ENVIRONMENTAL IMPACT ASSESSMENT

FOR

ESTABLISHING A REGIONAL LABORATORY

AT

HDH. HANIMAADHOO, MALDIVES

PROPONENT

MINISTRY OF ENVIRONMENT, CLIMATE CHANGE AND TECHNOLOGY

MALDIVES

CONSULTANT

Mr. Adam Saaneez

(EIA P03/2020)

MALDIVES

PREPARED BY

esis

OCTOBER 2021

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LEAD CONSULTANT'S DECLARATION

I certify that the statements made in this Environment Impact Assessment are true, complete and correct to the best of my knowledge and available information.

Mr. Adam Saaneez

EXECUTIVE SUMMARY

1. The purpose of this EIA is to critically analyse and assess the potential environmental impacts associated with the establishment of a regional water testing laboratory at Hanimaadhoo, Haa Dhaalu Atoll and present the solutions and preferred alternatives as well as mitigation measures to minimize any negative impacts whilst trying to derive the maximum positive impacts from the project;
2. Existing regulations and operating licensed issued by URA require the water supplied by utility companies to adhere to a specific standard, which includes daily, weekly, monthly, and annual testing of water. In addition to this, regular testing of groundwater and seawater at point of discharge is required for sewerage systems as well. Most islands cannot complete regular water testing due to a lack of facilities.
3. In addition to this, the existing mechanism for all islands is to send regular water samples to Male' for testing as MWSC and NHL are the two facilities with fully equipped laboratories capable of testing water samples.
4. The laboratory is proposed to be constructed at a location whereby public nuisance could be minimised as it is close to the industrial zone where the current powerhouse and water plant are located. The project will also involve construction of admin building, and chemical storage. The rooms for chemical, microbiological and wastewater testing have been separated to comply with best practise and ISO 17025 standards.
5. The construction works of the laboratory facility presented in this report are not expected to adversely impact the environment if the mitigation measures mentioned in the report are followed. The most important mitigation measures are daily maintenance of machinery, following chemical handling procedures, waste segregation and storage in closed labelled containers until disposal to Vandhoo or Thilafushi.
6. Potential groundwater contamination from chemical spills and oil spills during fuel handling and vegetation clearance are the most significant environmental impacts associated with the project. Therefore, handling of fuel or other chemical substances has to be as per the fuel handling procedure and the chemical storage procedure. Since the proposed is vegetated, vegetation clearance is required.
7. Overall, the proposed project is expected to bring in positive outcomes. It is expected that the newly established regional laboratory can cater to operators of water supply and sewerage systems in inhabitant islands, tourism and industrial islands in the region, ensuring the safety of supplied water and reduce the contamination of groundwater and marine life due to sewage by ensuring the quality of sewerage system and outfall pipe through regular monitoring by test water samples.

ސާދާ ޚުލާސާ

1. މި އީ.އައި.އޭ ގެ ބޭނުމަކީ ހދ.ހަނިމާދޫގައި ފެން ތަހުލީލު ކުރާ ލެބޯރެޓަރީއެއް ޤާއިމު ކުރުމުގެ ސަރަހައްދުން ތިމާވެއްޓަށް ދިމާވާނެ މައްސަލަތައް ދެނެގަނެ މިމައްސަލަތައް ހައްލު ކުރެވޭނެ ގޮތްތައް ހޯދާ މިމަޝްރޫޢުގެ ސަރަހައްދުން ކުރާނެ ފައިދާތައް ބަޔާންކުރުމެވެ.
2. ދިވެހިރާއްޖޭގެ ތިމާވެށީގެ ޤާނޫނު (ޤާ.އާ.ނ.4) ގެ ގަވާއިދުތަކާއި، އެޕްރޫވަލްތަކާއި ލައިސަންސްގެ ދަށުން ޤާއިމު ކުރެވޭ ނަޝަނަލް ގާއިދު ކަނޑައަޅާ ހަދާއިރު ރިޢާޔަތް ކުރަންވާނެ ޙާލަތްތަކާއި ގަވާއިދުތައް ދެނެގަނެ ބަޔާންކޮށްފައިވެއެވެ. މިކަމުގެ ދަށުން ގުޅޭ ދާއިރާތަކުގެ ގަވާއިދުތަކާއި، އެއްވަރަކަށް ހުރިހާ އުސޫލުތަކާއި ރިޢާޔަތް ކުރެވިފައިވާ ގޮތް ކަނޑައަޅާ ޤާއިމުކުރެވިފައިވާނެއެވެ. އަދި ނަމޫނާ ނިންމުމަށް ކުރިއަށް ގެންދެވޭ ރަސްމީ ކަންތައްތަކާއި ގަވާއިދު ކަނޑައަޅާ ބޭނުންކުރެވޭ ބައިބަލާ ކަމުގެ ގޮތުން ވާނެއެވެ. ނަމަވެސް ދިނަ ރަސްމީ ކަންތައްތަކުގެ މަޢުލޫމާތު ކަނޑައަޅާ ވަސީލަތްތައް ޤާއިމު ކުރެވޭނެ ނެތެވެ.
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1 INTRODUCTION AND RATIONALE

1.1 Introduction

This Environmental Impact Assessment (EIA) is prepared in accordance with the Environmental Impact Assessment Regulation 2012 to assess the impacts of establishing a regional laboratory in HDh. Hanimaadhoo.

This EIA aims to identify and determine the significance of potential impact construction and operation of the laboratory in Hanimaadhoo.

1.1.1 Proponent

This EIA is initiated by the Ministry of Environment, Climate Change and Technology. The project is financed by the Green Climate Fund and will be implemented by the Ministry of Environment, Climate Change and Technology as the Implementing Agency.

The details of the proponent are as follows:

Wilshana Moosa
Project Coordinator
Ministry of Environment, Climate Change and Technology
Green Building, Male'
Contact: 3018300

1.1.2 Contractor

The civil works of the project or procurement of machinery and materials have not been contracted out to any party to date.

1.1.3 EIA Consultant

The EIA consultant for this project is Mr. Adam Saaneez, representing ESIS Pvt Ltd.

1.2 Background to the Environmental Impact Assessment

1.2.1 Purpose and Scope of EIA:

The development of a regional laboratory equipped with facilities to test the quality of water supplied to households, monitor the wastewater disposal consistency and addition of a biological and microbiological test lab will help overcome the challenges in ensuring access of safe water to all and proper disposal of wastewater. To achieve the policy objective of "Establish and improve regional water quality testing facilities to ensure timely water quality monitoring and reporting" (MEE 207, National Water and Sewerage Policy, Policy Goal 1.7), 6 regional laboratories have been proposed across the nation with Hdh. Hanimaadhoo being the first regional lab to be developed of its kind.

Currently, the only solution for most islands in Maldives to adhere to Utility Regulatory Authority (URA) regulations for water and sewerage systems' water testing requirement is to regularly send the water samples to Male' for testing. In construction projects where dewatering is required, the groundwater needs to be tested as well. These tests can currently be done to a competent standard at Male' Water and Sewerage Company (MWSC) and National Health Laboratory (NHL) laboratories.

This project provides an alternative solution to the islands in the northernmost region of the island to test their water samples at a lower cost and burden than now.

This document has been developed based on the Terms of Reference (Appendix A) issued by the Environmental Protection Agency (EPA) on 14th July 2021.

1.2.2 EIA Implementation and Methodology

This study was mainly based on data collected during a field investigation mission on 5th August 2021 by the consultancy group ESIS Consulting Pvt. Ltd. The design work for the project was done by Epoch Associates Pvt. Ltd. The EIA is based on this design, input from the island council, the community, and the proponent. The EIA is compiled by Adam Saaneez (Lead Consultant).

Established and widely accepted methods have been applied in this EIA study. Field studies have been undertaken using methods generally employed for EIA studies in the Maldives – and each of the relevant sections describe the field assessment methodologies at the beginning of their respective sections.

1.2.3 Review and Updates:

Ministry of Environment, Climate Change and Technology (MECCT) is responsible to review and initiate any addendums to the EIA if they are to assure that the EIA reflects the facilities and the operations of the laboratory and address any changes to the regulatory requirements.

1.2.4 EIA Approval:

The EIA will be reviewed by the Environmental Protection Agency within 5 days of submission to the agency. A Decision Statement (DS) will be issued by the EPA to the proponent, and the project can only be executed upon approval of the EIA through the release of the DS.

1.2.5 Document Control:

MECCT is mandated to ensure that the Contractor as well as the associated Sub-Contractors are familiar with the EIA requirements. MECCT is required to disseminate the information to relevant parties. A copy of this EIA and the Decision Note for the development of a regional laboratory facility in HDh. Hanimaadhoo must be kept at MECCT as well as at HDH. Hanimaadhoo Council at all times.

1.3 Rationale and Background to the Project

1.3.1 Aims and Objectives of the project

The primary objective of the proposed project is to establish a regional water testing laboratory at Hdh. Hanimaadhoo which can cater for the surrounding atolls of Haa Alif, Haa Dhaalu, Shaviyani and Noonu Atoll.

The purpose of this EIA is to critically analyze the environmental and socio-economic impacts which may arise due to the construction of the proposed laboratory facility at HDh.Hanimaadhoo. After analyzing the impacts, it would then be possible to suggest proper mitigation measures to prevent/reduce any negative impacts and to enhance any positive impacts. The study involves the evaluation of baseline conditions, prediction of the likely impacts, stakeholder consultation, and design mitigation measures.

1.3.2 Project Rationale

The lack of adequate laboratory facilities in outer islands is noted as a key challenge to ensure access of safe water and proper disposal of wastewater. As such, the water supply and sewerage systems on most islands are designed with basic laboratory facilities within the administration buildings which can carry out daily or weekly testing requirements set forth by the regulatory authorities. These on-site laboratories have limited capacity to conduct physical and chemical quality tests on only water and wastewater. Furthermore, there are difficulties in meeting the microbial testing requirements.

URA and EPA enforce regulations to test different types of water at regular intervals. Most islands do not have the capacity to adhere to these regulations within their community, and therefore send regular water samples via airfreight, speedboats or cargo boats to Male' laboratories of MWSC and NHL for water testing. The cost of sending the samples, as well as the cost of testing the samples is a large burden for most islands.

Implementation of this project will allow the islands of Haa Alifu, Haa Dhaalu, Shaviyani and Noonu atoll to send over their water samples to Hdh, Hanimaadhoo at a much lower price and get their water samples tested at a competitive price, saving both time and energy.

1.3.3 Completed Tasks

Currently, the detailed design of the laboratory has been approved by the relevant authorities. The bid documentation preparation is ongoing.

1.4 Project Location

The primary allocated land is located on the eastern side of the island, next to the island council (Figure 2.1). An A3 sized map of the area is attached in Appendix C. The total area of the land is 1105.27 sqm or 0.11 Ha as shown in Figure 2.2.

The land is allocated adjacent to the council office. The laboratory facility does not have any machineries or equipment that could cause significant noise or air pollution. Moreover, the laboratory requires easy access for customers which is provided by this location with approaching roads from the harbor providing direct access to the location. As a result, there are no significant disturbances in accessing the location even though the lab is to be constructed close to a residential area.

Figure 1.1 Primary location of the regional laboratory at HDh. Hanimaadhoo

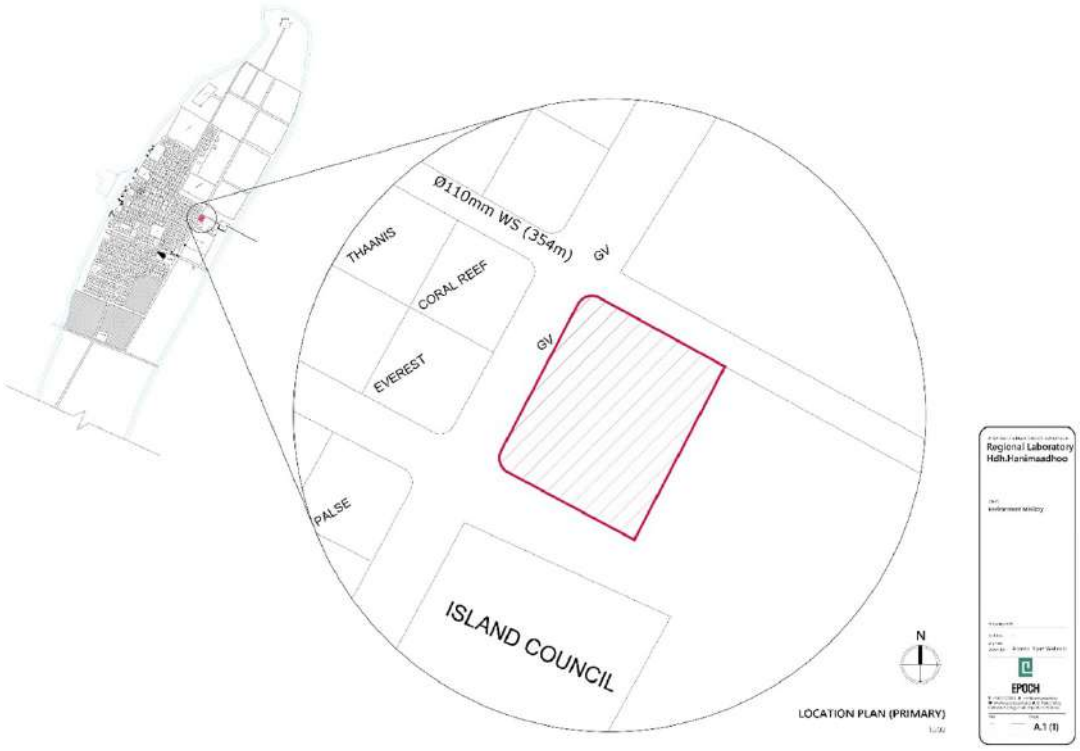
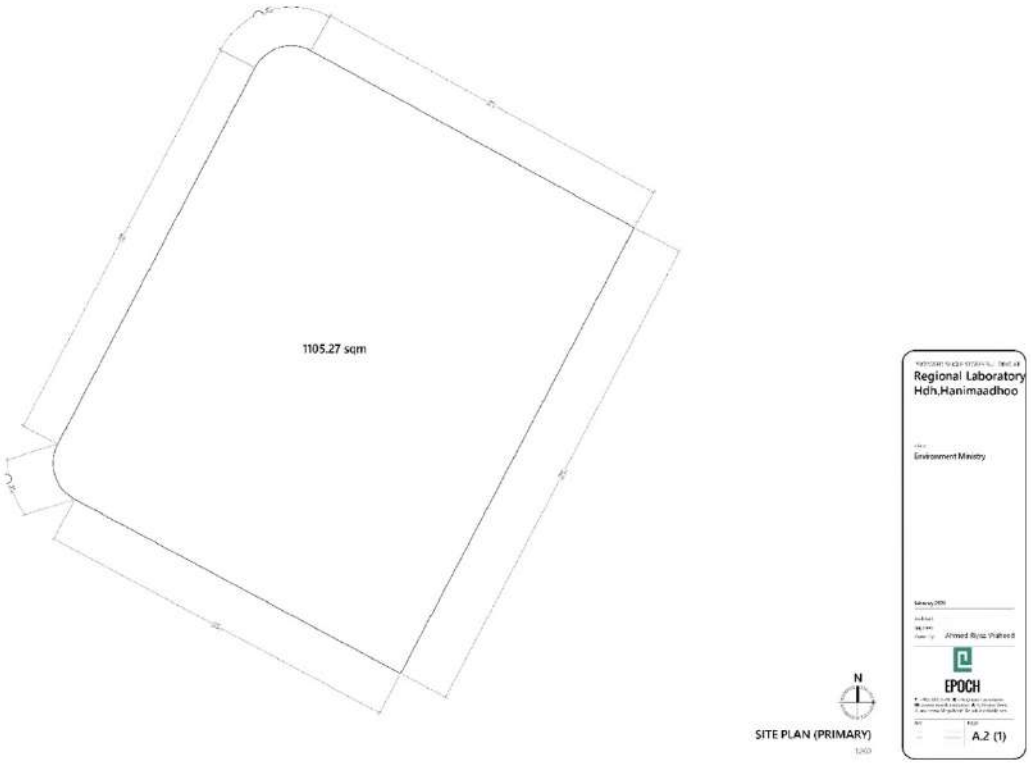


Figure 1.2 Boundary wall and land size



1.4.1 Relevant developments in the area

The road construction project is ongoing in Hanimaadhoo, which will improve access to the laboratory.

1.4.2 Protected and Sensitive Areas

There are no protected areas relevant to current project within a radius of 10 km from Hanimaadhoo. However, there is a sensitive area adjacent to the proposed plot for construction, which is a mangrove area as shown below:

Figure 1.3 Mangrove area marked in red

1.4.3 Historical Sites

There are no significant historical sites that are relevant to the project.

2 DESCRIPTION OF PROPOSED PROJECT

The main aspects of the project can be divided into the following stages.

1. Construction of main building and support buildings
2. Outfitting the laboratory
3. Operation of laboratory

The below sections will outline how the project has been designed and how the lab is intended to operate. For any further reading, please refer to the detailed design document in Appendix C.

2.1 Project Design

2.1.1 Approved Design

The building form is in three main massing blocks connected by a shaded walkway with access to a shared parking area.

Table 2.1 Blocks in the laboratory facility design

Block Name	Space Description	Area (sqm)
Administrative Block	Reception	15.24
	Security	5.13
	Office Area	33.77
	Toilet	2.36
	Meeting Room	17.92
	Pantry	9.89
Laboratory Block	Water Test Lab	38.29
	Bio and Micro Test Lab	30.93
	Wastewater Lab	30.53
	Common Corridor (staff area)	9.52
	Wash Area	5.05
Storage and Waste Management	Storage	39.29
	Garbage Area	8.04
Parking Shed	Motor and four-wheel vehicles	75.00
Total Built Up Area		300.00
Total Plot Area		1,105.52

2.1.2 Masterplan concept

The primary focus of the laboratory facility's architectural program is health and safety. An A3 drawing of the buildings is given in Appendix C. Pertinently, careful consideration has been given to easing the vehicular and pedestrian movement in and around the proposed site and buildings. A main design aim of the architectural project is to create modular buildings that would be able to duplicate, adapt, and expand to different sites with minimal changes.

The three blocks are the Administrative block, Laboratory block and the Storage and waste management block. These separate blocks are connected by a shaded walkway, to provide ease and

safe access with shelter from sun and rain. All three blocks have access to the facility's shared parking area which has been designated accounting for functionality, safety, and efficiency.

Administrative Block

Administrative Building serves as the main entrance to the facility. The building spaces are categorized into public, semi-private and private areas as per Table 2.1.

Laboratory Block

The main consideration in designing the laboratory block is achieving ISO 17025 standard compliance certification. Three different testing rooms are designated for the main categories of water testing: namely, physical, chemical, and microbiological. The laboratory block consists of;

1. Microbiological Laboratory
2. Wastewater Laboratory
3. Chemical Laboratory
4. Common Corridor
5. Toilet / Wash area

Entry to all three laboratories is via an access controlled common corridor. This allows for the restriction of unauthorized entry to the laboratory area, while also facilitating easy movement in between the laboratories for authorized personal.

Microbiological Laboratory

The microbiological laboratory is housed in a separate room to ensure a sterile and controlled environment which decreases the risk of sample contamination. The room area is approximately 30m^2. It is assessed that all the essential equipment, including an autoclave machine, refrigerator for reagents and the required number of incubators can be accommodated within the room, minimizing the transfer distance of samples, and testing apparatuses, further reducing the risk of contamination. Door and window numbers and types are determined with the aim of achieving a reasonable degree of dust proofing.

Wastewater Laboratory

Wastewater can be unpleasant and separating these rooms can decrease the toxic fumes and gases released from filling the entire chemical lab. As experiments such as BOD and COD will be conducted in this room, consideration is given to maximize the work bench space available to conduct such tests. Similarly, storage space for equipment and reagents is maximized. Experiments such as BOD and COD will be conducted in this room hence it requires a lot of bench space. A sizable sink is placed inside the room for easy access.

Chemical Laboratory

As this is the main testing room with the most instruments and equipment, bench top space is maximized to meet the requirements. Similarly, storage space for chemicals and glassware is also maximized. The fume hood allocation space is at a corner of the room, with acid storage cabinet space provided adjacently.

Storage and Waste management Block

It is important to store the chemicals and reagents properly, to prevent accidental contamination. The architectural program considers the need for temperature and humidity control within the storage area. It also considers desired minimum spacing of 4ft between storage isles. As per safety requirements the storage and waste management block have two exits.

Building Access Control System

The entrance area, security room and office area have an electromagnetic door lock system which is accessible by RFID card reader for only authorized personals. Forced entry into the building activates the alarm located at the security room.

The main door into the staff area of the laboratories is equipped with RFID card readers which allows the staff access to all three laboratories. Visitor access will not be authorized unless with confirmation from security room/office personal.

The storeroom main door is equipped with an electromagnetic door lock system accessible by RFID card reader. The back door of the storeroom facing the laboratory building has an electromagnetic door lock which is only openable from the inside of the storeroom with the help of a push button.

CCTV & Security System

Cameras are installed at the main entrance area, entrance to the buildings and common corridors with 24 hours video recording. The CCTV system will be designed to include a network video recorder to record the footage of each camera for playback if necessary.

Security cameras will be placed at the building perimeter to keep track of the activity within the premises and the surrounding area.

The centralized CCTV system equipped with monitors and a network video recorder for cameras in and around the building is located at the security room.

2.1.3 Health and Safety

The health and safety plan is based on the National Fire Protection Agency's (NFPA) 45: "Standard on fire protection for laboratories using chemicals", 2019 edition. The standard is designed to control hazards and protect personnel from the toxic, corrosive or other harmful effects to which personnel might be exposed to because of fire or explosion. It was made with the objective to limit injuries to occupants, emergency response personnel and limit property loss to a maximum of a single laboratory unit.

The plan is incorporated into the laboratory unit design and construction, and the fire protection details of the building. Also, ventilating systems and hood requirements, as well as chemical storage and handling procedures given in NFPA 45 will be closely followed. This will apply to the laboratory operations and the laboratory apparatus as well.

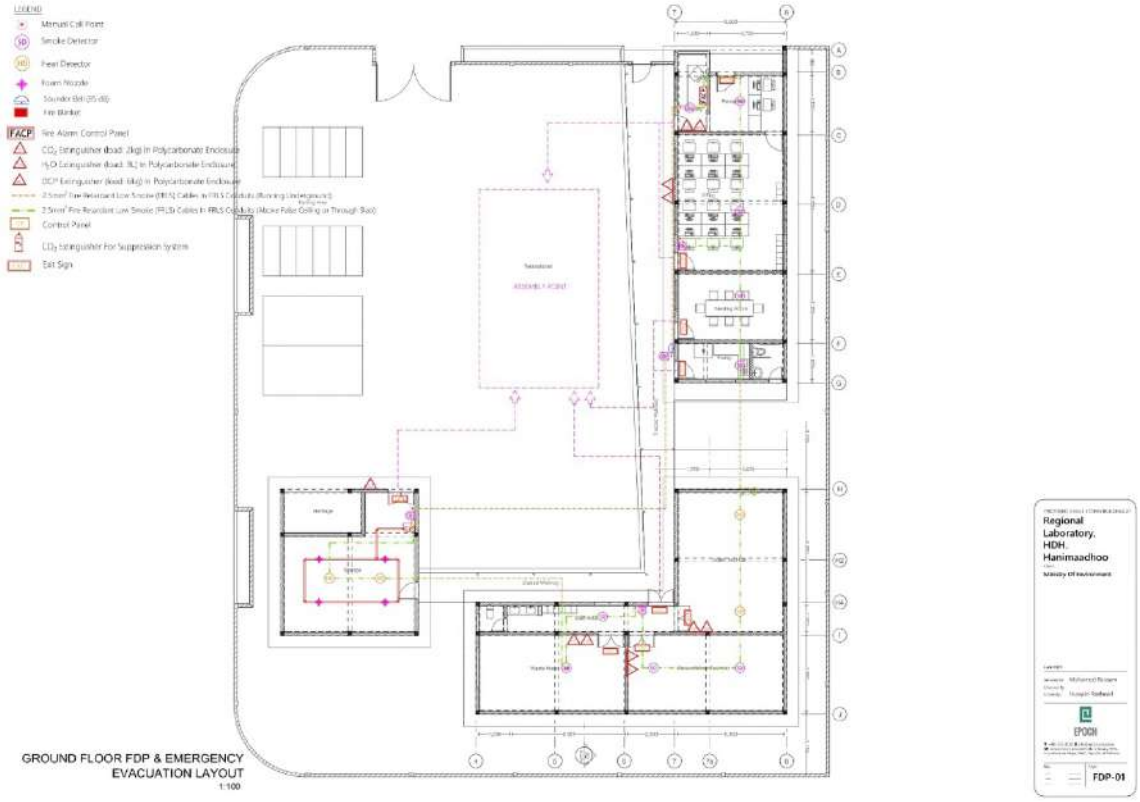
Evacuation Procedure

Evacuation procedure will be incorporated with and will be part of the emergency action plan. A specific personnel will be in-charge of conducting evacuation drills and to take initiative in case an emergency arises where evacuation of the facilities is required. These personnel need to be trained for such scenarios and should take initiative to increase awareness of the rest of the staff and all

visitors to the laboratory facilities. Evacuation should immediately be conducted whenever the fire alarm sounds.

Every room in the laboratory facility will have the fire escape doors and the emergency evacuation layout including walkways and assembly points clearly marked. Any assembly point will be clearly labeled as such. Emergency lights will be placed in all laboratory rooms and chemical storage locations to aid in case of a power blackout. Emergency walkways will also be well-lit to indicate the pathway to the assembly point. The evacuation plan is shown below:

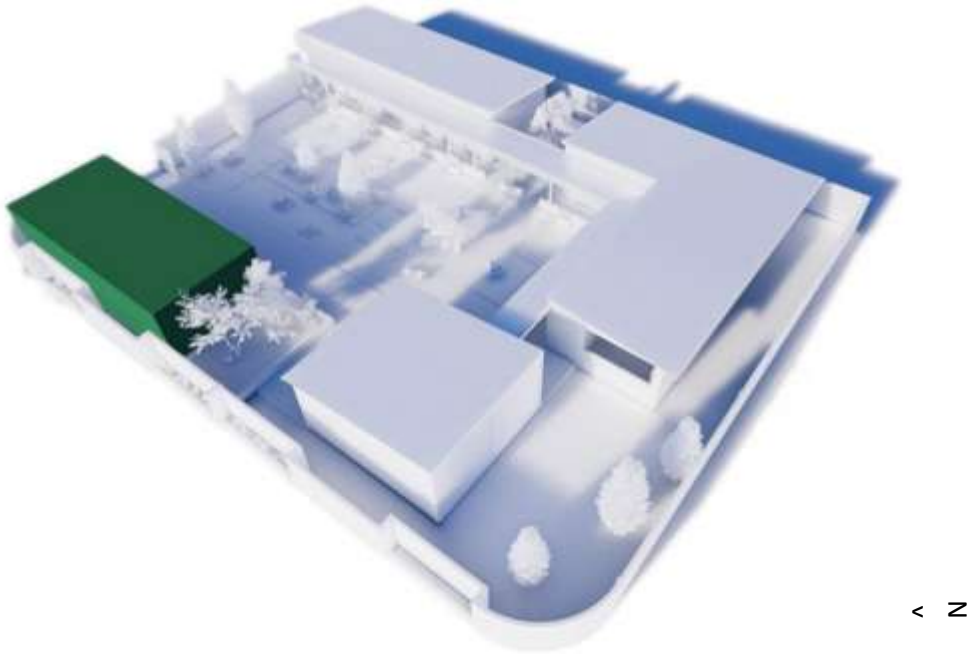
Figure 2.1 Evacuation Plan



2.1.4 Parking and accessibility

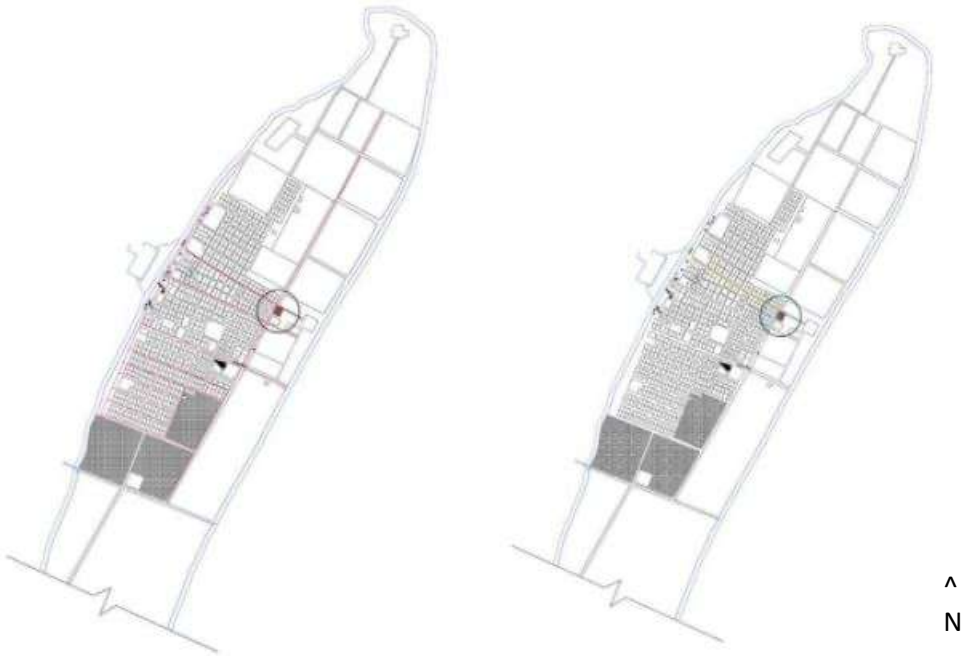
The parking shed is a minimalist standalone structure which is designed to accommodate 12 motorbikes and 2 four-wheel vehicles. The location of the parking is at the corner of the site for accessibility and easy access to the buildings. The location of the parking shed in relation to the overall building is highlighted in green in the figure below.

Figure 2.2 Parking shed location



To provide easy access to the Laboratory for both vehicles and pedestrians, the site is located at a corner plot on a main road from the harbor and a main road at west of the island. There are several main roads on the island and these roads are used for both vehicular and pedestrian movements. Figure 3.3.1 shows the main roads on the island marked in light red and the main access road from the harbor and the possible pedestrian access to the site marked in yellow and blue respectively.

Figure 2.3 Pedestrian access from the harbour (left) and pedestrian access roads (right)

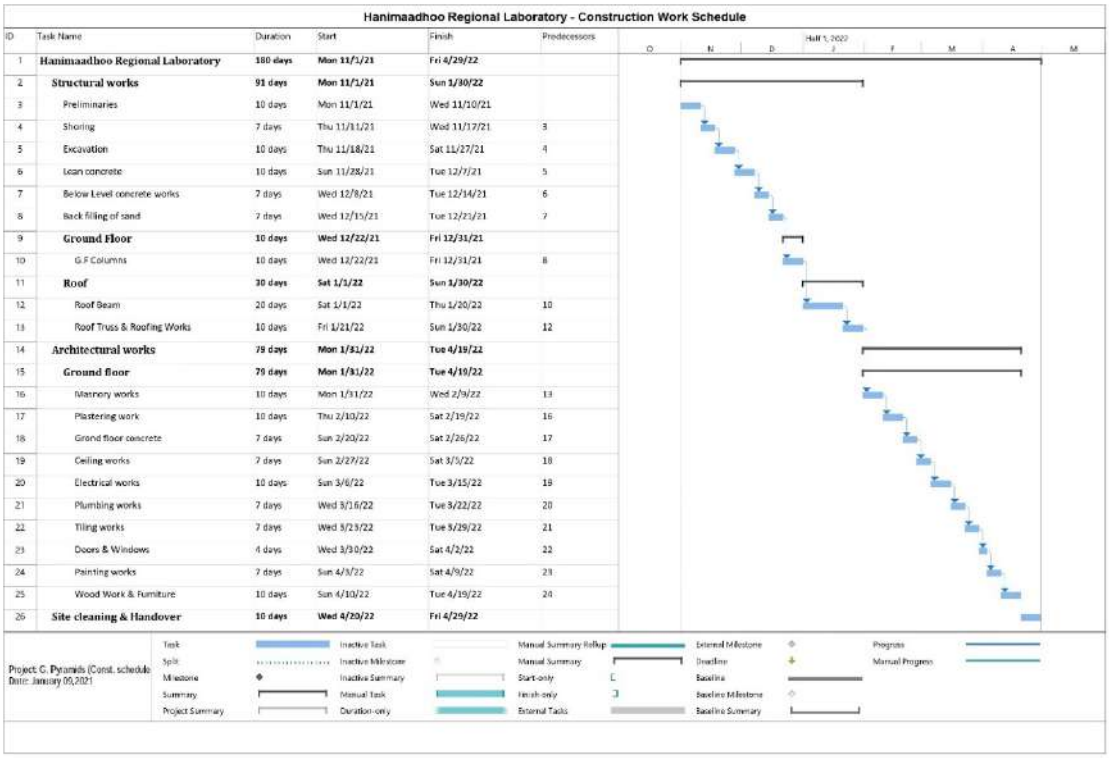


2.2 Project Development

2.2.1 Project schedule

The construction scheduled is as below.

Figure 2.4 Construction schedule



2.2.2 Activities completed

A baseline assessment of the project was done by Epoch Associates prior to the proposed construction phase of the project. This assessment includes an inception report, concept report, as well as detailed design of all the components of the project. The TOR for this assessment was made by Ministry of Environment, Technology and Climate Change. The components of the assessment are:

Phase IA: Data collection – Complementary Diagnosis

This phase includes conducting desk review and carrying out the necessary investigations required to produce the Inception Report which identifies technical requirements, possible customer markets and potential risks and constraints.

Phase IB: Preliminary Design

This phase includes concept design for the building and services, building a business model incorporating financial feasibility analysis and developing ISO 17025 standard certification requirements and procedures.

Phase IC: Environmental and Social Impact Assessment (EIA)

This phase undertakes an environmental and social impact assessment of all solutions according to EPA guidelines and subject to their approval. All effects of construction and operation of the regional laboratory on terrestrial and marine environment is being addressed and evaluated in this phase. Relevant avoidance and mitigation measures are also identified.

Phase II: Detailed Design

The second phase developed detailed design of the regional laboratory main building and support structures accounting for the EIA and planning for implementation of mitigation measures. The Detailed Design Report contains three parts:

- Part 1 (Main report) - approved by registered architectural checker, structural checker, architect and licensed engineer and checked and approved by Ministry of National Planning, Housing and Infrastructure and Utility Regulatory Authority.
- Part 2 (Bill of Quantities and Cost Estimate) - Bill of Quantities for each structure and then by type of works with unit costs and percentage considered for miscellaneous and contingencies carried out based on quantities and unit costs.
- Part 3 (Technical Report) - includes a drawings section with a first sub-section related to the existing structures (‘reference drawings’) and a second sub-section related to rehabilitate or new structures (including general layouts, civil structures and electromechanical equipment).

Phase III: Tender Documents & Selection of Contractors

The third phase develops tender documents for construction tendering of the final approved design which includes:

- Volume 1: Tender and Administrative Documents
- Volume 2: Technical Specifications and Schedules
- Volume 3: Drawings and Layouts

2.2.3 Key factors controlling the schedule and uncertainties

The key factors controlling the schedule is the availability of sufficient funds and technical expertise during the construction phase. In addition to this, the global COVID-19 pandemic situation will have a huge impact on material procurement as well as work schedule.

Based on expertise provided by the National Health Laboratory staff, laboratory materials are provided to them by STO. Uncertainties related to the project:

- Difficulty in procuring consumables to run the laboratory uninterrupted.
- Qualified BioMedical Engineers are required to calibrate and do regulator maintenance of machines. There are very few biomedical engineers in the Maldives.
- Maintenance of machines and equipment as per schedule is a challenge.
- There is no proper chemical waste disposal plan in Maldives except for disposal through Maldives National Defense Force in K. Thilafushi.
- Improper management and operation could lead to injuries, unreliable service and financial failure.

- Occupational health and safety procedures need to be followed carefully to avoid accidents or injuries, and the risk of chemical injuries not being treated properly due to lack of resources is high.

2.3 Excavation and Dewatering

The volume for excavation is 26 cbm and the area for excavation is 130 sqm. The depth of the foundation has been established at 0.8 m below the existing ground level, and this will be the maximum depth of excavation. The water table was estimated at 1.0 m from ground level. As the ground water table is below the foundation depth at all tide levels, no dewatering will be expected for the foundation casting works.

Excavation will be undertaken with a backhoe excavator or manually using shovels. When the necessary excavation is complete, a 50 mm thick lean concrete will be casted. The foundation will be casted on the lean concrete as per the technical drawings. Foundation pads and foundation beams will be casted with column stumps. Once the concrete works of substructure is completed, the ground will be backfilled with the excavated sand. There will be no excess sand and no sand will be disposed.

Proposed foundation is a shallow foundation thus shoring is not required.

There are no below ground structures in this project.

2.4 Foundation and Concrete Works

Standard methodology for foundation construction and foundation protection will be in place for the project. Isolated pad footing foundation with supporting foundation beams will be built after excavation. This is currently the most adopted method of construction for single storey buildings in Maldives.

It enables to spread the load from a structure over a large area, minimizing the pressure exerted on the base. Beams will then be incorporated into the structure to stiffen the foundation and to prevent any differential settlement of the pad footings during the service life of the building. Foundation has been designed for a safe bearing capacity of 150 kN/m^2. Backfilling will be undertaken using the excavated material.

Weak pockets found below the assumed foundation level shall be removed and replaced with soil or concrete. Excavation in loose sand requires continuous support, and therefore supports will be placed immediately as excavation commences. The concrete works for the pad footing foundation will be done using C30 Grade concrete.

The contractor will maintain dry working conditions throughout the construction period. No backfilling shall be done against walls retaining earth unless the walls achieve sufficient strength to prevent movement or structural damage. Waterproof membrane will be put on top of the lean concrete.

2.5 Construction Management

2.5.1 Construction waste management

Construction waste will be separated and sorted at the site. The waste will be transported to R. Vandhoo or Thilafushi Regional Waste Management Centre to dispose of the waste by the Contractor at his expense. No construction waste should be left on site or transferred to the island waste

management center. The Contractor must discuss with Council and come to an agreement on how to manage waste prior to the start of the construction works.

2.5.2 Traffic flow and management

Since there is enough space within the project plot to carry out the construction works, there is no need for road closure and traffic management. Some level of high traffic may be experienced during material loading and unloading. Thus, it is recommended to deliver the materials to the site at late night or early morning to avoid the public use time.

2.5.3 Project site office and temporary storage area details

The proposed temporary site is a vacant land next to the council with an access road. Thus, there is no need for land clearance. A temporary site office and storage will be constructed using GI pipes and roofing sheets at the below temporary plot.

Figure 2.5 Temporary Site

2.5.4 Transportation mechanisms and costs

Contractor will buy materials from Male' and delivered to Hanimaadhoo via sea cargo at Contractor's own expense. Delivery from the harbour to the site will be via lorry at the Contractor's own expense. Contractor and Island Council will identify a location for material unloading and temporary storage at the harbour before transferring to the worksite. Additionally, both parties need to come to an agreement on how long the materials can be kept at the harbour after unloading from the vessel.

2.6 Laboratory

2.6.1 Chemical storage details

A storage and waste management block has been designed which considers the need for temperature and humidity control as well as 4 ft of safety spacing between storage aisles. The block also has two exits

Chemical Storage and Handling

The following steps are proposed to be followed at the laboratory:

- Whenever a chemical is ordered, steps should be taken to determine its hazards and to transmit that information to those who will receive, store, use and dispose of the chemical.
- Restrictions imposed by the Ministry of Defense and any other applicable regulations and inhouse rules should be followed.
- Safe storage facilities should be provided for materials that have unique physical or hazardous properties such as temperature sensitivity, water reactivity or explosivity.
- Hazardous chemical containers stored and handled in laboratory work areas should not exceed 20 Liters.
- Receiving, transporting, unpacking and dispensing of chemicals should be carried out by trained personnels.
- Handling and storage of chemicals should conform to the manufacturer material safety data sheet.
- Containers of materials that are time sensitive and might become hazardous during prolonged storage should be dated when first opened and properly managed.
- Storage cabinets in laboratories are not required to be vented for fire protection purposes.
- Chemical storage should be inspected at least annually.

2.6.2 Removal of Laboratory Waste

The detailed Laboratory Waste Management plan can be found in Appendix C. In general, hazard waste containers will be removed from the laboratory every 6 months from accumulation start date indicated on the container label. The collection limit of laboratory is 200 Litres and if the collection limits are exceeded, the date will be noted, and the waste containers will be removed within 10 consecutive calendar days. The hazard containers will be handed over to MNDF for disposal.

Waste Separation:

The fewer the number of chemicals associated with the waste, the more economical is the disposal method for that waste. Therefore, it is very important to separate the incompatible materials. The table below outlines the different categories that must be segregated at the lab to ensure proper disposal.

Category	Waste Separation Guide
Acid and Bases	Separate acids and bases from one another in individual, compatible containers. Do not mix with solvent or oil wastes.
Biocides	Chemicals which are persistent in the environment, or any concentrated solutions of biocides must not be released to the sanitary sewer and are collected separately for hazardous waste disposal.
Oil Waste	Used oil wastes from vacuum pumps, transformers, motors etc are collected for disposal and can be sent to a recycling service if the oil has not been mixed or contaminated with hazardous waste. Collect oil that has not been mixed or contaminated with hazardous waste in a container labelled as “Used Oil”. Oils that are mixed with hazardous wastes must be collected and disposed of as hazardous waste.

Oily Rags	Oily rags must be placed in a red can with a self-closing lid. The red can must be clearly marked with the label 'Oily Rags'. Oily rags should not be left lying around because they can ignite and cause fire to spread to other areas.
Oxidizers	Package oxidizers separately; store and accumulate away from organics including flammable materials. Oxidizers should never be stored or accumulated adjacent or proximate to any organic substances.
Paints	Oil-based paints are considered hazardous waste. DO NOT discard oil-based paint down the drain or place in the regular trash. Oil-based paints may be combined with solvents and linseed oil for hazard waste disposal. Latex or acrylic paints cannot be discarded down the drain. They may be dried completely and the solid placed in the regular trash. Do not place liquid latex paints in the regular trash.
Solvents	Collect non-halogenated solvents separately from halogenated solvents whenever possible. Most solvents are flammable and should be separated from oxidizing and combustible materials. Non-halogenated flammable solvents are sent to an incinerator or recycler and must be free of heavy metals and reactive materials, e.g. sodium metal.
Unknown	Unlabeled and unidentified chemicals present a challenging, dangerous and very costly disposal problem. Exercise every precaution to avoid generating unknowns in the laboratory and ensure that all containers are properly labelled. If you discover unknown chemicals, please contact MNDF.

Drain Disposal of Chemicals:

Only compounds that are water soluble to at least 3%, present a low toxicity hazard, and have a pH between 6 and 10 are suitable for drain disposal. Limited quantities (generally not more than a few hundred grams or milliliters) of these chemicals can be disposed of in the sanitary sewer. The disposal will be performed by flushing with at least 100 -fold excess water at the sink so that the chemicals become highly diluted. The water must be run at maximum flow for 2 minutes per 100 mL of chemical.

2.7 Utilities

Water, sewerage and electricity services in Hdh. Hanimaadhoo are provided by FENAKA Corporation limited. FENAKA Corporation Limited was established on 18 June 2012 by a Presidential Decree under the Companies Act of 10/96, as a limited liability company. The company was registered on 1st of August 2012 and it is a 100% Government-owned utility company with a mandate to provide island communities with electricity, water, and sewerage.

Power generation at Hanimaadhoo is provided by diesel generator sets as well as solar panel systems. Water is supplied through a reverse osmosis system and an ultrafiltration system which purifies harvested rainwater, and sewerage services are provided by a conventional gravity system.

Any nonhazardous waste will be disposed of through the island waste disposal system, which is operated by the council. For hazardous waste, as highlighted in the disposal of used chemicals, will either be diluted and drained into sewer system or collected and handed over to MNDF for disposal.

Provisions will be provided for future installation of PV modules on the roofs of the buildings but use of energy conserving utilities is not part of the scope of this project.

Sanitary systems will be designed according to BS EN 12056-2:2000 and ISO 44271 using PVC pipes. Three separate pipes will be used for lab wastewater, greywater and blackwater respectively. Main greywater pipes will be connected to an inspection chamber before connecting to Main blackwater pipes. The inspection chamber will be accessible at ground level for maintenance. Rodding eyes will be provided at the end of the joints which are accessible at ground level in case of a clog in the main blackwater and greywater pipes. Lab wastewater will be connected to a dilution tank before discharging the wastewater to the Manhole.

Rainwater will be drained and collected from the roof area of the laboratory buildings facing the boundary of the plot. The collected rainwater will be used for irrigation purposes within the plot. Rainwater from the rest of the roof areas will be discharged to a rainwater infiltration pit/soak pit or will connect to the existing rainwater collection network of the island.

Water Supply systems will be designed using BS EN 806. Fresh Water Main Pipe will be connected to an individual water meter located within the plot boundary. Fresh Water will be supplied to the toilets and laboratory sinks from a single pipeline. Fresh water will be supplied to the garbage area as well for cleaning purposes.

The figures below show the sewer and water connection details, as well as the rainwater irrigation drawings.

Figure 2.6 Laboratory drainage drawing

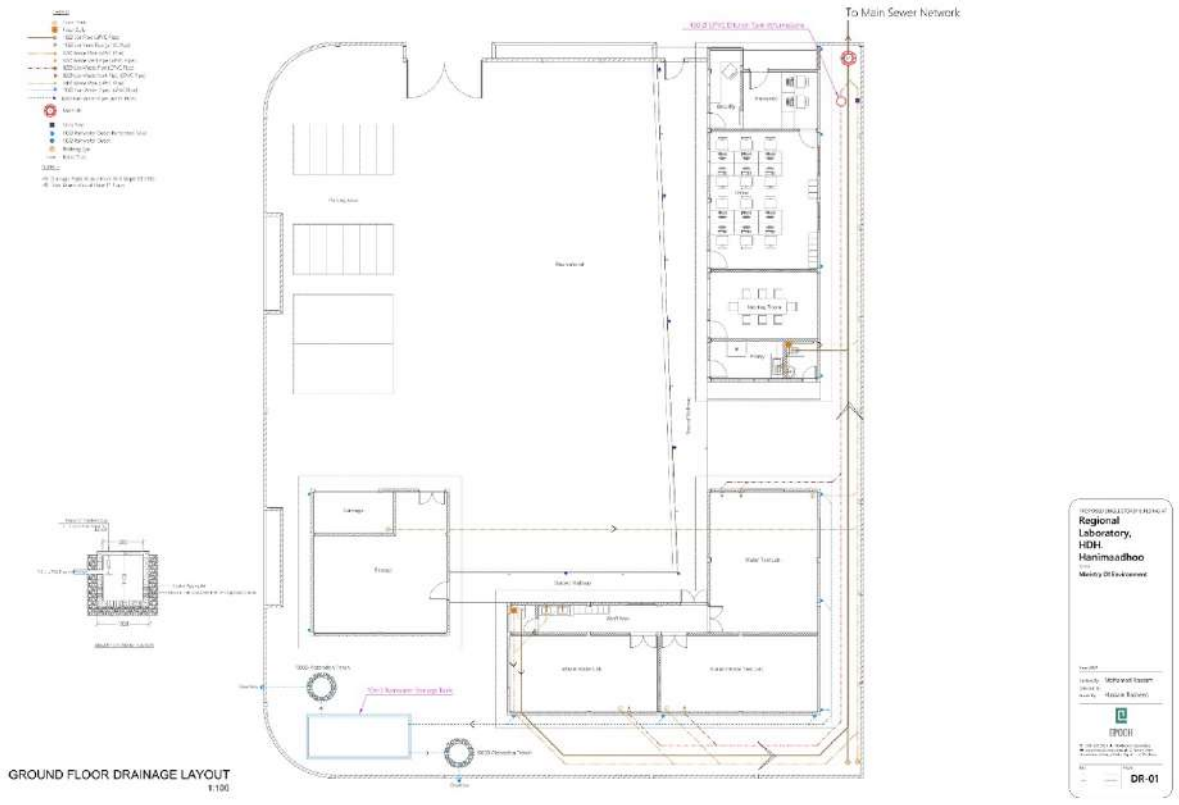
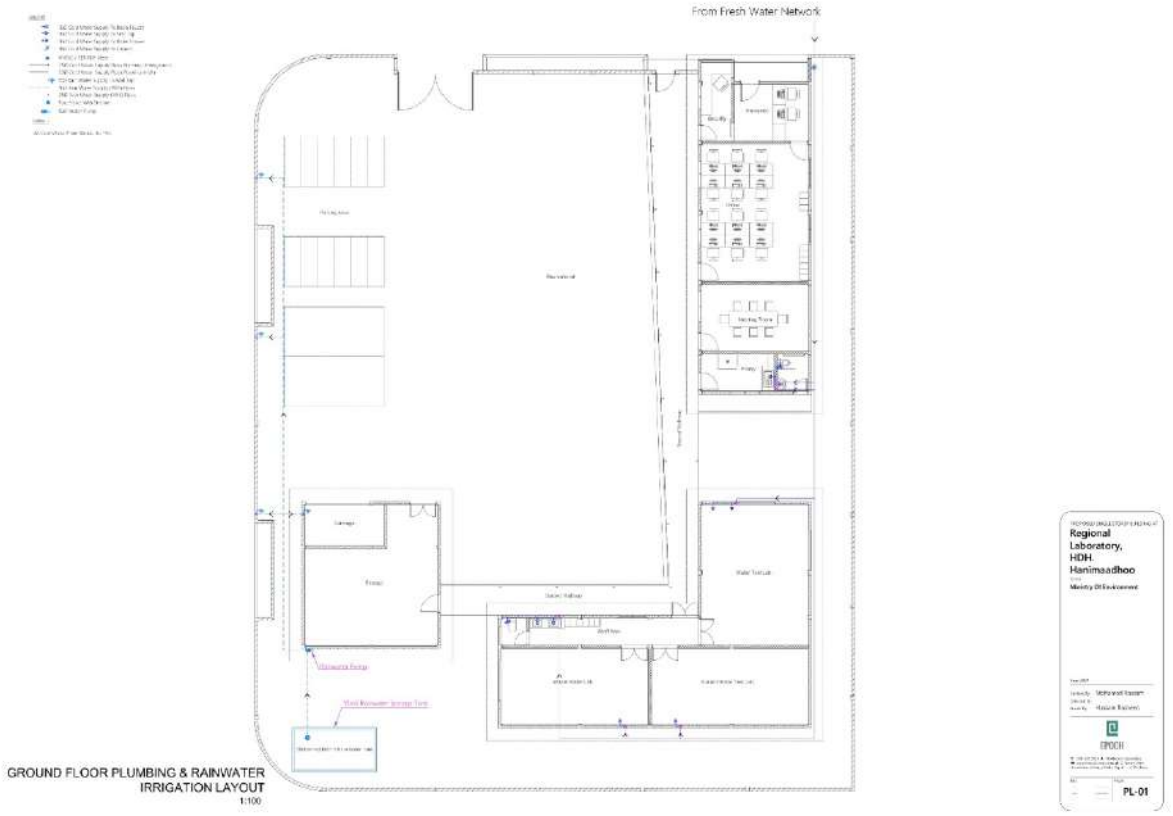


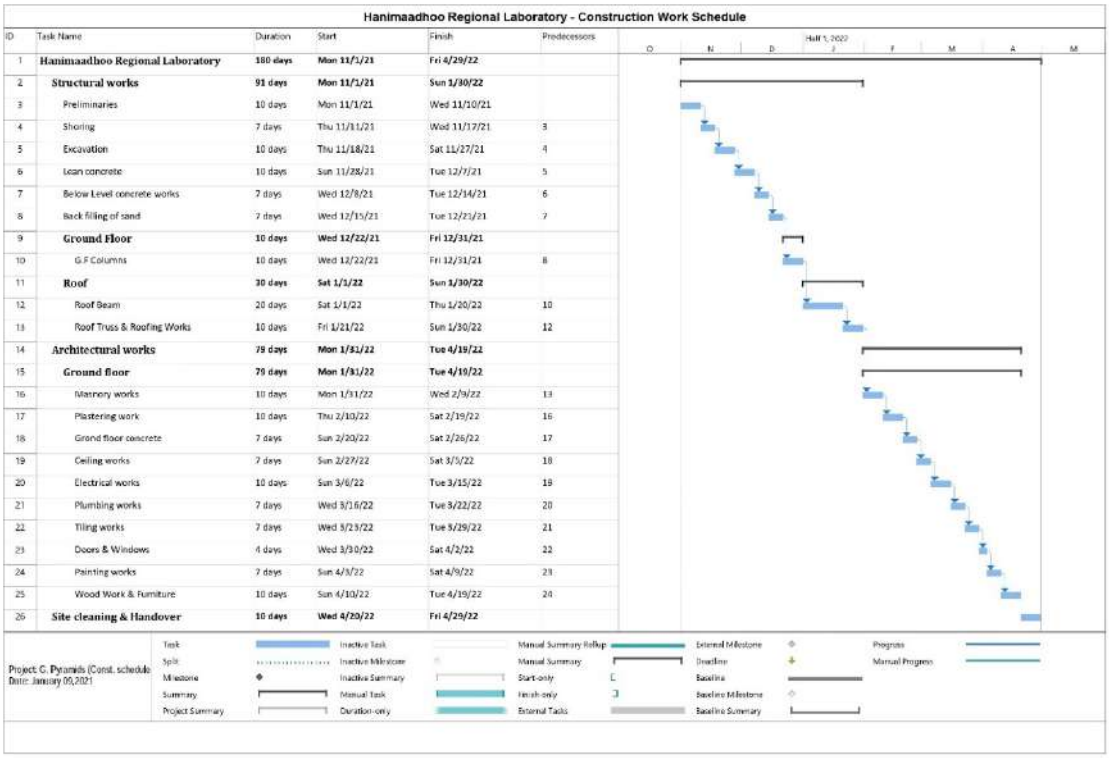
Figure 2.7 Laboratory water connection and rainwater line details



2.8 Project Management

2.8.1 Project Work Schedule

The project work schedule is as below:



2.8.2 Emergency Water Supply Plan

Water for the construction stage will be arranged by the Contractor from the existing water facilities in the island or by supplying packed water bottles to the island.

2.8.3 Construction Stage Waste Management

A specific area within the site will be prepared to keep the waste. A designated area will be marked for main categories of wastes such as general waste, plastic, metal and oil. The waste oil will be stored in designated storage containers and will be transferred to R. Vandhoo or Thilafushi to discard safely. Storage tanks will be clearly marked and inspected regularly for any leakage. Tanks will be placed in metal trays to avoid spillage of oil into the ground accidentally. These trays will collect any spilled oil and retain them.

The bulk of waste generated during the construction stage must be disposed of at R. Vandhoo Waste Management centre or Thilafushi by the Contractor. The small amount of municipal waste generated during the construction will be disposed of at the existing waste management facility in the island.

2.9 Project Inputs and Outputs

Table 2.2 Inputs to implement the methodology

Project Inputs	Quantity	Source of resources
Construction workers	1 Project Manager 1 Project Engineer 1 Consultant Engineer	Contractor's permanent staff. Project Staff. Labourers

	1 Supervisor 5 Skilled Laborers 5 Non-Skilled Laborers 2 Security Staff (24 hrs security) 1 Environmental Officer 1 Health and Safety Officer	mostly registered workers from Bangladesh.
Machineries and equipment mobilized for construction	Excavator Concrete mixer Concrete vibrator Dump truck Shovels Drills Chainsaws Crane	Contractor's own equipment
Other construction materials	Cement Sand Aggregates Plywood Timber Rebars GI pipes Paint Masonry blocks Tiling material Putty Electrical material Plumbing material	Local supplier Imported from abroad Imported from abroad Local supplier Local supplier Imported from abroad Imported from abroad Local supplier Imported from abroad Imported from abroad Imported from abroad Local supplier Local supplier
Fire extinguishers	10 nos	Imported from abroad
Energy supply during construction	As required	From FENAKA mains
Water consumption during construction	As required	Ground water

Table 2.3 Additional outputs expected from implementing the methodology

Project Outputs	**Quantity**	**Method of Disposal**
Vegetation	57 coconut palms	Any uprooted trees or coconut palm will be replanted in a location within the island designated by the Council. For the removed and discarded trees and coconut palm, 02 additional plants will be replanted
Waste generated during construction	Moderate amount	Collected and sorted, taken to R. Vandhoo or K Thilafushi
Waste oil and grease	Minute quantities	Collected and stored using proper procedures (storage

		containers with base trays) and will be transported to R.Vandhoo/ Thilafushi or any designated site.
Noise pollution	>75 db at peak times	Minimized by site demarcation barriers. Earmuffs and safety equipment for workers on site.
Waste generated during operations	Minimal quantities	Collected on site and transported to Hanimaadhoo waste center
Waste water generated during operations	Minimal quantities	Via sewerage network

3 EXISTING ENVIRONMENT

This section outlines the baseline environmental condition of the project site and the surrounding area at HDh. Hanimaadhoo.

3.1 Climate

The islands of Maldives are located across the equator, most of the atolls lying immediately North of the equator. Due to this location, all islands experience a monsoonal climate. Towards the North, the effects of seasons are more apparent and hence experience infrequent torrential rain, while towards the South the effect of changing seasons are negligible and thus experience frequent rain.

The two distinctive monsoons in all areas of Maldives are the North-East Monsoon (dry monsoon) which lasts from January to March, and the South-West monsoon (wet monsoon) which lasts from May to November. In both seasons, the temperature varies only slightly despite the huge differences in rainfall.

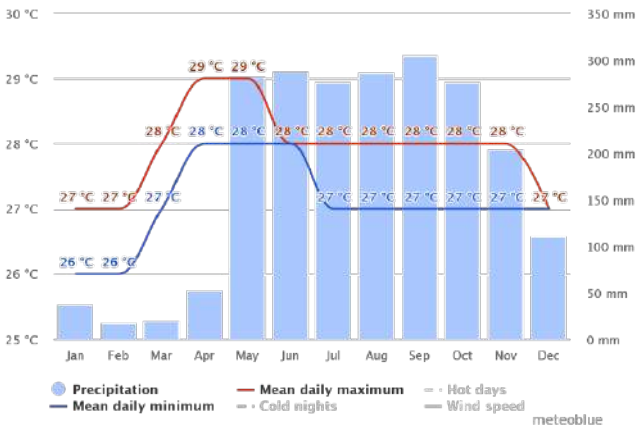
3.1.1 Temperature

As the Maldives consists of small islands surrounded by sea, even hot days are tempered by cooling sea breezes and mild evening temperatures. Therefore, throughout the year there is little change in temperature. However, the daily temperatures can fluctuate between 31˚C in daytime and 23˚C at night.

The highest temperature recorded in Maldives was on 19th May 1991 recorded at Kadhdhoo Meteorological office at 36.8˚C. The lowest temperature recorded was on 11th April 1978 recorded at the National Meteorological Center at 17.2˚C.

Looking closely at the monthly maximum and minimum temperatures from four different meteorological centers, it becomes clear that there is a very small fluctuation in the maximum and minimum temperatures throughout the year. However, as expected there is a considerably huge variation in the maximum and minimum temperature for Hanimadhoo. From February to May, the minimum temperature for Hanimaadhoo rose from 26˚C to 29˚C.

Figure 3.1 Mean monthly maximum and minimum temperature and precipitation for Hanimaadho. Source: meteoblue



3.1.2 Rainfall

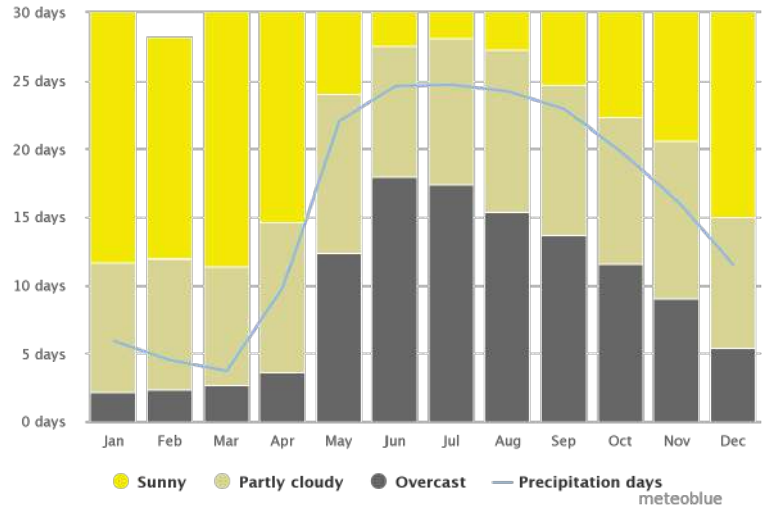
During the South-West monsoon, from mid-May to December, heavy rainfall is experienced in all atolls. The highest rainfall ever recorded during a 24-hour period was on 9th July 2002 at Kaadedhdhoo Meteorological office, which was 219.8 mm of rainfall.

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

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

Figure 3.1 shows the precipitation patterns per month for Hanimaadhoo. Below, Figure 3.2 demonstrates the number of sunny, partly cloudy, overcast and precipitation days on a monthly basis for Hanimaadhoo (Meteoblue, 2020).

Figure 3.2 Precipitation patterns at Hanimaadhoo. Source: meteoblue



The National Environmental Action Plan of 1993 reported that evaporation rates are high and up to 6mm per day (Ministry of Planning and Environment, 1993). A more recent report in 2001, The First National Communication of the Republic of Maldives to the United Nations Framework Convention on Climate Change reports that they were unable to take measurements on evaporation rates due to the absence of basic measurement instruments and the lack of human resources necessary to carry out such research (Ministry of Home Affairs, Housing and Environment, 2001).

No information regarding evaporation rates could be found at the time of writing this report, besides the reference to the 1993 report of up to 6 mm per day.

3.2 Structural Environment

3.2.1 State of adjacent buildings

As the area proposed for building the laboratory is in the natural forest area of Hanimaadhoo and towards the end of the residential areas, only 5 adjacent buildings are in the immediate vicinity and relevant for this study.

The buildings are marked with letters A – E in the map below in Figure 3.3 Adjacent buildings and **Error! Reference source not found.** outlines the existing condition.

Figure 3.3 Adjacent buildings

Table 3.1 Structural condition assessment of adjacent buildings

#	Building Type	Existing Condition	Photo
A	Government Building - Council	• The boundary wall is newly built. • There is one large crack on the boundary wall. • No visible cracks on the building.	 

#	Building Type	Existing Condition	Photo
B	Residential	• Newly built house • House is in a very good condition • No visible cracks on the walls.	 

#	Building Type	Existing Condition	Photo
C	Residential	House is in a good condition. No visible cracks on the boundary wall or the building.	
D	Residential	Empty Plot- No boundary wall and no building.	

#	Building Type	Existing Condition	Photo
E	Residential	Boundary wall is in good condition. No visible crack on the boundary wall. Building is under construction. No visible cracks on the existing walls and RC structure.	

3.2.2 Existing structures/uses of proposed site

There are no existing structures on proposed site. There is no approved land use plan for HDh Hanimaadhoo, so the proposed site was unallocated land. The proposed site has been approved by the Council and the Maldives Survey and Land Use Authority.

3.3 Biological Assessment

3.3.1 Trees

The site has 57 coconut palms and under growing plants such banana, screw pine and beach gardenia plants. The site shows signs of flooding during the storm events and is lower than newly developed asphalt road. Thus, there is risk of flooding the area during a storm event. Ground improvement is not required for the site as the site consists of layers of fine sand and sand with coral fragments. It is recommended to elevate the building finish level (at least 300 mm from the road finish level) to avoid any damages during a severe storm event due to flooding. Also, it is recommended to design and implement a stormwater drainage system within the plot to avoid flooding of the compound. Infiltration trenches can be built in the open green areas to mitigate the risk of flood damages to the property.

Figure 3.4 The terrestrial condition of the site

Figure 3.5 Banana crops at the site

3.3.2 Vegetation removal and management

The following are a summary of action points pertaining to specific trees as outlined in the above tables.

1. Coconut palms removed from site will be replanted at the harbour area
2. Dhigga plants will be cut down and cuttings will be planted at the proposed replanting site.
3. Boakashikeyo and Magoo will be cut down and used as firewood or agricultural fencing.

Coconut plant relocation

Coconut palm trees present in the project footprint shall be removed and relocated to the proposed area with an additional 2 trees planted for each tree removed. An excavator will excavate the surrounding soil of the tree taking care to not damage the roots of the palm tree. Then, the root bulbs are wrapped in a moisture cover and the crown in secured for transportation. There will be no stockpiling and the tree will be transported directly to the transplanting location. An excavator is used to dig the hole in the transplanting location, after which the moist cover is removed and the tree is carefully lowered into the ground. Sand is filled and compacted around the palm tree. The initially removed pit on the project site will be filled, compacted and leveled to match the surrounding land, however, since the initial location of the palm tree was in the footprint of the project, the pit will only be filled with sand.

Dhigga cuttings propagation

The most common and easiest method of propagation is branch cuttings. Cuttings can be collected any time of year, but it is recommended to collect during rainy season so as to propagate with minimal effort.

Take a cutting of a straight branch section (approximately 7 – 10 feet long). Remove cutting with a sharp tool and remove all leaves from the branch cutting. Before planting, make several small incisions through the bark on the lower section of the cutting (12 – 16 inches). This will promote side rooting, encouraging a strong root structure. Plant cutting to approximately 1/3 of its length in the soil, ideally during the rainy season or wet weather. Make sure the soil is packed firmly around the base of the cutting. Air pockets could inhibit root establishment. Remove weeds from around the base of the planted cutting.

In dry conditions, supplemental watering must be provided once or twice weekly until cuttings are established. Cuttings take approximately four months to become established. Once established, little maintenance is required. Cuttings should be planted as soon as possible after collection. If immediate planting is not possible, store branch cuttings upright in a bucket of water located in a shady location. (Tropical Plants and Flowers Guide, n.d.)

3.3.3 Replanting area

Palm trees that fall under the footprint of project activities must be removed. As per environmental guidelines and local laws, it is proposed that two trees for each removed tree (coconut palm) shall be planted in the proposed location given in the figure below.

Figure 3.6 Tree replanting area

3.3.4 Mangrove

The mangrove area is located to the North of the proposed plot and is in proximity of the site. The following shows photos of the trees found in the mangrove. The most common mangrove found in the location is Small leafed orange mangrove (kandoo) and Mangrove apple (kuhlhavah). It is not expected that the project activities will negatively impact the mangrove area.



Figure 3.7 Mangrove area in Hanimaadhoo

3.3.5 Soil

A pit of depth 1.2 m was used for the visual soil inspection. The following diagram represents the soil profile.

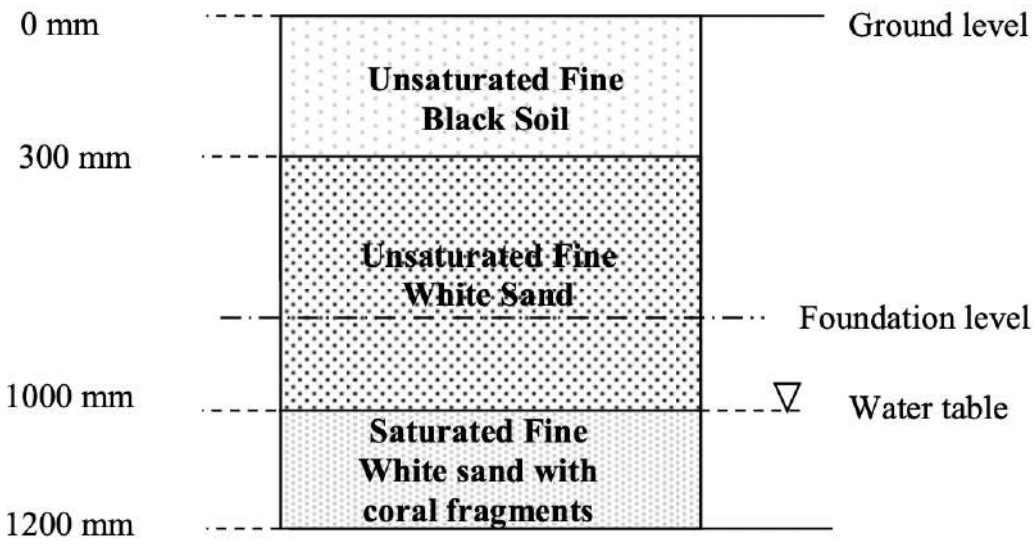


Figure 3.8 Soil profile

Foundation to be laid at 0.8 m below the natural ground level. Dewatering will not be required during foundation construction.

3.4 Physical Parameters

3.4.1 Groundwater quality assessment

The groundwater table was observed to be shallow. The ground water quality was measured in the following locations

Table 3.2 Ground Water Quality Test Sites

#	GPS point	Remarks
GW	6°45'54.57"N, 73°10'43.87"E	Ground water and proposed site Proposed Site

Ground test results were compared with the EPA supply water quality standards for the parameters with a specified guideline values as follows. MWSC laboratory test results are attached in Appendix E.

Table 3.3 Ground water quality optimal ranges given by EPA

Parameter	Optimal Range	Reference
Conductivity (µS/cm)	<1000	EPA
pH	6.5-8.5	EPA
Salinity (%)	NA	EPA
Temperature (°C)	NA	EPA
TDS (mg/L)	<500	EPA
DO (mg/L)	NA	EPA
Total Coliform (MNPI/100ml)	0	EPA
Fecal Coliform (MNPI/100 ml)	0	EPA
Turbidity (NTU)	<1	EPA
BOD (mg/L)	NA	EPA
Total Petroleum Hydrocarbon (mg/L)	0	EPA

Table 3.4 Ground water quality test results

Parameter	GW Test Results
Conductivity (µS/cm)	66100
pH	7.59
Salinity (%)	44.83
Temperature (°C)	24.7
TDS (mg/L)	33000
Turbidity (mg/L)	0.139

(parameters exceeding EPA standards are highlighted in red)

Conductivity is strongly correlated to salinity and total dissolved solids (TDS). Conductivity can increase because of the presence of chloride, phosphate and nitrate from a failing sewage system (US EPA, 2012) (Fondriest Environmental, Inc, 2014) or saltwater intrusion. The Conductivity, TDS and salinity are all abnormally high in this case, indicating extreme saltwater intrusion in this location.

This may be because of the proximity to the high wave energy side of the island on the east and the natural depression on the island near the mangrove area. It could be that saltwater intrusion is taking place due to intertidal intrusion or saltwater intrusion is taking place due to storm event flooding. Longer term and further study will be required to understand the groundwater conditions in this area.

Detailed water test results are attached in Appendix E.

3.4.2 Ground condition assessment

A 1.2-meter-deep well was dug on site to compile the soil profile of the site. It was observed that there is topsoil layer of thickness 300mm. This black colored layer has lot of palm roots and other organic matters. The layer below the topsoil layer consists of medium size sand with coral fragments. The groundwater table was observed at a depth of 1.0 m below the natural ground level.

Figure 3.9 Soil profile

3.4.3 Noise assessment

Table 3.3 shows the noise levels measured at the selected locations.

It was observed that the noise level was quite low and uniform throughout the island. As there is no major industrial work being carried out on the island, and no significant construction work being conducted at the moment, the ambient noise is fairly minimal.

The noise level was measured using a handheld sound meter in the early morning when the background noises are low.

Table 3.5 Noise level measurements

Location	GPS Coordinates	Min (DB)	Avg (DB)	Max (DB)
Project location	6°45'54.4"N 73°10'43.5"E	42	51	64
Control Site 1	6°45'54.3"N 73°10'42.8"E	40	50	62
Control Site 2	6°45'53.7"N 73°10'42.9"E	41	52	65

The readings that are above 70 are highlighted in red.

According to the WHO community noise guidelines, broad ranged outdoor environments including industrial, commercial and traffic areas should not have equivalent continuous sound levels over 70 decibels in a 24-hour period.

3.5 Socio-economic Environment

Hanimaadhoo lies in Haa Dhaalu Atoll which has 13 inhabited islands, with the capital island being HDh. Kulhudhuffushi. Haa Dhaalu Atoll has 17 uninhabited islands, 1 resort island, 1 international airport island and domestic airport island. There are 3 industrial islands, 1 island for fisheries, 2 environmentally protected islands, 7 islands for resort development and 3 islands for agriculture.

Hanimaadhoo is a focus area for various development activities including the International Airport, opportunities for agricultural, tourism, trade and other commercial opportunities, a number of people from different parts of the Atoll as well as other areas from the Maldives may have migrated to the island looking for various economic opportunities. This may be the main reason for having a higher population growth rate.

The main economic activities of the island are fishing, agriculture, tourism, trade and employment. Currently there are 5 active fishing vessels. Hanimaadhoo can be regarded as an agricultural island with a number of people engaged in the activity. Some of the agricultural products such as bananas, tomato, lettuce, papaya are produced locally and are also brought to Male' local market. Also, there is an established agricultural center on the island for the purpose of developing agriculture and training personnel. The center is operated by the Ministry of Fisheries and Agriculture.

The Hanimaadhoo City Hotel developed by Noomadi Pvt. Ltd. on the NW coastal part of the island currently plays a key economic activity on the island. According to the Council, more areas for tourism purpose will be allocated soon. Additionally, several guesthouses are now in operation on the island.

Employment in the regional airport, city hotel, agriculture center, MET center, bank, etc is an important economic activity on the island. Additionally, trade of general goods and operation of cafes and restaurants also play a vital role in the overall local economy of the island.

Key infrastructure of Hanimaadhoo include health center, power, harbor, two telecom sites, religious sites, public administration facilities, and Hanimaadhoo School. The school teaches up to grade 12 and currently has 246 students studying on the island. The Health Center caters for the immediate health

needs and emergency care and has an ambulance and 1 doctor and 12 nurses. There is an ATM at the airport but no bank branch, but online banking services are used widely.

3.5.1 Demography

The registered population of the island is 2,162 with 1,075 males and 1,037 females. However, there are over 500 persons living on the island for various reasons who are not registered in the island, most of them are foreigners and employers working in key establishments such as airport and guesthouse, hence, the total population of the island may be close to 3,000 persons.

There are 340 households in the island having an average 6.3 persons per household. The average population growth rate has been estimated to be 2.7% and the population of the island is expected to reach close to 5,000 in the next 10 years.

3.5.2 Economic activities

The public administration sector including education, health, Council and FENAKA has the highest employment, making the Government the single largest employer. In addition, a significant amount of the population are engaged in agricultural activities, although most of this is subsistence farming and excess is sold locally. Another main source of income is the remittances received from temporary emigrants working in the tourism sector in resorts, as well as those who have permanently emigrated to Male' for jobs and education.

As a result of direct and fast access to the island by having regular connectivity to Male', the trade sector in the island was identified to be generally good. There are over 30 shops and stores selling daily goods, general goods, garments, groceries and pharmaceuticals. With further development of the tourism sector, the trade sector is also expected to be developed with more outlets added and more people engaged in the activity.

3.5.3 Accessibility and public transport

- Nearest airport: Hanimaadhoo International Airport
- Daily inter atoll ferry available except Fridays
- Speedboat from Male' to Hanimaadhoo available
- Speedboat hire between Hanimaadhoo and other islands available

3.5.4 Services quality and accessibility

Power generation at Hanimaadhoo is provided by diesel generator sets as well as solar panel systems. Water is supplied through a reverse osmosis system and an ultrafiltration system which purifies harvested rainwater, and sewerage services are provided by a conventional gravity system.

Waste Management

Waste is collected and managed by a third-party contracted by the council. The old waste center is currently full and a new waste center is being constructed.

3.5.5 Roads Condition

Development of road in front of the proposed site is ongoing. At the time of survey, ABC layer has been laid and curbstone installation work is ongoing. Laying of asphalt layer is planned of coming month.

Main Road

Figure 3.10 Main road images


Access Road

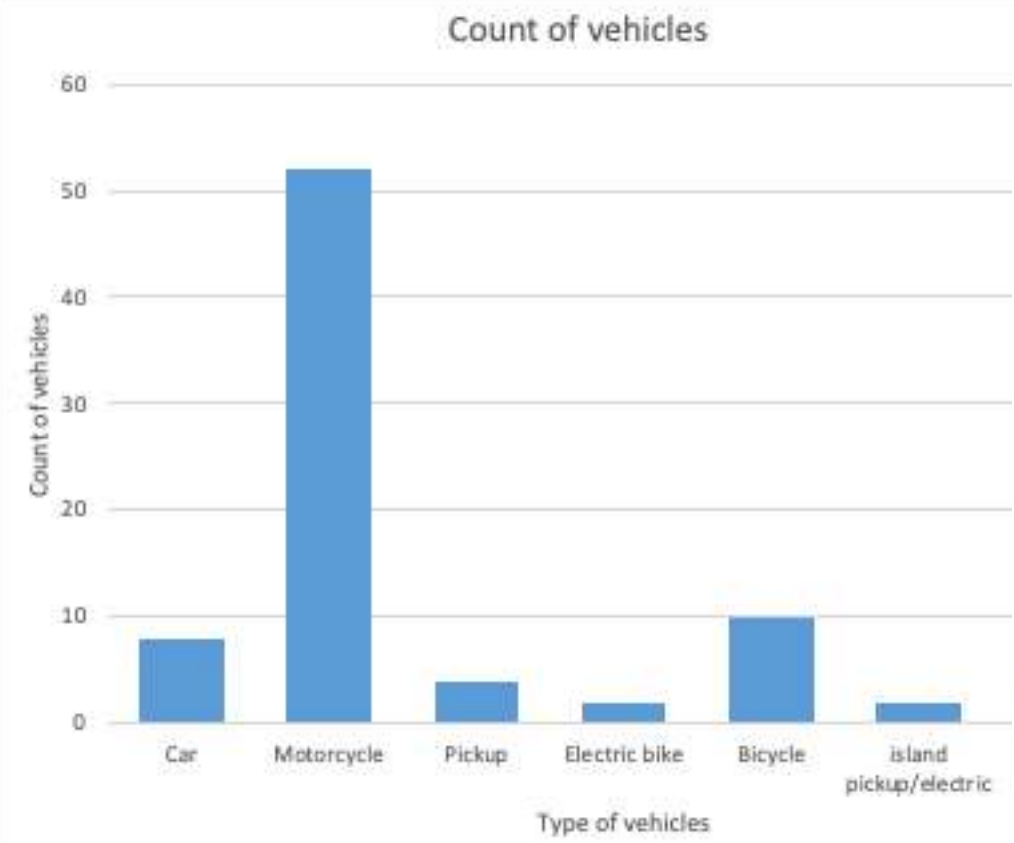
The access road is newly cleared sandy road which is covered with patches of grass.

Figure 3.11 Access roads images


3.5.6 Vehicles and traffic

Traffic survey was conducted between 4 pm and 5 pm on the main road area in front of the proposed laboratory building. The following were observed:

Figure 3.12 Vehicle count



3.6 Hazard Vulnerability

Maldives has moderate hazard levels expect for the low probability and high consequential tsunami hazard in the near future, and high probability and high consequential sea level rise hazard in the distant future. However, climate change impacts of coastal erosion from sea level rise, storm surges, sea swells and storm generated waves have increased over the last decades.

According to the historical data, maximum storm surge height is reported to be 0.84m with a return period of 100 years. If coupled with high tide, this historical trend could generate a storm tide of 1.82m in height. Future predictions indicate storm surges can create up to 2.78m waves under medium prediction, enough to completely inundate a medium to small sized islands in the Maldives.

In terms of tidal waves - Maldives has recently been subject to earthquake generated tsunami reaching heights of 4.0m on land (UNDP Maldives, 2006).

4 LEGISLATIVE AND REGULATORY CONSIDERATIONS

This section briefly describes the relevant the legislations, regulations, guidelines, standards and design criteria, national policies that need to be adhered for the construction and operation of the proposed laboratory. The legal requirements highlighted in this chapter should be confirmed by the Proponent, Contractors and sub-Contractors.

4.1 Legislations

4.1.1 Environment Protection and Preservation Act:

Main area of concern: Environment as a whole

Main regulatory body: Ministry of Environment, Climate Change and Technology

Key components covered: This Act set the basic principles and rules for the protection of the environment in the Maldives and whereby the Environmental guidance shall be provided by the authorized government bodies. Under this Act Environmental Impact Assessments (EIA) is mandated to be undertaken for all economic development projects that may have an undesirable impact on the environment, addresses the disposal of oil, waste and toxic gas or any substance that may harmful effects on the environment within the Maldivian territory, the penalty for breaching the law and damaging the environment. The following articles are relevant to during the undertakings of this project:

- Article 2 states that the instructions for environmental protection will be given from the competent authority and everyone must respectfully follow these instructions
- Article 3 states that all matters relating to environmental protection and preservation must be handled by the Ministry of Planning, Human Resource and Environment (MPHRE);
- Article 5 states that any projects which pose significant impacts to the environment, an EIA report has to be made and submitted to the MPHRE. The projects which require an EIA and the regulation must be made by MPHRE;
- Article 6 states that if any project is found to cause significant adverse impacts, MPHRE have the right to stop the project;
- Article 7 states that any waste, oil or hazardous gas must not be dumped into any part of the Maldives, however, if strictly needs to be disposed it should be disposed of in an area designated by the Government. If such hazardous gas, waste or oil is to be disposed by combustion, it should be done in a way it does not impact human health and environment;
- Article 8 states that any hazardous waste must not be disposed into any part of the Maldives. Before trans-boundary transfer of such waste, approval must be taken from the Ministry of Transport and Communication by writing to the Ministry at least 3 months beforehand.
- Article 9 states that any party who violates this law or any regulation under this law is punishable to no more than MVR 100 million according to the offence. The fine will be applied by the MPHRE.
- Article 10 states that any offence to this law or any regulation under this law or any action resulting in environmental damage, the compensation for such damages can be taken through judicial processes.
- 1st addendum to Environmental Protection and Preservation Act (4/93) law no 12/2014
- Article 3 and 11 of the Environmental Protection and Preservation Act (4/93) of Maldives is amended as follows:-

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

Relevance to project: Apply in assessing and addressing the social, economic and environmental aspects of the impacts in the context constructional and operational phase of the project. Any oil, waste or toxic gas generated under the project will be managed as per the rules stated in the Act.

This project will proceed in accordance to the decision note issues by the EPA in response to the EIA submitted to EPA for establishing a Regional Laboratory at HDh. Hanimaadhoo.

4.1.2 Maldivian Land Act

Main area of concern: Land use

Main regulatory body: Ministry of National Planning, Housing and Infrastructure

Key components covered: This is the law which set the rules for identifying the lands of Maldives for different purposes and uses, allocating such land, allocating government owned land for living, government land allocated for living, owning and using private land, selling, conveyancing, leasing lands and other related matters.

Any matters regarding the allocating of land, receiving land, owning land, selling land, leasing land, utilizing land, using land, and any transactions concerning land in the Maldives shall be undertaken according to this law

Relevance to project: Applicable in allocating and getting land approval for the project

4.1.3 Public Health Protection Act:

Main area of concern: Public Health

Main regulatory body: Ministry of Health

Key components covered: The purpose of this act is to establish policies for protection of public health, identify persons responsible for protection of public health, define how public health protection policies will be implemented and establish policies to limit basic rights ensured under the Maldives Constitution to Maldivians and people living in Maldives.

Relevance to project: The Contractor in coordination with the Council and the project implementing agency shall follow the Act in ensuring the protection of public health during the course of the project works. Hence, all the parties shall establish health and safety measures that would avoid, minimize and reduce any kind of risk to the public to comply with the clauses of the Act.

4.1.4 Employment Act:

Main area of concern: Staff employment and employment rights

Main regulatory body: Labour Relations Authority

Key components covered: This Act determines the fundamental principles relating to employment in the Maldives, the rights and obligations of employers and employees, establishes a Labour Relations

Authority and an Employment Tribunal to protect such rights, and makes provision for all other matters related to employment.

Relevance to project: The employees and labors hired by the Contractor and Consultant for the duration of the project shall be treated as per the Employment Act. Hence, in accordance with the Employment Act all employees shall have an employment contract and job description valid for the duration of work and the agreed salary shall be depicted in the agreement.

4.1.5 Decentralization Act (7/2010)

Main area of concern: Decentralization, governance, development

Main regulatory body: Ministry of Home Affairs, Local Governance Authority

Key components covered: The Decentralization Act established the local Councils as the highest authority in the locality and who shall have executive powers to be exercised in accordance with this Act. The Act establishes Atoll Councils, Island Councils and City Councils. The project was formulated after consulting the with atoll Council.

Relevance to project: The project must be formulated based on their input. Their concerns and suggestion must be addressed/ integrated to successfully implement the project.

4.1.6 Cultural Heritage Act:

Main area of concern: Culture and heritage

Main regulatory body: Ministry of Arts, Culture and Heritage

Key components covered: The Act will ensure that preserving and protecting heritage in the country is made compulsory, further ensuring that rules will be set to maintain the country's heritage. Some of the sites included under the act are historic sites and archaeological findings, crafted items, paintings, archives, books and writing as well as other items that have historic value to it.

A penalty will also be set for damaging items or vandalizing historic buildings. Exporting items with historic value is also to be banned under the Act.

The following aspects are covered under the Act:

1. Determination of Cultural Heritage in the Maldives
2. Development of regulation for the protection and maintenance of Cultural Heritage
3. Defining the roles of government and public regarding the maintenance and protection of Cultural Heritage
4. Defining any activities that involves damages to Cultural Heritage as violation of law and setting a penalty for the damages
5. Research and Development in the area of Cultural Heritage

- Article 36 of the Act states that any development project should be carried out after doing an assessment to determine whether there will be any impact on the existing Cultural Heritage of the islands and this is part Environmental Protection Act 4/93 and should be part of EIA report. The assessment report should be submitted to Ministry of Arts, Culture and Heritage.
- Article 42 states that the actions that need to be undertaken if a Cultural Heritage area or any artifact or historic site is found out during the implementation of the project.

Relevance to project: Will comply with the clauses of the Act and as part of the EIA, prior to moving forward with the project meetings will be conducted with Ministry of Arts, Culture and Heritage to identify whether the island has any Cultural Heritage and Historical sites. Likewise, during the Construction and operational phase of the project, considerations will be given to the protection of Cultural Heritage or any Historic Sites.

4.1.7 Water and Sanitation Act (8/2020):

Main area of concern: Water and sewerage services

Main regulatory body: Ministry of Environment, Climate Change and Technology

Key components covered:

- Ensure the delivery of safe and clean water to all persons in the country
- Stipulates guidelines and procedures for protection of water resources
- Enable establishment of suitable water sewerage network for all inhabited islands
- Article 20: states that no actions that contaminate groundwater lens due to leeching of chemicals or oils can be carried out. If it occurs, it is the responsibility of the Contractor to mitigate the accident
- Article 31: states that distributed water must conform to standards set by FDA and URA, and states that any wastewater from sewerage systems can only be discharged into the groundwater if it is treated to acceptable water quality levels set by URA.

Relevance to project: Will comply with the clauses of the act and as part of the EIA, ensure that the no actions during construction or operation of the laboratory will contaminate the groundwater lens due to chemical disposal or leakage. Furthermore, this act is highly applicable to this project as it will ensure the quality of water and discharged wastewater as stipulated.

4.1.8 Utility Regulatory Authority Act (26/2020):

Main area of concern: Utility services, including water and sewerage services

Main regulatory body: Ministry of Environment, Climate Change and Technology, Utility Regulatory Authority

Key components covered:

This law assigns URA to oversee utility services, which includes water and sewerage services. Article 4 which deals with the responsibilities of the authority states in (b) that the authority is responsible to create and enforce all regulations related to utilities, (f) states that URA will provide operating licenses for utilities, and (l) states that all utility guidelines and regulations must adhere to the Utility regulatory authority act.

Relevance to project: URA must be maintained in close consulting throughout implementation of the project, and reports also need to be shared as per their guidelines.

4.2 Regulations

4.2.1 Environmental Impact Assessment Regulations (2012/R-27)

Main area of concern: Sustainability of Development Projects

Main regulatory body: Ministry of Environment /Environmental Protection Agency

Key components covered: The regulation sets out criteria to determine whether a development proposal is likely to significantly affect the environment and is therefore subject to Environmental Impact Assessment. It also includes the procedure for carrying out an EIA as well as the review process.

2nd addendum to the Environmental impact Assessment Regulation 2012

This addendum brought about some procedural changes to the EIA process, the most important of which was shifting tourism related development project EIAs to the Ministry of Tourism. Additionally, slight changes were made to the process such as the finalization of the ToR during the scoping meeting (article 11(b)) and changes in the fees for the review processes under three different categories (article 7(c)).

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

- Environment Management Plan;
- Initial Environmental Examination;
- Environmental Impact Assessment;
- Approval to go forth with the screened project; and
- Approval to go forth with the project according to the mitigation measures proposed by EPA.

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

- Environmental Impact Assessment report if the project is anticipated to have major environmental impacts;
- Environment Management Plan; and
- Approval to go forth with the project if the project is not anticipated to have major environmental impacts.

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

3rd addendum to the Environmental Impact Regulation 2012

One of the main modifications to the EIA regulation is that the EIA Consultants are classified into 2 categories. To be eligible for a category A Consultant, the applicant should hold a minimum of level 7 qualification in an environment related field recognized by the Maldives National Qualification Framework. Likewise, to be eligible for a category B Consultant, the applicant should hold a minimum of level 7 qualification in specific fields relevant for the nature of the project recognized by the Maldives National Qualification Framework. As such, this report is prepared by a registered category B EIA Consultant.

4th addendum to the Environmental Impact Regulation 2012

One of the main modifications to the EIA regulation is that the exclusive list for EIAs were changed such that EIAs are not required for reclaimed lands until three years from the reclaimed date unless the project involves dangerous chemicals, oil storage, incinerators, release of toxic chemicals to atmosphere, and fiber works.

Relevance to project: The development of water facilities is in the inclusive list of EIA Regulation, an EIA report needs to be submitted to the competent authority before the implementation of the project. The EIA report is this document and will be submitted to EPA for approval.

4.2.2 Regulation on Environmental Liabilities (2011/R-9)

Main area of concern: Environmental Offences

Main regulatory body: Ministry of Environment, Climate Change and Technology /Environmental Protection Agency

Key components covered: This regulation is also pursuant to Environment Protection and Preservation Act of Maldives (4/93). The regulation is aimed at maintaining equal standards for reprimanding and enforcing environmental liabilities, fines for those who violate the rules and regulations and give guidance to those who are involved in the implementation process of the regulations pursuant to Preservation Act of Maldives (4/93). Provide the basis for levying fines on environmentally damaging violations to avoid environmental deterioration, extinction of biological resources, environmental degradation and wastage of natural resources.

One of the key objectives of the environmental liability regulation is also to practice polluter-pay-principles in the Maldives.

Relevance to the project: Apply with respect to the environmentally relevant aspects of the construction and operation phase and Contractors shall take all practical measures to ensure that the EMP proposed in this EIA is followed

4.2.3 Waste Management Regulation (2013/R-58)

Main area of concern: Waste Management

Main regulatory body: Ministry of Environment /Environmental Protection Agency

Key components covered: The waste management regulation dictates the principles needed to follow when handling waste. The aim is to minimize adverse impacts to the environment and human health from waste. Under this regulation, island councils are required to make a waste management plan and submit it to the competent authority. This plan must be reviewed at least every five years. Relevant articles under this regulation pertaining to the proposed project are:-

- Article 8 states that hazardous waste are specified in Schedule J and under no circumstance should it be burned or disposed off in any area of the Maldives. While transporting hazardous waste, it must be in a closed container without any leaks. Further a sign must be on the container, specifying that it is hazardous waste. The import of any hazardous waste mentioned in Schedule J to Maldives is an offense.
- Article 11 states that waste generated at islands must be disposed off in areas specified for the purpose or areas approved by competent authority. Disposal of waste to following

areas is prohibited under this regulation and is an offense: Mangroves, Island Lagoon, Reef, Lagoon (falhu), Finolhu, Beach, Vegetation line, Harbor, Park, Road

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

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

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

1. Waste segregation at household
2. Composting at household

- Article 12 states that anybody responsible for public sites must place and manage a dustbin. The waste in these dustbins must be managed according to this regulation. Disposal of waste to public sites (besides the dustbin) is an offense.
- Article 16 states that approval must be taken from the competent authority for the following waste management works
    1. Waste collection
    2. Transportation of waste by land and sea
    3. Waste treatment
    4. Storage of waste
    5. Management of waste disposal sites
    6. Landfill
    7. Handling of hazardous waste

  The number of waste management approvals for a particular area or areas will be decided by the competent authority based on the following;
    1. Waste generation
    2. Economic gains from waste management actions
    3. Environmental protection requirements for the area
- Article 25 states that waste must be transported from one place to another in accordance with the standards set in schedule A of this regulation. If waste is to be removed from an Island, it should be taken to a regional waste management facility.

1st amendment to waste management regulation (2014/R-10)

This amendment only included the amendment of dates to start implementing articles of this regulation (article 4).

2nd amendment to waste management regulation (2014/R-10)

This amendment also only included the amendment of dates to start implementing articles of this regulation (article 4). The date to implement the articles 13, 14, and 16 were amended to 05th October 2014.

3rd amendment to waste management regulation (2017/R-90)

This amendment included amendments to the schedule A and K of this regulation. Further article 25 was amended to include that action will be taken against parties which does not transport waste according to the standards set under this regulation.

4th amendment to waste management regulation (2018/R-63)

With this amendment the most notable, was the establishment of a system for fining offences under this regulation under Schedule N. Further article 25 was amended such that waste that needs to be removed from an Island must be taken to the nearest waste management center**.**

Relevance to the project: Ensure that the project wastes are handled according to this regulation.

4.2.4 Regulation on Dangerous Chemicals (2019/R-1057)

Main area of concern: Handling and storage of dangerous chemicals

Main regulatory body: Ministry of Defense

Key components covered: This regulation was made in accordance with Act on banned goods in Maldives (4/75) article 5 (3a) and is enforced by Ministry of Defense. This regulation defines what a dangerous chemical is and categorizes those chemicals and explains how those different categories of chemicals must be stored, as well as all the related occupational health and safety procedures that need to be followed when handling such chemicals, and regulates import of such chemicals. This project has chemicals which falls under the following categories:

- IMDG Class 6: toxic and infectious substances
- IMDG Class 8: Corrosives
- IMDG Class 9: Other dangerous substances

Annex A of the regulations specifies the requirements of a chemical storage warehouse, and all the requirements of this regulation will be closely following with assistance by MNDF.
1st amendment to dangerous chemicals regulation (2019/R-1072)
This amendment states that the Ministry of Defense will keep an updated list of all dangerous chemicals in its website. Additionally it makes some changes to the regulatory requirements of chemical storage warehouses, and defines important safety requirements such as separation of fire hazards, explosive hazards, fuel hazards and multifuel hazards. It also includes a list of requirements to be kept in a first aid box which must be located in the warehouse.

Relevance to the project: Ensure that the chemicals are handled and disposed of as per this regulation. The handling and storage must be in line with this regulation.

4.2.5 Regulation on Safety Standards for Construction Work (2019/R-156)

Main area of concern: Working conditions of laborers and protection of public from health hazards due to construction activities

Main regulatory body: Ministry of National Planning, Housing and Infrastructure

Key components covered: This regulation was made under the Building Act (4/2017) with the aims to improve working conditions for laborers and to protect the general public from potential health hazards due to construction activities. Relevant articles under this regulation pertaining to the proposed project are:-

- Article 5 states that the following are Contractors responsibilities;
    - If the contractor's work exceeds MVR 1,500,000 a health and safety plan has to be prepared and followed for the safety of employees as well as the public.
    - While handling construction materials, must ensure the safety of the workers and the general public
    - Informing the workers of any potential health hazards during construction works
    - Have an emergency response plan
    - Ensure that works are proceeding in accordance with the health and safety plan
    - Providing personal protective equipment for workers and they must be trained to use the equipment
    - Ensure construction site is safe for the workers and general public
    - Ensure that there is no disturbance to the general public from the construction site
    - Ensure waste is managed properly at the worksite
    - Ensure that the construction materials are properly stored

    - Ensure that safety boards and signs are installed around the construction site
- Article 6 states that if the contractor's work exceeds MVR 1,500,000 an emergency response plan must be made and the following must be fulfilled accordingly;
    - Emergency response plan must be made available at the constructions site
    - Inform the workers on the emergency response plan and its protocols
    - Have at least 2 emergency response drills every year
    - Ensure that a first aid personnel is always available at all times at the construction site
    - First aid kit must be readily available at the construction site
    - Ensure that the equipment's in the first aid kit is in proper condition
    - Installing safety boards at the construction site
    - Contacts for Emergencies must be available on a notice board at the construction site
- Article 7 states that the contractor must appoint a safety supervisor with more than five years of experience for the project.
- Article 8 states that the responsibilities of the site safety supervisor is to carrying out daily site inspections to ensure the proper measures are being taken to ensure safety and to report to the contractor/Competent Authority if the measures are not being implemented.
- Article 9 states that if the contractor's work exceeds MVR 5,000,000, the contractor must have an insurance policy taken to compensate for any damages to the workers and the surrounding people.
- Article 10 states that all contractor's must ensure that the general public is protected from the construction site by doing the following;
    - Installing pedestrian detour boards
    - Ensure construction materials and equipment's are stored in a way that does not pose any difficulties to the general public
    - Installing safety boards, fences, tapes, sheets to protect the general public
- Article 11 states that the contractor should ensure that workers are always using personal protective equipment when on site. These include safety helmets, safety boots, safety goggles, noise cancellation headphones, gloves, masks, safety belt, and other safety equipment's necessary as per the type of work.
- Article 12 states that all construction sites must be fenced off. The article also explains in details how the fence must be erected.
- Article 13 states that the contractor must ensure the required safety equipment's are provided to the works if they are handling hazardous substances.
- Article 14 explains in detail the safety procedures that must be followed while working at higher than 3 m.
- Article 15, 16, and 17 explains in detail the safety measures that must be taken while working on an overhead platform, roofs, and ladders.
- Article 18, 19 explains how scaffolding are to be used.
- Article 20, 21, 22, 23 states the safety measures that must be followed for using electrical equipment's,
- Article 24 states that the contractor must implement a chemical handling procedure for handling chemicals. The article also explains in details what is to be included in the chemical handling procedure.
- Article 25, 26, 27, 28 states the safety measures that must be followed while working with asbestos, gas cutters, and compressed gas welding.
- Article 29 states that, if there are flammable materials at the construction site, fire prevention equipment must be made available.
- Article 30, 31, and 32 states the safety measures that must be followed for using equipment's powered by mechanical power and electricity, cranes,
- Article 33 states the safety measures that must be followed for while working in closed spaces.
- Article 34 states the measures that must be followed while decommissioning a building.

- Article 35 states the construction materials must be stored within a close area. Approval must be taken from the Competent Authority to store at the designated area and the approval must be shown on a board.
- Article 36 states the measures that must be followed while loading and unloading materials to a construction site.
- Article 37 and 38 explains the requirements for the safety board and other signs that must be installed at construction sites.
- Article 39 states that, when an accident occurs at a construction site, it must be immediately reported to the police. The record of accidents must be maintained by the contractor.
- Article 49 states that, if there is no entity responsible for implementing the measures mentioned under this regulation, then the proponent shall be responsible for implementing the measures. The proponent must report any offences against this regulation to the Ministry.
- Article 50 states that with the enforcement of this regulation the Male' Planning Regulation Chapter 3 is void

Relevance to the project: Ensure all staffs are treated as per the regulation. Ensure that all safety measures are taken to ensure the safety of public and workers as per the regulation.

4.2.6 Groundwater Extraction and Disposal Regulation (2021/R-20)

The groundwater extraction and disposal regulation is enacted with aim of minimizing impacts to groundwater while carrying out dewatering activities, enacted under Water and Sewerage Act (8/2020) Article 21 and 58(a). Relevant articles under this regulation pertaining to the proposed project are:-

- Article 4 states that the fresh water lens of every island in Maldives is property of the government, and for any economic activity water can only extracted and used after getting written approval from the competent authority.
- Article 6 states that dewatering must be done only after getting the necessary approval from the competent authority. The proponent must inform the people living with 100 meters of the dewatering activity via the council using the application form mentioned in annex 1 of this regulation.
- Article 7 states that an administrative fee of MVR 100 has to be paid to the competent authority when submitting the form mentioned in article 6.
- Article 8 states that water samples must be tested from a certified laboratory and their results attached with the form in this regulations annex 1. The results must not be more than 45 days old from the tested date. The following parameters must be tested;
    - pH
    - Temperature, 0C
    - TDS, mg/l
    - Dissolved Oxygen, mg/l
    - Electrical Conductivity, µS/cm
    - Turbidity, NTU
    - Salinity, ppm
    - Ammonia, mg/l
    - Fecal Coliforms 0/100
    - Hydrogen Sulphide, mg/l
    - Nitrates, mg/l
    - Phosphates, mg/l
    - Hydrocarbons, mg/l

- Oil & Grease, mg/l

If any of the parameters cannot be tested then it should mentioned in writing from the laboratory.

- Article 9 states that the approval for dewatering will be issued from the competent authority. Dewatering approval will be given for 28 consecutive days including public holidays. For big projects involving dewatering at different places, the places from where dewatering can be started with 28 consecutive days must be submitted as a single approval. The period of approval will be decided based on the following;
    - Size of proposed water discharge area
    - Water quality
    - Work schedule
    - Method of water discharge
    - Water discharge area
- Article 10 states that designated impact radius from water discharge is 30 meters from the discharge point. The proponent must inform the houses within this radius by writing before 24 hours. During the course of dewatering activities if a damage is caused to any of the houses within this radius, the proponent has to take responsibility and also if any of the houses face any difficulties getting groundwater from their wells the proponent has to provide no more than 250 liters of water per household or pay no more than MRV 30.
- Article 11 states that an option other than draining water into the ground will be considered if the water quality tests mentioned in article 8 of this regulation shows that the waters quality is bad or if the council decides that there is no space in the island for drainage. Approval to discharge water into sea will be given if a catch pit is created to trap sediments and sand. If water is to be discharge through sanitation system then it is the sanitation service operator's responsibility to create a catch pit and install a valve such that the amount of water going into the sanitation system can be controlled. During ongoing dewatering works a copy of the approval must be at site and a sign board has to be fixed as the model in annex 3 of this regulation.
- Article 12 states that for any reason if the site engineer believes that the dewatering works will not be finished within the approval period, then the proponent must fill the form on annex 2 of this regulation and submit to competent authority before 3 days (the 3 days will be counted excluding public holidays) of approval deadline. Upon receival of the form and associated documents the competent authority will issue the approval within 2 working days. However, extension will be granted if the original approval granted under article 10 of this regulation is less than 6 months old, if more than 6 months then a new approval must be requested.
- Article 13 states that a non-refundable fee has to be paid to the competent authority according to following principle;
    - For the first 28 days approval MVR 500 per day
    - For the first addition of days to the approval MVR 1000 per day
    - For the second addition of days to the approval MVR 1500 per day
    - For the third addition and onwards with an increasing rate of MVR 2000 per day
    - However, if the works were delayed due to a natural hazard or bad weather, without any fee days will be added. These type of days will be decided by considering the information from the respective authority.
- Article 14 states that the competent authority has to maintain records about the dewatering approvals they give. If a sanitation service provider gives service of water discharging from dewatering activities, then they must provide those dewatering activity details before the 10 of each month for the previous month's activities.

- Article 15 states that the competent authority has the full discretion to stop any dewatering activities ongoing without approval.
- Article 16 states that the following actions are offenses to this regulation and will be punishable according to article 18;
- For projects requiring dewatering approval, commencing project without dewatering approval
    - Sanitation service provider gives water discharge service to a proponent who did not get the dewatering approval according to this regulation
    - Re-starting the project when the project without approval, when the project was halted by the competent authority
    - Not complying with the project halting order mentioned in article 16 of this regulation from the competent authority
    - Article 18 states the principles which will be used to penalize any offences against this regulation

4.3 Guidelines

4.3.1 Requirement for Fire Prevention Equipment in Buildings

This is a guideline enforced by the Ministry of Defense and National Security of the Maldives which sets out a list of requirements and standards that need to be met in fire prevention equipment provided in buildings prone to fire hazards. The main points have been highlighted as follows:-

Hose reel: Should comply with the specified standards under the guideline. The overall width of the reel should be no more than 850mm. The overall height of the Reel should be less than 850mm including Hose and integral Flexi guide for hose withdrawal guide. The overall depth of the hose reel should be no more than 150mm. The colour of the Reel should be Red, fitted with an operating instruction plate. The Hose Reels nozzle retainer or hose guide and the inlet valve should be fitted at a height of about 900mm above floor level;

Hose reel cabinets: The hose reel cabinet should be Recess mounting type with or without glass-paneled door for use with the above-mentioned sized Hose Reels. Hose Reel Cabinet dimension should be no more than 900mm in width, 900mm in height, 160mm in depth (including door). The colour of the cabinet should be Red. Special permission should be taken for other Colour. Recessed Latch Type handle should be installed. Hose reel signage should be in accordance with BS 5499 or any other equable International Standard. Fixing hole should be provided;

Water supply for hose reel system: Should be such that when the two topmost reels in the building are used simultaneously, each should provide a jet of about 6 m in length and will deliver less than 0.5 L. Minimum storage required for the hose reel is 2275 L and 1137.5 L up to a maximum of 9100 L for each additional reel. Tanks supplying water for domestic purposes should not be used as a suction tank for hose reel installation. The pipings for the supply of water for hose reel should be in and out galvanized schedule 40. Diameter of the piping should not be less than 50 mm;

Hose reel booster pump system: Hose reel booster pump set, complete with in and out galvanized steel pipework with or without expansion vessels;

Fire extinguishers: 2kg CO_2 stored pressure Extinguisher approved to BS EN 3. Aluminium Alloy Body approved to BS5045 Part 3 or any other equable International Standard. Red body with black band or Black colored head cap, swivel Horn, English screen. Fully charged. 6 Kg DCP Extinguisher (Gas Cartridge Type) approved to BS EN 3 or any other equable International Standard. Blue Body Headcap, English Screen, Fully charged. 9 Liter Water Extinguisher (Gas Cartridge Type) approved to BS EN 3 or

any other equable International Standard. Red Body Headcap, English Screen, Fully charged. Fire Extinguishers should be located in conspicuous positions on brackets or stands where they will be readily seen by person. The carrying handle of larger heavier extinguishers should be about 01m from the floor level. But smaller extinguishers should be mounted so as to position the handle 1.5m from the floor level;

Cabinets for fire extinguishers: Cabinets for fire extinguishers should be of stainless steel with or without glass-fronted doors. The colour of the cabinet should be Red or to suit the requirements of architectural surroundings. Recessed Latch Type handle should be installed. Fire Extinguisher Single Cabinets dimension should be no more than 190mm in width, 640mm in height, 180mm in depth (including door). Fire Extinguisher Double Cabinets dimension should be no more than 440mm in width, 640mm in height, 180mm in depth (including door);

Fire Blankets: Fire Blankets should be certified to BS EN 1869: 1997 or any other equable International Standard. Fire Blankets should be extremely flexible and drape easily the slim pack of fire blanket should be Red or White;

Dry riser gate valve: Dry riser gate valve to BS 5041/2, or any other equable International Standard, Gunmetal c/w Padlock strap, blank cap and chain. Inlet 2 ½" ASA 150 F/F. Outlet 2 ½" Inst. Female couplings to BS 336. Colour red;

Dry riser outlet box: Dry riser outlet box for Dry Riser gate valve. Construction should be similar to BS 5041. Standard finish colour Red. Dry Riser outlet cabinet dimension should be as specified in the guideline;

Pumping in breeching: Twin pumping in breeching, approved to BS 5041, or any other equable International Standard, Gunmetal inlets 2 x 2 ½" BS Instantaneous Male Coupling c/w non-return valves. Outlet 4" ANSI 150 F/F flange;

Dry riser inlet box: Dry Riser inlet box for horizontal/vertical pattern. Double inlet to BS 5041 or any other equable International Standard finish color Red. Dry riser inlet cabinet dimension for flush mounting should be as specified in the guideline.

Air release valve: Air release valve, Gunmetal, Inlet 1" BSP Male;

Piping for dry riser system: The Piping for Dry Riser System should be In and Out Galvanized schedule 40. The diameter of the Piping should be not less than 100mm.

Fire doors: All fire doors should be opened to the direction of the flow of people while on emergency. These doors should be installed with a self-closing device including the Panic Latch. These Panic Latch devices should conform to BS 5725 Pt 1 or any other equable International Standard. Fire doors conforming to the method of construction as stipulated in the guideline;

Fire exit signs: Photoluminescent Fire exit signs should sign each Fire Exit Door. The Symbol height should be no more than 100mm;

Fire detection and alarm system: Fire Detection and Alarm System should conform to BS 5839 or any other equable International Standard. Fire Detection and Alarm System should be Analogue Addressable System with mimic diagram. A system in which signals from each detector and/or call point are individually identified at the control panel. Fire Detection and Alarm System should consist of Automatic Detectors, Manual Call Points, Control and Indicating equipment, etc. It should also cover

System capable of providing signals to initiate, in the event of fire, the operation of ancillary services such as fixed fire extinguishing systems and other precautions and actions. Main Fire Control Panel should be located at the reception and the Repeater Panel should be located in the guardroom;

Installation and testing of wet riser system: Wet rising systems shall be provided in every building in which the topmost floor is more than 30.5 meters above the fire appliance access level. A hose connection shall be provided in each firefighting access lobby. Wet risers shall be of minimum 152.4 millimeters diameter and shall be hydrostatically tested at a pressure 50% above the working pressure required and not less than 14 bars for at least twenty-four hours. Each wet riser outlet shall comprise standard 63.5 millimeters instantaneous coupling fitted with a hose of not less than 38.1 millimeters diameter equipped with an approved typed cradle and a variable fog nozzle. A wet riser shall be provided in every staircase which extends from the ground floor level to the roof and shall be equipped with a three-way 63.5 millimeters outlet above the roofline. Each stage of the wet riser shall not exceed 61 metres unless expressly permitted by D.G.F.S but in no case exceeding 70.15 meters;

Wet or dry rising systems for buildings under construction: Where either wet or dry riser system is required, at least one rise shall be installed when the building under construction has reached a height of above the level of the fire brigade pumping inlet with connections thereto located adjacent to a useable staircase. Such riser shall be extended as construction progress to within two floors of the topmost floor under construction and where the designed height of the building requires the installation of wet riser system fire pumps, water storage tanks, and water main connections shall be provided to serve the riser;

Wet riser booster pump system: Wet riser booster pump set, complete with In and Out galvanized steel pipework with or without expansion vessel and specified in the guideline;

Symbols, as well as installation of firefighting systems on the basis of building usage, are outlined on the table in the guideline; and

All equipment mentioned above should be approved by the Maldives National Defense Force (MNDF) fire and rescue services before installation. Special permission should be taken if different from the guideline specifications.

4.3.2 National Wastewater Guideline

The purpose of the guideline is to assist all stakeholders in the water cycle to manage the discharge of wastewater in such a way that it does not limit water's fitness for use by different water users. The guideline suggests specific values of maximum concentrations that can be tolerated by future users of each parameter potentially present in wastewater. These values may not be exceeded when treated wastewater is released back into surface water, groundwater or into the ocean. The values are generic and should be used together with the EIA and clean Production Protocols to finalize the license for the discharge of specific wastewater. All relevant sections in the guideline are conformed for the proposed project.

5 POTENTIAL IMPACTS

5.1 Introduction

Project impacts are assessed for both positive and negative impacts, and does this through the lens of physical, natural, economic and sociocultural impacts.

5.2 Methodology

5.2.1 Impact Identification and Evaluation

Impacts on the environment from various activities of the proposed project have been identified through:

- A consultative process within the EIA team and the Proponent
- Purpose-built checklists
- Existing literature and reports on similar developments in small island environments and other research
- Data specific to the context of the Maldives and HDh. Hanimaadhoo
- Baseline environmental conditions described in Chapter 3.
- Consultant's experience of projects of similar nature
- Public consultation survey

5.2.2 Impact Evaluation and Criteria

In assessing project impacts, we used an extrapolative analogue model by comparing the impacts of proposed development with similar existing developments and comparing with sites with similar environmental conditions. This was developed based on site visits, literature searches and monitoring of similar projects. This method is the most suitable for the current project due to a lack of long-term data for mathematical modeling, and the given timeline of the EIA process.

Furthermore, we used field and laboratory experimental methods to further predict the impacts of the project by doing field surveys on the existing environment in Hdh. Hanimaadhoo.

To assess impact, we took the following criteria into consideration.

Table 5.1 Environmental impact evaluation criteria

Criteria	Scale	Attribute
Direct or Indirect Whether the impact arises as a direct result of project implementation or whether they are indirect – produced away from or because of a complex impact pathway.	Direct Indirect	Indicates direct Indicates indirect
Magnitude The level of effect or influence an impact could have on the environment on a scale of -10 to 10.	-10 to -7 -6 to -4 -3 to -1 0 1 to 3 4 to 6 7 to 10	Major adverse Moderate adverse Minor adverse Negligible Minor beneficial Moderate beneficial Major beneficial
Reversibility The probability of the baseline environment or condition to return to original state at any time on its own	R IR	Reversible Irreversible
Time Scale Whether the impacts are short term or long term, indicated by the following abbreviations	a b c d	1 year 1 – 10 years 10 – 30 years irreversible
Significance Importance for decision making	i ii iii iv v	Low Medium Low Medium Medium High High
Geographical Extent of impacts Refers to the spatial scale of the area affected.	local regional national global	local regional national global
Probability Refers to the probability of impact occurring	low high	low high
Mitigation Requirement Signifies what action must be taken to mitigate the effect of the impact	avoid reduce repair compensate enhance	Avoid Impact Reduce Effect Repair Damage Compensate for unavoidable impact Enhance positive impact
Project Phase Shows which stage of the project the impact is relevant to. These can be further broken down to C1-C12 and O1 -O3 as outlined in Table 6.2	C O	Construction Operation

5.2.3 Uncertainties

Uncertainties about the physical, social and economic environment are difficult to predict, as underlying societal values may change over the life of the project. Including construction, operations and dismantling phase, this project has a life of 30-40 years, during which there may be significant change in the social environment.

The data collected for this report represents the existing environment of the proposed project location and its surrounding area. There is very limited data on long-term environmental conditions and climate of the Maldives. Therefore, this EIA presents an analysis based on the surveys conducted within a short period of time. In turn, this EIA document should be interpreted with the acknowledgement of these gaps and the possible errors and limitations. This EIA was prepared by qualified Environmental Consultants who have ensured that the results and analyses are conveyed with highest accuracy and representation. During the assessments, the existing gaps have been acknowledged and a detailed monitoring plan has been proposed to ensure that environmental impact is minimized.

Impacts were identified for the following project activities:

- Construction
    - C1 Site set up and mobilization
    - C2 Structural works (shoring, excavation, concrete works, back filling, columns, beams and roofing works)
    - C3 Architectural works (masonry, plastering, concrete, ceiling, electrical, plumbing, tiling, finishing)
    - C4 Machinery installation works
    - C5 Site cleaning and handover
- Operation of Laboratory
    - O1 Operating Laboratory
    - O2 Monitoring and Maintenance

5.3 Impact Identification

Table 5.2 Impact identification matrix

Environmental Component	Project Action						
	Construction Phase (1 year period)					Operation Phase (30 year period)	
	C1 Site set up and mobilization	C2 Structural works	C3 Architectural works	C4 Machinery installation works	C5 Site cleaning and handover	O2 Operating Laboratory	O3 Monitoring and maintenance
Vegetation and flora	x b	-	-	-	-	+ c	+ c
Groundwater quality	x a	x a	-	-	-	+ c	+ c
Soil quality	x a	x a	x a	x a	x a	-	-
Marine water quality and habitat	-	-	-	-	-	x a	+ c
Ambient air quality	x a	x a	x a	x a	-	-	-
Noise impact	x a	x a	x a	x a	x a	x c	+c
Aesthetics	x a	x a	x a	x a	+ b	x c	+c
Health and safety	x a	x a	x a	x a	x a	+ c	+c
Hazard risk	x a	x a	x a	x a	-	+ c	+ c
Local economy	+ a	+ a	+ a	+ a	+ a	+ c	+ c
Social cohesion	x a	x a	-	-	+ a	+ c	+ c

KEY
x negative impact + positive impact a = impacts last for 1 year or less c = impacts last for 10-50 years

- no impact b = impacts last for 1-10 years d = impacts irreversible

5.5 Impact Prediction and Evaluation

Table 5.3 Impact evaluation matrix

**Key available in Table 5.1

Environmental Component	Project Phase	Impact Description	Direct or Indirect	Magnitude	Geographical Scale	Cumulative	Time Scale and Reversibility	Significance for decision making	Probability of occurring	Mitigation Requirement
Vegetation and Flora	C1	**Loss of terrestrial flora** as the proposed site requires clearing of vegetation as well as cutting down trees. The details of the trees that have to be cleared and removed, and the method and area to replant trees have been identified in Section 3's Terrestrial Survey.	Direct	-5	Local	N	B, reversible	ii	High	Mitigate
	Oall	**Improved green spaces** during operational phase and monitoring and maintenance. A landscaping plan exists.	Direct	+3	Local	N	A	ii	high	Enhance
Ground water quality	C1 and C2	**Temporary groundwater salinization** due to dewatering and other construction activities. However, the conductivity was seen to be higher than normal in the area, with the groundwater sample already showing signs of high salinity. It will be important to do continuous monitoring through the construction stage to ensure that the conductivity is managed.	Direct	-3	Local		A, reversible	v	high	Reduce
	Oall	**Improvement in groundwater quality/maintain existing quality** as the collected rainwater will be used for irrigation purposed within the plot. Rainwater from the rest of the roof areas will be discharged to rainwater infiltration pit/soak pit or will connect to the existing rainwater collection network of the island.	Direct	+3	Local	Y	B	iv	high	Enhance

	C all, O all	**Groundwater contamination** due to leakage of any oils from machineries during construction; and/or due to leakage of chemicals and poor storage during operation	Direct	-7	Loc al		C, reversi ble	i	High, avoid able	Avoid
Soil Quality	C all	**Reduction in soil quality** due to stockpiling soil. Stockpiled soil runs the risk of being mixed with different soil layers and construction materials and could become compacted and eroded. This could lead to a lack of oxygen in the soil and lead to deteriorating landscape post construction.	Direct	- 3	Loc al	N	A, reversi ble	ii	Med, unavo idable	Reduc e and Avoid
	C all	**Restricted ability to support vegetation** due to lack of oxygen and poor drainage due to compaction.	Direct	+9	Loc al	Y	D	ii	High	Avoid
	C all	**Soil contamination** due to potential chemical spills and building rubble**.**	Direct	-3	Loc al	N	A, reversi ble	ii	Med, avoid able	Avoid
Marine water quality and habitat	O all	**Potential impact from wastewater discharge from the laboratories** if proper dilution and chemical handling guidelines are not followed	Direct	-1	Loc al	N	A, reversi ble	v	Low, avoid able	Reduc e and Avoid
Ambient air quality	C all	**Smoke and dust can cause pollution in the set-up area** – this will be localized and quickly dispersed. Local populations will not be affected as the area will be zoned out and is away from residential areas.	Direct	-1	Loc al		A, reversi ble	i	High, unavo idable	Reduc e
Noise impact	C all	**Considerable noise impact construction activities** during construction period	Direct	-2	Loc al		A, reversi ble	i	High, unavo idable	Reduc e
		Vibrations from construction *could* cause damage to buildings in the vicinity. However, it is an unlikely scenario as they are located with enough distance from the proposed construction site. Moreover, the building is to be constructed as a single storey building. However, the surrounding buildings must be monitored before, during and after construction activities to ensure no damage is done.	Direct	-5	Loc al		A	v	Low, avoid able	Avoid

Aesthetics	C all	**Land aesthetics will suffer due to removal of vegetation and the ongoing construction activities.** Will likely improve during the operational phase with the landscaping plan.	Direct	-1	Local	Y	A, reversible	iii	High, unavoidable	Reduce
Health and safety	C all	**Worker safety may be compromised during construction stage** if proper safety measures are not followed.	Direct	-7	Local	N	D	v	Low	Avoid
Hazard Risk	O1	**Fire and explosion risks if the fire safety procedure is not followed**	Direct	-9	Local	N	D	v	Low	Avoid
	O1	**Chemical hazard risk if the health and safety procedures are not followed** from improper storage and disposal of chemicals	Direct	-9	Local	N	D	v	Low	Avoid
Local economy	O all	**Improved access to water testing services can increase demand** for the Hanimaadhoo Laboratory, which can improve the speed of projects and cause savings for clients in both time and money	Direct	+9	Local	Y	C	v	High	Enhance
	All	**Employment opportunities** for locals as the business plan and the concept design states to hire locals as much as possible. Construction stage could also see opportunities for locals through sub-contracting	Direct	+8	Local	Y	B	v	High	Enhance
		Potential business opportunities as support services could arise for such a laboratory. For example, sample collection and shuttle services could be provided as a subsidiary service by an independent party from harbor or airport to the laboratory	Indirect	+8	Local	Y	B	ii	High	Enhance
		Opportunity cost of land use displacement as this area could have been used for other needs as deemed necessary by the council. However, there is no approved land use plan as of now and so the land was not allocated for another use at the time of council approval and Maldives Land and Survey Authority approval.	Indirect	-2	Local	N	A	i	Low	-
Social cohesion	C all	**Construction stage activities may negatively impact residential houses** due to noise pollution, obstruction of roads, health and safety concerns nearby and clashes between locals in the area and the contractor	Direct	-4	Local	N	A	ii	Low	Reduce and Avoid
	All	**Increased demand on natural resources and services** due to use of domestic water supply, wastewater disposal, solid waste disposal systems and energy supply.	Direct	-1	Local	N	A	i	Low	Reduce

No identifiable impact on local natural resource uses such as fishing areas or other tourism ventures nearby and has not been included in the above table.

6 MITIGATION OF IMPACTS

Table 6.1 Proposed mitigation activities

Environmental Component	Impact Description	Mitigation measure	Responsible Party	Cost MVR
Vegetation and Flora	**Loss of terrestrial flora** as the proposed site requires clearing of vegetation as well as cutting down trees.	Remove and relocate palms that fall in the site area (for full list and process please see Section 3, terrestrial survey). Plant 2 trees for every tree removed. Remove vegetative cover only from the specific site the construction is to take place and only disturb the adjacent areas as little as possible. Land clearing activities should be kept to the absolute minimum as possible	Contractor: Project Manager, Site Supervisor	150,000 MVR
Ground water quality	**Temporary groundwater salinization** due to dewatering and other construction activities.	Dewatering must take place as per the EPA guideline. Conduct foundation works at low tide to minimize dewatering needs. Do NOT use free flow of water for curing. Water ponding to be practiced as much as possible to conserve water.	Contractor	50,000 MVR
	Groundwater contamination due to leakage of any oils from machineries during construction; and/or due to leakage of chemicals and poor storage during operation	Develop and implement an environmental management plan for managing impacts during construction stage which should include the following: - Materials used for construction must be stored and transported in properly sealed containers - Appoint a supervisor to monitor the storage site and construction site for any spillage or leaks - Any spills or leakage of construction material must be cleaned up immediately and thoroughly	Contractor	50,000 MVR

		- Workers should be trained in spill prevention and clean up and designate responsible individuals - Construction materials should be stored in a paved area - All materials must be covered with appropriate netting or other appropriate material		
Soil quality	**Reduction in soil quality** due to stockpiling soil **Restricted ability to support vegetation due to lack of oxygen and poor drainage due to compaction.** **Soil contamination** due to potential chemical spills and building rubble**.**	Prepare a Soil Resource Plan showing the areas and type of topsoil and subsoil to be stripped, haul routes, the methods to be used, and the location, type and management of each soil stockpile. When stripping, stockpiling or placing soil, do so in the driest condition possible and use tracked equipment where possible to reduce compaction. Confine traffic movement to designated routes. Keep soil storage periods as short as possible. Clearly define stockpiles of different soil materials. Provided the soil is spread and prepared correctly, damage to soil structure can be kept to a minimum and the soil can usually recover to a healthy state quickly. To achieve this, it should be handled only when dry or slightly moist and using suitable machinery in an appropriate way. Multiple handling of soil materials increases the risk of damage to soil structure, so should be minimised. The 'loose tipping' method, using dump trucks and hydraulic excavators to move and spread the topsoil, is the most appropriate method to use	Contractor: Project Manager, Site Supervisor	150,000 MVR
Marine water quality and habitat	**Potential impact from wastewater discharge from the laboratories** if proper dilution and chemical handling guidelines are not followed	Ensure that the ISO standards as per the wastewater discharge guidelines in the design document are followed	Contractor: Project Manager, Site Supervisor	30,000 MVR

Ambient air quality	**Smoke and dust can cause pollution in the set-up area** – this will be localized and quickly dispersed. Local populations will not be affected as the area will be zoned out and is away from residential areas.	Ensure the machines are cleaned and maintained properly. Ensure that the public is aware of working times and the area is properly demarcated.	Contractor: Project Manager, Site Supervisor	15,000 MVR
Noise impact	**Considerable noise impact construction activities** during construction period	Ensure that the construction works adhere to a reasonable schedule that is well communicated with the council and the nearby residential areas	Contractor: Project Manager, Site Supervisor	10,000 MVR
	Vibrations from construction *could* cause damage to buildings in the vicinity. However, it is an unlikely scenario as they are located with enough distance from the proposed construction site. Moreover, the building is to be constructed as a single storey building.	The surrounding buildings must be monitored before, during and after construction activities to ensure no damage is done. These can be compared to the baseline assessment of building conditions presented in this EIA.	Contractor: Project Manager, Site Supervisor	10,000 MVR
Aesthetics	**Land aesthetics will suffer due to removal of vegetation and the ongoing construction activities.**	Ensure that the landscaping plan of the site is carried out	Contractor: Site Supervisor	30,000 MVR
Hazard Risk	**Fire and explosion risks if the fire safety procedure is not followed**	Ensure that the fire safety, chemical handling and storage guideline, health and safety guideline as presented in the design documents are adhered to during the operational phase	Contractor: Project Manager, Site Supervisor	50,000 MVR
	Chemical hazard risk if the health and safety procedures are not followed from improper storage and disposal of chemicals			
Social cohesion	**Construction stage activities may negatively impact residential houses** due to noise pollution, obstruction of roads, health and safety concerns nearby and clashes between locals in the area and the contractor	Ensure that the Contractor and Council establish a grievance mechanism Ensure that the staff are trained properly and made aware of the customs to be followed on the island	Contractor: Project Manager, Site Supervisor	10,000 MVR
	Increased demand on natural resources and services due to use of domestic water supply, wastewater	Proper communication with relevant authorities during the construction phase is vital to avoid clashes. However, this EIA concludes that the existing facilities at Hanimaadhoo will not be	Contractor: Project Manager, Site Supervisor	-

	disposal, solid waste disposal systems and energy supply.	depleted due to the establishment of this laboratory

6.1.1 Impact Area Map

7 ALTERNATIVES

7.1 Description of Proposed Project

The following is the simplified description of proposed project for ease of comparison with alternatives.

7.1.1 Proposed Project

Overview: Frequent water and groundwater testing is required to ensure water quality control and minimize waterborne health risks in every island in Maldives. The availability of a regional lab in the northernmost area of the country will greatly assist islands in the region to adhere to regulatory requirements and ensure water quality in both water supply as well as detect any changes to the groundwater aquifer system. It also reduces the burden of having to transport samples to Male' for testing.

The primary location is situated at the east of the island. Consultations were held with island council regarding the land allocation, and it was agreed that the primary site was the ideal option for the laboratory even though residential area was within proximity to the location.

Advantages:

1. Close to the utility services and as a result, provision of electricity and water will be much easier, and the pressure of the water can be maintained at a constant level.
2. The land allocated is adequate and it is located moderately away from residential areas.
3. This location is also more accessible for larger vehicles, which will aid in sample transport to the laboratory and during the construction phase where heavy machinery is installed

Limitations:

1. Close to residential areas
2. More vegetation clearance will take place within the plot

7.2 Description of Alternatives

The following alternatives to constructing a laboratory were considered:

7.2.1 No Project Option

Overview: The first option is a "Do Nothing" scenario, whereby the laboratory will not be constructed.

Advantages:

1. No environmental or financial costs of implementing the project
2. The allocated land can be used for alternative community uses

Limitations:

1. Any islands that require water testing will have to continue to carry the burden of transporting heavy water cool boxes with samples via sea or air to test them and ensure water quality
2. This will result in fewer islands having the capacity to test and ensure water quality
3. As more and more islands install their own water supply and sewerage systems, the laboratories at MWSC and NHL become overburdened and will have to prioritize urgent water tests.

7.2.2 Alternative Location

Overview: The second option considered is to construct the laboratory at a different location than the proposed location. This location is on the western side of the island.

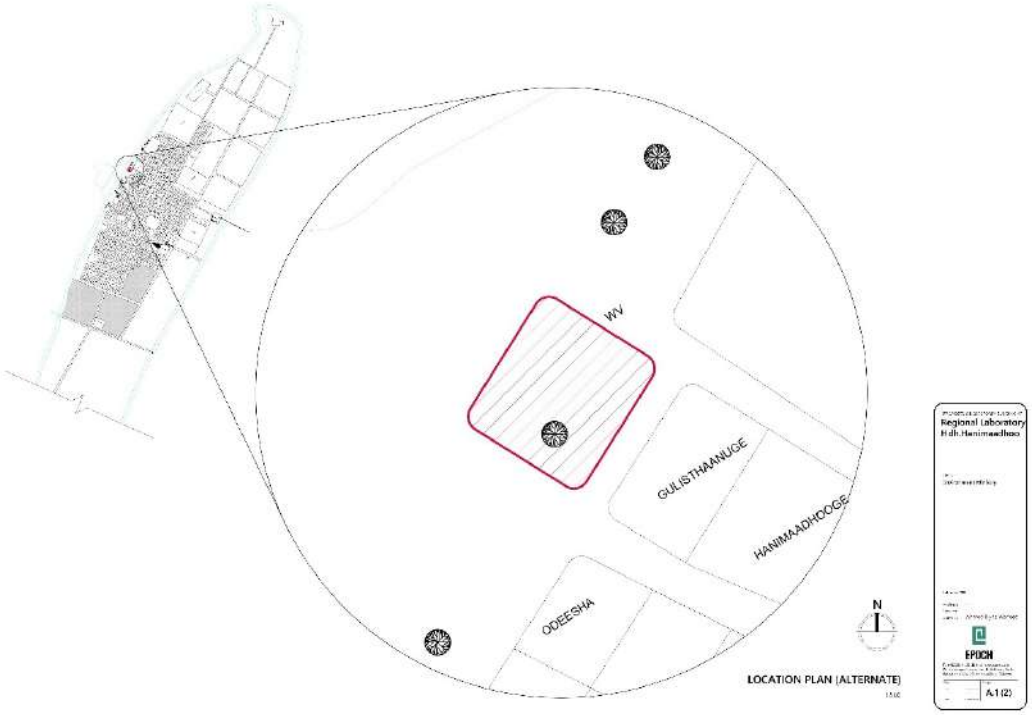


Figure 7.1 Alternative location for the laboratory

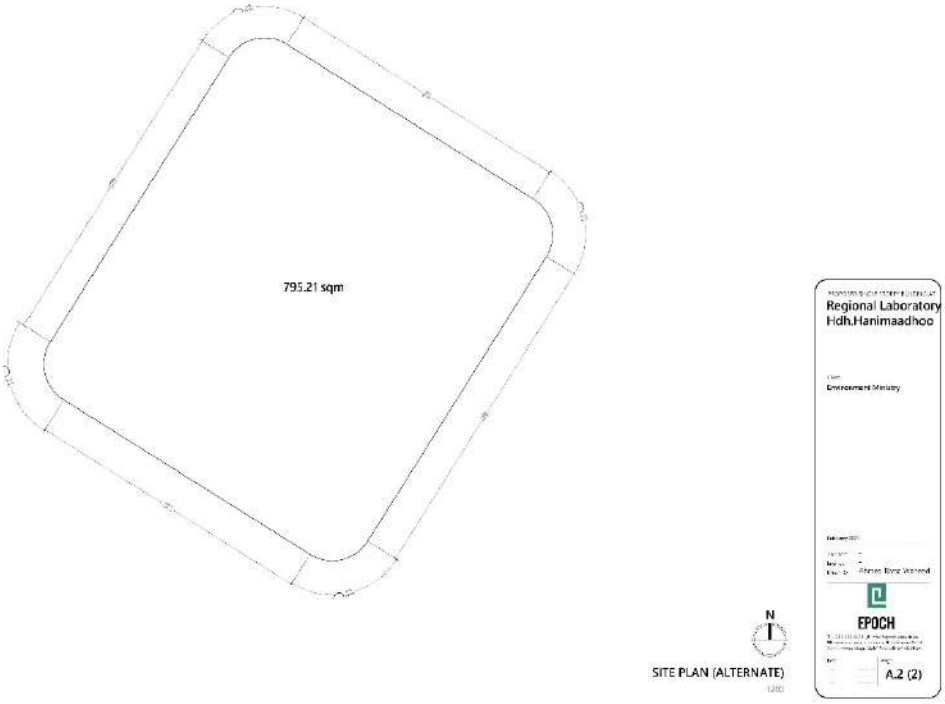


Figure 7.2 Boundary wall and size of alternative location

Advantages:

1. Marginally closer (more direct route) from the airport
2. Much closer to the harbour – will make it easier for clients to drop off samples rather than having to carry heavy samples further
3. Requires less vegetation clearance

Limitations:

1. The alternative site lies in an area where there is a lot of commercial activities including storage of oil. The security of the premises will be more difficult to maintain.
2. The land area is also smaller than the primary location
3. Further from utility services
4. Not the preferred option by the Island Council as the plot is close to the harbour and has higher land value, therefore can be used for other more lucrative commercial activities

7.2.3 Different scale of laboratory

Overview: The current laboratory design includes the minimum viable tests and is supported by an initial business plan with financials. It is not advisable to minimize the scale of the laboratory in terms of services

offered, and will incur a large cost if scaling up. Moreover, the design stage of the laboratory has gone through multiple changes to minimize the footprint and the cost of construction of the laboratory building.

7.3 Analysis

The following alternative analysis matrix is based on the above investigation into each of the possible alternatives to current project. Five biophysical and socioeconomic parameters (technical feasibility, economic feasibility, environmental outlook, social outlook, and typical utility scale) were assessed in the matrix and given a score 1-10 for each matrix. These scores were added up and percentage calculated, after which for simplicity, a percentage was taken to find which alternative is more preferred.

All preferred alternatives must score a minimum of 50%.

Table 7.1 Analysis of alternatives

Alternative proposed	Technical feasibility/10	Economic feasibility/10	Environmental outlook/10	Social outlook/10	Typical Utility Scale/10	Final Score/50	Overall %
Proposed Project	9	7	6	7	9	38	76
A1 No Project Option	9	7	7	5	5	33	66
A2 Alternative Location	9	7	5	5	8	34	68
A3 Different Scale of Project	9	2	5	6	7	29	58

7.4 Overall Conclusion

All project options score over 50%, with the proposed project scoring the highest at 76%. Overall, the proposed project has the highest typical utility as it will greatly improve the customer experience of those who do water testing in islands in HA, HDH, SH, and N atolls. The proposed project scores higher on the social outlook and typical utility scales for this reason. The alternative location scores lower overall as lengthy discussions have already taken place regarding the locations with the island council and the proposed location were finalized through these discussions. Therefore, in terms of social outlook the alternative location does not score high. A different scale of project would mean either increasing the scale or decreasing the scale. Increasing the scale would not be feasible economically and decreasing the scale would not achieve utility goals of the project. Therefore, it is recommended to go ahead with the proposed project option.

8 MONITORING PLAN

8.1 Before Construction

The following activities must be carried out (as detailed in the mitigation section)

1. Soil profiling and soil care works
2. Electrical conductivity testing of ground water
3. Existing condition of the adjacent buildings

The results of these activities must be presented in a pre-construction monitoring report.

8.2 Construction Phase Monitoring Plan

The table below summarizes the key aspects of the construction phase monitoring plan.

Table 8.1 Monitoring schedule for construction stage

Component	Indicators	Methodology	Locations	Frequency	Cost
Ground water monitoring	The following parameters must be tested: Temperature, pH, Salinity, TSS, turbidity, nitrates, phosphates, DO, ammonia, Biological Oxygen Demand (BOD), Chemical oxygen demand (COD) and total petroleum hydrocarbon.	Laboratory Analysis	From all points given in EIA	Bi-annually during the construction period	20,000 MVR per trip
Traffic Monitoring	Survey the traffic within the same area as undertaken for this EIA	Logs from Contractor	Project Site surrounding area	Monthly during construction	2,000 MVR per survey
Noise Level	Noise level in decibels Noise complaints received from businesses	Spot measurement during work hours. Logs from contractor of complaints	Project site, accommodation and residential areas close to the construction site	Monthly during construction	6,000 MVR per trip
Status of adjacent buildings	Visual inspection of exterior structure of nearby buildings	Observation, logs and photographic evidence	Buildings marked in this report	Before construction, once every 3 months until	8,000 MVR per inspection

				construction is completed, after construction	
Labor force	Number of laborers Accommodation units Valid work visa and passport PPE provision Fire safety Pay slips	Logs from Contractor*	Project site	Bi-annually during construction	6,000 MVR per trip
Waste management	Waste type and quantity Method of disposal	Observation, logs and photographic evidence	Project site	Once every four months during construction phase	6,000 MVR per trip

*The following logs will be kept and recorded daily.

- Daily attendance sheets
- Working hour sheets
- Equipment use logs
- Material use logs
- Labour quarters cleaning rota and logs
- Medical records and sick leaves

8.3 Operating Phase Monitoring Plan

Operational phase monitoring program will be carried out for through the operational life of the building.

Table 8.2 Monitoring schedule for operational phase

Component	Indicators and Parameters	Methodology	Locations	Frequency	Cost
Ground water monitoring	The following parameters must be tested: Temperature, pH, Salinity, TSS, turbidity, nitrates, phosphates, DO, ammonia, Biological Oxygen Demand (BOD), Chemical oxygen demand (COD) and total petroleum hydrocarbon.	Laboratory Analysis	From all points given in EIA	Bi-annually during the first two years of operation	20,000 MVR per trip

Health and Safety	All health and safety procedures and evacuation procedures must be reviewed periodically. Drills and staff awareness programs must be conducted	Updated procedures, logs of training and drills carried out	At the laboratory	Annually	20,000 MVR
Building maintenance	Visual walk-through survey for the building looking for any structural defects	Log and report	At the laboratory	Every 2 years	20,000 MVR per inspection
Machinery maintenance	Routine checks for machinery maintenance must take place for safety	Log and report	At the laboratory	Depending on the machinery	Built in cost to the operations

8.4 Cost of monitoring

During the construction phase, the cost of monitoring should be included in the contractor's construction cost. During the operational phase the cost of monitoring will be borne by the operator of the laboratory. Competent monitors must be employed to complete the monitoring procedure as per the schedule. The estimated costs are not a fixed value and should be considered as a reference to the monitoring party.

8.5 Monitoring report

Ecological monitoring will be submitted to the EPA to evaluate the damages during construction, after project completion and every three months thereafter, up to one year and then on a yearly basis for five years after.

The following is the monitoring report format expected for this project. The report will include details of the site, data collection and analysis methodologies, sampling frequency, and analysis. All data collected in the monitoring period shall be presented in the monitoring without bias.

1. Introduction
2. Aims and Objectives
3. Existing conditions
4. Comparison with EIA Baseline Data
5. Impact Monitoring
6. Compliance Monitoring
7. Conclusion and Recommendations

Professional consultants must be hired to undertake the monitoring and the necessary equipment for monitoring must be procured. The proponent is fully committed to undertake the monitoring programme given.

9 STAKEHOLDER CONSULTATION

9.1 Hanimaadhoo Island Council and Hanimaadhoo FENAKA Branch

Date: 5th August 2021

Venue: Hanimaadhoo Council Office

Participants: Abdul Sattar Hassan (Council President), Firaaq Mohamed (Council VP), Haarisa Mohamed (Council Member), Ali Ibrahim (Council Member), Ibrahim Ali (ASDG), Abdul Raoof Ali (FENAKA Asst Engineer), Adam Saaneez (EIA consultant), Ibrahim Anoof (Environmental Analyst)

Minutes:

- EIA team presented the building design and EIA scope
- Council highlighted that the design is very good and it is important to start the construction process ASAP
- Council highlighted that they will provide all the support to ensure the smooth implementation of the project.
- FENAKA confirmed that it will greatly increase convenience for water testing and believes there is a good market in the North
- FENAKA confirmed that the powerhouse has enough capacity for the needs of this laboratory
- Although FENAKA has a small lab in its premises, the testing capacity is limited and they still have to send samples to Male' for testing, which is a great inconvenience

9.2 Utility Regulatory Authority

Date: 12th July 2021

Venue: Online via Google Meet

Participants: Isaac Ahmed Naseer (URA), Fizna Yoosuf (URA), Adam Saaneez (EIA Consultant)

Minutes:

- The project details were presented by the EIA consultant. It was explained that the location was finalized by the MLSA and island council.
- URA recommended to include a waste management plan in the EIA and how the reagents will be managed and how hazardous chemicals will be discarded.
- Explained that detailed drawings need to be submitted to URA for review and approval.

9.3 National Health Laboratory

Date: 15th September 2021 at 11:00 am

Venue: Online via Google Meet

Participants: Aishath Luthufy, Adam Saaneez (EIA Consultant)

Minutes: The following challenges to running a laboratory operation in the Maldives were highlighted by NHL officials:

- It is difficult to procure consumables to run the tests undisrupted. Currently reagents / consumables are procured via STO.
- Need qualified BioMedical Engineers to calibrate and do regulator maintenance of Machines. There are very few biomedical engineers in the Maldives.
- Maintenance of machines and equipment as per schedule is a challenge.

9.4 Hanimaadhoo Public consultation

Date: 11 September 2021

Venue: 11 residents living in households around the proposed area were consulted regarding building a regional lab in Hanimaadhoo.

Participants: 11 anonymous residents (5 female, 6 male; between the ages of 29 and 63. Average age of participants is 41)

General responses:

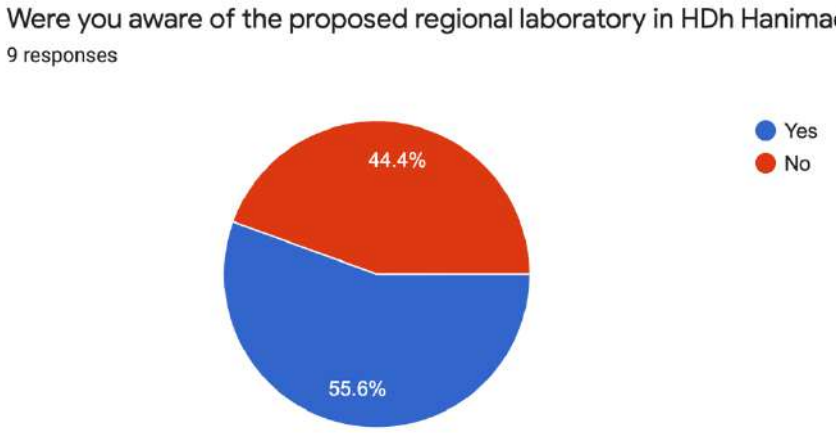
- Demographic information: All respondents are residents in Hanimaadhoo. 5 female and 6 male respondents. Respondents are between the ages of 29 and 63, with average age of participants being 41.
- All respondents believe that water testing service is important for Hanimaadhoo even though only 3 out of 11 respondents had been part of water and sanitation projects in any way and 7 out of 11 were aware of this current project.
- Those who received information about the project received it mainly through council announcements or through word of mouth.
- All respondents believe that constructing the lab in Hanimaadhoo will bring an economic boost to the island as well as provide employment opportunities for those on the island. 10 out of 11 respondents report personally knowing locals on the island who will be interested in job opportunities at such a laboratory.
- 4 out of 11 respondents are concerned that uprooting trees and palms will impact the environment negatively.
- Respondents request to replant the palms on the island, and to ensure that the project progresses in a way that will benefit locals sustainably.

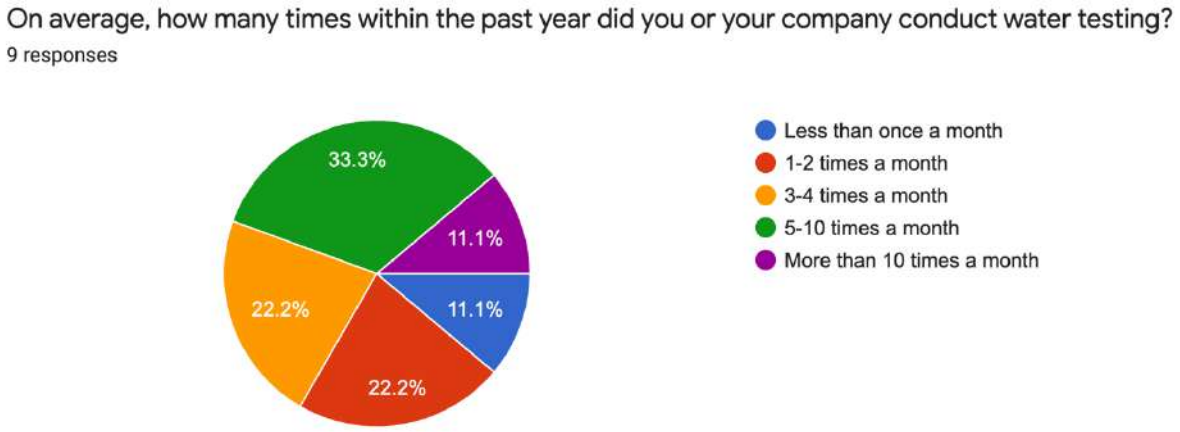
9.5 Potential customers consultation

Date: 11 September 2021

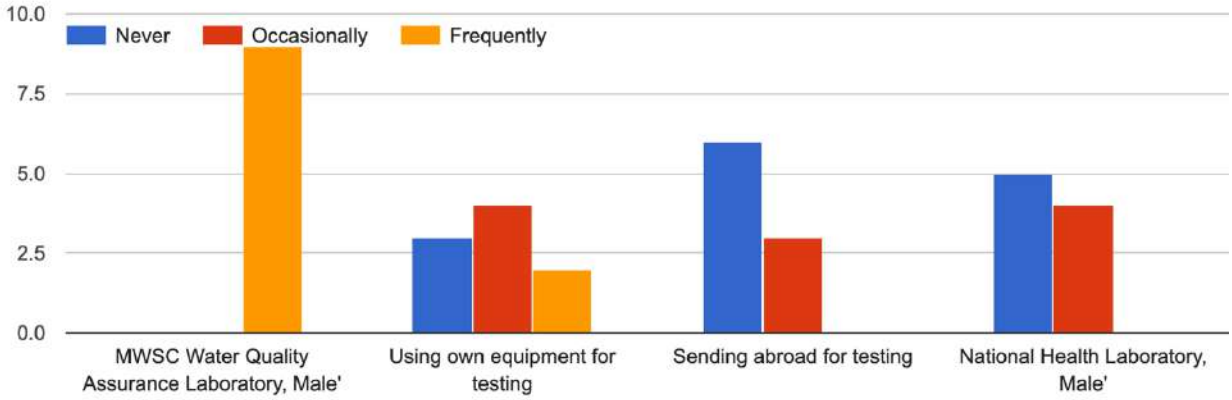
Venue: Google forms, via email. An online survey form was shared with the list of registered EIA consultants and their responses were recorded. The figures below show some of their responses.

Participants: 9 anonymous EIA Consultants



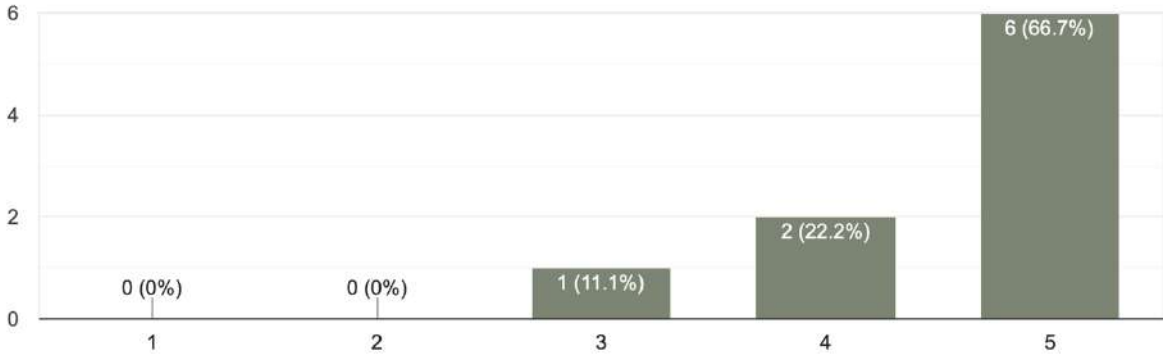


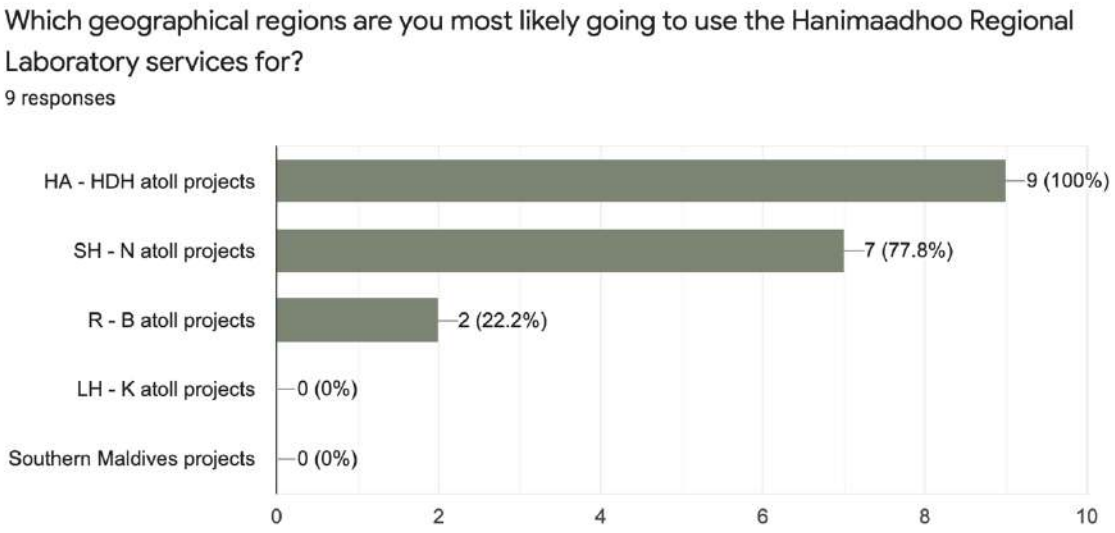
How frequently do you use the following services to test your water samples?



When you think about the Hanimaadhoo Regional Laboratory, do you think of it as something you need or don't need?

9 responses





Concerns and comments:

- Ensure that the lab is open on weekends and holidays even if for a few hours to accept samples. Find a way that samples can also be accepted during long holidays
- Process efficiency needs to be faster
- Have not received enough information about the project
- Increasing testing capacity is very important
- An online portal for transactions/payments will be convenient

10 CONCLUSION

This EIA details the proposed Regional Laboratory at HDh. Hanimaadhoo, and assess the impact of its construction and operation. To do this, stakeholders were consulted to identify the need for such a laboratory, and it was found that a laboratory in the north will greatly ease the logistics of water testing as the scope widens in water and sewerage facilities of each island. This will decrease the dependency on the Male' laboratory for testing and get quicker results from a more accessible location.

The main negative impacts that can be expected include general construction impacts, and those that will arise from not following the set-out procedures during operations such as hazard risks from improper management and disposal of chemicals.

They key mitigation measures include ensuring that the guidelines are followed and that the construction activities take place in the most minimally invasive way as possible.

Overall, the negative impacts on the natural and social environment due to the construction of the laboratory is significantly less than the gains from the proposed project. Therefore, it is recommended to go ahead with the Horizontal Directional Drilling method for installation of the outfall pipes.

11 REFERENCES

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APPENDIX A: PROPONENT'S DECLARATION

APPENDIX B: TOR

APPENDIX C: DETAILED METHODOLOGY

APPENDIX D: STAKEHOLDER ATTENDANCE SHEET

APPENDIX E: SCHEDULE

APPENDIX F: CV OF CONSULTANTS

APPENDIX G: COMMUNICATION TO COUNCILS