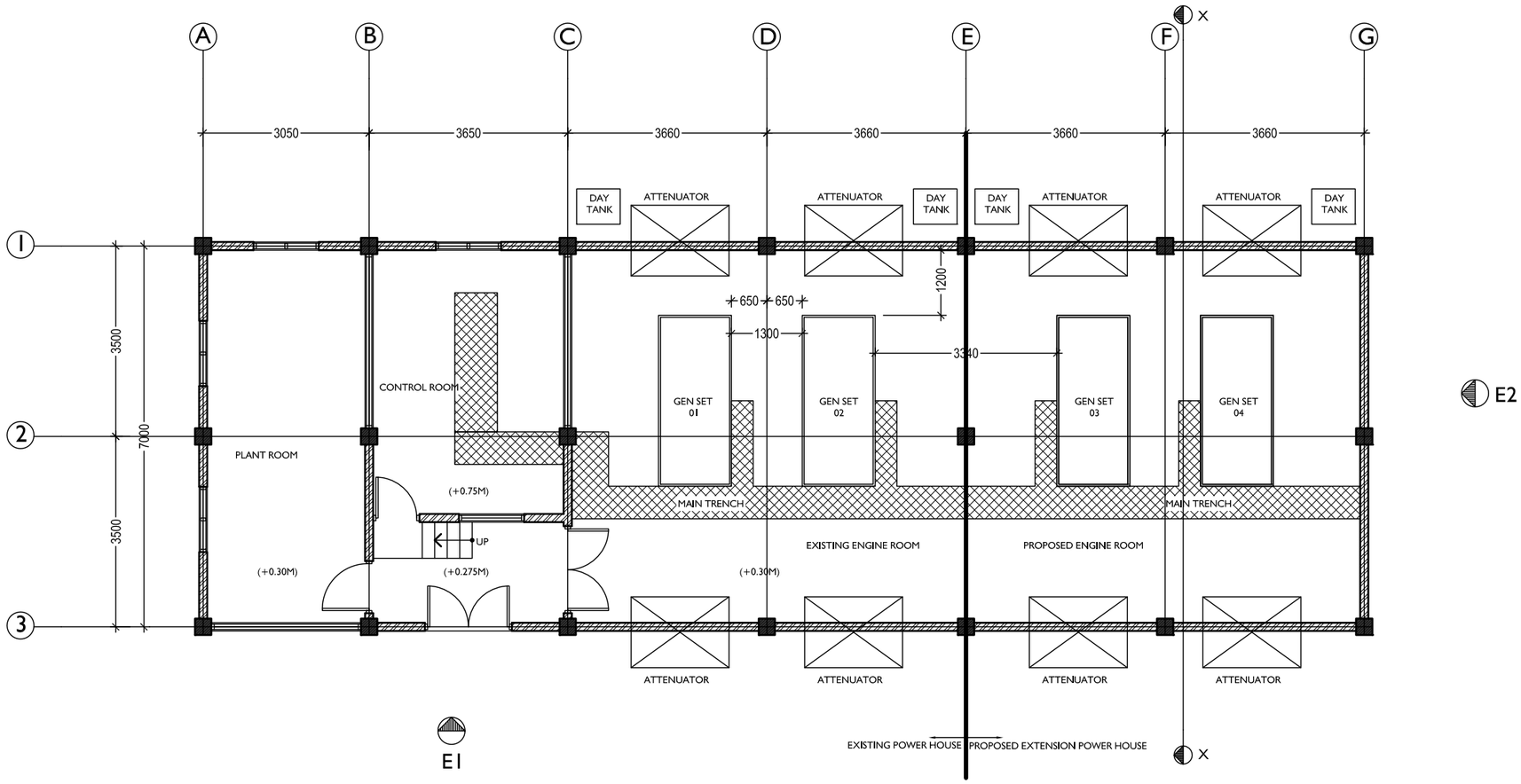
			2		



GROUND FLOOR PLAN 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS	DRAWING TITLE: 03- GROUND FLOOR PLAN
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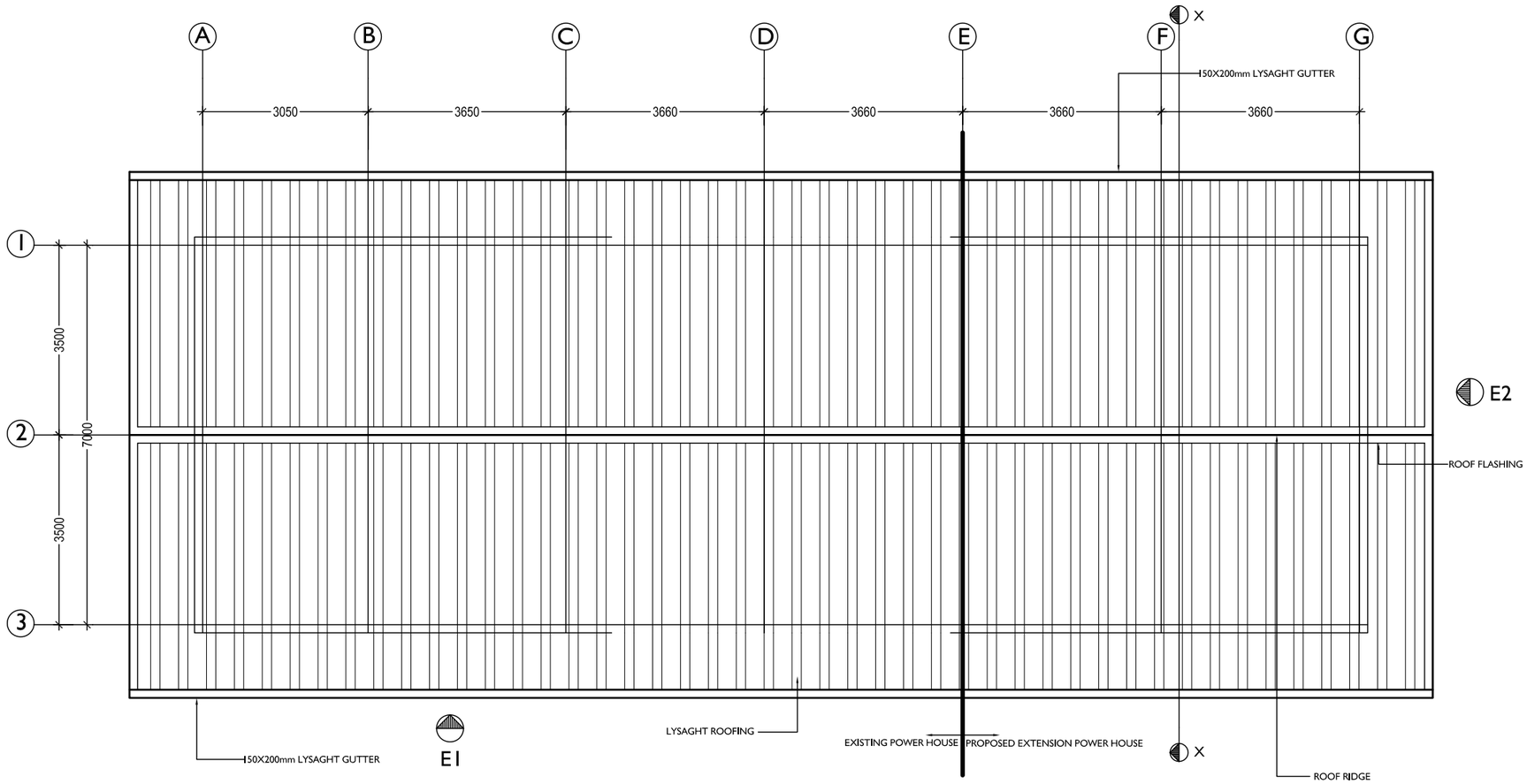
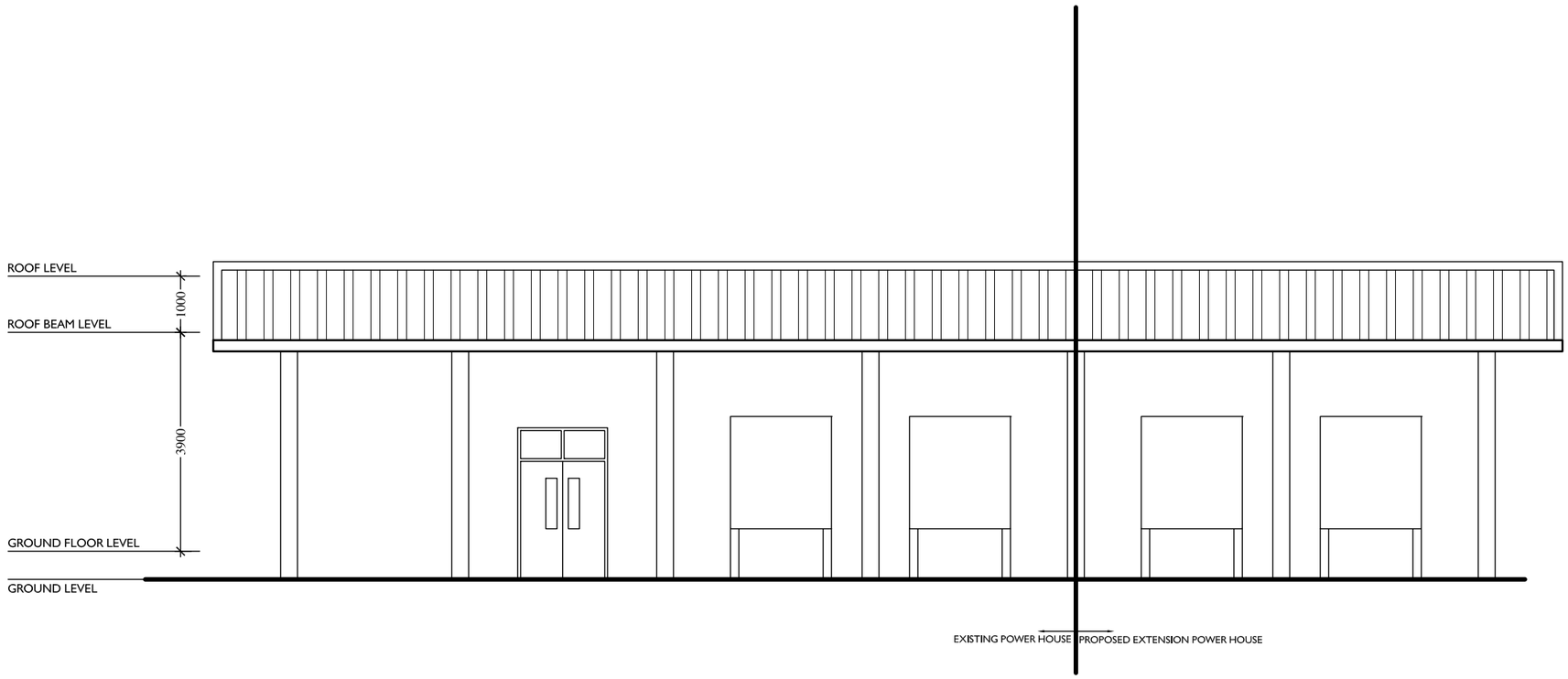
			2		



ROOF PLAN 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS		DRAWING TITLE: 04 - ROOF PLAN	
			1			SCALE : 1:100	DATE : 31 AUGUST 2017
			2				



FRONT ELEVATION (E1) 1:100

NOVEA ENGINEERING
PO Box 3013
Male
Maldives
m : +9609999413

CLIENT :
MINISTRY OF FISHERIES & AGRICULTURE

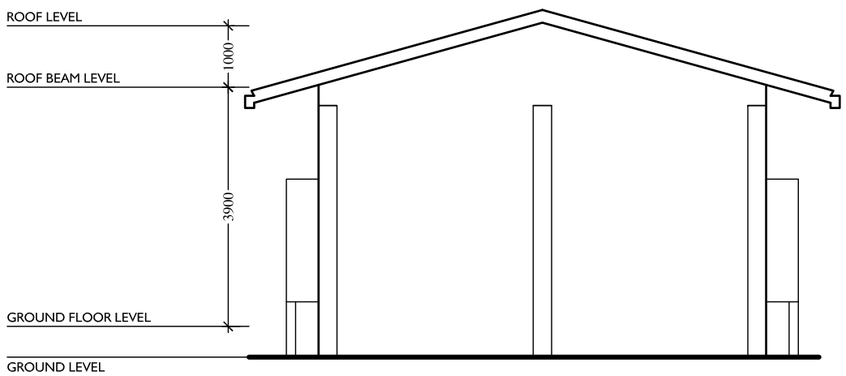
PROJECT :
EXTENSION OF K. MANIYAFARU POWER HOUSE

	REVISIONS	
1		
2		

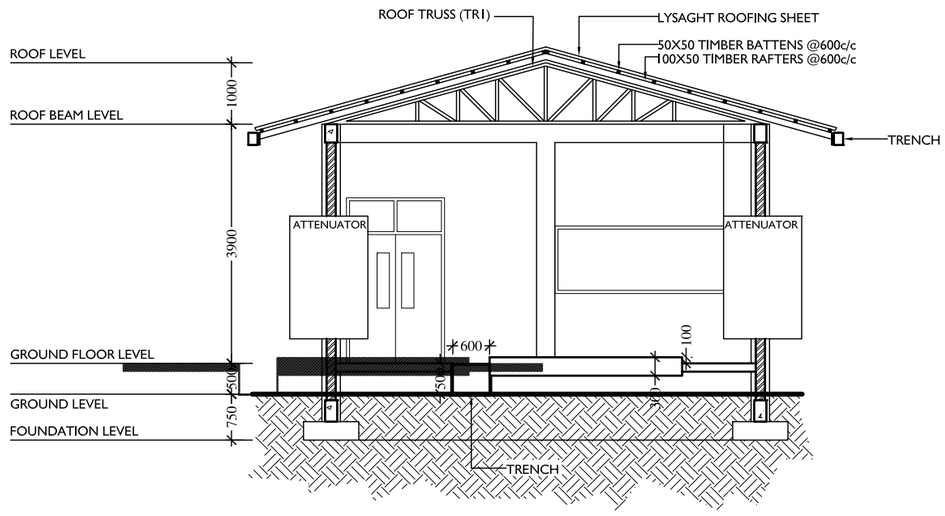
DRAWING TITLE:
05 - FRONT ELEVATION

SCALE : 1:100

DATE : 31 AUGUST 2017

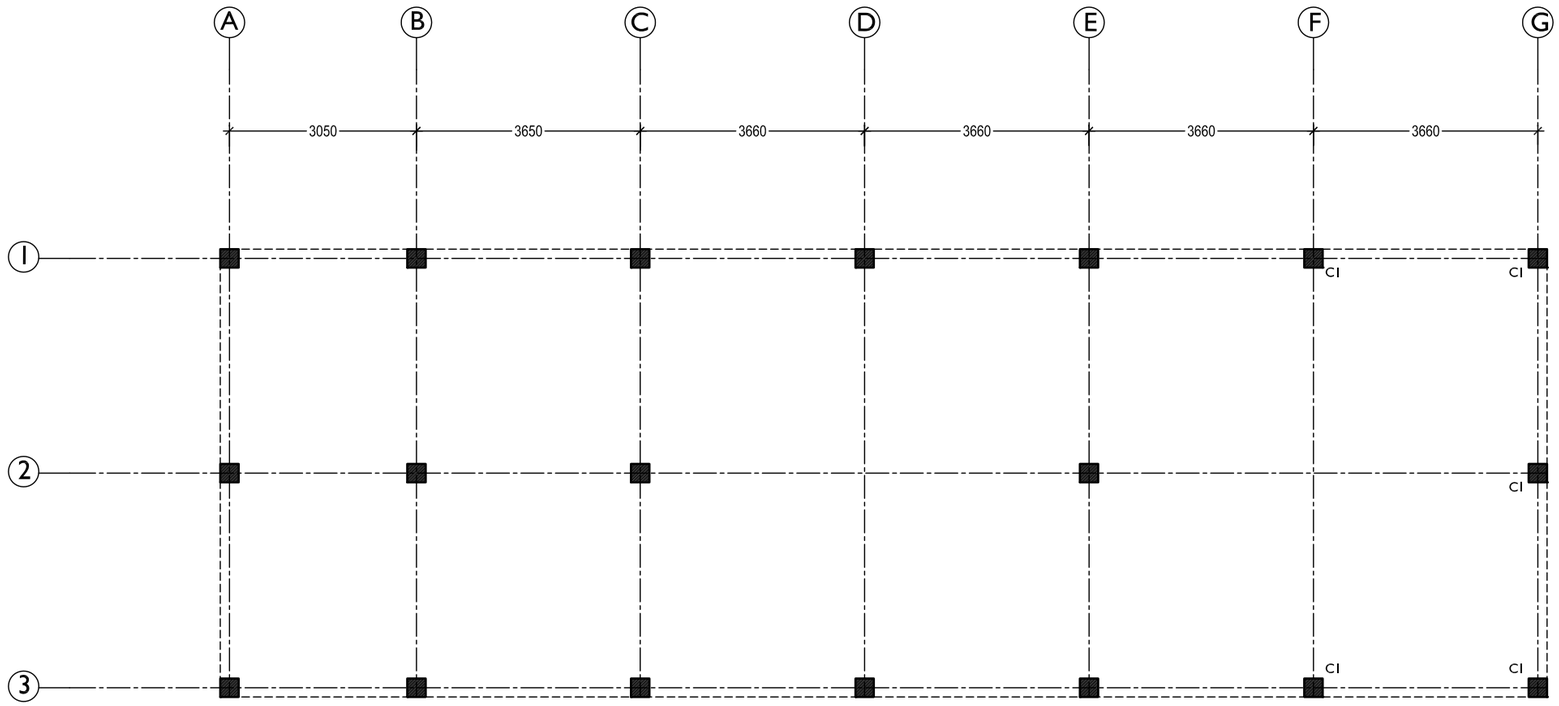


SIDE ELEVATION (E2) 1:100



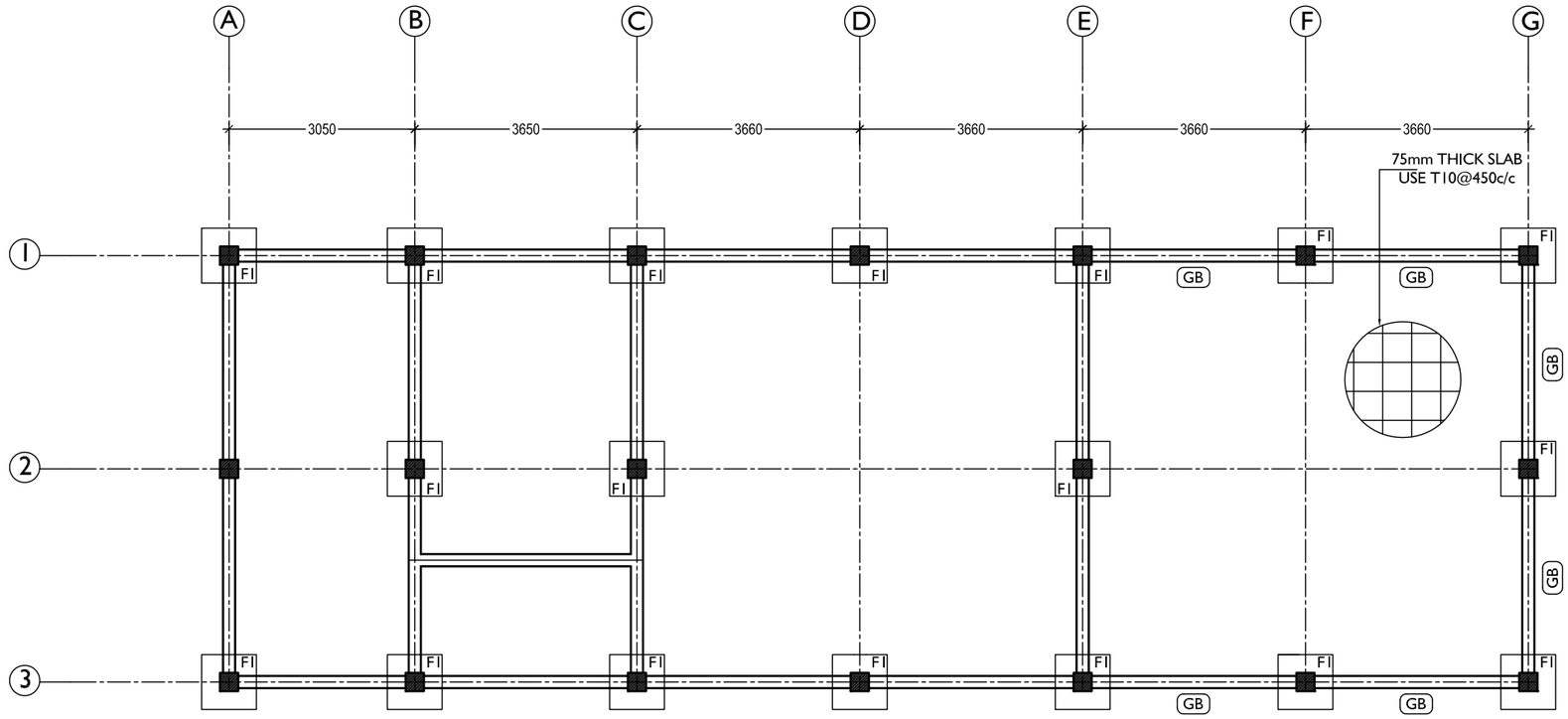
SECTION X-X 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS	DRAWING TITLE: 06 - SIDE ELEVATION & SECTION
			1		
			2		SCALE : 1:100 — DATE : 31 AUGUST 2017



COLUMN LOCATION PLAN 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS	DRAWING TITLE: 07 - NEW COLUMN LOCATION PLAN
			1		SCALE : 1:100 / DATE : 31 AUGUST 2017
			2		



NOTE:-

FOUNDATION DEPTH = 750mm

FOOTING DETAIL

#	SIZE	REINFORCEMENT
F1	900 X 900 X 300	T12@200c/c BW(B)

FOUNDATION PLAN 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS	DRAWING TITLE: 08 - FOUNDATION PLAN
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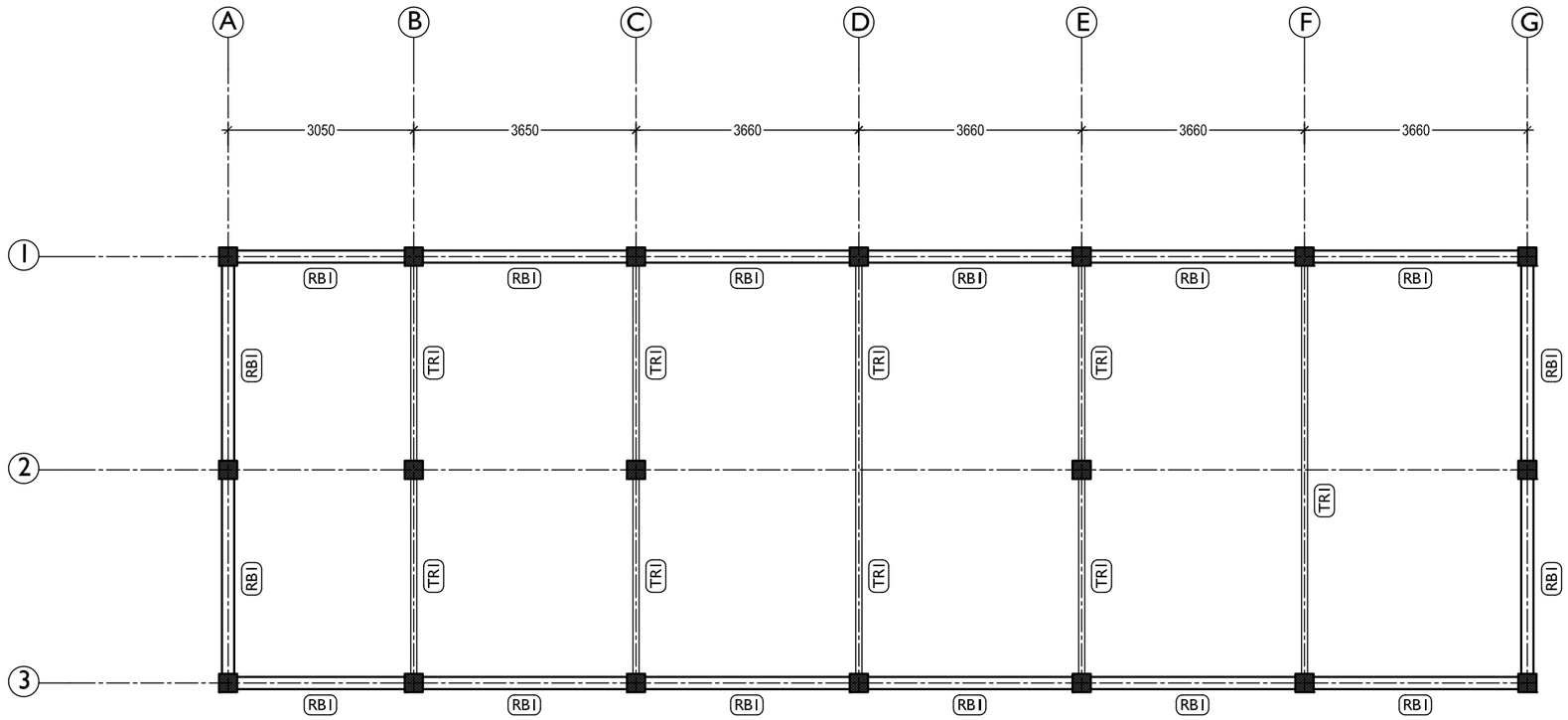

ROOF BEAM/ TRUSS LAYOUT 1:100

NOVEA ENGINEERING PO Box 3013 Male Maldives m : +9609999413	CLIENT : MINISTRY OF FISHERIES & AGRICULTURE	PROJECT : EXTENSION OF K. MANIYAFARU POWER HOUSE		REVISIONS	DRAWING TITLE: 09 - ROOF BEAMS & TRUSS LAYOUT
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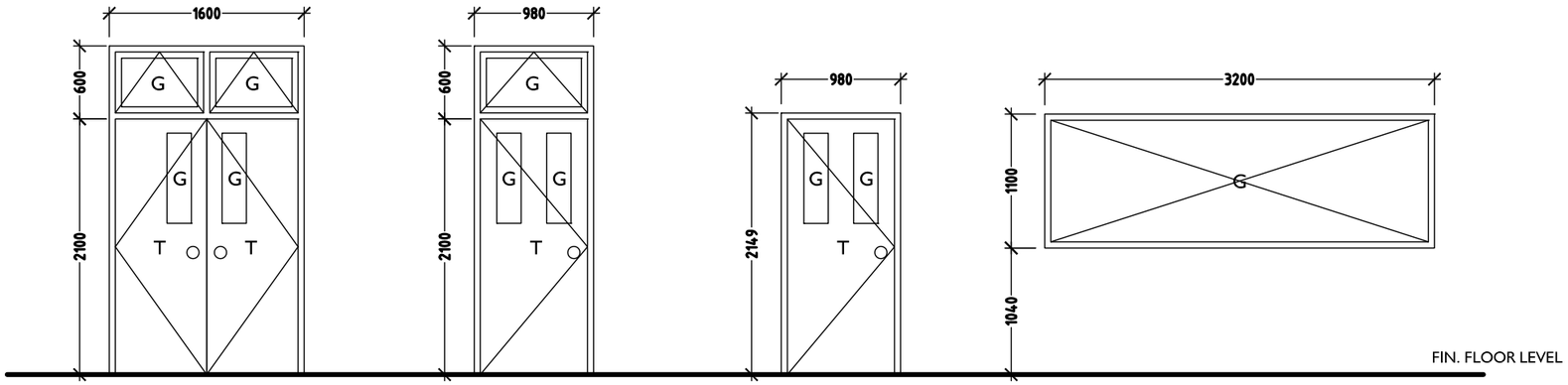
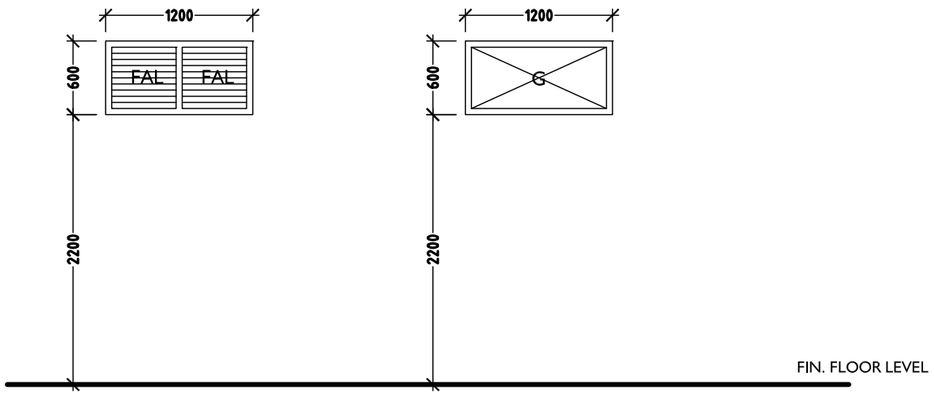


D1 OPEN AREA = 1.57 m²
TIMBER DOOR

D2 OPEN AREA = 1.57 m²
TIMBER DOOR

D3 OPEN AREA = 1.57 m²
TIMBER DOOR

W1 OPEN AREA = 1.57 m²
FIXED GLASS W/ ALUMINIUM FRAME



W2 OPEN AREA = 1.57 m²
FIXED ALUMINIUM LOUVERS

W3 OPEN AREA = 1.57 m²
FIXED GLASS W/ ALUMINIUM FRAME

- ALL DOORS/WINDOWS ARE ALUMINIUM (WHITE COLOUR POWDER COATED ALUMINIUM) UNLESS OTHERWISE STATED
- ALL DIMENSIONS TO BE CHECKED ON SITE PRIOR TO FABRICATION
- ALL DOOR/WINDOWS VIEWED FROM EXTERIOR
- FOR THE DOOR SWING REFER TO FLOOR PLANS

G - 6MM THK CLEAR GLASS
T - TIMBER
FAL - FIXED ALUMINIUM LOUVERS
PV - PVC

DOOR WINDOW DETAILS 1:50

NOVEA ENGINEERING
PO Box 3013
Male
Maldives
m : +9609999413

CLIENT :
MINISTRY OF FISHERIES & AGRICULTURE

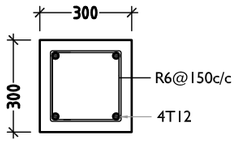
PROJECT :
EXTENSION OF K. MANIYAFARU POWER HOUSE

	REVISIONS	
1		
2		

DRAWING TITLE:
10 - DOORS & WINDOWS

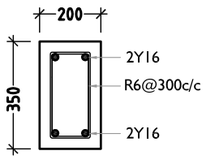
SCALE : 1:100

DATE : 31 AUGUST 2017

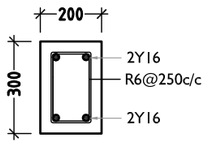


C1

COLUMN DETAILS 1:20



GB

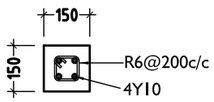


RB1

NOTES:

MINIMUM COVER TO REINFORCEMENT:

FOUNDATION	= 50MM
SLAB	= 25MM
BEAMS	= 35MM
COLUMNS	= 40MM
BEAMS BEND-UP BARS	= 12XDIA
ANCHOR BARS	= 55XDIA
LAPPING BARS	= 45XDIA
MID BARS	= 0.85 X SPAN
SUPPORT BARS	= 1/3 X SPAN



LINTEL BEAM

BEAM DETAILS 1:20

NOVEA ENGINEERING
PO Box 3013
Male
Maldives
m : +9609999413

CLIENT :
MINISTRY OF FISHERIES & AGRICULTURE

PROJECT :
EXTENSION OF K. MANIYAFARU POWER HOUSE

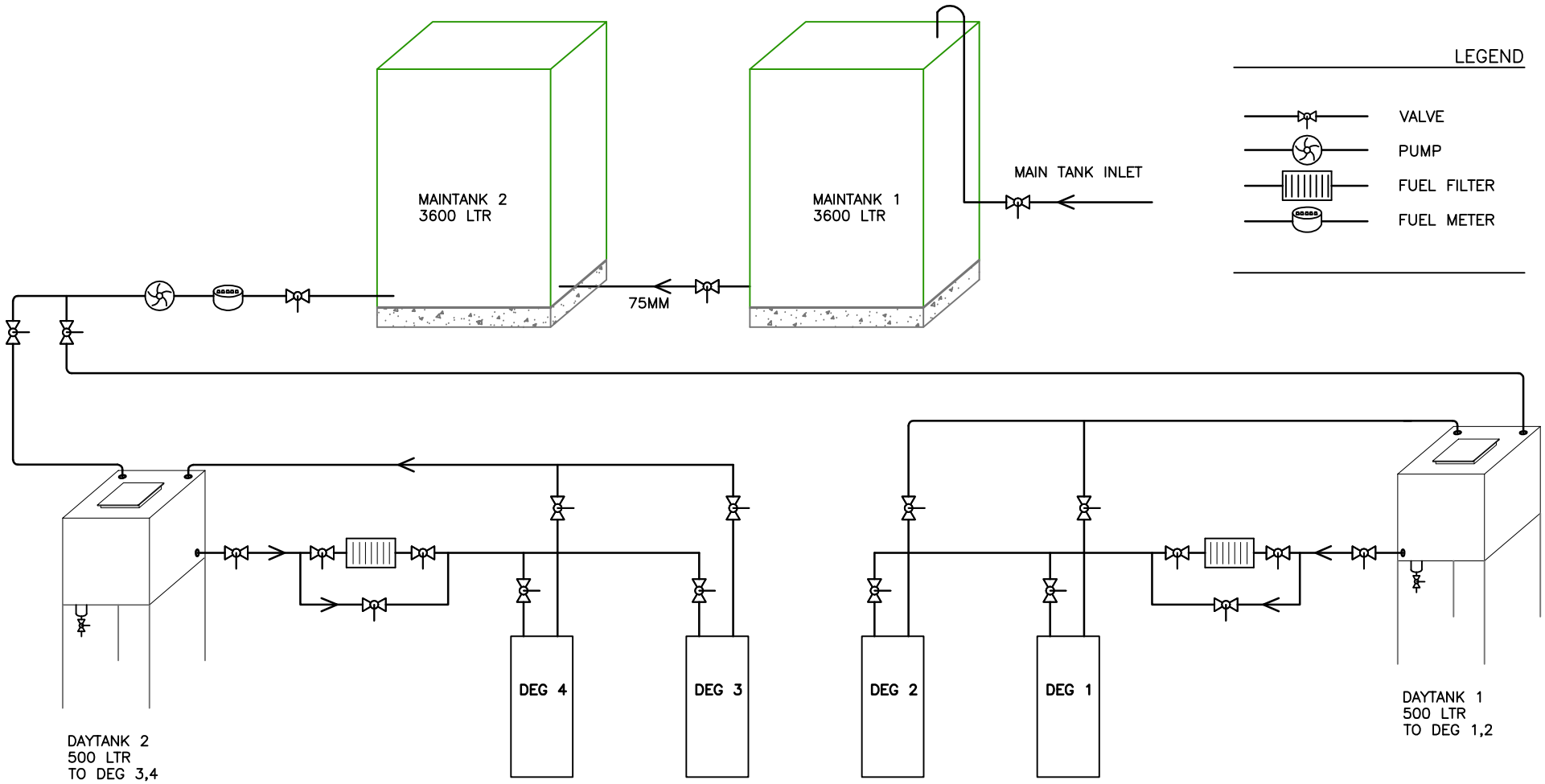
	REVISIONS	
1		
2		

DRAWING TITLE:
11 - STRUCTURAL DETAILS

SCALE : 1:20

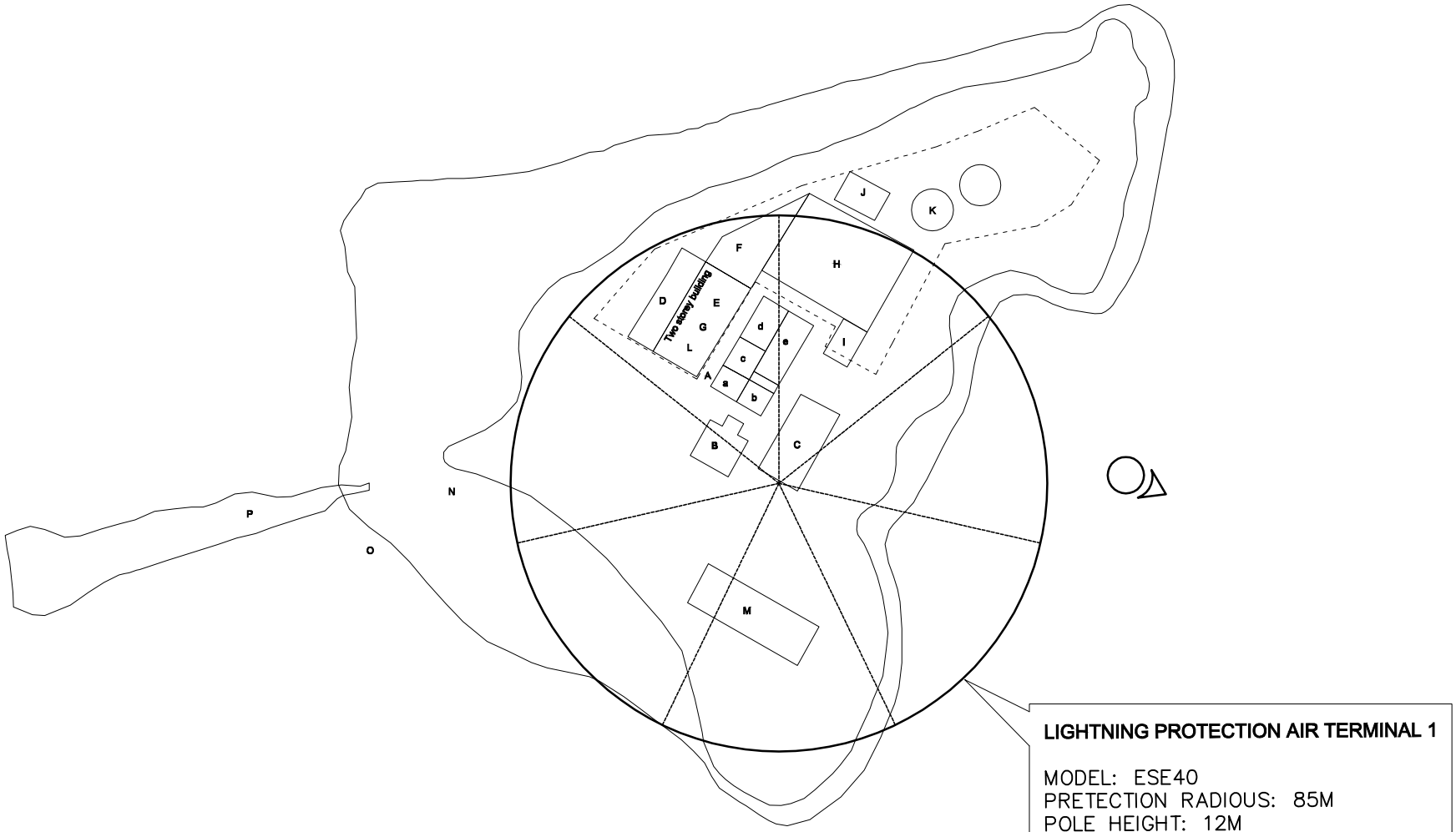
DATE : 31 AUGUST 2017

Appendix 5 Fuel tank design



STATE ELECTRIC COMPANY LTD. Amaeenee Magu, Male', Maldives. Phone : 332 0982 Fax : 332 7036 E-mail : admin@stelco.com.mv	TITLE: FUEL SYSTEM SCHEMATIC DIAGRAM PROJECT: MANIYAFUSHI POWER SYSTEM	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale: NA
		Checked By	Ahmed Shafeeu	01	added DB, added 2 gensets		Drawing No NA
		MEA Licence No.	MTIL/97/0016				Date 03/05/2016
		Signature					Sht No 01 of 01 Next Sht 0

Appendix 6 Lightening protection layout



LIGHTNING PROTECTION AIR TERMINAL 1

MODEL: ESE40
PRETECTION RADIOUS: 85M
POLE HEIGHT: 12M
LOCATION: FREE STANDING MAST

LIGHTNING PROTECTION LAYOUT

STATE ELECTRIC COMPANY LTD.
Amaeenee Magu, Male', Maldives.
Phone : 332 0982
Fax : 332 7036
E-mail : admin@stelco.com.mv

TITLE: LIGHTNING PROTECTION LAYOUT	Drawn By	Amjad Mohamed	Rev	Remarks	Rev Date	Scale:	1:1000
	Checked By	Ahmed Shafeeu	00		-	Drawing No	NA
PROJECT: MANIYAFUSHI POWER SYSTEM	MEA Licence No.	MTIL/97/0016				Date	03/05/2016
	Signature					Sht No	01 of 01 Next Sht 0

Appendix 7 Environmental and Social Management Plan (ESMP) of Maniyafushi Field Station

Environmental and Social Management Plan (ESMP) for the Construction Phase of Maniyafushi Research Development Facility
TO BE INCLUDED IN CONTRACTS

SUSTAINABLE FISHERIES RESOURCES DEVELOPMENT PROJECT

MINISTRY OF FISHERIES AND AGRICULTURE/WORLD BANK

REPUBLIC OF MALDIVES

2.1 EARTHWORK AND SOIL CONSERVATION

2.1.1 SITE CLEARANCE AND LAND DEVELOPMENT

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
Removal of palm trees	Throughout construction process	Flora and fauna impacts, land disturbance	Impact on terrestrial vegetation and species	Low	✓			Uprooting trees regulation 2005 5a	Avoid cutting of trees unless absolutely necessary. Trees that are of rare endemic should not be removed. During removing, attention maintain minimum disturbances to soil cover and care should be taken not to damage adjoining trees. Compensation for the trees removed should be conducted at a 1:2 ratio at least Water spraying should be done to avoid dust generation due to site clearance.	Contractor	MRC	

2.1.2 CONSERVATION AND REUSE OF TOP SOIL

Masonry and Construction	Within the project sites where topsoil from productive land to be removed	Soil and debris	Soil quality	Low					Top soil of the agricultural areas and any other productive areas where it has to be removed for this project shall be stripped to a specified depth of 150mm and stored in stockpiles of height not exceeding 2m, if directed by the engineer. If the contractor is in any doubt on whether to conserve the topsoil or not for any given area he shall obtain the direction from the engineer in writing	Contractor	MRC	Engineering Cost
	Site(s) identified for replantation program					✓			Removed top soil could be used as a productive soil when replanting/establishing vegetation			
	Locations where topsoil is stockpiled for reuse								Topsoil thus stockpiled for reuse shall not be surcharged or overburdened. As far as possible multiple handling of topsoil stockpiles should be kept to a minimum.			

2.1.3 PROTECTION OF GROUND COVER AND VEGETATION

Vehicle and machinery operation	Within the project areas/ new servicing yards developed by contractor for the project	Ground cover and vegetation	Soil quality, impact on terrestrial fauna	Low		✓			Vehicles, machinery and equipment shall be used and stationed only in the areas of work and designated sites approved by the engineer. Entry and exit of construction vehicles and machinery should be restricted to particular points as directed by the engineer. Sites used for maintenance and plant service should be restored back to its final status, and site restoration is considered as incidental to work.	Contractor	MRC	
									Do not destroy ground vegetation cover unnecessarily			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.1.4 DISPOSAL OF DEBRIS AND SOIL												
Masonry and Construction	Disposal sites to be identified by the contractor and approved by Engineer.	Land disturbance	Soil quality	Low			✓	Experienced Contractor	Precautions in excavation and construction	Contractor	MRC	
		Soil and debris	Soil quality						All debris and residual spoil material including any left earth shall be disposed only at locations approved by the engineer for such purpose and subjected to the clause **2.1.1**			Engineering Cost
			Ground and surface water						The contractor shall obtain the approval from EPA for disposal and spoil at the specified location, as directed by the Engineer			
									The debris and spoil shall be disposed in such a manner that; (i) waterways and drainage paths are not blocked (ii) the disposed material should not be washed away by runoff and (iii) should not be a nuisance to the public			
	All burrow sites (licensed sites) identified by contractor and approved by engineer.		Soil quality						The debris and residual spoil material including any left earth shall be used, to refill the burrow areas as directed by the engineer, subjected to laying of topsoil as per EMP clause **2.1.3.**			
	Applicable throughout the project sites		Ground and surface water						Excavated earth materials and all debris materials shall be disposed immediately without allowing to stockpile at identified locations for debris disposal, recommended by the engineer. During transportation, dispose materials should be covered with tarpaulin.			
	In identified filling sites subjected to the approval of engineer								If approved by the engineer, contractor can dispose the debris and spoil as a filling material provided that the contractor can ensure that such material is used for legally acceptable purposes with disposed in an environmentally acceptable manner.			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.1.5 CONTAMINATION OF SOIL BY FUEL AND LUBRICANTS												
Vehicle and machinery operation	Servicing yards to be used for vehicle servicing	Spills and leaks	Surface water and ground water contaminatio n	Medium	✓			Experience d contractor to handle machinery and vehicle operation	Approval from Transport Authority or relevant authority in the form of a Licence should be secured by the contractor if he intends to prepare his own vehicle servicing yard	Contractor	MRC	Engineering Cost
									Vehicle/machinery and equipment servicing and maintenance work shall be carried out only in designated locations/ service stations approved by the engineer			
	Servicing yards to be used for vehicle servicing and locations where vehicles will be temporarily stationed								Waste oil, other petroleum products and untreated wastewater shall not be discharged on ground so that to avoid soil pollution. Adequate measures shall be taken against pollution of soil by spillage of petroleum/oil products from storage tanks and containers. All waste petroleum products shall be disposed of in accordance with the guidelines issued by the CEA or the engineer.			
	New servicing yards developed by the contractor for the project								Sites used for vehicle and plant service and maintenance shall be restored back to its initial status. Site restoration will be considered as incidental to work			
2.1.6 DISPOSAL OF HARMFUL CONSTRUCTION WASTES												
Disposal of construction wastes	Locations identified to store chemicals and waste disposal	Waste disposal chemicals and debris	Surface and ground water impact to marine life and human health	Medium	✓			Waste Manageme nt Regulation clause 1.4 Solid waste and hazardous materials will be transporte d to Thilafushi	Contractor prior to the commencement of work shall provide list of harmful, hazardous and risky chemicals/ material that will be used in the project work to the Engineer. Contractor shall also provide the list of places where such chemicals/materials or their containers or other harmful materials have been dumped as waste at the end of the project.	Contractor	MRC	Engineering Cost
									All disposal sites should be approved by the engineer and approved by EPA and relevant local authority.			
	All affected water bodies close to material storage and waste disposal sites								The contractor shall clean up any area including water-bodiesaffected/contaminated (if any) as directed by the engineer at his own cost.			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.2 STORAGE AND HANDLING OF CONSTRUCTION MATERIAL												
2.2.1 EMISSION OF DUST												
Storage and handling of construction material	At all material storage locations (stock piles of sand, gravel and metal)	Emissions to air	Air quality and impact to human health	Medium		✓			Storage locations of sand, metal, soil should be located away from settlements and other sensitive receptors and covered (with artificial barriers or natural vegetation). Measures given under clauses **2.5.1** should be considered within material storage site to minimize dust during handling of material. All access roads within the storage site should be sprinkled with water for dust suspension.	Contractor	MRC	Engineering Cost
2.2.2 STORAGE OF FUEL, OIL, AND CHEMICALS (AVOID FUMES AND OFFENSIVE ODOUR)												
Chemicals and oil	At all material storage locations (cement, bitumen, fuel, oil and other chemicals used for construction activities)	Spills and leaks	Surface and ground water impact to marine life	Medium					All cement, bitumen (barrels), oil and other chemicals should be stored and handled on an impervious surface (concrete slab) above ground level. Storage facility of cement, bitumen (barrels), oil and other chemicals should be an enclosed structure ensuring that no storm water flows in to the structure. A ridge should be placed around the storage facility to avoid runoff getting in to the structure.	Contractor	MRC	Engineering Cost
		Risks to labour	Impact to human health			✓			Adequate ventilation should be kept to avoid accumulation of fumes and offensive odour that could be harmful to material handlers.Measures given under clause **2.9** should be considered to avoid any accidents and risks to worker population and public.	Contractor	MRC	
2.2.3 TRANSPORTATION OF MATERIAL												
Transportation of vehicles	Within the project locations and the vicinity	Air pollution, traffic congestion, public nuisance	Air quality, community impact	Low		✓			Avoid over- loaded trucks to transport material. During transportation, materials should be covered with tarpaulin. Minimize public nuisance due to dust, traffic, congestion, air pollution, etc., due to such haulage. Select routes based on the truck load; divide the load to prevent damages to local roads. If there are damages to local roads Contractor shall repair all damaged infrastructure/ roads.	Contractor	MRC	

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.3 PROTECTION OF WATER SOURCES AND QUALITY												
2.3.1 LOSS OF MINOR WATER SOURCES AND DISRUPTION TO WATER SOURCES												
Use of water	Project sites and worker camps	Water waste	Water conservation	Medium		✓		**Dewatering Regulation**	Contractor should make employees aware on water conservation and waste minimization in the construction process.	Contractor	MRC	Engineering Cost
		Conflict with community water	Impact on community water sources	Low		✓			Arrange adequate supply of water for the project throughout the construction period. Not obtain water for project purposes, including for labour camps, from public or community water supply schemes without a prior approval from the relevant authority. Not extract water from ground water or surface water bodies without the permission from engineer & EPA licence for dewatering.			
	Wells and other public water sources locations within the project sites	Conflict with community water	Impact on community water sources	Low	✓				Contractor shall protect sources of water (potable or otherwise) such as water sources used by the community so that continued use these water sources will not be disrupted by the work. In case the closer of such sources is required on temporary basis contractor shall provide alternative arrangement for supply. Alternative sources such as wells thus provided should be within acceptable distance to the original sources and accessible to the affected community.			
	Project sites	Effluents to water	Ground and surface water contaminati on	Low	✓				In case the contractors activities may adversely affect the quantity or quality of water, the contractor shall serve notice to the relevant authorities such as EPA and downstream users of water sufficiently in advance.			
	Construction sites, material and soil storage areas, and equipment and machinery service areas			Medium	✓				Apply best management practices to control contamination of run-off water during maintenance & operation of equipment.			
					✓				Maintain adequate distance between stockpiles & water bodies to control effects to natural drainage paths.			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.3.2 SILTATION INTO WATER BODIES												
Masonry and Construction	All water bodies located around the project areas	Ground water contamination, discharge to waterways	Surface water and ground water contamination	Medium		✓				Contractor	MRC	Engineering Cost
Storage of construction materials									Construction materials containing small / fine particles shall be stored in places not subjected to flooding and in such a manner that these materials will not be washed away by runoff.			
Waste disposal									Temporary soil dumps should be placed at least 200m away from all water bodies			
Soil and debris									If temporary soil piles are left at the site for a long time those piles should be covered with thick polythene sheets			
									All fills, back fills and slopes should be compacted immediately to reach the specified degree of compaction and establishment of proper mulch			
2.3.4 CONTAMINATION OF WATER FROM CONSTRUCTION WASTE												
Masonry and Construction, Wastewater disposal	At all water courses located adjacent construction sites		Surface water and ground water contamination	Medium					The work shall be carried out in such a manner that pollution of lagoons, sea and other coastal water bodies paths located within construction areas or downstream. **Measures as given in 2.1.6., 2.3.2 and 2.3.6** clauses shall be taken to prevent the wastewater produced in construction from entering directly into water bodies or the irrigation systems.	Contractor	MRC	Engineering Cost
Masonry and Construction	At all water courses located adjacent construction sites								Avoid / minimize construction works near / at such drainage locations during heavy rainy seasons			
Waste disposal	At all water courses located adjacent construction sites and downstream							Waste Management Regulations 2013	All waste arising from the project is to be disposed in a manner that is acceptable to the engineer and as per the guidelines/instructions issued by the EPA.			Engineering Cost

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.3.5 CONTAMINATION FROM FUEL AND LUBRICANTS												
Wastewater disposal, Vehicles, machinery and plant servicing and maintenance	Vehicle and plant maintenance and servicing centres		Ground and surface water, Impact to marine life	Medium			✓		All vehicle and plant maintenance and servicing stations shall be located and operated as per the conditions and /or guidelines stipulated under the relevant local authority. In general these should be located at least 200m away from water bodies and wastewater shall not be disposed without meeting the disposal standards of the EPA.Wastewater from vehicle and plant maintenance and servicing stations shall be cleared of oil and grease and other contaminants to meet the relevant standards before discharging to the environment	Contractor	MRC	
	Yards, servicing centres								Vehicle, machinery and equipment maintenance and re-filling shall be done as required in EMP clause **2.1.6**. to prevent water pollution as well			
2.3.6 WASTAGE OF WATER AND WASTE MINIMISATION												
Use of water	Within project sites and labour camps	**Water waste**	Water conservation	Medium			✓		The contractor shall educate and made employees aware on water conservation, waste minimization and safe disposal of waste following guidelines.	Contractor	MRC	
2.3.7 EXTRACTION OF WATER												
Extraction of Water	Within project sites and labour camps	Conflict with community water	Impact on community water sources	Low	✓			Dewatering regulation	The contractor is responsible for arranging adequate supply of water for the project purpose throughout the construction period. Contractor shall not obtain water for his purposes including for labour camps from public or community water supplies without approval from the relevant authority. Such extraction (if approved) should be under direct supervision of the engineer	Contractor	MRC	Engineering Cost
	At all natural water sources used for construction works	Ground water contamination, discharge to waterways	Ground and surface water		✓				Extraction of water by the contractor for the project purposes shall comply with the guidelines and instructions issued by EPA The Contractor shall not extract water from groundwater or from surface water-bodies without permission from the Engineer.			
						✓			. The Contractor may use the natural sources of water subject to the provision that any claim arising out of conflicts with other users of the said natural sources			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.3.6 LOCATING, SANITATION AND WASTE DISPOSAL IN CONSTRUCTION CAMPS												
Sewage disposal	At all labour camps	Ground water contamination, discharge to waterways	Ground and surface water, Impact to marine life, impact to human health	High			✓		Locations selected for labour camps should be approved by engineer a Construction of labourer camps shall not be located within 200m from waterways or near to a site or premises of religious, cultural or archaeological importance and school.	Contractor	MRC	Engineering Cost
				High		✓		Direct disposal to sea	Labour camps shall be provided with adequate and appropriate facilities for disposal of sewerage. The sewage systems shall be properly designed, built and operated so that no pollution to ground or adjacent water bodies takes place. Compliance with the relevant regulations and guidelines issued by the EPA shall be strictly adhered to. There must also be sewage treatment, and frequent seawater quality monitoring			
Wastewater disposal				Medium	✓			Sand, cartridge, and UV filtered for final disposal to sea	Contractor shall adhere to the EPA recommendations on disposal of wastewater. Wastewater shall not be discharged to ground or waterways in a manner that will cause unacceptable surface or ground water pollution			
Solid waste disposal				High			✓	Waste Management Regulation, Solid waste and hazardous materials will be transported to Thilafushi	Labour camps shall be provided with adequate and appropriate facilities for disposal of solid waste. Garbage bins shall be provided the camps and regularly emptied. Waste segregation is highly encouraged. Garbage should be disposed of in a hygienic manner, to the satisfaction of the relevant norms.			
Labour camps		Outbreak of disease	Impact to human health	High	✓				All camps are kept clean and hygienic to prevent breeding of vectors			
				Medium			✓		Report any outbreak of infectious disease in a labour camp to the engineer , MRC, and Health Protection Agency immediately. Contractor shall carry out all instructions issued by the authorities. All relevant provisions and any other relevant regulations aimed at safety and health of workers shall be adhered to.			
					✓				Remove all labour camps fully after its need is over, empty septic tanks, remove all garbage, debris and clean and restore the area back to its former condition. A consent letter from the relevant local authority should be obtained that certifies the decommissioning has taken place to the level acceptable to the land owner			Engineering Cost

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.4 FLOOD PREVENTION												
2.4.1 BLOCKAGE OF DRAINAGE PATHS AND DRAINS												
Masonry and Construction	All construction work sites	Land disturbance	Impact to terrain and property	Low	✓			Experienced Contractor	Contractor's activities shall not lead to flooding conditions as a result of blocked drainage paths and drains. The contractor shall take all measures necessary or as directed by the Engineer to keep all drainage paths and drains clear of blockage at all times.. If flooding or stagnation of water is caused by contractor's activities, contractors shall provide suitable means to (a) prevent loss of access to any land or property and (b) prevent damage to land and property Contractor shall compensate for any loss of income or damage as a result.	Contractor	MRC	Engineering Cost
2.5 AIR POLLUTION												
2.5.1 ODOUR AND OFFENSIVE SMELLS												
Chemicals	Within construction and work sites including all sites used for store all chemicals and places where chemical reactions take place.)	Spills and leaks	Surface and ground water impact to marine life	Medium			✓	Experienced Contractor	Contractor shall take precautions such as storing all chemicals used for construction works in properly closed containers with good ventilations to prevent odour and offensive smell emanating from chemicals and processes applied in construction works or from labour camps. In a situation when/where odour or offensive smell does occur contractor shall take immediate action to rectify the situation. Contractor is responsible for any compensation involved with any health issue arisen out of bad odour and offensive smells	Contractor	MRC	Engineering Cost
Sewage	At all labour camps	Risks to workers	Impact to human health						Adequate ventilation should be kept to avoid accumulation of fumes and offensive odour that could be harmful to material handlers. The waste disposal and sewerage treatment system for the labour camps shall be properly designed, built and operated so that no odour is generated. Compliance with any existing regulations or guidelines.			
2.5.2 EMISSION FROM CONSTRUCTION VEHICLES, MACHINERY AND EQUIPMENT												
Vehicles, equipment and machinery operation	All plants, machinery and vehicles used for construction		Air quality from fuel combustion from vehicles and plant machinery	Medium	✓			EPA Vehicle Emissions standards Experienced Contractor	Comply with EPA Vehicle Emission Standards All vehicles, equipment and machinery used for construction shall be regularly serviced and well maintained to ensure that emission levels comply with the relevant standards. Fuel efficient vehicles and machinery	Contractor	MRC	Engineering Cost

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.5.3 GENERATION OF DUST												
Topsoil removal, transporting sand, rubble, cement, bitumen	Within the construction area where earth work will take place, storage locations of sand, rubble, bitumen, cement and all sub roads used for material transportation, paying special attention to sensitive locations.	Air emissions	Air quality and impact to human health	Medium			✓	Experienced Contractor	The contractor shall manage the dust generating activities such as topsoil removal, handling and transporting sand, rubble, bitumen, and cement during periods of high winds or during more stable conditions with winds directed towards adjacent residences and other facilities.	Contractor	MRC	Engineering Cost
									All stockpiles shall be located sufficiently away from sensitive receptors.			
									All vehicles delivering materials shall be covered to avoid spillage and dust emission.			
									The Contractor should avoid, and take suitable action to prevent dirt and mud being carried to the roadway (particularly following wet weather).			
									The contractor should enforce vehicle speed limits to minimize dust generation.			
									The Contractor shall employ a water truck to sprinkle water for dust suppression on all exposed areas as required (note: the use of waste water / waste oil for dust suppression is prohibited)			
									All cleared areas shall be rehabilitated progressively			
									All earthwork shall be protected in a manner acceptable to the minimize generation of dust.			
									All existing roads used by vehicles of the contractor, or any of his sub-contractor or supplies of materials or plant and similar roads which are part of the works shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles or their tires.			
									Clearance shall be affected immediately by manual sweeping and removal of debris, or, if so directed by the Engineer, by mechanical sweeping and clearing equipment. Additionally, if so directed by the Engineer, the road surface will be hosed or sprinkled water using appropriate equipment.			
									Plants, machinery and equipment shall be handled (including dismantling) so as to minimize generation of dust.			
									The contractor shall take every precaution to reduce the level of dust emission from the hot mix plants and the batching plants up to the satisfaction of the Engineer in accordance with the relevant emission norms, and use a sprinkler system for dust suppression.			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.6 NOISE PROTECTION AND VIBRATION												
2.6.1 NOISE FROM VEHICLES, PLANTS, AND EQUIPMENT												
Machinery, equipment and vehicle									All machinery and equipment should be well maintained and fitted with noise reduction devices.			
operation	Project sites and worker camps	Noise pollution	Impact to workers,	Low				Maniyafushi is not a locally inhabited island	In construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, etc., will be stopped between 8 pm to 6 am. No construction shall take place within 100m around hospitals between 20.00 hours to 06.00 hours. Near noise sensitive sites, such as schools noisy equipment shall not be used during noise sensitive times of the day.	Contractor	MRC	Engineering Cost
	Wells and other public water sources locations within the project sites				✓				All vehicles and equipment used in construction shall be fitted with exhaust silences. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-compliant plant shall be removed from site.			
	All equipment, machinery and vehicles used for construction works								Noise limits for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators, and saws shall not exceed 75 dB(A).			
									Maintenance of vehicles, equipment and machinery shall be regular and proper to keep noise from these at a minimum.			
	Construction sites, material and soil storage areas, and equipment and machinery service areas								Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall be provided with Personal Protective Gear.			
	Within the construction sites and their vicinity					✓			Blasting shall be carried out during fixed hours (preferably during mid-day), as permitted by the Engineer. The timing should be made known to all the people within 500 m (200 m for pre-splitting) from the blasting site in all directions. People, except those who actually light the fuse shall be excluded from the area of 200 m (50 m for pre-splitting) from the blasting site in all directions at least 10m minutes before the blasting. Only chemical blasting where rocks have to be removed for landslide mitigation measures			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.7 IMPACTS TO FLORA												
2.7.1 LOSS OR DAMAGE TO TREES OR VEGETATION												
Removal of trees	All project sites	Flora and fauna, land disturbance	Impact to flora and habitat, and heritage				✓	Uprooting plants and trees Regulation 2006/ National Biodiversity Strategy Action Plan (NBSAP)	All works shall be carried out in a manner that the destruction to the flora and their habitats is minimised. Trees and vegetation shall be felled / removed only if that impinges directly on the permanent works or necessary temporary works. In all such cases contractor shall take prior approval from the Engineer.			
				Low			✓		Contractor shall adhere to the guidelines and recommendations made by the Environmental Protection Agency, if any with regard to felling of trees and removal of vegetation.	Contractor	MRC	Engineering
	Indicative number of trees plants and indicative number of planting structures necessary are to be identified by the contractor. Planting should take place as soon as the plant removal takes					✓			The contractor shall plant over 5 year old root-balled native trees suitable for the location as identified by the Engineer. The planting should take place in public land suitable for the purpose The contractor shall build hardy structures around the trees for protection. The contractor shall be responsible for ensuring the well-being of the trees/plants until the end of the contract			
						✓			Vegetation buffers and habitat corridors			
						✓			Contractor shall make every effort to avoid removal and/or destruction of trees of religious, cultural and aesthetic significance. If such action is unavoidable the Engineer shall be informed in advance and carry out public consultation and report on the same should be submitted to the Engineer.			
2.7.2 CHANCE FINDS OF IMPORTANT FLORA												
Land clearance, construction		Flora and fauna, land disturbance	Impact to flora and habitat	Low			✓	Uprooting Plants and Trees regulation 2006	During construction, if a rare/endangered flora species is found, it shall be immediately informed to the relevant agency by the contractor through the engineer. All activities that could destroy such flora and/or its habitat shall be stopped with immediate effect. Such activities shall be started only after obtaining the Engineer's or EPA's approval. Contractor shall carry out all activities and plans that the Engineer instructed him to undertake to conserve such flora and/or its habitat.	Contractor	MRC	

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.9 DISRUPTION TO PEOPLE												
2.9.1 LOSS OF ACCESS												
Masonry and Construction	All project sites	Public nuisance	Impact to community	Low	✓			Maniyafushi is not a locally inhabited island	At all times, the Contractor shall provide safe and convenient passage for vehicles and pedestrians. Work that affects the use of existing accesses shall not be undertaken without providing adequate provisions to the prior satisfaction of the Engineer.	Contractor	MRC	Engineering Cost
									The works shall not interfere unnecessarily or improperly and ensure convenience of public at all times			
						✓			On completion of the works, all temporary obstructions to access shall be cleared away, all rubbish and piles of debris that obstruct access be cleared to the satisfaction of the Engineer			
									Providing advance information to the public about the planned construction works and activities causing disruption to access and the temporary arrangements made to give relief to public in order to avoid any inconveniences due to the construction activities			Engineering Cost
2.9.2 TRAFFIC CONTROL AND SAFETY												
Vehicle operation	Road-side construction sites	Accidents, congestion	Impact to human safety	Low	✓			Maniyafushi is not a locally inhabited island	The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the street under improvement. The provision of traffic safety measures shall be considered incidental to work and follow	Contractor		
	Construction areas								Vehicles travelling in and out of the Project area should maintain low speeds when transporting material to avoid d the risk of accidents.		MRC	Engineering Cost

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.10 ACCIDENTS AND RISKS												
2.10.1 PUBLIC WORKER SAFETY												
Labour	Construction areas, material storage and worker camps	Accidents	Impact to worker health	Medium			✓	Maniyafushi is not a locally inhabited island	All reasonable precautions will be taken to prevent danger of the workers and the public from accidents such as fire, explosions, blasts, falling rocks, falling to excavated pits, chemical sprays, unsafe power supply lines etc.	Contractor	MRC	Engineering Cost
								Experienced Contractor	The Contractor shall comply with requirements for the safety of the workmen as per the international labour organization (ILO) convention No. 62 and Occupational Health and Safety of the Maldives Association of Construction Industry (MACI) to the extent that those are applicable to this contract. The contractor shall supply all necessary safety appliances and personal protective equipment (PPE) for eye and face, head, hearing, foot, hand, body and leg, and respiratory protection such as safety goggles, helmets, masks, boots, etc., to the workers and staff. The contractor has to comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, excavations, trenches and safe means of entry and egress.			
									Construction activities on existing facilities where operation is underway should be conducted post times of operation, post operational hours of the centre if on the same site.			
									The Contractor shall comply with requirements for the safety of the workmen as per the international labour organization (ILO) convention No. 62 , guidelines of the Health Protection Agency , MACI, and Labour Authority of the Maldives to the extent that those are applicable to this contract. The contractor has to comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, excavations, trenches and safe means of entry and egress.			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.10.2 PREVENTION OF RISKS AND ELECTROCUTION												
Labour	Construction areas, material storage and worker camps	OHS	Impact to worker safety	Medium			✓		All electrical wiring and supply related work should confirm to **British Standards (BS) or relevant Maldivian Standards**. Adequate precautions will be taken to prevent danger of electrocuting from electrical equipment and power supply lines including distribution boards, transformers, etc. Measures such as danger signboards, danger lights, fencing and lights will be provided to protect the public and workers. All electric power driven machines to be used in the construction shall be free from defect, be properly maintained and kept in good working order, be regularly inspected and as per BS provisions and to the satisfaction of the Engineer.	Contractor	MRC	Engineering Cost
2.10.3 RISK AT HAZARDOUS ACTIVITY												
Labour	Construction areas, material storage and worker camps	OHS	Impact to Worker health	High			✓		All workers employed in hazardous activities shall be provided with necessary protective gear. These activities include mixing asphalt material, cement, lime mortars, concrete etc., welding work, work at crushing plants, blasting work, operators of machinery and equipment such as power saws, etc.	Contractor	MRC	Engineering Cost
							✓		Substitute harmful chemicals for less harmful chemicals. The use of any toxic chemical shall be strictly in accordance with the manufacturer's instructions. The Engineer shall be notified of toxic chemicals that are planned to be used in all contract related activities. A register of all toxic chemicals delivered to the site shall be kept and maintained up to date by the Contractor. The register shall include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product			
									Materials Safety Data Sheets MSDS) and International Chemical Safety Cards (ICSC) should be visible for workers to see in their language			
2.10.4 LEAD POLLUTION												
Labour	Workshops, yards where spray painting is done	OHS	Impact to Worker health	Medium		✓			The Contractor shall at all times take every possible precaution and shall comply with relevant laws and regulations relating to the importation, handling, transportation, storage and use of explosives. Contractor shall obtain **MNDF** approval for importing and handling explosives	Contractor	MRC	Engineering Cost

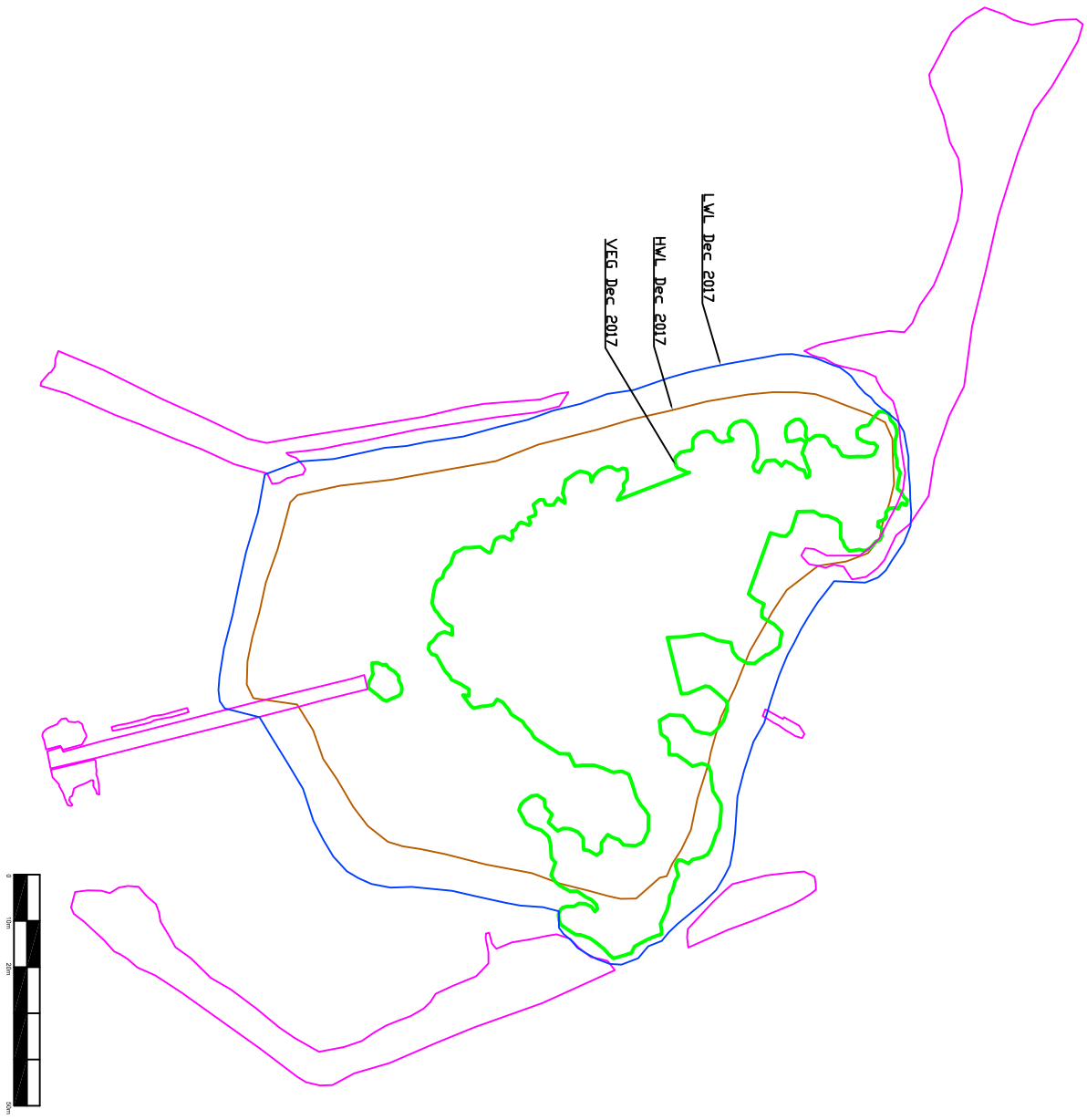
Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.11 HEALTH AND SAFETY												
2.11.1 PREVENTION OF VECTOR BASED DISEASES												
Disease	At worker camps, stores, yards	OHS	Impact to Worker health	Medium		✓			Contractor shall take necessary actions to prevent breeding of mosquitoes at places of work, labour camps, plus office and store buildings. Stagnation of water in all areas including gutters, used and empty cans, containers, tires, etc. shall be prevented. Approved chemicals to destroy mosquitoes and larvae should be regularly applied. All burrow sites should be rehabilitated at the end of their use by the contractor in accordance with the requirements/guidelines issued by the relevant local authorities Contractor shall keep all places of work, labour camps, plus office and store buildings clean devoid of garbage to prevent breeding of rats and other vectors such as flies.	Contractor	MRC	Engineering Cost
2.11.2 WORKERS HEALTH AND SAFETY												
Labour	Within construction sites, workshops and worker camps	OHS	Impact to Worker health and safety	Medium			✓		Contractor shall comply with the provisions in Health Protection Agency Protocols with regard to provision of health and safety measures and amenities at work place(s).	Contractor	MRC	
2.11.3 FIRST AID												
Labour	Within construction sites, quarry, crusher, concrete batching plants, workshops and worker camps	OHS	Impact to Worker health and safety	Medium			✓		At every workplace, first aid kit shall be provided as per the regulations. At every workplace an ambulance room containing the prescribed equipment and nursing staff shall be provided.	Contractor	MRC	Engineering Cost
2.11.4 POTABLE WATER												
Drinking water	Within construction sites, quarry, crusher, concrete batching plants, workshops and worker camps	OHS	Impact to Worker health and safety	Low	✓				In every workplace and labour camps portable water shall be available throughout the day in sufficient quantities.	Contractor	MRC	Engineering Cost

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.11.5 HYGEINE												
Labour	Worker camps and temporary sheds at work sites	OHS	Impact to Worker health and safety Impact to Worker health and safety	Low		✓			The contractor shall provide and maintain necessary (temporary) living accommodation and ancillary facilities for labour to standards and scale approved by the engineer.	Contractor	MRC	Engineering Cost
									At every workplace and labour camps sufficient number of bathing facilities, latrines and urinals shall be provided in accordance with the Health and Safety regulations and/or as directed by the Engineer. These bathroom and toilet facilities shall be suitably located within the workplace/buildings. Latrines shall be cleaned at least three times daily in the morning, midday and evening and kept in a strict sanitary condition. If women are employed, separate latrines and urinals, screened from those for men and marked in the vernacular shall be provided. There shall be adequate supply of water, within and close to latrines and urinals			
				Medium		✓		Open disposal to sea	The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.			
				Medium			✓	Waste Regulations	Garbage bins must be provided in the camp, work sites and regularly emptied and the garbage disposed of in a hygienic manner. Construction camps shall have a clean hygienic environment and adequate health care shall be provided for the work force.			
				Medium	✓			Waste Regulations	Unless otherwise arranged for by the relevant local authority such as local level or atoll councils, the contractor shall arrange proper disposal of sludge from septic tanks. The contractor shall obtain approval for such disposal from the EPA.			
2.12 PROTECTION OF ARCHAELOGICAL, CULTURAL, AND RELIGIOUS PLACES AND PROPERTIES												
2.11.1 PREVENTION OF DAMAGE TO CULTURAL AND RELIGIOUS PLACES AND PROPERTIES												
Masonry and Construction, topsoil removal, site clearance	Near physical cultural resources	Loss of heritage	Impact to community	Low	✓				During construction activities the contractor should take all necessary and adequate care to minimize impacts on cultural properties which includes cultural sites and remains, places of worship. Workers should not be allowed to trespass in to such areas.	Contractor	MRC	

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.12.2 CHANCE FINDS OF ARCHAELOGICAL PROPERTY												
Masonry and Construction, topsoil removal, site clearance	In all project sites	Loss of heritage	Impact to community	Low		✓			All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest etc. discovered on the site and/or during construction work shall be the property of the government of Maldives. The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, awaiting which all work shall be stopped within 100m in all directions from the site of discovery. If directed by the Engineers the Contractor shall obtain advice and assistance from the relevant local authorities such as Department of Heritage and Ministry of Tourism on conservation measures to be taken with regard to the artefacts prior to recommencement of work in the area.	Contractor	MRC	
2.13 ENVIRONMENTAL ENHANCEMENT												
2.13.1 LANDSCAPING												
Revegetation, landscaping, replanting	All project sites and associated sites			Medium	✓		✓	National Biodiversity Strategy Action Plan (NBSAP)	Landscape plantation, re-vegetation etc, shall be taken up as per either detailed design or typical design guidelines given as part of the Bid Documents. The contactor also shall remove all debris, piles of unwanted earth, spoil material, away from the roadsides and from other work places and disposed at locations designated or acceptable to the Engineer or as per Clause 2.1.1. On completion of the works, the temporary structures shall be cleared away in full, all rubbish burnt, waste dumps and septic tank shall be filled and closed and roadsides, workplaces and labour camps, cleared and cleaned.	Contractor	MRC	Engineering Cost
					✓			Waste Management Regulations 2013	In case of an inadvertent damage cause to a utility, the contractor shall immediately inform the service provider and help to restore the service without delay.			

Activity	Location/Project Phase	Aspect	Impact	Risk Rating	Control in Place			Method	Proposed Protective and Preventative Measures	Institutional Responsibility		Mitigation Cost
					Yes	No	Planned			Implementation	Supervision	
2.13.3 HANDLING ENVIRONMENTAL ISSUES DURING CONSTRUCTION												
Management of environmental and social issues	Relevant construction sites during the construction period	Environmental and social issues	Implementation of the EMP	Medium		✓			For large contracts, the Contractor will appoint a qualified Environmental Officer following the award of the contract. The Environmental Officer will be the primary point of contact for assistance with all environmental issues during the pre-construction and construction phases, and will be responsible for ensuring the implementation of EMP	Contractor	MRC	Engineering Cost
			Implementation of the ESMP			✓			The Contractor shall appoint a person responsible for community liaison and to handle public complaints regarding environmental/ social related matters. All public complaints will be entered into the Complaints Register. The Environmental Officer will promptly investigate and review environmental complaints and implement the appropriate corrective actions to arrest or mitigate the cause of the complaints. A register of all complaints is to be passed to the Engineer within 24 hrs. They are received, with the action taken by the Environmental Officer on complains thereof			
		Grievance and redress	Transparency and established feedback mechanism between project and stakeholders			✓			Contractor shall develop suitable method to receive complaints. The complaint register shall be placed at a convenient place, easily accessible by the public.			
		Environmental and social issues	Implementation of EMP			✓			Contractor shall prepare detailed Environmental Method Statement (EMS) clearly stating the approach, actions and manner in which the EMP is implemented. It is required from the contractor to prepare the EMS for each work site, if work will be carried out at more than one site at once and time plan for implementation. The EMS shall be updated regularly and submit for Engineers review.			

Appendix 8 Island survey map of Maniyafushi (Oct 2017)



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Title:

Page: A - 01/01

Maniyafushi
Client: MOFA
Project Number: -
Date: -

Architect :-
Engineer : -
Drawn by : -
Services : -
Interior : -

Rev no	Date
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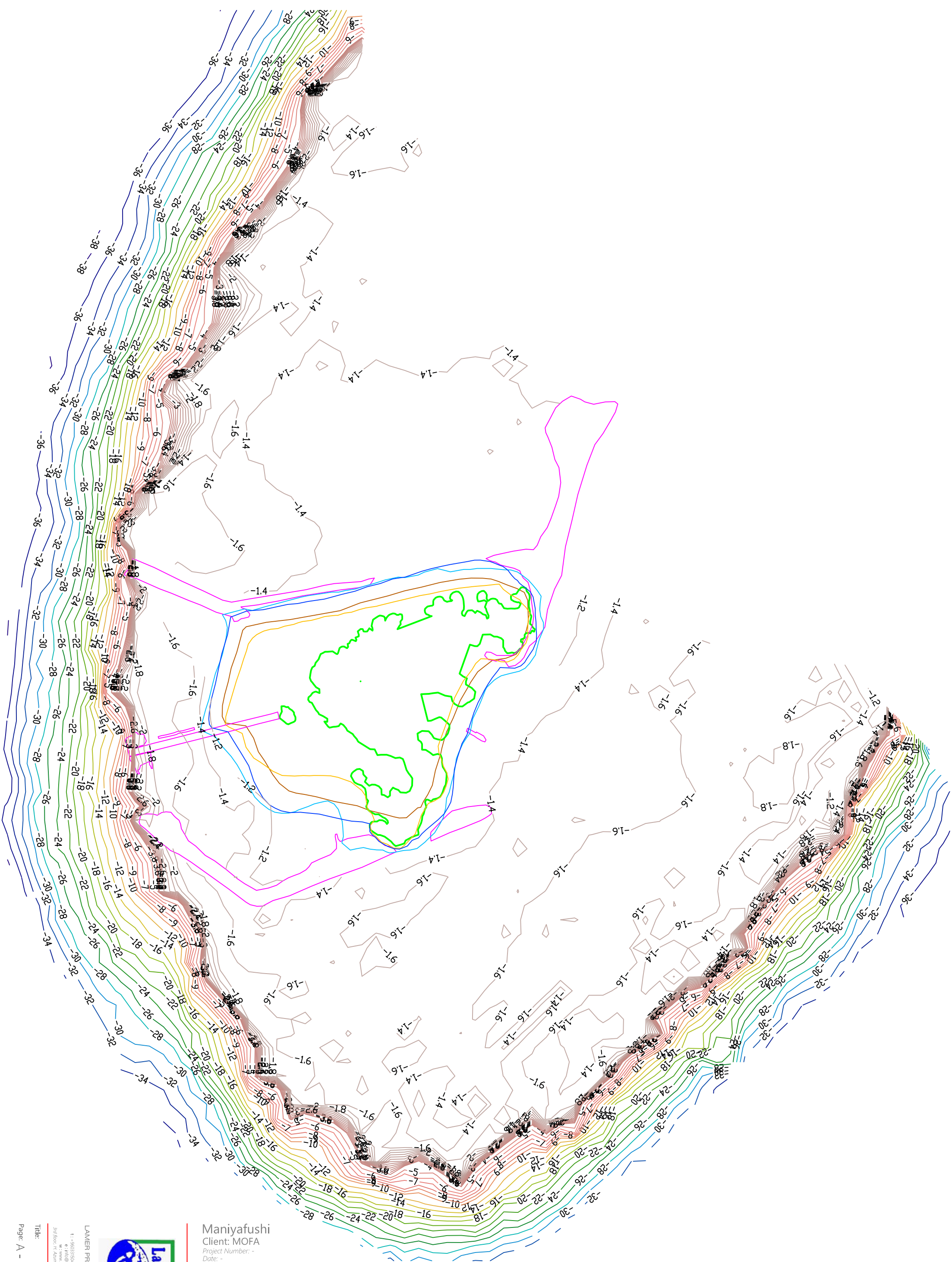
Appendix 9 Bathymetric survey map



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Maniyafushi

Client: MOFA

Project Number: -

Date: -

Architect :-
Engineer : -
Drawn by : -
Services : -
Interior : -

Rev no	Date
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Appendix 10 Water test results report

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

MWSC

WATER QUALITY TEST REPORT

Report No: 500178079

Customer Information:
Land & Marine Environment Resources
H.Azum
Ameeneemagu
Male' MALE

Report date: **27/12/2017**
Test Requisition Form No: **900182740**
Sample(s) Recieved Date: **25/12/2017**
Date of Analysis: **25/12/2017 - 25/12/2017**

Sample Description	Control (Maniyafushi)	Site 1 (S1,Maniyafushi)	Site 2 (S2,Maniyafushi)	**TEST METHOD**	**UNIT**
Sample Type	Sea Water	Sea Water	Sea Water		
Sample No	83195666	83195667	83195668		
Sampled Date	23/12/2017	23/12/2017	23/12/2017		
PARAMETER	**ANALYSIS RESULT**				
Physical Appearance	Clear with particles	Clear with particles	Clear with particles		
Nitrate	3.1	3.7	3.0	Method 8171 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Nitrogen Ammonia	<0.02 (LoQ 0.02 mg/L)	0.03	<0.02 (LoQ 0.02 mg/L)	Method 8038 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Phosphate	<0.05 (LoQ 0.05 mg/L)	<0.05 (LoQ 0.05 mg/L)	<0.05 (LoQ 0.05 mg/L)	Method 8048 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L

Keys: mg/L : Milligram Per Liter

Checked by

Aminath Sofa
Assistant Laboratory Executive

Approved by

Adam Rasheed
Manager, Quality

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

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

Appendix 11 List of stakeholders consulted

Office	Name	Designation	Contact
Environmental Protection Agency	Adam Mubeen	Assistant Engineer	7588930
	Ahmed Afrah Ismail	Engineer	9690600
	Aminath Mohamed	Environment Analyst	7504494
	Riffath Naeem	Senior Environment Analyst	3335949
Health Protection Agency	Moosa Haneef	Senior Public Health Program Officer	7423180
Kaafu Atoll Council	Abdul Waris	Vice president	7955002